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Oral Presentations

OP-CM.01-01

Infundibular Recess Angle Reduction After Endoscopic Third Ventriculostomy: Does It Reflect Clinical Success?

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Background: Ventricular size reduction is not always seen after a successful endoscopic third ventriculostomy (ETV). There still exists a need for practical and reliable radiological parameters to assess the clinical success of an ETV. Our aim is to evaluate the relevance of infundibular recess angle reduction to clinical success during the early postoperative period after ETV.
Method: We retrieved the clinical and radiological data of patients who underwent an ETV. Patients with the following criteria were included: (1) Preoperative MRI studies are available (2) Postoperative MRI studies are done within the first 2 postoperative weeks. (3) The infundibular recess is clearly seen on pre- and post-operative sagittal MR images. Pre- and post-operative measurements of the angle of the infundibular recess of the third ventricle were performed on midsagittal T1-weighted, T2-weighted, FIESTA or CISS images.
Results: The extent of reduction of the infundibular recess angle highly predicted the clinical outcome of ETV during the early postoperative period. The average reduction was about 48% in successful versus only 15% in failed procedures.
Conclusion: The degree of reduction of the angle of the infundibular recess of the third ventricle correlated with the amount of third ventricular decompression after ETV. Most importantly, such a reduction was noted to occur during the early postoperative period when radiological changes are less pronounced. Infundibular recess angle measurement is practically easy and may prove very helpful in cases with no clear cut clinical evidence of success of ETV.
Keywords: Endoscopic third ventriculostomy, Hydrocephalus, Infundibular recess, Third ventricle

OP-CM.01-02

Endoscopic Plan for Management of Foramen Monro Stenosis

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Background: Foramen of Monro stenosis is not common problem, it can be suspected by MRI brain, and sure diagnosis will be established through endoscopic visualization of ventricles, also the etiology can be identified.
Method: 12 cases were presented in this work during the period from 2010 to 2015, all patients are males, age from 22-43 years, and patients were presented with chronic headache, papilledema on fundus examination. Brain MRI showed dilatation of both lateral ventricles, endoscopic cranial procedure was done exploring the pathology, ensuring the diagnosis and resolving the problem.
Results: All patients were recovered well with regression of symptoms and resolving papilledema, with early resuming activities.
Conclusion: Endoscopic approach to the ventricular cavity is important to visualize foramen of Monro and diagnose its problems as well as to plan for resolving the problem during intraoperative procedure.
Keywords: Foramen, Monro, Stenosis, Cranial, Endoscopy

OP-CM.01-03

Subjective Endpoints as Evaluation Method for Surgical Treatment of Intracranial Cysts

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Background: Subjective improvement of patients who have undergone surgery for intracranial arachnoid cysts has justified their surgical treatment. The evaluation of improvement is oftentimes performed short time after the surgical treatment. In a previous study, we demonstrated that the subjective improvement could not be verified in neuropsychological or balance testing despite reported patient improvement. We aimed to examine the long-term outcome of the surgery.
Method: Prospective study setting. Long-term follow-up was conducted 7-10 years after surgery/evaluation. The same questionnaire as before and after surgery was used including headache analysis. In addition, Minor Symptom Evaluation Profile, Headache Impact Test and Migraine Disability Assessment Test were used.
Results: There was no improvement remaining after the long-term follow up in headache (p=0.59) and/or imbalance (p=0.8). Several patients had undergone multiple surgeries based on lack of improvement or complications. 70% felt they were improved during the long-term yet only 36% had complete disappearance of at least one preoperative symptom. Patients who were not surgically treated had the same degree of headache than operated patients.

Conclusion: The results support a restrictive approach toward surgical treatment of arachnoid cysts and questions subjective improvement as an endpoint for evaluation of patients undergoing surgical treatment of intracranial arachnoid cysts.
Keywords: Arachnoid cysts, Headache, Imbalance, Subjective improvement

OP-CM.01-04

Molecular Stratification of Pediatric Infratentorial Ependymoma- Correlation with Clinical Parameters

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Background: Ependymomas (EPs) are glial tumors seen all along the neuro- axis. They are the third most common infratentorial tumors in children and are associated with poor prognosis. The WHO grade is also not a good indicator of survival. Recent emerging data shows that different sub groups have different genetic differences in their origin, progression and behavior. Our aims are to evaluate the expression of novel bio-markers namely, EGFR, CBX7, LAMA-2, NELL-2, p27 and TP53 in pediatric infratentorial EPs, to study association of these novel bio-markers, clinical and histological parameters with prognosis and to study the differential expression of bio-marker in paired sample of recurrent cases.
Method: A correlation study of clinical, pathological and molecular characteristics of pediatric infratentorial patients operated between 2000 and 2012 in single institute in Indian subcontinent. Clinical, operative and radiological data collected retrospectively, H & E slides reviewed and reclassification according to WHO (2007) done. Paraffin blocks were retrieved and TMA constructed, IHC staining done for bio-markers prospectively. Follow up collected from case records, outpatient visit or telephonic conversation.
Results: Clinical parameters (age, extent of resection and adjuvant therapy) are associated with overall survival whereas bio-markers (EGFR and CBX 7) are associated with recurrence free survival. EGFR, p27 expression and MIB index were significantly higher in recurrent samples.
Conclusion: The present study identifies the need to address subgroups of EPs for optimizing treatment protocol, for prognostication and for targeting of genetic pathways as the future of EP management.
Keywords: CBX-7, EGFR, Ependymoma, Infratentorial ependymoma, Pediatric ependymoma

OP-CM.01-05

Preoperative Endoscopic Third Ventriculostomy in Recurrent Medulloblastoma

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The medulloblastoma is the most common malignant tumor in children, accounting for 20-25% of all pediatric cerebral tumors and are localized in the posterior fossa. The histological types are**:** classic, desmoplasic/nodular, extensive nodularity, anaplasic and large cells. They present clinically with lower nerve palsies, hydrocephalus or cerebellar compromise. Actually the best treatment is gross total safe resection, followed by radiotherapy and chemotherapy. The hydrocephalus can be treated with a ventriculoperitoneal shunt but this can lead to metastases in the peritoneal cavity. Another valid option is the endoscopic third ventriculostomy which avoids the risk of metastases. We present the case of an 18 year old male patient who presented at our neurosurgical service first on September 2016, with hydrocephalus and a posterior fossa tumor. In that hospitalization we offered surgical treatment almost immediately for resection of the tumor through a retrosigmoid approach due to it's the lateral localization, and a 90% resection was achieved. The patient was discharged with no major neurological deficit and clinical/radiological remission of the hydrocephalus. After that the patient presented at 2 months follow-up with a new lesion and hydrocephalus. The volumetric MRI showed a tumor larger than the first one and hydrocephalus. With this we offered first an endoscopic third ventriculostomy which was made with no intraoperative complications. 2 days after we did the tumoral resection with a midline approach, achieving a 95% resection. The patient was discharged and referred to oncological treatment, with no major neurological deficit.
Keywords: Medulloblastoma, Endoscopic, Hydrocephalus

OP-CM.01-06

Resection of Pineal Cysts without Ventriculomegaly - To Do or Not to Do?

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Background: Surgical indications for patients with pineal cysts are controversial. Absolute indications for resection are hydrocephalus or tectal compression, in some situations it is difficult to decide whether a surgical treatment beneficial or not. We tried to clarify the indications of resection in cases of pineal cysts in the shadow of our experience.
Method: We reviewed retrospectively our database for all patients who underwent a surgical resection for a pineal cyst from 2003 to 2016. We studied the presenting symptoms, the size of the cyst, the surgical approach, the extent of resection, the clinical and radiological follow-up. The follow up period ranged from 6 months to 14 years.
Results: We found 30 patients operated for a pineal cyst. The presenting symptoms were headache in all patients, nausea and vomiting (19), visual disturbances (12), dizziness (9), sleep disorders (3), memory troubles (2), and gait unsteadiness (2). Twenty-seven patients underwent a microsurgical total resection through a supracerebellar-infratentorial approach. In three patients, an endoscopic transventricular cyst fenestration was done. In two of them, recurrence occurred two and five years after surgery

respectively and a microsurgical total cyst resection was performed. Symptoms disappeared completely in 18 patients, improved markedly in 10 patients and did not improve in 2 patients.
Conclusion: Indication for pineal cyst resection should be widened to include patients with small ventricles when the pattern of the headache suggests a temporary increase in intracranial pressure. Obviously, a slight aqueductal compression causes temporary increased intracranial pressure due to a valve mechanism.
Keywords: Pineal cyst, Endoscopic fenestration, Microsurgical resection

OP-CM.01-07

Using Pediatric Anoscope in Endoscopic Brain Lesions Surgery

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Aim: To present a new simple disposable tubular retractor which provides fully endoscopic resections of the intraaxial brain lesions.
Method: A total of 13 patients underwent surgical resection of an intraaxial brain lesion larger than 3 cm with a fully endoscopic approach using the navigation-guided pediatric anoscope. The anoscope was adapted to serve as a tubular retractor. All lesions were resected under endoscopic visualization and navigation guidance. There were 7 men and 6 women with a mean age of 49.6 years (range, 19-76 years). Lesion location was as follows**:** frontal (n=4), parietal (n=1), frontoparietal (n=2), temporal (n=2), and intraventricular (n=4).
Results: With the use of this technique, preoperative goals of surgery were met in all patients. Gross total resection of the lesions was achieved in 7 of 13 patients (53.8%), near-total resection in 3 patients (23.1%) and subtotal resection in 3 (23.1%) patients. The histological diagnosis included 2 metastases, 5 (38.5%) glioblastomas, 3 meningiomas, 2 low grade gliomas and one oligodendroglioma. There were no complications related to the surgical procedure. Duration of surgery ranged from 60 to 110 minutes, with an average 90 minutes. The average postoperative hospital stay was 2.7 days.
Conclusion: Endoscopic resection of deep-seated brain lesions with the neuronavigated tubular retractor is a safe and an effective technique and may be a feasible alternative to conventional microsurgical or endoscope-assisted methods in selected patients. The modified transparent plastic pediatric anoscope can be used as a tubular retractor and it is easy to apply, simple, lightweight, inexpensive and effective.
Keywords: Anoscope, Endoscopy, Neuro-oncology, Technique

OP-CM.01-08

The Determination of Symptoms and Severity in Patients Who Had Surgical Treatment Due to Primary Brain Tumor

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Aim: To identify the symptoms and determine the severity of the symptoms seen in patients who underwent surgery for primary brain tumors.
Method: The study was conducted with 90 patients who underwent surgical treatment in a neurosurgical clinic of an education and research hospital in Ankara between March-November 2016. In the survey, approval of the ethics committee, written permission from the institution and scale owners, and written consent were obtained from the individuals participating in the study.
Results: 37.8% (n=34) of the patients were female and 62.2% (n=56) were male. Meningiomas (25.6%), pituitary adenomas (23.3%) and glioblastomas (23.3%) were the most common tumors according to the pathologic diagnosis. 25.6% (n=23) of the cases were diagnosed at stage 1. The most common tumor location was frontal lobe and the rate was 28.9% (n=26). Cognitive symptoms were severe when location of disease was at temporal; Emotional symptoms at frontal; Focal-neurological symptoms at parietal; and general symptoms were severe at frontal lobe. It has been found that the inhibition of the activity of the individual's life is greater in patients with parietal tumor. It was found that there was a statistically significant relationship between localizations and symptoms which were sleepiness, xerostomia, mood swings, vomiting, numbness, comprehension difficulty, speech difficulty, visual impairment, appearance change, daily activity inhibition, emotional disturbance state and walking disturbance when the relationship between tumor localization and symptom and severity was examined ($p<0.005$). All symptoms were observed to be greater in Stage 4 patients.
Conclusion: The awareness and management of symptoms and severity after surgery by health professionals in patients who are diagnosed with primary brain tumor, may improve the patients quality of life.
Keywords: Primary brain tumors, Surgery, Symptom, Symptom severity, Nursing

OP-CM.01-09

Outcome of Endoscopic Fenestration of Arachnoid Cyst; Report of 6 Cases

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Background: Endoscopic fenestration of the cyst into the subarachnoid or intraventricular system enables the procedure to be performed through a smaller opening than is necessary with a craniotomy and alleviates the need for any long-term morbidity of shunt placement. Optimal candidates for endoscopic fenestration should have an area of continuity between the cyst wall and the ependyma or subarachnoid space. A large opening into the cyst wall should be made to prevent re-closure of the stoma. Aim of this study is to asses whether endoscopic surgery in arachnoid cyst is safe or not.
Method: A prospective study of six cases were observed in which four were female and two were male. In four cases endoscopic cysto-cysternostomy and in two cases cysto-ventriculostomy were performed. A minimum six months follow up was observed in all cases. Both clinical and radiological evaluation was made in follow up period.

Results: Out of six one had CSF leak which was managed by lumbar drain and one patient had no improvement in memory function though the cyst was decreased in size. The visual symptom was not satisfactory in one patient, though other symptoms like headache, vomiting and seizure were satisfactory in most of the patients.
Conclusion: Endoscopic fenestration for arachnoid cyst is safe and effective in selective cases though a longer follow up is required to evaluate the procedure related complications and the small number of cases may bias the outcome.
Keywords: Arachnoid cyst, Endoscopic fenestration, Cysto-cysternostomy, Cysto-ventriculostomy

OP-CM.02-01

Inferior Clival Chordomas

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Background: Lower clival chordomas represent a surgical challenge due its aggressive behavior and anatomical relationships.
Method: A review of 14 patients with diagnosis of chordoma that involved the lower third of the clivus who underwent EEA, was performed. The degree of resection, the need of an occipitocervical fusion, postoperative complications and time without tumor activity were also evaluated by statistical description analyses.
Results: There were 6 males (42.9%) and 8 females (55.1%) with the mean age of 32.5 years. Condyle destruction was observed in 8 cases. Transverse ligament were disrupted in 6 cases, and apical and alar ligaments were disrupted in 8 cases. The degree of resection was subtotal (78.6%) and near total resection (21.4%). Six patients required fusion in a first stage and two patients a fusion in a second stage. Meningitis (7.1%) and CSF leaks (14.3%) were the most frequent complications. Progression free-survival was 2.7 years. No complications was observed related to the fusion patients. It is to note that none of the patients that were operated in a second stage for cranio-vertebral fusion developed other symptom than pain and radiographic deformity.
Conclusion: Patients will mostly benefit from complete resection as the most important prognostic factor, together with an interdisciplinary approach including adjuvant therapy and follow-up of craniovertebral junction stability has proven to improve outcomes on these patients. It is reasonable to delay the fusion stage when there is doubt about instability since most of the patient will not develop any neurologic symptom associated with the instability.
Keywords: Chordoma, Skull base surgery, Endoscopic endonasal approach, Occipito-cervical fusion, Lower clivus

OP-CM.02-02

Use of Individual Three-Dimensional-(3D)-Printed Plastic Model for Preoperative Planning of Supraorbital "Key Hole" Approach to Suprasellar Tumors

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Background: Supraorbital "key hole" approach is often used for suprasellar tumors. Clear view to complex relations of the tumor and neurovascular structures in a limited surgical corridor is required. The goal is to assess the utility of the individual 3D-printed plastic model (IPPM) in preoperative simulating of the supraorbital "key hole" approach.
Method: 41 patients (mean age=47.5 years) with different suprasellar tumors (meningiomas-18, craniopharingiomas- 9, adenomas -10, epidermoid- 2, optic nerve gliomas- 2) were operated from Sep 2013 to Dec 2016. Mean tumor size was 3.4±0.4 cm. The supraorbital "key hole" approach was selected for 23 (56.1%) cases. Contraindications for it were**:** 1) huge frontal sinus (3 cases); 2) deep anterior cranial fossa – (3 patients); 3) tumor size >4 cm (3 patients); 4) retro- or parasellar extention of the tumor (3 cases). Two or more those factors was found in 6 patients. In all cases 3DIPPM were utilized to simulate the supraorbital "key hole" approach using the same surgical tools as in real surgery (holders, craniotome, endoscope, microscope, microinstruments).
Results: In 90.2% cases 3DIPPM was almost identical to the real intraoperative anatomy. Some deviations were found in 9.8%, but they didn't influence the surgeries. Tumor removal was coresponded to planned in all cases. There were no approach-related complications and cosmetic problems.
Conclusion: 3D IPPM is an effective tool for optimal selection of patients with suprasellar tumors for supraorbital key-hole approach. This tool may be particularly useful for easy learning curve for this minimally invasive approach.
Keywords: 3D-printing, Surgical planning, Supraorbital "key hole" approach, Suprasellar tumors.

OP-CM.02-03

Visualization of Cranial Nerve Using Diffusion Tensor Imaging Technology Feasibility Analysis of Application in Skull Base Tumor Surgery

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Background: In-vivo 3-dimensional (3D) visualization of the cranial nerves (CN) allows neurosurgeons to estimate location and morphological changes of CN caused by tumor. However, exact identification of CN is still a challenging task. The present study aimed to visualize CN using diffusion tensor imaging (DTI) with special parameters. It also involved the evaluation of preoperative

estimates and intraoperative confirmation of the relationship between nerves and tumor by verifying the accuracy of visualization.
Method: 3T magnetic resonance imaging scans including 3D-FSPGR, FIESTA, and DTI were used to collect information from 12 healthy subjects and 12 patients with space-occupying lesions. DTI data were integrated into the 3D slicer for fiber tracking and overlapped anatomic images to determine course of nerves. 3D reconstruction of tumors was achieved to perform neighboring, encasing, and invading relationship between lesion and nerves.
Results: Detailed fibers of the cranial nerves were depicted. Optic pathway including the optic chiasm could be traced. Oculomotor nerve was found to be coursed from the brainstem to the cavernous sinus distally, and trigeminal nerve allowed visualization of distal trigeminal branches as cisternal segment. Cisternal parts of abducens, facial/vestibulocochlear, vagus, and hypoglossal nerves were also imaged well. The 3D-spatial relationship between CN and skull base tumor estimated preoperatively by tumor modeling and tractography corresponded to the results determined during surgery.
Conclusion: Supported by DTI and 3D slicer, 3D reconstruction of cranial nerve is feasible in normal and pathological circumstances. Combined with neuronavigation, it could greatly expand the scope of functional neurosurgery.
Keywords: Cranial nerve, skull base surgery, diffusion tensor imaging

OP-CM.02-04

Use of the Pedicled Buccal Fat Pad for Skull Base Reconstruction After Endoscopic Endonasal Transpterygoid Tumor Resection

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Background: A variety of local pedicled flaps was developed for skull base reconstruction in endoscopic endonasal skull base surgery. Nasoseptal flap has become the most important. However, sometimes this flap is not available. Aim of this study was to evaluate efficacy and safety of using a buccal fat pad for endoscopic skull base defect reconstruction.
Method: Anatomical study was performed on 12 fresh human cadaver specimens with injected arteries (24 sides). Internal carotid artery was exposed in the coronal plane via endoscopic transpterygoid approach. The pedicled buccal fat pad was used for reconstruction. 3 patients were operated using the proposed technique.
Results: Harvesting procedure was carried out using combination of endonasal approach and anterior transmaxillary corridor. The pedicled buccal fat pad flap can be used to pack the sphenoid sinus or cover the internal carotid artery from cavernous to upper parapharyngeal segment.
Conclusion: The buccal fat pad can be safely harvested through the same approach without external incisions and is compliant enough to conform to the skull base defect. The proposed pedicled flap can replace free abdominal fat in central skull base reconstruction. The volume of the buccal fat pad allows obliteration of the sphenoid sinus or upper parapharyngeal space.
Keywords: Buccal fat pad, Endoscopic endonasal approach, Transpterygoid approach, Skull base defect, Skull base reconstruction

OP-CM.02-05

The Surgical Strategy of Management for Solid Hemangioblastoma Involved Medulla Oblongata

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Background: Hemangioblastomas involved medulla oblongata present the most challenge for neurosurgeon because of high disability and mortality in patients. This presentation's aim is to describe and analyze the presentation, radiographic features, surgical management, and outcomes of patients with pathologically proven hemangioblastomas located in medulla oblongata.
Method: We retrospectively reviewed and analyzed the medical recorders of 35 patients with solid hemangioblastomas located in medulla oblongata in the past 10 years.
Results: Sixteen female and 19 male patients with solid hemangioblastomas located in medulla oblongata (mean 42.5 years) were included in the study, represented 12.2% of all single intracranial hemangioblastoma in the same period. Primary manifestations included headache (82.1%), paraesthesis (75.3%), ataxia (59.1%), and pyramidal sign (62.8%). The disease often attacked young adults, and the diagnosis often is relying on MR imaging and DSA. Tumors located in the medullary oblongata (17/35), ponto-oblongata (8/35), and cervicomedulla (11/35). The diameter was small (2cm), large (2-4cm), giant (4cm) in 8, 20, 7 cases, respectively. Preoperative embolization was performed in 16 cases. Total tumor removal was accomplished in all patients. Postoperative death occurred in 3 cases (8.57%), long-term follow-up (mean 89.5 months) revealed good quality of life in 28 cases, and recurrence in 4 cases.
Conclusion: Surgical removal for hemangioblastoma in medulla oblongata is still a high risk and a challenge for neurosurgeon. With full understanding of the characteristics of lesion, combine with preoperative embolization, intraoperative excellent microsurgical techniques and perioperative management, is helpful to total removal and can improve the quality of life.
Keywords: Hemangioblastomas, Involved, Medulla oblongata, Surgery

OP-CM.02-06

Diaphragma Sellae Orifice Ratio (A0/AD), is It an Anatomical Marker to Determine Direction of Growth of Pituitary Adenomas?

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Background: Pituitary gland is located in a cavity which has worn with a wall of duramater and bone and the growth of pituitary is mostly in superior and lateral directions. The diaphragm sella orifice is the opening in the superior wall which the pituitary stalk transmits through it.

Method: One hundred eighty cadaveric heads were analyzed in this study. The brain and its skull covering were removed, exposing the skull base. After take a photo of the level of the diaphragm sellae, pictures were measured by Osoris software.
Results: The average anteroposterior distance of the orifice was 4.87 mm, the average lateral-to-lateral distance was 5.37 mm and the average area of orifice was 21.98 mm2.The average anteroposterior distance of the diaphragm was 8.02 mm, the average lateral-to-lateral distance was 11.35 mm and the average area of diaphragm sella was 70.62 mm2. we categorize the cases according to ratio of the area of diaphragm sellae orifice to area of diaphragm sellae (AO/AD) in to 4 groups as the distinct part of this study.
Conclusion: The lateral and superior surfaces of the pituitary gland are covered only by dura mater, and both the lateral and superior walls have special features that can turn them into a less resistant path of growth to pituitary tumors. In this article, we consider that the proportion of diaphrama sellae orifice area to the diaphragma sellae area (AO/AD) is the most important factor that directing the growth of pituitary adenomas.
Keywords: Diaphragma sellae, Pituitary adenoma, Cavernous sinus, Cadaver, Autopsy

OP-CM.02-07

Skull Base Tumors with Infratemporal Fossa and Temporomandibular Joint Involvement

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Background: Temporomandibular joint involvement by the tumor is a rare condition in neurosurgical practice. In such cases middle cranial fossa tumors spread to the infratemporal fossa and reduce the mandible mobility. These patients suffer from facial pain and masticatory difficulties. A mouth opening difficulties become a problem for anesthesiologist. Fiber optic laryngoscopy assistance is essential for intubation in some cases. In several cases tracheostomy was performed when intubation was not possible.
Method: We present 11 cases with temporomandibular joint involvement and intradural extension. Multidisciplinary team, formed by neurosurgeons, neurologists, anesthesiologists and otorhinolaryngologists was take part in surgical planning and treatment options discussion.
Results: Craniomaxillofacial resection with skull base reconstruction was performed in all cases. Clinical variables, different treatment modalities, complications and outcomes are highlighted. In case of joint capsule involvement we noticed the ankyloses and movement block. In these cases condyle resection was made for masticatory improvement. In some cases we saw mandible fracture and pseudarthrosis formation as movement compensation. Mouth open ability was estimated before and after surgery. Auditory tube is usually involved in these cases. Different surgical techniques used for scull base reconstruction. Translocated pericranial flap and buccal fat pad were the best material for this purpose. In some cases a part of temporal muscle used for scull base closure. The most common complications were described**:** CSF leak, infection and neurological deterioration.
Conclusion: Craniomaxillofacial surgery with condyle resection and meticulous scull base reconstruction is a feasible option for these patients.
Keywords: Skull base, Temporomandibular joint, Craniomaxillofacial surgery

OP-CM.02-08

Our Surgical Experience in the Tumours of Sellar Area Compressing or Involving the Optic Tract (Series of 248 Cases)

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Background: Removal of a tumour of the sellar area (TSA) is one of the most appreciated surgical procedures in neurosurgery. The aim of our work was to study the removal quality (RQ) and the postoperative visual acuity (POVA).
Method: During a period of 27 years (1990-2016), 248 patients with TSA were operated in our department. The age varied from 14 months to 77 years. These tumours included 106 craniopharyngiomas (Cr), 103 meningiomas of the tuberculum sellae (MTS), 20 chiasm optic gliomas (COG) and 19 epidermoid cysts (EC). Blindness was encountered in 39 patients (bilateral**:** 23 cases, unilateral**:** 16). The most used routes were the pterional approach (75%) in case of Cr and the supra orbital subfrontal approach (85%) in case of MTS, COG and EC.
Results: Of 248 patients, the RQ was considered as total, including the Simpson II resection, in 61% of cases, large in 15% and partial in the remaining 24%. The POVA was improved in 51% of the patients, was the same in 40% and deteriorated in 9% of the series. We deplore a mortality of 7%.
Conclusion: QR in TSA was more radical in case of MTS and EC. Decreased POVA was more encountered in case of huge tumour especially in case of Cr and COG. Potential for profound impact of surgery of TSA on visual function should be a permanent worry.
Keywords: Meningioma, Craniopharyngioma, Sellar area, Tuberculum sellae, Visual acuity

OP-CM.02-09

Clinical Characteristics, Management and Prognosis of Skull Metastases: Single Institution Experience

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Background: The incidence of skull metastases is unknown in Indonesia. No previous report describes the clinical characteristics and management of this cancer, including its prognosis. This study describes clinical characteristics, management and prognosis of skull metastases.
Method: This is a retrospective-cohort study based on the medical records of patients treated 2011 - 2016. A complete follow up was available for 28 patients. We evaluated patient's characteristics**:** age, sex, symptom, number of nodule, location, position, bone

destruction, duramater infiltration, percentage of tumor removal, management and type of primary tumor. We used the STATA statistical software for data analysis and Kaplan-Meier curve for survival.
Results: Among 28 patients with skull metastases (mean age=51.2 years), only 39% were male and most of them (50%) presented with painless lump on the scalp. All the lesion had bone destruction with 68% presenting at the convexity. These tumors were highly vascular with average bleeding of more than one litre. Duramater infiltration was present in 9 cases (33%). The most common primary tumor was thyroid (32%) and followed by lung (25%), liver (21%), breast (14%) and others (7%). Kaplan-Meier curve suggest significant difference in patient prognosis receiving both radiation and chemotherapy. No significance was found between percentage of tumor removal and survival.
Conclusion: Our study showed these uncommon lesions occur mainly in women and primary tumor from thyroid. All our patients underwent surgery for decompression, cosmetic and histopathological diagnosis. Further management with irradiation and also chemotherapy is indicated according to the primary tumor.
Keywords: Skull metastases, Clinical presentation, Management

OP-CM.03-01

Surgery for Lesions of Mediobasal Temporal Region: A Clinical, Radiological and Anatomical Study

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Aim: To review clinical and radiological characteristics as well as surgical results in patients with mediobasal temporal (MBT) lesions and discuss microsurgical anatomy of various surgical approaches.
Method: We retrospectively collected demographic, clinical and radiological data of the patients with MBT lesions operated on at our institution between 2006-2016. We also performed surgical approaches on 6 formalin-fixed cadaveric heads.
Results: Thirty-eight patients (19M,19F) had 57 operations. Mean age was 48.8 years (range**:**15-77 years). Seizure was the leading symptom (50%), followed by headache (21%), visual (21%) and speech disturbances (18%). Transsylvian approach was the most commonly used surgical route (54%) followed by subtemporal (18%) and supracerebellar infratentorial approaches (11%). Gross or near-total resection was achieved in 82% of operations. Astrocytoma was the most common pathology (52.6%) (Grade II**:** 15.8%, Grade III**:** 13.1%, Grade IV**:** 23.7%). Other tumors included ganglioglioma (n=4), oligodendroglioma (n=3), DNET (n=2), lymphoma (n=2) and metastasis (n=1). Five patients (13.1%) had vascular malformations (4 cavernoma, 1 AVM). Mean follow-up period was 2.8 years. Twelve patients (31.6%) had tumor recurrences and eleven (28.9%) died after a mean follow-up of 1.3 and 1.8 years, respectively.
Conclusion: Careful preoperative planning and meticulous surgical technique yield favorable results in lesions of MBT region. Transsylvian approach can be successfully used for lesions located in the anterior one-third, subtemporal approach for lesions in the middle-third, and supracerebellar transtentorial approach for lesions in the posterior-third segment of the MBT region. Combined approaches and staged surgery should be considered for larger tumors.
Keywords: Mediobasal, Temporal, Tumor, Cavernoma, Arteriovenous malformation, Surgical approach

OP-CM.03-02

Preresectional Endoscopic Third Ventriculostomy (ETV) as the Procedure of Choice in Patients with Obstructive Hydrocephalus due to Posterior Fossa Lesions

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Aim: To study the surgical outcome and advantages of preresectional ETV in patients with obstructive hydrocephalus due to posterior fossa lesions.
Method: The study was conducted at Department of Neurosurgery, King Edward Medical University/Mayo Hospital, Lahore from September 2015 to August 2016. All patients with obstructive hydrocephalus due to posterior fossa lesions treated with preresectional ETV were included in the study. Patient demographics, preoperative and postoperative neurological status, peroperative and postoperative complications were recorded on a performa and analyzed.
Results: A total of 23 patients, included in the study underwent preresectional ETV. 14 were male and 9 were female. All patients had symptomatic improvement in headache after the procedure. 20 patients had improvement in visual acuity. 3 patients with no light perception remained static. Two patients had postoperative CSF leakage from operative site. None of the patients required any CSF diversion procedure during or after subsequent surgery for the tumor.
Conclusion: Preresectional ETV in patients with posterior fossa tumors is helpful in delaying the subsequent surgery. It is a cost effective alternative to VP shunt and being a more physiological procedure, prevents these patients from complications of VP shunt. It also enables the surgeon to operate on a relaxed brain and eliminates the risk of CSF infection related to external ventricular drain after posterior fossa surgery.
Keywords: Endoscopic third ventriculostomy, Posterior fossa lesion, VP shunt

OP-CM.03-03

ETV Score and Other Factors Contributing to Third Ventriculostomy Outcome

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Background: Endoscopic third ventriculostomy (ETV) has gained widespread acceptance as an effective way to manage hydrocephalus in selected patients. With improved surgical armament and techniques, however, ventriculostomy is now considered to become popular choice. To elucidate the ongoing discussion, a retrospective analysis of ETVs was conducted.

Method: 50 consecutive ETV patients were analyzed using the ETV success score and radiological features of Hydrocephalus. The radiological features studied were, thinned floor, downwards bulging of the third ventricle, enlarged supraoptic recess and anterior curvature of lamina terminalis, increased dilatation of proximal aqueduct compared to distal.
Results: Patients with benign space-occupying lesions and non tumorous aqueductal stenosis had the highest success rates. Complications encountered included, venous bleeding, infection and abandoning procedure. ETV score and radiological features were able to predict ETV success in majority of patients.
Conclusion: ETV is considered most effective in treating uncomplicated occlusive hydrocephalus caused by aqueductal stenosis and space-occupying lesions. The factors validated in this study are patients with previous shunt in place, an infectious etiology and their age. Neurosurgeons should be aware of ETV success score and its radiological success predictors. These factors should be elaborately discussed with patient or his family before proceeding with the procedure.
Keywords: Endoscopic, Ventriculostomy, Hydrocephalus

OP-CM.03-04

Superiority of ETV 7 to 10 Days Beforehand in Hydrocephalus Developed Posterior Fossa Tumor Surgery

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Background: Today, endoscopic third ventriculotomy (EVT) is the first treatment choice for patients with obstructive type hydrocephalus. It has been aimed to examine patients who apply with posterior fossa tumor causing hydrocephalus who have undergone ETV with early period tumor surgery 7-10 days beforehand to tumor surgery.
Method: 43 patients with posterior fossa mass and related obstructive type clinical and radiological hydrocephalus who applied to our clinic between January 2012-August 2016 have been divided into two groups. Group1**:**21 patients with early period mass excision. Group2**:**22 patients treated with ETV in early period 7-10 days post-operation whose hydrocephalus has improved clinically and radiologically and who have undergone mass excision. Clinical improvement and post-operation complications were compared.
Results: 27 were female, 16 were male between ages 5 and 68, with an average of 12,6. 35 of these patients had posterior fossa mass and 8 had masses in pineal region. As Group1 patients had advanced hydrocephalus, more retraction were required during tumor surgery than the 2nd group. Mutizm in 2, surface infection in 1, meningitis in another was observed. 5 patients developed hydrocephalus and V-P shunt was placed. In Group2, hydrocephalus was observed only in one patient, maceration and surface wound infection in another patient.
Conclusion: In the group applied with ETV instead of being submitted to surgery, as physiological BOS circulation and absorption was achieved, gradually radiological and clinical hydrocephalus symptoms,so retraction requirement during surgery is significantly reduced. The dissection of the surrounding tissues of the mass in this respect is relatively easier. As the complication rate was less in group 2 patients,we have been applying this procedure for a year in our clinic.
Keywords: Posterior fossa mass, Hydrocephalus, Endoscopic third ventriculostomy

OP-CM.03-05

The Effects of Different Types of Hair Shaving on the Body Image and Surgical Site Infection in Elective Cranial Surgery

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Aim: To investigate the effects of different types of shaving on body image and surgical site infection in elective cranial surgery.
Method: A randomised-controlled design was used in this study. The sample comprised 200 patients who underwent elective cranial surgery between March 2013–August 2014. The Center for Disease Control and Prevention criteria were applied for the preoperative preparation of patients and for the follow-up of surgical site infection. Wound swab cultures were obtained four times from all patients. The Social Appearance Anxiety Scale was used to assess changes in the body image of patients.
Results: The rate of surgical site infection was 1% for each group and for all patients. There was no difference between the groups of surgical site infection. Coagulase-negative staphylococci and Staphylococcus epidermidis were mostly isolated in the swab cultures. The Social Appearance Anxiety Scale score decreased in patients who underwent strip shaving and increased in patients with regional shaving.
Conclusion: There is no difference between strip shaving and regional shaving in the development of surgical site infection after cranial surgery. In addition, regional hair shaving negatively affects the patients' body image. Relevance to clinical practice**:** Findings of this study provide useful evidence-based information for healthcare professionals. The development and implementation of effective interventions result in the prevention of surgical site infection and improvement of the patients' body image in elective cranial surgery.
Keywords: Surgical site infection, Hair shaving, Body image

OP-CM.03-06

Frequency of Factors that Leads to Bleed in Tumor Bed After Brain Tumor Surgery

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Aim: To determine the factors that leads to bleed in tumor bed after brain tumor surgery.
Method: This was a descripective observational study conducted in neurosurgery department lady reading hospital peshawar from January 2016 to december 2016. A total of 184 patients, of both

gender and all ages who had clear diagnosis of primary brain tumor on MRI brain and who were willing and fit for surgery were included in study. Those who were unfit and not willing were excluded from study. After informed consent and permission from ethical committee of hospital, clinical record of the patient including their biodata, clinical features and complication in the procedure were noted in specially designed preformed performa and data evaluated with spss version 17.
Results: A total of 184 patients, 113 male (61%). and 71 female (39%) were enrolled in study. Age range was from 3 years to 75 years, patients taking antiplatelet medication were stopped one week before surgery. Postop CT scan brain was performed after 24 hours or early if patient developed signs of raised intracranial pressure, and bleed of 10ml diagnosed on post op CT brain ml was taken significant, most common factors that leads to bleed in tumor bed were incomplete resection 2 patients, tumor location (posterior fossa). Histologic type of tumor, tumor size, pre op coagulation profile and platelet count and raised blood pressure during surgery were also a factors in bleed in tumor bed but bleed were less significant.
Conclusion: Incomplete resection and tumor location are most common factors that leads to bleed in tumor bed after brain tumor surgery.
Keywords: Primary brain tumor, Coagulation factor, Bleed in tumor bed

OP-CM.03-07

Minimally Invasive Correction of Hydrocephalus in Patients with Hydrocephalus Secondary to Brain Tumors

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Background: Hypertensive hydrocephalus syndrome contribute to the development of fatal outcome at patients with deep brain tumors, and occurs 20-96% of patients with brain tumors. The method open third ventriculocisternostomy may be used to correct CSF circulation especially when alternative methods can not be used. The purpose of this study is to analyze the effectiveness of the method open third ventriculocisternostomy in patients with hydrocephalus secondary to brain tumors.
Method: The work is based on the results of clinical observation of 12 patients with tumors of the posterior fossa with secondary hydrocephalus, treated at the Republican Research Center of neurosurgery from 2014 to 2016 years. All patients underwent a full comprehensive examination. Due to presence of secondary obstructive hydrocephalus, as a first stage performed open fenestration of terminal lamina of the third ventricle. The aim of the operation was to achieve regression of hypertensive-hydrocephalus syndrome. Open fenestration of terminal lamina made under microscopic assistance by Key hole approach through small incision at the right Kocher point.
Results: The results of the open fenestration of terminal lamina evaluated based on neurological and ophthalmological examination in the postoperative period. MRI signs was a decrease in ventricular size, reduction of periventricular reaction, the appearance of subarachnoid spaces. Regression of hypertensive-hydrocephalic syndrome was observed in 11 patients (91.7%). In 1 patient hypertensive hydrocephalus syndrome was persisted, whom subsequently performed ventriculoperitoneal shunting.
Conclusion: Minimally invasive open third ventriculocisternostomy is an effective method for resolving secondary hydrocephalus in patients with brain tumors.
Keywords: Brain tumor, Secondary hydrocephalus, Open third ventriculocisternostomy

OP-CM.03-08

Brain Tumor Interface Dissection Technique with Surgical Blade from Laboratory to Neurosurgical Operating Room

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Background: Ideal tumor resection requires brain/ spinal cord tumor interface separation in perfect and precise surgical plane within few micrometers for radical tumor resection and maximum normal tissue preservation. Despite the availability of several dissection techniques, search for additional alternatives and an ideal technique continues. We evaluated the feasibility and advantages of dissection using number 15-blade scalpel in special brain tumor surgery situation. We developed a leaf model wherein its outer layer is progressively dissected from its inner skeleton using scalpel. Additional model included use of tomato wherein its skin is peeled of its pulp. We developed an inexpensive leaf model. Scalpel knife is used in a microneurosurgical setting and its outer layer is peeled off. The technique is then used in operative room set up where surgery on meningiomas and intraaxial brain and spinal cord tumors was done by using the technique.
Method: Number 15 scalpel was used for dissection between the layers of Peltophorum pterocarpum leaf model. This dissection method was compared with other neurosurgical dissecting tools.
Results: Dissection of 120 micrometers thick leaves into two layers with removal of 18 to 55 micrometers thick layer leaving behind transparent layer was possible using 15 number blade of scalpel. Similarly, it was possible preserving 30 to 40 micrometers thick arachnoid layer that separated a meningioma from the underlying brain parenchyma.
Conclusion: Scalpel with sharp edge could be used to perform precise and fine dissection. Scalpel deserves to occupy place of pride as a dissecting tool in neurosurgery.
Keywords: Brain tumor, Meningioma, Microdissection technique, Microsurgery

OP-CM.04-01

Effect of the Degree of Head Elevation on the Incidence and Severity of Venous Air Embolism in Cranial Neurosurgical Procedures in the Semi-Sitting Position

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Background: This study compared changes in the severity of venous air embolism according to the degree of head elevation (30 or 45 degrees) in patients undergoing elective cranial neurosurgical procedures in the semi-sitting position.
Method: One hundred patients undergoing an elective infratentorial craniotomy in the semi-sitting position were included, and patients were divided into two groups. In group 1, each patient's head was elevated 30 degrees; in group 2, head elevation was 45 degrees. Patients were assigned to groups according to the location of their lesion. During surgery transesophageal echocardiography was used to detect air in the blood circulation. All results were compared statistically and a p value < 0.05 was considered statistically significant.
Results: There was a statistically significant difference between groups for the total rate of venous air emboli detected on transesophageal echocardiography**:** 22.0% (n=11) in group-1 and 62.5% (n=30) in group 2 (p < 0.0001). The rate and severity of air embolism were significantly lower in group 1 than in group-2 (p < 0.001). The rate of clinically important venous air embolism (grades 2, 3, and 4**:** venous air embolism with decreased end-tidal carbon dioxide levels and/or hemodynamic changes) was 8.0% (n=4) in group-1, and 50.0% (n=24) in group-2 (p < 0.0001).
Conclusion: For patients in the semi-sitting position, an increase in the degree of head elevation is directly related to a higher rate of venous air embolism. With 30 degrees of head elevation and our standardized technique of positioning the semi-sitting position can be utilized safely in neurosurgical practice.
Keywords: Craniotomy, Posterior fossa surgery, Semi-sitting position, Transesophageal doppler, Venous air embolism

OP-CM.04-02

Usefulness of Routine Pre-Operative Coagulation Profile for Elective Craniotomy

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Background: It's a general practice is to order pre-operative work up as a knee jerk response. Neurosurgical pathologies in particular, are linked with deranged coagulopathy. It's compounded by the fact that the bleeding brain tends to swell, which coupled with limited options for proximal control, packing and overall hemostasis, leads to an over emphasis on pre-operative coagulation profile for every patient undergoing craniotomy. Most neurosurgeons order routine Prothrombin Time (PT) and Activated Partial Thromboplastin Time (APTT) for all preoperative patients.
Method: It's a retrospective review of the medical records of patients admitted at Aga Khan University Hospital in last five years for elective craniotomy. Hospital registry was used to identify files for review. Data was collected on a predefined proforma and analysed using SPSS version 19.
Results: A total of 1800 patients were included in the study. Out of these 1800 patients, 26 patients (1.4%) had elevated aPTT or INR. Of these 26 patients, 17 (0.9%) were expected to have deranged coagulation profile as indicated by their history. In 9 (0.5%), of these 26 patients, unpredictable derangement of coagulation profile was found. Coagulation profile of 7 (77%) out of these 9 patients were repeated which all came out to be normal.
Conclusion: This study suggest that preoperative coagulation testing in elective neurosurgical cases, excluding patients with relevant history or anticoagulant use, is not mandatory. Furthermore, the pursuit of abnormal coagulation tests in normal population increases preoperative costs and cause unnecessary delays in surgery, causing unwanted anxiety in patients.
Keywords: Coagulation, Craniotomy, Interquartile range (IQR), INR (international normalized Ratio), aPTT (activated partial thromboplastin time

OP-CM.04-03

Bone Flap Resorption After Autologous Cranioplasty may be Preventable with ACEI-Inhibitors

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Background: Bone flap resorption (BFR) is a long term complication after autologous cranioplasty (AC). This study investigates risk factors for BFR after AC. We focus on Angiotensin-converting enzyme inhibitors (ACEI) which have been associated with a beneficial effect on bone metabolism in orthopaedic, osteoporosis and endocrinology research.
Method: Clinical and radiographic data of 158 patients who received AC after decompressive craniectomy (DC) between June 2003 and August 2015 at the Department of Neurosurgery, Inselspital, Bern University Hospital, University of Bern, Switzerland, were evaluated retrospectively. A Kaplan-Meier analysis of time from AC to diagnosis of BFR was performed. Factors associated with BFR were investigated using the log-rank test and Cox regression.
Results: Median follow-up time was 2.2 years (95%CI 1.9-2.5 years). BFR occurred in 47 patients (29.7%) with a median time to event (mTTe) of 3.7 years (95%CI 3.3-4.1 years). Univariate KM analysis and log-rank test associated ACEI (mTTE not reached vs. 3.6 y, p=0.02) and ventriculo-peritoneal-shunt (VP-shunt, mTTE 4.2 vs. 3.6y, p=0.024) with a lower probability of BFR. Cox regression analysis associated ACEI (HR 0.24, 95%CI 0.09-0.63, p=0.004), VP-shunt (HR 0.31, 95%CI 0.13-0.21, p=0.012), and male gender (HR 0.51, 95% CI 0.27-0.62, p=0.043) with a lower risk for BFR.

Conclusion: This study demonstrates a lower rate of BFR in patients receiving ACEI. Our results are in line with reports on the positive influence of ACEI on bone healing and preservation. Further analysis of the association between ACEI and BFR is needed and will be evaluated in a multicenter prospective trial.
Keywords: Bone flap resorption, Craniectomy, Autologous cranioplasty, Arterial hypertension, Ace-inhibitors

OP-CM.04-04

The Value of Routine Postoperative CT After Cranial Neurosurgical Procedures, Retrospective Analysis

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Background: Routine post operative imaging is a common practice by many neurosurgeons. Rationale for that is mainly to rule out post operative complications such as hemorrhage, edema and tension pneomocephalus. The need for proper resource allocation and concerns with patients safety (radiation exposure and risk of patient transfer) requires a careful assessment of the value of routine post operative CT.
Method: Retrospective analysis of all patients who underwent cranial procedures both in pediatric and adults population at King Abdulaziz University Hospital in Jeddah, Saudi Arabia between January 2010- August 2016. The rate of routine post op CT, abnormal CT findings and subsequently the rate of medical or surgical interventions based on these findings were calculated.
Results: 320 patients who underwent cranial neurosurgeical procedures were included. 126 adults (39.4%). 169 female (52.8%). 162 had routine post op CT within 72 hours (50.63%). In the routine CT group 81 of the cases (64.29%) were elective, while in the no CT group 83 cases; almost half were elective cases (51.24%) and half were emergency cases. Only 9 out of the 126 patients with routine CT had changes in their management based on CT findings (7.14%). The majority of these cases were emergency operations (77.8%).
Conclusion: The use of routine post operative CT with the goal of evaluating post operative complications has limited value on the post operative patient management particularly in elective cases. Careful clinical surveillance is superior to routine imaging for the evaluation of such complications.
Keywords: CT, Imaging, Complications, Surgery, Cranial

OP-CM.04-05

Demographic and Operational Characteristics of Foreign Patients Operated by Same Neurosurgical Team in Ankara, Turkey

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Background: Turkey is among the first ten countries preferred for health tourism on the world. In the last five years the number of foreign patients was increased five times. We report the demographic and operational data of foreign patients who were operated by a same surgical team in 3.5 years period.
Method: From Nov 2012 to May 2016, 148 patients, 72 women (3 months-70 years), and 76 men (6 months-103 years) were enrolled. 95% of the patients were from Iraq.
Results: Total 167 operations were done. Fifteen patients were operated before in other centers. Transcranial operations for tumoral lesions were performed on thirty-four patients with six endoscopic transsphenoidal approaches, and one chronic subdural hematoma drainage. Nine operations for V/P and V/A shunts and revisions were done. Six patients were operated for congenital diseases. Eighty-four operations for spinal degenerative diseases/ traumas, and four operations for spinal tumors were performed. Eleven operations of functional neurosurgery, twelve operations of peripheric nerves, and other approaches were performed.80% of patients with tethered cord were explored before and none was done un-tethering. We performed re-operation and un-tethering for these cases. Lumbar microdiscectomy (n=33) and pedicle screw fixation/decompression (n=22) followed by the ACDF (n=14) were the most common procedures for the spinal diseases. The important problem was persuading the patients for oncological therapy after operations if they had metastasis or high grade gliomas. The patients did not return for control evaluations if there was no neurological symptom or complaint.
Conclusion: Since there is an increasing numbers of patients travelling in search of medical care beyond their national boundaries despite its associated risks, Turkey offers comprehensive and outstanding services under superior conditions.
Keywords: Neurosurgery, Turkey, Health tourism

OP-CM.04-06

Clinical Features Following Traumatic Brain Injury in a Combined Multidisciplinary Neurotrauma Clinic: Experiences from a Tertiary Centre

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Background: Physical, cognitive and emotional sequelae in patients with Traumatic Brain injury have been identified; some as late as 2 years post-injury. To aid in the specialist management of such patients, a multidisciplinary neurotrauma clinic was initiated. This study describes the outcomes of patients who attended the clinic.
Method: All patients who had attended the clinic since inception were selected. Patient data was collected under the categories**:** basic demographics, details of injury, initial CT findings, hospital stay details, symptoms in clinic and outcomes (further investigations, return to employment etc).
Result: 305 patients were included. Mean age was 47.5 and 72.1% were male. Commonest mechanism of injury was falls (53.1%). 17.4% of injuries were classed as mild, 68.2% moderate and 14.1% severe. Commonest injury locations were frontal (21.6%) and temporal (16.1%) with contusions (37.4%) and subdural hematomas (27.9%) the commonest type of injury. The most frequent physical

complaint was headache (47.9%). 41.6% were referred to further services**:** most frequently psychology (19.3%) and neuropsychiatry (18.4%). Of 184 known to be employed before their injury, 48.4% of these returned to work before their last appointment. Further analysis of the data is ongoing.
Conclusion: Information gathered in this study about characteristics of the TBI population and their outcomes allows for better targeting of suitable patients for referral to a multidisciplinary clinic.
Keywords: Trauma, Rehabilitation, TBI

OP-CM.04-07

Critical Analysis of Complications of Brain Tumor Surgery in Alexandria Main University Hospital

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Aim: To critically analyze complications of brain tumor surgery.
Method: In this study, 115 brain tumors patients (aged 5-70years) were operated at department of neurosurgery, Alexandria Main University during 6 months. Detailed history, complete neurological examination, Neuroimaging according to the situation were done. Detailed operative,postoperative course and follow-up for three months were reviewed prospectively.
Results: Open craniotomies were done in 110 cases, while stereotactic biopsies were done in 5 cases. Overall mortality (1.9 %) and morbidity 33%. Overall neurological complications 0.14%. Postoperative hematoma (0.16%), averaging from tumor bed hematoma and hematoma that needed urgent evacuation. Postopertaive CSF leak (0.05%), wound-related infection (0.05%), (0.07%) chest infection and (0.017%) meningitis and seizures (0.02 %). In open craniotomies, total excision was done (84%). Partial resection (0.06%) and near total resection (0.08%). Awake craniotomy tried twice, failed once. Complications included intraoperative injury to carotid artery in 1 case, neuological complications in Gliomas in eloquent areas that was operated without neuromonitoring (0.06%),Cranial nerve injuries (0.017%). Cerebral salt wasting occurred in 1 case. Electrolyte imbalance following Endoscopic transsphenoidal (0.4%). Posterior fossa tumors needed CSF diversion whether endoscopic ventriculostomy or shunt (0.38 %).
Conclusion: Our study is favourably comparable with the literature.
Keywords: Brain tumor, Morbidity, Mortality

OP-CM.04-08

Titanium Mesh Primary Cranioplasty in Open Depressed Skull Fracture

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Background: Approximately 25% of all skull fractures are compound and merit immediate attention. Inadvertently fracture segments are removed in emergency to worsen the cosmetic problem. Open skull fractures have been traditionally managed in 2 stages**:** urgent craniotomy and elevation of the fracture with removal of contaminated bone, debridement, and delayed cranioplasty. Primary, single-stage repair of these injures has been said to entail risks such as infections. Recent experience, however, disproved these concerns.
Methods: We used a primary single-stage reconstruction for patients presenting with open depressed skull fractures. All patients received antibiotic prophylaxis. The patients underwent elevation of the compound fracture and craniotomy if necessary. Debridement was performed, followed by skull reconstruction using a 0.6-mm titanium mesh. We present 7 consecutive 5(71%) male, 2(29%) female patients (age b/w 13 to 45 years) who underwent primary reconstruction of open depressed skull fractures from May 2014 to September 2014, were analyzed retrospectively. Clinical and radiologic follow-up was performed 1 month after surgery. The duration of the surgery was 2 to 3 hours.
Results: No evidence of adverse healing, wound infection, or implant exposure or extrusion in any of the patients reviewed in our series. Cosmetic deformity correction to excellent level was achieved in better way as compared to contra lateral site.
Conclusion: Primary reconstruction of open fracture with titanium mesh should be attempted as and when possible because it is feasible, safe, and cosmetically preferable than the conventional staged approach.
Keywords: Cosmetic deformity, Depressed fracture, Reconstruction

OP-CM.04-09

Cranioplasty- Reconstructive Surgery in Neurosurgical Arena

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Cranioplasty is an infrequently adopted procedure in Neurosurgery. It is done in bone gap due to trauma, metastasis as well as some after-procedure like decompressive craniotomy. In our center we usually do this by autologus bone flap preserved after surgery, bone cement (polymethyl methacrylate) and titanium mesh. In addition to this reconstructive surgery is also done in patients with craniosynostosis. The results of the procedures are favourable which has been shown here.
Keywords: Cranioplasty, Craniosynostosis, Craniotomy, Bone cement, Titanium

OP-EDS.01-01

Extended Endoscopic Endonasal Approach to the Skull Base

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Background: Different approaches to the skull base have been developed through the sphe-noidal sinus. Traditional boundaries of the trans-sphenoidal approach can be extended in antero-posterior and lateral plane. We review our experience with extended endoscopic endonasal approach in 402 cases.
Method: We used the extended endoscopic endonasal approach in 402 patients with dif-ferent lesions of the skull base. This study

specifically focuses on**:** type of lesions, surgical approach, outcome and surgical complications.
Results: Extended endoscopic endonasal approach was used in 402 patients with following lesions**:** 184 invasive adenomas, 10 clival chordomas, 52 craniopharyngiomas, 114 meningiomas, 4 cerebrospinal fluid leakages, 8 meningoencephalocele, 10 malignan lesions and 20 thyroid ophthalmopathy. In tumoral lesions gross total resection was achieved in 89%, with better results in craniopharyngiomas 94%, followed by invasive adenomas with 90%, and meningiomas with 86%. The most frequent complications were the insipid (8.6%) diabetes, meningoencefalitis (3%) and the hydrocephalic (3.9%). Mortality was 3.2%.
Conclusion: The extended endoscopic endonasal approach is a promising minimally invasive alternative for selective cases with skull base lesions. As techniques and technology advance these approaches have been the procedure of choice for most skull base lesions. The extended endoscopic approaches are an excellent option in the management of the patients with these complex pathologies of skull base.
Keywords: Extended endoscopic approach, Skull base, Tumor

OP-EDS.01-02

Endoscopic Approach to Clival Chordoma and Chondrosarkoma

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Aim: To present the clinical results and the endoscopic surgical approaches of total 40 chordomas and chondrosarkomas which were radiologically and pathologically diagnosed.
Method: Between September 1997 and March 2017, 1887 patients who were operated on endoscopic transnasal route in Kocaeli University Medical Faculty Neurosurgery Department were retrospectively screened. In our study, 37 chordoma and chondrosarkomas patients underwent 44 endoscopic approach. Twenty-four of 37 patients were primary. Endoscopic surgical anatomy of the clivus is classified in literature into three categories; superior, middle and inferior. These 44 cases were divided into groups according to this anatomic classification. Transclival, transcavernous and transmaxillary approaches were used in the cases. In four cases we performed combined transnasal and transcranial approach.
Results: Gross total resection was performed in 16 patients. Nearly-total resection was performed in 8 patients and subtotal resection was performed in 13 patients. There was invasion to the pterygopalatine fossa and parapharyngeal area in two cases and occipitocervical junction invasion in one case. In three cases there were intradural components with extradural component, in one case there was only intradural component. Internal carotid artery injury, cerebrospinal fluid leakage and postoperative cranial VI nerve palsy were occurred in one patient.
Conclusion: Primary purpose in chordoma surgery is gross total resection. Extended endoscopic approach is the most appropriate surgical approach for extradural and intradural chordomas extending in the midline from the suprasellar area to the foramen magnum. Combined approaches are needed for the cases extending to intracranial and infratemporal fossa.
Keywords: Endoscopic, Chordoma, Chodrosarkoma

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Three-Dimensional Multimodal Imaging and Intraoperative Navigation in Endoscopic Skull Base Surgery

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Aim: To validate the utility of 3-dimensional multimodal imaging (3D-MMI) and intraoperative navigation (ION) in endoscopic skull base surgery.
Method: We performed 16 endoscopic skull base neurosurgical operations (pituitary adenomas, chordomas, chondrosarcomas and others) guided by 3D-MMI and ION techniques.
Results: In all patients, the 3D-MMI and ION techniques enabled adequate visualization of the microsurgical skull base anatomy (lesions, nerves, vascular structures, etc.) stereoscopically, especially the relationship between lesion and internal carotid artery (ICA). It is convenient for doctors to locate surgical procedures and lesions. Thereby, allowing the surgeons to increase tumor resection and avoid ICA injury during endoscopic skull base surgery.
Conclusion: 3D-MMI and ION techniques were found to be helpful for endoscopic skull base surgery.
Keywords: 3D, Multimodal imaging, Navigation, Endoscopy, Skull base surgery

OP-EDS.01-04

Impact of Evolution of the Endonasal Transsphenoidal Approach on Overall Patients' Outcomes at a Single Institution

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Background: Over the past twenty years, the endonasal transsphenoidal approach has evolved from a pure microscopic approach to an assisted endoscopic one, followed currently by the pure endoscopic approach. This has been true at our institution too.
Method: Retrospective analysis of the records of the patients operated upon via the endonasal transsphenoidal approach at the neurosurgery department, Ain Shams University, Egypt, during the period from January 2003 till December 2015 revealed 524 cases. The microscope has been utilized in the first 132 consecutive cases. While the endoscope has been adopted in the following 392 consecutive cases. We have compared both groups regarding their demographic data, clinical presentations, laboratory and radiological investigations, extent of excision, clinical and radiological cure rates, overall patient satisfaction, morbidity and lastly mortality.
Results: The overall extent of excision has been superior in the endoscopic group compared to the microscopic group, 89% and 68% respectively. This has been true too for the overall clinical improvement rates which have been 91% for the endoscopic group compared to 78% for the microscopic one. Meanwhile, the overall

morbidity rates have been relatively higher in the endoscopic group, 13% compared to 8% in the microscopic group. There have been three mortalities in the endoscopic group and two in the microscopic one.
Conclusion: Our data suggest that the endoscopic endonasal transsphenoidal approach is relatively superior to the microscopic one in the hand of experienced surgeons. Adopting the technique for sellar and perisellar pathologies will certainly improve the overall results.
Keywords: Microscope, Endoscope, Endonasal, Transsphenoidal

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The Effectiveness of Neuroendoscopic Treatment of Intracranial Cysts: A Retrospective Medical Record Review Study

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Background: To assess the effectiveness of neuroendoscopy compared with non-neuroendoscopic procedures for treating patients with arachnoid membrane cysts in the lateral ventricles.
Method: The medical records of 28 patients with arachnoid membrane cysts in the lateral ventricles who were treated with neuroendoscopy and 39 such patients treated with non-neuroendoscopic techniques using classic treatment procedures were reviewed. The neuroendoscopic approach combined craniotomy, corticectomy, lesion resection and cyst ventriculostomy or cyst cisternostomy to restore normal cerebrospinal fluid circulation. The non-neuroendoscopic techniques included craniotomy, corticectomy, and lesion resection performed under a microscope. Clinical outcomes of symptoms and cyst size change on imaging were compared between the two treatment groups during follow-up (range**:** 1–5 years).
Results: Patients in the neuroendoscopy group had significantly less blood loss ($p< 0.001$) and shorter operative time ($p<0.001$), better marked improvement in symptoms (64.3% vs. 5.1%, respectively), and a higher total resection rate (92.9% vs. 66.7%; $p=0.011$) compared with the patients in the non-neuroendoscopy group. In the neuroendoscopy group there was no cyst recurrence whereas in the non-neuroendoscopy group 8 (20.5%) patients had cyst recurrence. However, all patients in the neuroendoscopy group had postoperative transient fever and 8 (28.6%) patients had subdural fluid accumulation which was treated and subsequently resolved during follow-up. These symptoms did not occur in the non-neuroendoscopy group.
Conclusion: We found that neuroendoscopic therapy for arachnoid cysts in the lateral ventricles was more efficacious than non-neuroendoscopic methods.
Keywords: Neuroendoscopy, Cysts, Intracranial, Operation

OP-EDS.01-06

Robotic Endoscopic Endonasal Transsphenoidal Surgery: Preliminary Clinical Application

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Background: Based on our previously published reports on development and applications of robotic neurosurgery,1-7 the authors applied the supporting robotic device (Intelligent Arm Support System "iArmS®") to endoscopic endonasal transsphenoidal surgery (ETSS) and assessed its early clinical experience.
Method: Here, 43 patients with sellar region tumors were included (29 pituitary adenomas, 3 meningiomas, 3 Rathke's cleft cysts, 2 craniopharyngiomas, 2 chordomas and 4 other lesions). Multimodality ETSS were conducted to all cases. iArmS ® was used to maintain the surgeon's endoscope-holding arm during nasal and sphenoid phases.
Results: The iArmS ® was a valuable tool for stabilizing the surgeon's arm securely and following the surgeon's arm-movement automatically. It reduced surgeon's fatigue and eliminated shaking of the video image by providing a steady surgeon's scope-holding hand. There were no complications relating to the use of iArmS ®.
Conclusion: As a novel of this study, the clinical results of robotic ETSS verified that our "iArmS®" is an effective device that improves preciseness and safety. The iArmS® allows continuous precise manipulations that provide high-quality surgical results in neurosurgical techniques. Besides, it is a useful automatic tool for holding/following the surgeon's arm. Robotic technology might be an indispensable modality during ETSS that allows continuous precise manipulations that provide high-quality surgical results in neurosurgical techniques even in such a deep and narrow operative field.
Keywords: Robotic surgery, Multimodality, ETSS, iArmS

OP-EDS.01-07

Endoscopic and Endoscopic Assisted Supraorbital Approach

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Aim: To assess the assumed advantage of the pure endoscopic to the endoscopic assisted or microscopic supraorbital key hole approach. The idea is to measure accessibility in addition to the possibility to avoid the surgical complications.
Method: In addition to illustration of clinical cases using microscopic endoscopic approaches. We have performed eight dissections on four cadaver heads integrated an operating microscope,

endoscope, and neuronavigation. Comparison between visibility and accessibility of sellar and parasellar region was evaluated. Special structures to assess their preservation in both approaches were defined. This was afforded by the pure endoscopic in the eight sides and the microscope combination in the same eight sides of each specimen. Accessibility was quantified for key structures using linear measurements taken by the navigation system.
Results: Our measurements of the formalin fixed heads including each side; the mean ± SD (in mm) from the bone margin to anterior communicating artery, to ipsilateral internal carotid artery, to contralateral internal carotid artery, to basilar bifurcation, to optic chiasma, to ipsilateral anterior clinoidal process, to ipsilateral posterior clinoidal process, to ipsilateral optic canal.
Conclusion: Using endoscope alone during conducting the keyhole approach is possible than using the endoscope as an assistance tool. Our recommendations are to use the introduced measurements in this study for the preoperative key hole approach planning taking into consideration the racial variations. We do belief that after starting the pure endoscopic approaches with more advances of technology of endoscopes may replace the microscopic in the near future.
Keywords: Endoscopic assisted, Pure endoscopic, Supraorbital, Keyhole approach

OP-EDS.01-08

Endonasal Transsphenoidal Approach For Skull Base Lesions

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Background: There are wide variety of Anatomical Structures and its Pathology Occupied the Skullbase area. In this Modern Era of High resolution Radiological diagnostic aid we can able to reach the pathology with help of modern Navigation system using Endoscopic approach through the nose. As for as the Transsphenoidal approach is concerned, sphenoid sinus is at the centre in all axis, from centre we can extend laterally, Cranially as well as caudally to reasch and remove the lesion.
Method: Almost 190 cases were operated irrespective of age & sex in the period between 2010 to 1014 which includes benign tumors of skull base like pituitary macroadenoma, planum sphenoidale meningioma, aneurysmal bone cyst of anterior clinoid process, craniopharyngioma, pituitary tuberculoma, clivus lesion, skull base secondaries, CSF fistulas.
Results: In most of the cases total excision of tumor was done except in few cases of pituitary macradenoma in which suprasellar and para sellar extension was left behind as well craniopharyngioma with calcification.
Conclusion: Endoscopic approach anterior skull base approach using 4 hand surgical technique & Rigid Endoscope is safe and effective for skull base leison surgeries. Meticulous preoperative planning with Biochemical, radiological specially CT and MRI, and also Intraoperative Navigation made the surgery successful wit negligible percentage and complications. Dedicated Team work with Rhinologist and Neurosurgeon ware key to the success of this approach, inspite of a quite long learning curve. Due varied normal anatomy and extremely variable pathology, expect intraoperative as well as post operative complications, ready to take appropriate measures to avoid as well treatment them.
Keywords: Skull base lesion, Endonasal transsphenoidal approach, Neurosurgeon & Rhinologist team

OP-EDS.01-09

Conceptual Design of a Surgical Instrument-Guided Robotic Neuroendoscope Holder - NeuRoboScope

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Background: Since the introduction of endoscope into skull base surgery, one of the most important drawbacks has been the necessity of the surgeon to operate with one hand while holding the endoscope with the other. A second surgeon or a static endoscope holder has been proposed as a solution however, both are far from fulfilling the need. In this study, we seek to meet this demand and to develop an innovative, easily operable and widely applicable robotic endoscope holder system.
Method: In this multicenter, multidisciplinary R&D project we used radiology database to define normative values and variations regarding paranasal bony anatomy for determining minimal required workspace. We used sensors specifically designed for this project to collect motion data from surgical tools in the operative field.
Results: Sensors attached to surgical tools and endoscope provided motion data in a three-dimensional space during surgical procedures. Together with radiological data, we defined a workspace and quantified safe physical boundaries. Generated data is used in defining system requirements. We analyzed various solution models for the conceptual design of mechanical, electrical and software components of robotic endoscope control system that meet the set and calculated system requirements.
Conclusion: Design and production of system components are currently underway. Once prototypes of components have been produced, design verification, system integration and preclinical tests will be conducted to ensure a precise, efficient, safe and compact design for our novel robotic endoscope holder system, which is aimed to be a competitive one among its counterparts in the industry.
Keywords: Skull base, Neuroendoscopy, Robotic surgery, Endoscope holder

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Analyses of Long-Term Results of Pituitary Surgery for Cushing's Disease and Predictive Factors for Remission and Recurrence

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Aim: To determine early, third month remission rates, complications of surgery, recurrence rate, time to recurrence and factors that may influence remission and recurrence.
Method: Medical records of 162 consecutive patients operated for Cushing's disease by a single surgeon (NG) between 1997 and 2017 were evaluated retrospectively. 26 patients were excluded as they didn't show up for the first follow-up at the third month. Age, gender, radiological, histological factors, type of surgery, pre and post-operative hormone levels were analysed for possible impact on remission and recurrence. The results were analysed statistically with Fisher exact, Mann Whitney-U and Kolmogorov-Simirnov tests.p<0,05 was considered statistically significant.
Results: Mean age was 37,5 (ranging from 5-71)with mean follow-up of 103 months (range 3-247). According to size of tumor %53 (n:72) was microadenoma(0-10 mm), %23,5 (n:32) macroadenomas (>10 mm) and %23,5 (n:32) has undetectable tumor on MRI. %83,1 (n:113) of the patients underwent microscopic transsphenoidal surgery (TSS), %15,4 (n:21) endoscopically and %1,5 (n:2) transcranial approach as the first-line treatment. First week remission rate was %66,2 (n:90), 3rd month remission rates was %75,7 (n:103) and recurrence rate was %19,1 (n:26) after first surgery. With further treatments including additional surgery, gamma-knife, adrenalectomy and medical therapy (ketaconazole, pasireotid) final follow-up remission rates increased to %90,4 (n:123). There was statistically significant difference between 24th hour cortisol levels and final follow-up remission status (p=0,013).
Conclusion: Treatment of Cushing's disease is problematic. Pituitary surgery is safe and effective but at long-term there are increasing number of recurrences. Early hypocortisolemia is not a sine qua non condition for remission. There is need for more studies with larger series to define precise remission criteria and predictive factors for relapse.
Keywords: Cushing's disease, Pituitary surgery, Transsphenoidal, Remission

OP-EDS.02-02

Extended Endoscopic Endonasal Transsphenoidal Approach for Sellar-suprasellar Tumour

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Extended Endoscopic transphenoidal approach for sellar-suprasellar tumour is now popular throughout the world. Common sellar-suprasellar tumours are pituitary adenoma, craniopharyngioma, tuberculam sella meningioma. We have operated 34 cases of sellar-suprasellar tumour by extended Endoscopic Endonasal approach. Pituitary adenoma 20 cases, Craniopharyngioma 12 & Tuberculam sella meningioma 2 cases. Gross total removal done-12 cases of pituitary adenoma, 7 cases of craniopharyngioma and 1 case in tuberculam sella meningioma. Visual acuity and visual field improve in 15 cases. CSF leak developed in 6 cases, 3 cases required secondary repair. Permanent DI developed in 10 cases. Two patient died, One patient due to tumour bed haematoma and another case may be due to hypothalamic injury. One patient developed meningitis was treated by antibiotics. Nasal problems was seen in 2 patients. Extended Endoscopic Endonasal approach is an excellent alternative approach with good result for removal of selective seller-supraseller tumour due to Panoramic view and better visualisation of lateral and supraseller region. Endoscope also provide better visualisation to differentiate between normal tissue and tumour tissue.
Keywords: Extended, Endoscopic, Endonasal, Transsphenoidal, Suprasellar

OP-EDS.02-03

Endoscopic Endonasal Treatment of Acromegaly

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Acromegaly is a chronic disease, related to excess of GH and IGF-1, generally caused by pituitary adenomas which are GH- secreting. Because of uncured acromegaly lead to high mortality and morbidity, it should be treated surgically. The aim of this study is evaluate the consequensus of pure endoscopic transsphenoidal surgery in series with acromegaly and rewieve the remission rates according to 2002 and 2010 consensus remission criterias, also produce the predictors of remission and mention about associated complications. In this study, we retrospectively analyzed the medical records of 129 patients who have GH-secreting adenomas and operated via pure endoscopic endonasally at Ankara Numune Training and Research Hospital between November 2010 and March 2016. Tumors were classified according to size and tumor extension. Patients' follow up periods were minimum 6 months. The consequences were evaluated in accordance with 2002 and 2010 consensus remission criterias. According to 2002 criteria the total remission rate was 73.4% and this rate decreased to 65.3% according to 2010 criteria.

Parasellar extension, cavernous sinus invasion and relapse of tumor were associated with lower rates of disease control. After surgery new endocrinopathies were seen in 6 patients; 3 were transient DI, 1 was permanent DI and 4 were hypopituatirism. Pure endoscopic transsphenoidal surgery is an effective and safe option for the treatment of acromegaly. In this study we have high remission levels with this option according to 2002 and 2010 consensus criterias.
Keywords: Acromegaly, Endoscopic transsphenoidal surgery, Remission, Outcome

OP-EDS.02-04

Outcome of Neurosurgical Management (Transsphenoidal Endoscopic and Microscopic) of Giant Pituitary Adenomas: Our Experience with 210 Cases

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Background: Patients with pituitary adenoma with parasellar and suprasellar extension usually present to an ophthalmologist or a neurosurgeon due to visual impairment and endocrine dysfunction. Pituitary apoplexy is a special entity and neurosurgical emergency. Pituitary adenoma represents 10% of all intracranial tumours.
Method: 210 cases of giant pituitary tumors that presented to us with HA, visual impairment, endocrinopathies, or with altered level of consciousness were included. All patients were investigated and operated from January 2006 to October 2015.Average follow up period is 26 months.
Results: Total number of cases-210. Clinical presentation was visual impairment, HA, ocular palsy, proptosis and endocrinopathies. Carotid encasement was found in 12 cases. All patients were operated by transsphenoidal approach either endoscopically (95 cases) or microscopically (115 cases).Total removal done in 145 cases and subtotal resection done in 64 cases with adequate optic apparatus decompression. More than one operation was done in 41 cases. One patient with gigantism died due to peroperative carotid artery injury. Two patients died from septicaemia. Tumor recurred in 46 cases. Mild to moderate DI developed in 32 cases that were managed accordingly. One patient developed pseudoaneurysm in cavernous sinus ICA that was treated transcranial microsurgical trapping. Complete visual recovery was in 108 cases. Vision improved to some extent in 80 cases. One patient developed pseudoaneurysm in cavernous sinus ICA that was treated transcranial microsurgical trapping. Complete visual recovery was in 108 cases. Vision improved to in 80.
Keywords: Giant pituitary adenoma, Endoscopic, Transphenoidal

OP-EDS.02-05

Endoscopic Endonasal Approach to Sellar and Parasellar Areas. Anatomical and Clinical Experience in Cairo University

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Background: Endoscopic Endonasal Approaches had gained significant popularity among skull base surgeons replacing microscopic transsphenoidal and even lateral skull base approaches for selected pathologies. The design of the approach depends primarily on the targeted anatomy and the aim of surgery.
Method: 287 cases of sellar, suprasellar and parasellar lesions were operated upon by EEA from 2007 to 2016 by the authors in Cairo University Hospitals. clinical examination, radiological and laboratory studies were done and recorded both pre and post operatively.
Results: Main parasellar lesions were cavernous sinus lesions, middle fossa schwannomas, and angiofibromas. The amount of bone resection varied from cases to case. total resection was possible in 68%. No operative related mortality.
Conclusion: In planning the endoscopic approach to sellar and parasellar area, careful study of the preoperative imaging is crucial with pretend good command of knowledge of anatomy of this region.
Keywords: Sella, Parasellar area, Cavernous sinus, Pterygoids

OP-EDS.02-06

Outcome of Endoscopic Endonasal Transsphenoidal Surgery for Pituitary Adenoma: A Study of 151 Cases

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Aim: To analyze the outcome of endoscopic endonasal transsphenoidal surgery for pituitary adenoma in terms of improvement in symptoms, hormonal profile, recurrence and complications.
Method: This observational retrospective study was conducted in the department of Neurosurgery, Lady Reading Hospital Peshawar from January 2014 to June 2016. The documentation was done according to the preformed proforma including demographics, symptomatology, hormonal profile and finally outcome was measured in terms of improvement in symptoms, hormonal profile, hospital stay and post-operative complications.
Results: Total 151 patients were included, of which 94% were operated first time. Most of them were male (55%). The most common symptom at presentation was headache, 93.38% followed by visual loss, 87%. Post-operative visual improvement occurred in 86%, while headache improved in about 90% and hormonal control was achieved in 74% of the patients. Diabetes insipidus occurred in 9.27%, CSF leak in 4.63% and one patient expired due to secondary infection.
Conclusion: Pituitary adenoma is common in middle age males; if endoscopic endonasal transsphenoidal surgery is done by experienced hands then there is minimal mortality and morbidity due to procedure.
Keywords: Outcome, Endoscopic endonasal transsphenoidal surgery, Pituitary adenoma

OP-EDS.02-07

Can We Predict Visual Impairment Based on the Size of Pituitary Tumor?

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Aim: To find a cut point for tumor size based on perimetry that shows the beginning of significant visual impairment.
Method: In this cross-sectional study on 92 patients, the sagittal pituitary MRI was used to assess the superior-inferior diameter (SId) of the tumor, the suprasellar part, and the axis of tumor growth. The effect of the axis on the displacement of chiasm was calculated using the Sinus of the angle of axis with the anterior skull base (Sinθ). Visual impairment was defined using mean deviation of the worst eye in each patient. Receiver operating characteristic curve analysis was used to define a cut point.
Results: The size cut point for visual field defect was 25.5 mm for total SId, while it was 11.5 mm for suprasellar SId. With the inclusion of the axis in the calculation, the new cut point was 10.3 mm for suprasellar SId multiplied by Sinθ.
Conclusion: A discrepancy was showed between SIds of various parts of the tumor. The SId of the suprasellar part, along with the axis of growth can be used to predict the visual field defect more accurately than the total SId. This result help the surgeon to better decide the time of surgery.
Keywords: Pituitary adenoma, Visual impairment, Trans-sphenoid surgery

OP-EDS.02-08

Surgical Treatment of Pituitary Tumours

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The pituitary gland is also called the master gland of the body and its tumours represent 10-15% of all intracranial tumors, with an annual incidence of 0.2-2.8 cases per 100,000 persons. The surgical treatment of pituitary tumours underwent considerable evolution during the past centennial. Since Schloffer's first description, excellent surgeons refined the surgical techniques, utilized hormonal measurements and imaging investigations at different times to define surgical success or failure. To date, transsphenoidal surgery is the approach of choice for over 90% of pituitary tumours, but still transcranial operations are needed even in experienced hands when asymmetrical and large pituitary tumours with minor intrasellar components present. When the indication for surgery stands, the complication rate to date is relatively low, particularly if the surgeon and his or her centre have sufficient experience in the field. Re-operations are generally associated with less favourable outcomes. This is a prospective study of data of all patients operated from September 2013 to September 2016(3years).The demographic factors of Age, Sex is studied along with the the size of adenoma, clinical symptoms before and after surgery, type of surgery, complications and final outcome. The total number of cases was 50, with predominantly males (32 cases) than females (18 cases).The most common mode of presentation was with headache followed by visual changes. Hormonal changes was found in 31 patients with pituitary apoplexy in only 3 cases. DI and CSF leak were coomon post op complications, no mortalities. Tumour resection was complete in 45 patients.
Keywords: TSS, Pituitary Tumor, Sublabial

OP-EDS.02-09

Efficacy of Multilayer Reconstruction After Endonasal Endoscopic Transcribriform Approaches

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Background: Endonasal endoscopic transcribriform approaches aiming to manage various pathologies like olfactory groove meningiomas could reveal large craniotomies opening to the sinonasal cavity at the end of the procedure. Large defects created by this approach between two lamina papyracea could involve resection of crista galli and reveal challenges during reconstruction. The aim of this report is to emphasize the value of multilayer reconstruction techniques for watertight closure after endoscopic transcribriform approaches.
Method: Retrospective analysis of all patients operated between 2009 and 2015 at our tertiary care unit through an endoscopic transcribriform approach. Postoperative outcomes of reconstruction were evaluated by endoscopy and objective CSF testing in nasal secretion.
Results: Fourteen patients were included to the study, 11 requiring surgery for tumor removal (olfactory groove meningioma 6, esthesioneuroblastoma 2, fibrous dysplasia 2 and meningoencephalocele 1) and 3 for CSF fistula closure. Multilayer reconstruction was done in all patients using fascia lata in intradural underlay, extradural underlay and overlay fashion. After 2013 nasoseptal flap was utilized as the last layer in 8 patients. Twelve patients had Draf III and 2 required Draf IIB drainage procedure for frontal sinus aeration during reconstruction. No postoperative clinical CSF leak was encountered, verified by Beta-2-Transferrin test in nasal secretion at 1st month and endoscopic mean follow-up of 21 months.
Conclusion: Multilayer reconstruction of the large anterior skull base defects with facia lata promises a stable and effective closure method after transcribriform approaches. Use of nasoseptal flaps as the last layer improves stability and results in rapid healing.
Keywords: Transcribriform approach, Reconstruction, Surgery outcomes

OP-EDS.03-01

Results of Complications of Endoscopic Transsphenoidal Surgery for Pituitary Adenomas: Retrospective Evaluation of 1630 Cases

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Aim: To present complications of 1630 cases with pituitary adenomas confirmed by radiological imaging methods and endocrinological tests whose surgical interventions were performed in our clinic with endoscopic transsphenoidal approach. We discussed the clinical outcomes of the cases, the length of stay in the hospital and the life quality of the patients in the postoperative period.
Method: Between September 1997 and March 2017, 1630 pituitary adenomas operated with endoscopic transsphenoidal route were screened retrospectively in Kocaeli University Neurosurgery Clinic. Results of endoscopic transnasal approach of pituitary adenomas were assessed by patient medical discharge reports, operation reports, preoperative and postoperative magnetic resonance imaging reports, laboratory results and long-term follow-up.
Results: The treatment goal for adenomas releasing growth hormone and adrenocorticotropic hormone is to remove as much tumor tissue as possible and allow the patient to enter remission without additional treatment need. In our series, the greatest number of complications was cerebrospinal fluid (CSF) fistulas (2.8%). It was followed by transient diabetes insipidus (2.2%), syndrome of inappropriate antidiuretic hormone (ADH) secretion (1.6%), intratumor hemorrhage (1.4%), permanent diabetes insipidus (1.1%) and epistaxis (0.8%), respectively.
Conclusion: These complication rates lead to reduced life quality and cause need for a new surgical or medical treatment in the postoperative period. Endoscopic technique contributes greatly to the excision of adenomas with a wide view of field opportunity compared to the microscopic technique. It is also a technique that shortens the length of stay in the hospital and has a lower complication rate.
Keywords: Complication, Endoscopic, Pituitary adenoma

OP-EDS.03-02

Outcome of Endoscopic Endonasal Transsphenoidal Surgery for Pituitary Adenoma

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Aim: To analyze the outcome of endoscopic endonasal transsphenoidal surgery for pituitary adenoma in terms of improvement in symptoms, hormonal profile, recurrence and complications of this approach.
Method: Study type (observational retrospective,duration); 1st Jan 2014 to 1st Nov 2016.consent taken from ethical research committee. Predesigned proforma filled including age, gender, address of the patient, presenting complaints,hormonal profile, and outcome of patient in terms of improvements in symptoms, hormonal profile,hospital stay and post-operative complications. Patients with pituitary adenoma who underwent endoscopic endonasal transsphenoidal surgery were included in the study while excluding patients other suprasellar lesions.
Results: Total 162 patients were included in this study (151/93.21%) were operated 1st time while (11/6.79 %) were redo cases. Male 88(54.32%) and female were (74/45.68%). age ranged from 20 – 75 years with mean age 36 ± 5 SD. Most common symptom at presentation was headache in 151 (93.20 %),visual loss in 140 (86.42%) patients. Nonfunctional adenomas in (40/24.69%),prolactinoma 46 /28.4%) and acromegaly accounted in 9 cases(5.69%). Average time of surgery was 45 minutes. Post operative visual improvement occurred in140 /(86.42%)patients while headache improved in patients (151/93.21%) and hormonal control was achieves in 121(74.70%). patients Diabetes insipidus occurred in 15/(9.26%) patients, CSF leak in 7/ (4.32%) patients and mortality was one patient died due to secondary infection.
Conclusion: Pituitary adenoma is common in middle age males if endoscopic endonasal transphenoidal surgery is done by experienced hands then there is minimal mortality and morbidity due to procedure.
Keywords: Endoscopic endonasal transsphenodal, Pituitary adenoma, Prolactinoma, Acromegaly

OP-EDS.03-03

Volumetric Assessment for Completeness of Resection Using Intraoperative MRI in Endoscopic Transsphenoidal Pituitary Surgery

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Aim: To assess the role of intraoperative MRI in endoscopic transsphenoidal pituitary surgery with regards to efficacy and volumetric completeness of resection.
Method: Total 220 patients were operated from August 2013 to July 2106 for pituitary macroadenomas. After initial resection a volumetric assessment analysis was done and decision to re-operate was taken intraoperatively. completeness of resection was assessed postoperatively and also at 3 months follow-up. All complications noted. Details study done on requirement of hormonal supplements and complication, CSF leaked, etc
Results: 28 cases were reoperated after assessment of residual mass in the intraoperative MRI. The resection rates increased significantly from 51.3% to 85.6 % in these cases. It did not increase in the risk of complications such as CSF leak and Meningitis. Complication rate was 5.6%, transient DI 20%,ICA injury in one patient.
Conclusion: Intraoperative MRI increases the extent of resection by giving real time information about the residual tumor after initial resection intraoperatively. It is a safe and effective adjunct to achieve better resection rates. It is all real-time assessment, many patients are saved of a re-do surgery. It also Reduces the cost of overall management as well as the duration of treatment if significant tumor tissue was removed at the primary surgery with intraoperative MRI help. It ensures to a greater extent the remission of hormonally active tumors and decreased recurrences over a long term follow-up
Keywords: Intraoperative MRI, Volumetric analysis, Endoscopic pituitary, Extent of resection, CSF leak

OP-EDS.03-04

Intraoperative Lumbar Drainage Facilitates Gross Total Resection of Pituitary Macroadenomas and Reduces the Cerebrospinal Fluid Leak Rate Associated with Endoscopic Transsphenoidal Surgery

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Background: Premature prolapse of the suprasellar extension of a macroadenoma may hinder gross total resection (GTR) and increase the risk of perioperative cerebrospinal fluid (CSF) leak. The aim of this study is to postulate and evaluate whether controlled, intraoperative lumbar drainage of CSF facilitates tumor removal and reduces the rate of CSF leak.
Method: Clinical data of 135 patients with pituitary macroadenoma who received endoscopic transsphenoidal surgery were retrospectively analyzed. Patients were stratified into an intraoperative lumbar drainage group and a control group without CSF drainage. Lumbar catheters were placed preoperatively and CSF was drained during tumor removal for all patients in the lumbar drainage group. GTR rate and CSF leak rate were assessed, both intraoperatively and postoperatively.
Results: Intraoperative cerebrospinal fluid drainage was associated with a higher rate of total tumor resection, with a GTR rate of 92.94% compared to 78.00% (P = 0.0115), especially in macroadenomas with suprasellar extension (Grade A, 100% vs. 89.29%). The rate of intraoperative CSF leak showed a similar pattern of improvement, with a leak rate of 10.59% in drainage group vs. 32% in control group, p = 0.002. No catheter-associated complication was observed in our study.
Conclusion: Intraoperative lumbar drainage may assist surgeons during endoscopic transsphenoidal resection of macroadenomas by achieving a higher rate of GTR and decreasing the rate of perioperative CSF leak, without catheter-associated complication. This data suggests that this technique may be preferable for the endoscopic treatment of patients with macroadenomas.
Keywords: Cerebrospinal fluid leak, Pituitary adenoma, Endoscopic transsphenoidal surgery, Lumbar drainage, Gross total resection

OP-EDS.03-05

Endoscopic Transnasal Transsphenoidal Surgery for Large Pituitary Adenomas

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Background: Large pituitary adenomas(≥3cm) were mostly approached from transcranial surgery, which may create higher mortality and morbidity rates while achieved lower resection results. With panoramic and different angled views, endoscopic transnasal transsphenoidal approach (ETSS) potentially provides another efficient but less risky operation for large pituitary adenomas compared with craniotomy procedures.
Method: From 1998 to 2013, 210 cases of large pituitary adenomas were all exclusively first treated with ETSS. The procedures were tailored in different individualized cases with one or two-nostril, and extended or simple ETSS. The seller floor and skull base were repaired in multi-layers without naso-septal flap.
Results: Post-operative MRI at 3 months showed 160(76.2%) tumors were radically(≥95%) removed. Among 196 cases with pre-operative visual deficits, 171(87.2%) got improved optic functions and 4(2%) deteriorated after ETSS. There was no peri-operative mortality but 8(3.8%) major complications were encountered including 1 ICA injury, 1 seller hematoma, 3 intraventricular hematomas, and 3(1.4%) cases of post-operative CSF leakage. In a mean follow-up of 38.4(3-150) months, 68(32.1%) cases received subsequent treatments with gamma-knife radiosurgery (n=61, 29%), dopamine-agonist (n=18, 8.6%), 2nd or 3rd transsphenoidal surgery (n=10, 4.8%) and craniotomy (n=3, 1.4%) for long-term tumor control.
Conclusion: Compared with craniotomy approach, endoscopic transsphednoial surgery as the first treatment for large pituitary adenomas affords both superior treatment efficacy and acceptable low complication rate. Coupled with radiosurgery or medical control, most cases with this challenging tumor were long-term controlled. Extensive skull base craniotomy for large pituitary adenomas is decreased when the ETSS was properly selected.
Keywords: Large pituitary adenomas, Endoscopic transsphenoidal surgery, Gamma-knife radio-surgery, CSF leakage

OP-EDS.03-06

Quality of Life Following Endoscopic Endonasal Transsphenoidal Surgery for Pituitary Adenoma

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Aim: To investigate the feasibility and safety of using endoscopic endonasal transphenoidal approach for resection of non-funtioning invasive pituitary adenoma.
Method: A retrospective review of 27 cases of non-functioning invasive pituitary adenoma under endoscopic endonasal transsphenoidal surgery (EETS) resections data was collected at the Neurosurgical Department of Zhongshan Hospital Fudan University from May 2014 to December 2015. In the overall, 17 cases are Male, 10 cases are female, and age is between 27-75 years old, average 54 years old. Tumor's diameter is between1.5~5.2cm, average 3.1cm.The postoperative and followed-up data of all cases of patients after endoscopic endonasal transsphenoidal surgery was evaluated.
Results: In this series of 27 cases of IPA resected through endoscopic endonasal approach, 20 cases (74%) achieved gross total resection and 7 cases (26%) achieved subtotal gross resection. The follow-up periods ranged from 3 to 12 months. During this follow-up periods, MRI showed no sign of recurrence in 17 cases, 0 cases were confirmed

recurrence, 7cases were confirmed residual. The preoperative visual impairment in 20 patients was improved in 14 cases (70%) after operation, remained no change in 5 cases (25%), deteriorated in 1 case (5%). Postoperative visual impairment occurred in 28.57% (2/7) of patients, but then improved. Preoperatively 12 patients had hypopituitarism but perfectly improved after operation in 5 cases (42%), the remain cases have significantly improved.
Conclusion: We suggest that the endoscopic endonasal transsphenoidal surgery (EETS) method is a safe and efficient surgical technique for removal of invasive pituitary adenoma, providing the suitable cases to be sure the efficacy of surgery, and also minimal postoperative complications.
Keywords: Invasive pituitary adenoma, Surgery, Endoscopic, Outcome, Follow up

OP-EDS.03-07

Clinical Presentations, Imaging Features and Results of the Endoscopic Endonasal Transsphenoidal Surgery for Pituitary Tumors

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Aim: To evaluate the efficacy and safety of the endoscopic endonasal transsphenoidal surgery in patients with pituitary adenomas.
Method: Between April 2008 and December 2014, 45 pituitary adenomas were operated by the endoscopic endonasal transsphenoidal surgery. The clinical presentations, imaging features and the results of surgery were evaluated and compared with the literature.
Results: 45 patients consisted 19 males and 26 females. The age ranged from 16 to 74 years (the mean age 45.2±14.8 years). It consisted 66,8% nonfunctioning pituitary adenoma and 33.2% functioning adenoma. Clinical presentation was dominated by visual disturbances (53.3%) and headache (48,9%). The rate of marcoadenoma was 93.3%. Cavernous invasion was related in 24,2% the patients. The rate of gross total resection (GTR) was 80%. The rate of GTR for tumors with diameter ≤30 mm was 91.2% and that for the tumors with diameter >30 mm was 45.5%. For the tumors with cavernous invasion, the rate of GTR was 36.4%. The rate of endocrinological cure was 66.67%. There was no mortality. The complications were CSF leakage (6.7%), diabetes insipidus (6.7%), epistaxis (8.9%), sphenoidal sinusitis (4.4%). The recurrent rate was 6.67%.
Conclusion: The pituitary adenoma is predominant in woman. The main clinical presentation is visual disturbances and headache outside the endocrinological symptoms. Almost of pituitary tumors is macroadenoma. The endoscopic endonasal transsphenoidal surgery is effective and safe in treatment this lesions. Cavernous invasion, the diameter of tumor >30mm and optic atrophy is related with the outcome of surgery
Keywords: Pituitary adenoma, Nonfunctioning pituitary adenoma, Functioning pituitary adenoma, Endoscopic endonasal transsphenoidal surgery

OP-EDS.03-08

Management of Arachnoid Herniation After ETSS for Large Pituitary Adenoma

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The endoscope was introduced in clinical neurosurgical practice in 1963 by Gerard neurosurgical practice in 1963 by Gerard Guiot et al. Three decades after Guiot's intuition, Jho and Carrau and their colleagues, described in detail a "pure" endoscopic endonasal transsphenoidal technique, with the endoscope used as the sole visualizing tool throughout the entire procedure. The operation is usually performed through a single nostril up to the anterior sphenoidotomy. It can be considered three main surgical steps**:** a nasal phase, a sphenoidal phase and a sellar phase. Today ETSS is best option for managent of pitutray tumors. At the end of the procedure, once tumor removal has been completed and homeostasis is obtained, a reconstruction of the osteodural defect is performed. The aim of sellar repair is to create a protective barrier, reducing the dead space, and preventing the descent of the chiasm into the sellar cavity.
For reducing delayed CSF leaks, clinicians have attempted various methods of sellar reconstruction Sellar floor reconstruction is usually necessary only if intraoperative CSF leake, prolapse of the suprasellar cistern, or bleeding from the medial aspect of the cavernous sinus occur.
We want intrduce method for managment of arachnoid hernaion after large pituitary adenom ETSS in 17 patients afer 6 month follow-up, in this method we use fat layer and use new technique with Bipolar coagulation, results were very good at the end of follow-up as you will see in full article
Keywords: Arachnoid herniation, ETSS, Pituitary adenoma, CSF leakage

OP-EDS.03-09

Endoscopic, Endonasal Removal of Pituitary Adenoma- My Experience of 26 Cases

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Background: Endoscopic endonasal removal of pituitary adenoma is the first choice surgical procedure now a days. Rather than microscope, endoscope provides better magnification and illumination and gives very good outcome. The purpose of the study to find the benefits of endoscope in relation to microscopic surgery.
Method: We did 26 cases of pituitary adenoma surgery by endoscopic endonasal approach from December 2014 to December 2016.
Results: 26 cases underwent surgery endoscopic endonasal transsphenoidal approach for removal of pituitary adenoma. Residual tumor was seen in 4 cases postoperative follow-up MRI and CT scan. Visual improvement was satisfactory and hormonal

improvement of functional adenoma was nice. Postoperative visual acuity and visual field was improved in 80% cases. There were 30% cases of temporary D.I which was controlled by medications. The average duration of follow-up was 6 to 12 months. There were 23% cases of CSF leak and no mortality.
Conclusion: In comparison to microscopic surgery with other study, less complications and less hospital stay when we have done under endoscopic removal of pituitary adenoma. So endoscopic endonasal pituitary surgery now become a gold standard surgery for most of the pituitary adenoma because of its better advantages.
Keywords: Endoscopic, Endonasal, Pituitary, Adenoma

OP-EXP.01-01

COX-2, IL-15, IL-8, TNF-alfa,IL-1 beta, IL-6,IL-1 alfa Gene Expression in Ligamentum Flavum Hypertrophy

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Aim: To investigate the expression of genes COX-2, IL-15, IL-8, TNF-alfa, IL-1 beta, IL-6 and IL-1 alfa in patients with ligamentum flavum hypertrophy (LFH) and in individuals with no LFH.
Method: Two groups of patients each with 25 individuals were included in the study. The first group was composed of patients diagnosed with spinal stenosis while the second group included patients with lumbar disc herniation. The preoperative MRI's were evaluated for ligamentum flavum (LF) thickness. The surgical LF material removed from each patient was cut into 4 μm slices and stained wtih hematoxylin-eosin. Masson-trichrome staining was used to assess the degree of fibrosis according to the guide proposed by Sairyo et al.
Results: No fibrosis was graded as 0, fibrosis less than 25 % as grade 1, fibrosis between 25-50 % as grade 2, fibrosis between 50-75 % as grade 3 and fibrosis greater than 75 % as grade 4. All histomorphologic examination was made by two independent pathologists. The gene expression process included initial RNA isolation from the surgical material. cDNA synthesis was realized after qualitative and quantitative analysis of isolated RNA molecule. Semiquantitative RT-PCR method was used to analyze the expression of COX-2, IL-15, IL-8, TNF-alfa, IL-1 beta, IL-1 alfa and of alfa actine which was used as housekeeping gene.
Conclusion: We found similar expression of inflammatory cytokines in both lumbar disc herniation group (control group) and in lumbar stenotic group. Only the expression of IL-1 beta was found low in the stenosis group compared to lumbar disc herniation group.
Keywords: Gene expression, Hypertropic ligamentum flavum, Proinflammatory cytokine, Lumbar spinal stenosis

OP-EXP.01-02

Generation of Induced Pluripotent Stem Cells with High Efficiency from Human Embryonic Renal Cortical Cells

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Reprogramming of somatic cells into induced pluripotent stem cells (iPSCs) emerges as a prospective therapeutic angle in regenerative medicine and a tool for drug screening. Although increasing numbers of iPSCs from different sources have been generated, there has been limited progress in yield of iPSC. Here, we show that four Yamanaka factors Oct4 Sox2, Klf4 and c-Myc can convert human embryonic renal cortical cells (hERCCs) to pluripotent stem cells with a roughly 40-fold higher reprogramming efficiency compared with that of adult human dermal fibroblasts. These iPSCs show pluripotency in vitro and in vivo, as evidenced by expression of pluripotency associated genes, differentiation into three embryonic germ layers by teratoma tests, as well as neuronal fate specification by embryoid body formation. Moreover, the four exogenous genes are effectively silenced in these iPSCs. This study highlights the use of hERCCs to generate highly functional human iPSCs which may aid the study of genetic kidney diseases and accelerate the development of cell-based regenerative therapy.
Keywords: Induced pluripotent stem cells (iPSCs), Reprogramming, Human embryonic renal cortical cells (hERCCs)

OP-EXP.01-03

Evaluation of the Preventative Effect of Epidural Fibrosis Development by Using Diclofenac Sodium and Diltiazem in Rat Model

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Background: Epidural fibrosis (EF) can be seen after laminectomy and is very painful. Failed back surgery syndrome (FBSS) is the main cause. Our study investigated reducing effects of diltiazem (DTZ) and diclofenac sodium (DK.Na) in laminectomy related EF.
Method: Forty male Sprague-Dawley rats were used. They were equally divided into four groups of laminectomy, DTZ, DK.Na and DTZ + DK.Na Laminectomy performed on all groups. Dura mater fully exposed. On the first group, only laminectomy was performed. 0,625mg/0,125ml/kg DTZ was applied in diltiazem group, 1,875mg/0,075ml/kg DK. Na was applied in diltiazem group, 0,625mg/0,125ml/kg diltiazem and 1,875mg/0,075ml/kg DK.Na was applied in diltiazem + diclofenac sodium group. All rats sacrificed 4 weeks later. Vertebra removed en-bloc for microscopic assessment. Specimens were stained with hematoksilen-eozin and masson trikrom. Compared fibroblast density in accordance with grade system introduced by He et al. and total fibroblast percent and area of fibroblast percent by using modified Lubina, et al. grade system and fibroblast numbers among groups.
Results: Fibroblast density, fibroblast and area of fibroblast percent significantly lower in DTZ+ DK.Na group than others. Fibroblast numbers significantly lower in DTZ and DTZ+DK.Na groups than others.
Conclusion: We observed by combining DTZ and DK.Na better results were achieved than by separate administration. Assumed that DTZ and DK.Na inhibit inflammation with different pathways

and both effected synergist. DK.Na and DTZ are cheap, easily available and administered. We conclude these drugs can prevent EF. However, more study required for routine clinical usage.
Keywords: Diclofenac sodium, Diltiazem, Epidural fibrosis, Laminectomy

OP-EXP.01-04

Time Dependent Evaluation of Behaviour, Morphology and Molecular Characterization of Perihaematomal Area in Mouse Model of Cerebellar Haemorrhage

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Intracerebellar hemorrhage (ICbH) attributes to hemorrhaged blood to the brain tissue causing mortality. The perihaematomal area is defined as tissue around the hematoma in ICbH which has great clinical relevance because the presence of ischemia which induces glutamate release and free radical generation due to oxidative stress in perihaematomal area would drive clinical treatment considerations. Although there have been a few reports on the occurrence of perihaematomal around the ICbH, the precise mechanisms involved therewith still remains to be explored. Therefore, in the present study, adult male Swiss albino mice were divided into seven groups based on the time dependent manner and was stereotactically infused with collagenase type VII (0.4U/µl of saline) unilaterally in to the cerebellum, following anesthesia. Motor deficits were assessed at 1, 3, 7, 14 and 21 days after collagenase infusion. Then evaluated the neuronal morphological changes and elucidating the role of genes related to oxidative stress, glutamate and GABA around in the perihaematomal regions. The results suggest that at the perihaematomal area at 3 and 7 days implying that the neurons likely die via apoptosis through imbalance in anti-oxidative enzymes, GABA and glutamate excitotoxicity. These findings lead new data on the mechanisms underlying perihaematomal neuronal damage as well as oxidative stress can be prevented or treated after induction of ICbH.
Keywords: Intracerebellar hemorrhage (ICbH), Perihaematomal area, Mouse model, Oxidative stress, Glutamate, GABA

OP-EXP.01-05

Dose Depended Effect of 2-APB in Cerebral Vasospasm After Experimental Subarachnoid Hemorrhage and Early Brain Injury in Rats

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Background: Cerebral vasospasm remains to be a serious problem that affects morbidity and mortality in patients with SAH in neurosurgery. Our study aimed to demonstrate the role of TRP channels of Ca++ in the etiology by using 2-APB and to determine the effective dose range of an unstudied pharmacological agent that can limit vasospasm.
Method: Experimental study was performed in 32 Sprague-Dawley rats in 4 groups. Group 1**:** Sham (n=8), Group 2**:** SAH; blood drawn from right femoral artery was injected into cisterna magna. Group 3**:** 2APB 0.5 (n=8), SAH + intraperitoneal administration of 0.5mg 2-APB. Group 4**:** 2APB2 (n=8), SAH + intraperitoneal administration of 2mg 2-APB. Rats were sacrificed after 24 hours and SOD, GPx, MDA, TNF, IL1B was measured in the brain tissue and the serum. In the histopathological investigation of brain tissue, the diameter and wall thickness of basilar artery (BA) was measured, and apoptotic cells were counted in hippocampus after staining with Caspas method.
Results: Autologous arterial blood injection (SAH) into cisterna magna lead to vasospasm in rats. BA lumen diameter and wall thickness in rats, which received 2 mg 2-APB intraperitoneally, were comparable to those in rats without SAH.
Conclusion: Intraperitoneal administration of 2-APB 2 mg/kg prevents vasospasm. We think that the role of TRP channels in the etiology of vasospasm may be more than expected. We think that 2APB has favorable effects and prevents vasospasm in experimental SAH model and further studies on this issue are warranted.
Keywords: Cerebral vasospasm, 2-Aminoethoxydiphenyl borate, Subarachnoid hemorrhage

OP-EXP.01-06

Prophylactic Effects of Silver Nanoparticles in a Rat Model of Spinal Stabilization and Infection

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Aim: To evaluate prophylactic effects of silver nanoparticles in a spinal instrumentation and infection model.
Method: Thirty-two Sprague-Dawley rats were divided into 4 groups**:** microscrew (M), infection (I) (microscrew with Staphyloccus aereus-SA and Pseudomonia aeriginosa-PA), infection/transporter (IT) (microscrew, SA/PA, maltose solution, transporter of silver nanoparticles-AgNP-), and infection/silver (IS) (microscrew, SA/PA, AgNP in a concentration of 0.5 mg/kg). After 15 days, subcutaneous tissue, muscle and bone samples were taken and screws were removed for cultures. Operated segment was extracted to grade inflammation histologically. Lung, liver, kidney and brain samples were taken to evaluate silver deposition.
Results: There was not any positive culture in M group. SA and PA were yielded in local cultures of all subjects in I, IT and IS groups. There was one positive blood culture in I, 6 in IT, and 2 in IS groups.

There was not significant difference in culture results of I, IT and IS groups except the blood cultures. Blood culture positivity was significantly higher in IT group than I and IS groups. Histological inflammation grades were not significantly different between the groups except M group. There was not silver deposition in any organ.
Conclusion: Use of AgNP in that concentration did not provide prophylaxis according to infection group. However, it provided significant prevention of systemic infection according to use of transporter maltose solution. Possibly, maltose acted as a culture media for microorganisms. Repeat of the study with an inert transporter that had not nutritious effect could provide prophylaxis.
Keywords: Prophylactic effect, Silver nanoparticles, Rat model, Spinal stabilization, Infection

OP-EXP.01-07

Metastatic Brain Tumor Differences Based on Embryonic and Adult Stem Cell-Tissues of Origin

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Metastatic Brain Tumors, representing the most common tumor of the brain, challenge our preventive abilities, diagnostic and treatment knowledges, and most importantly these tumors challenge us continuously with the lack of ability in understanding their invading, evasion and dissemination mechanisms which will help us prevent their progress.
Of all the tumors with the potential to metastasize to brain, we diagnose histopathologically most frequently as the organ-tissue of origin**:** skin, lung, breast, colon, and prostate. These tumors have differences in their embryonic and or adult stem cells of origin and supporting cells in their tumorigenesis process, however, all these tumors have in common the target organ, brain. It is this common denominator that although this is the organ that is affected yet it has primary (stem cells) and supporting cells that interact with cells from the tumor of origin, mostly via cytokine-mediated mechanisms and provide the grounds for metastatic cells to invade and grow in the brain.
Even when there are similarities in the tissue of origin and or anatomical location, differences exist in the mechanism of evasion and dissemination for tumors arising from the same organ and or from the same tissue of embryonic origin, of these cells that have the potential to metastasize to the brain. These differences other than that of embryonic and or adult stem cells of origin exist in the mechanism of invasion, evasion of immunologic control and dissemination of the primary tumor. It is the scope of the lab-work to present some of these differences.
Keywords: Metastatic, Brain, Tumors, Cell of origin

OP-EXP.01-08

The Prevention Effect of Pirfenidone on Epidural Fibrosis in the Post-Laminectomy Rat Model

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Background: Postlaminectomy epidural fibrosis is implicated as a main case of failed back surgery syndrome and associated with increased risk of complications during revision surgery. Pirfenidone is a broad-spectrum anti-inflammatory and anti-fibrotic molecule that has been shown to inhibit the fibrosis progression in patients with idiopathic pulmonary fibrosis and animal models.
Method: Thirty two Wistar albino rats were divided randomly into four equal groups**:** control, spongostan, systemic pirfenidone and local pirfenidone groups. In all groups, total L1-L3 laminectomy was performed. At 4 weeks post surgery, the animals euthanized and their tissue samples at the laminectomy site were assessed both immunohistochemistry of anti-IL-1, anti- TNF-α and anti-α-SMA antibodies on epidural fibrosis of animal groups and histological evaluation for; dura thickness, epidural fibrosis grading, scar tissue consistency and inflammatory response grading and presence of arachnoidal involvement. All data were evaluated by statistically.
Results: Our data suggests that rats treated with pirfenidone at 4 weeks post-laminectomy had less, dura thickness, epidural fibrosis, scar tissue consistency and inflammatory response and arachnoidal involvement in comparison with the control and spongostan groups. Pirfenidone treated groups show weak labeling for anti-IL-1, anti-TNF-α and anti-α-SMA antibodies than control and spongostan groups. Moreover, by the local applicaton of pirfenidone we obtained better results than systemic administration for all parameters.
Conclusion: The results of our study suggested that pirfenidone has anti-fibrotic effects on epidural fibrosis, especially its effectiveness increased when it is used locally.
Keywords: Laminectomy, Epidural fibrosis, Pirfenidone, Immunohistochemistry IL-1,TNF-α, α-SMA

OP-EXP.01-09

Brain Blood Barrier Disruption in the Treatment of Central Nervous System Tumors

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Brain cancer is accompanied by high mortality rate and dismal prognosis. Its medical treatment presents as a major challenge to modern medicine as most therapeutic agents cannot reach the brain tissue due to their inability to cross the blood-brain barrier (BBB). The BBB presents as a paradoxical structure, physiologically protective and, simultaneously, a therapeutic hindrance. Thus, the transient, reversible and focused disruption of this barrier, combined with the administration of therapeutic agents, builds the conceptual basis for various treatment strategies. Through

the analysis of the results of published studies and review articles concerning the different disruptive techniques, the author intends to summarize the main characteristics of some of these techniques and partake in the increase of the knowledge about the role that these play as therapeutic strategies for brain cancer. The analysis of several studies shows the importance of these BBB disruptive techniques as potential therapeutic maneuvers, showing control in tumor progression and increasing the progression-free survival. Nevertheless, more clinical studies are needed for evaluation of the efficacy and, above all, the security of these disruptive techniques.
Keywords: Blood-brain barrier disruption, FUS BBBD, BBBD microbubbles

OP-EXP.02-01

Thymoquinone is an Effective Treatment Through Inhibition of p-STAT3 in a Murine Intracerebral Melanoma Model

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Background: Melanoma is a common and deadly tumor that upon metastasis to the central nervous system has median survival duration of less than 5 months. Thymoquinone has been reported to be effective treatment in various types of malignancies. However, there is no data on treatment of Thymoquinone in intracerebral melanoma. We hypothesized that Thymoquinone would be efficacious in a murine intracerebral melanoma model and this effect is evident through inhibition of p-STAT3.
Method: To assess the efficacy of Thymoquinone on B16/F10 melanoma cells, *in vitro* we performed ATP assay for cytotoxicty, flow cytomety and Acridine-orange staining for apoptosis, Commet assay for genotoxicity, CM-H2DCF-DA (2,7-dichlorodihydrofluorescein) for intracellular reactive oxidants and ELISA for inflammatory cytokines. Western blotting was performed to assess the expressions of p-JAK2, p-STAT3, caspase-3, bax, Bcl-2, survivin. Effect of Thymoquinone was investigated in an established intracerebral melanoma in C57BL/6J mice.
Results: The median survival of mice with intracerebral melanoma treated with Thymoquinone increased from 9 days to 16 days (p=0.008). Thymoquinone enhanced cytotoxicity in B16/F10 cells in a dose-dependent manner. Thymoquinone also induced apoptosis, DNA damage and increase in intracellular reactive oxygen species. Thymoquinone inhibited p-STAT3, resulting in apoptosis through regulation of pro- and anti-apoptotic proteins.
Conclusion: Thymoquinone would be effective in intracerebral metastatic melanoma model in mice. This is evident particularly by inhibition of p-STAT3. Further investigation is warranted to assess the efficacy of Thymoquinone in treatment of patients with metastatic brain disease.
Keywords: Apoptosis, Melanoma, p-STAT3, Thymoquinone

OP-EXP.02-02

Differential Expression of Folate Receptor 1 in Medulloblastoma and Its Relationship to Clinicopathological Characteristics and Targeted Therapy

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Medulloblastoma is the most common malignant CNS tumor of childhood. High expression of folate receptor 1 (Folr1) was observed in some malignant epithelial tumors. However its expression and the role for clinicopathological significance and targeted therapeutic potential in MB still remain unclear. Currently we have detected the expression of Folr1 in MB and identified its clinical, pathological and radiological values to be considered as a biomarker for diagnosis of MB. Then we studied the targeted treatment of MB with Folr1 targeted cytarabine (Folr1-Ara-C) both in vitro and in vivo. Folr1 were overexpressed in MB, while the level correlated with pathological subtypes. Folr1 expression was positively correlated with CSF spreading, Ki-67, MMP9, pathological subtypes and serum Folr1. Factors of age, CSF spreading, Ki-67, MMP9, strong Folr1 expression and pathological subtypes were found to be the independent prognostic values for patients with MB. Serum Folr1 showed rational sensitivity and specificity in demonstrating histological types. Folr1-Ara-C led to changes in cellular proliferation and invasion with down-regulation of MMPs proteins and activation of apoptosis in vitro. Using mouse xenografts, Folr1-Ara-C suppressed tumor growth and improved survival by MRI and PET/CT. Immunohistochemical analysis showed decreased Ki-67 and MMP9 index suggesting the effects on proliferation and invasion in vivo. Folr1 may be considered as a predictive candidate for histological types and serum Folr1 may be a novel non-invasive biomarker. The application of Folr1-Ara-C contributed to be one kind of targeted therapies for MB.
Keywords: Medulloblastoma, Folate receptor 1, Prognosis, Biomarker, Targeted therapy

OP-EXP.02-03

Genomic Alterations in Sporadic Pituitary Adenomas

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To better understand the genetic underpinnings of sporadic pituitary adenomas, we analyzed 175 pituitary macroadenomas by next-generation sequencing to identify mutations, insertions/deletions, and somatic copy number alterations (SCNAs). We identified two classes of tumors, one with SCNAs across a large fraction of the genome and a second class with relatively few arm-level SCNAs. Levels of genomic disruption correlated with tumor pathology, as approximately 70% of the genomically disrupted subclass were functional adenomas or atypical null-cell adenomas, compared to only 13% of the genomically quiet group were functional adenomas. Interestingly, 80% of silent corticotroph adenomas were genomically disrupted, despite their clinically nonfunctional status. Across all adenomas, a low mutational burden was observed. GNAS mutations remained the most common recurrent mutation in growth hormone-secreting adenomas. These results contribute to the growing repertoire of molecular data that have been generated in pituitary tumors, and will guide future efforts of pituitary tumor classification and risk-stratification.

Keywords: Pituitary adenoma, Genomics, Next-generation sequencing, Molecular classification

OP-EXP.02-04

Evaluating the p-STAT3 and PHH-3 Expressions in WHO Grade I Benign Meningiomas

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Background: Recent evidences have shown that mitotic index and MIB1 labeling(Ki-67) index may not be accurate in determination of proliferation and are difficult to be standardized. Recently, Phosphohistone-H3(PHH-3) and phosphorylated-signal transducer and activator of transcription3 (p-STAT3) have been proposed to be alternative methods for evaluating the proliferation activity and prognosis, respectively. In this study, we investigated the expressions of PHH-3 and p-STAT3 as well as various immunohistochemical markers in benign meningiomas.
Method: Medical records were retrospectively reviewed in 24 patients who were operated for WHO Grade I benign meningiomas. The characteristics of patients and tumors were reviewed, and immunohistochemistry for MIB1, PHH-3, p-STAT3 and PR was performed. Correlation between immunohistochemical parameters and also their relation with patient demographics were investigated.
Results: Among 24 patients, 12 were female and 12 were male. The median age was 56 years (range,18-70 years). Seventeen meningiomas were located supratentorial and seven were in infratentorial. Histological types were transitional in 18 patients, angiomatous in 3, fibrous in 2, and psammomatous in 1. The median values of mitotic index,MIB1, PHH-3 and p-STAT3 were 1, 5, 1, and 5.5, respectively. There was no correlation between different immunohistological markers and no association between patient and tumor characteristics and immunohistochemistry.
Conclusion: Our preliminary results suggest that immunohistological markers investigated in this study are not predictive for tumor behavior. This may be explained that the tumor grade is the most significant predictor compared to other immunohistological markers. However, this warrants further investigation with a larger cohort and evaluation of association of these factors with recurrences and survival times.

Keywords: Meningioma, Mitotic index, MIB1 labeling index, PHH-3, p-STAT3

OP-EXP.02-05

The Response to Chemoradiation Therapy in Glioblastoma Multiforme Patients in Relation to MGMT Promoter Methylation Status: A Study from a Single Saudi Center

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OP-EXP.02-06

The Pivotal Ischemic Mechanism in the Proliferation and Growth of Glioma – The Hypoxia Induced Glioma Derived Exosome and miRNA-199a-3p Increased Ischemic Injury of the Neurons by Inhibiting mTOR Pathway

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Background: The mechanism about the glioma remains unclear. Recent studies suggested that glioma would cause the hypoxic microenvironment in the areas of intra- and para-tumor. We hypothesize that glioma has the unique mechanism of aggravating the hypoxic injury of neural cells, which is related with the progression of glioma.
Method: We observed if there was any hypoxic injury in the para-tumor area through the imaging and pathological examination. Also we carried out the in vitro molecular experiments using C6 glioma cell line and neuron cells.
Results: In this study we found the definite hypoxic injury of nerve cells in the para-glioma area, which suggested that glioma had the specific mechanism of aggravating the hypoxic injury of the neural cells around the tumor. In indirectly co-culture system, hypoxia would enlarge the ischemic injury of neurons. Moreover, hypoxia could activate HIF-1α of C6 glioma cells and promote the expression of miRNA-199a-3p in Hypoxia Induced Glioma Derived Exosome (HIGDE) released by C6 cells. The induced miRNA-199a-3p in HIGDE could aggravate the OGD(Oxygen and Glucose Deprivation) ischemic injury in normal cultured neurons by inhibiting the transcription of mTOR, which suggest HIGDE derived from glioma cells had the definite ability of increase the ischemic injury of the normal neurons.
Conclusion: This study revealed the actual ischemic mechanism in the proliferation and growth of glioma. The experiments supported that HIGDE and miRNA-199a-3p may exacerbate the hypoxic injury of neurons in vivo, which may be an important insight and a potential therapeutic target against brain glioma.

Keywords: Glioma, Exosome, Ischemic injury, mTOR pathway

OP-EXP.02-07

Expression of miRNA-21, miRNA107, miRNA-137 and miRNA29b in Meningioma

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Background: Meningiomas are among the most common intracranial tumors, accounting for 30% of all tumors of the central nervous system. Recent studies analyzing microRNA (miRNA) profiles and functions in cancer have provided valuable information about the molecular pathogenesis of several tumor types, including glioblastoma, hepatocellular carcinoma, and breast, lung, colon, and prostate cancer. miRNAs are a family of small, endogenous, noncoding RNAs of 18 to 25 nucleotides. In this study, we carried out a genome-wide array screen comparing miRNA-21, miRNA107, miRNA137 and miRNA-29b expression in meningiomas.
Method: A total of 50 meningioma patients (16 men and 34 women) aged between 32 and 80 years were included. The study was conducted at Istanbul Research and Training Hospital Neurosurgery Clinic.
Results: Our results have shown a significant increase in miRNA-21 expression with increasing histopathologic grade, while there was a significant reduction in miRNA-107 expression with the increasing histopathological grade. miRNA-137 and miRNA-29b expression did not differ significantly according to histopathologic grade.
Conclusion: The subject of our study, i.e. the association between miRNA expression and meningioma, is continuously gaining more importance in the wider context of the recent developments in genetic treatments.
Keywords: Meningioma, miRNA-21, miRNA107, miRNA137, miRNA-29b

OP-EXP.02-08

Novel Biomarkers for Non-Functioning Invasive Pituitary Adenomas were Identified by Using Analysis of microRNAs Expression Profile

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The microRNAs (miRNAs) are involved in multiple pathological processes among various types of tumors. However, the functions of miRNAs in benign brain tumors are largely unexplored. In order to explore the pathogenesis of the invasiveness in non-functional pituitary adenoma (NFPA), the miRNAs expression profile was analyzed between invasive and non-invasive non-functional pituitary adenoma by miRNAs microarray. Six most significant differentially expressed miRNAs were identified including four upregulated miRNAs hsa-miR-181b-5p, hsa-miR-181d, hsa-miR-191-3p, and hsa-miR-598 and two downregulated miRNAs hsa-miR-3676-5p and hsa-miR-383. The functions and corresponding signaling pathways of differentially expressed miRNAs were investigated by bioinformatics techniques, including Gene Ontology (GO) and Kyoto Encyclopedia of Genes and Genomes (KEGG) pathway analysis. The result of GO analysis indicates regulation of voltage-gated potassium channel activity, positive regulation of sodium ion transport, positive regulation of GTPase activity, negative regulation of Notch signaling pathway, etc. KEGG pathway reveals a series of biological processes, including prolactin signaling pathway, endocrine and other factor-regulated calcium reabsorption, fatty acid metabolism, neuroactive ligand-receptor interaction, etc. The miRNAs hsa-miR-181a-5p was verified by quantitative real-time PCR, and the expression level was in accordance with the microarray result. Our result can provide the evidence on featured miRNAs which play a prominent role in pituitary adenoma as effective biomarkers and therapeutic targets in the future.
Keywords: microRNAs, Expression profile, Invasive pituitary adenoma, Nonfunctioning pituitary adenoma, Pathogenic mechanism

OP-EXP.02-09

Deficiency of miRNA-146a-5p Contributes to Malignant Transformation of Bone Marrow Derived Mesenchymal Stromal/Stem Cells in Intracerebral Xenograft Tumor by Targeting hnRNPD

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Malignant transformation of tumor stroma cells has been reported already, but mechanisms is remaining unclear. In this study, we established three intracerebral orthotopic xenograft tumor models by transplanted glioma stem/progenitor cells and glioblastoma specimens to enhanced green fluorescent protein (EGFP) nude mice and chimeric nude mice. With different fluorescent protein gene markers in tumor cells (Red fluorescent protein, RFP) and host (EGFP), three EGFP-expressing bone marrow derived mesenchymal stromal cells (MSCs) were sorted from different intracerebral xenograft models, showing characteristics of immortality and malignancy. High-throughput RNA-sequence results showed 19 miRNAs up-regulation and 24 miRNAs down-regulation significantly. MiRNA-146a-5p was one of the downregulated miRNAs, and overexpression of it can reverse malignancy of transformed cells, including proliferation, cloning, invasiveness and oncogenicity. Double-luciferase assay showed that miRNA-146a-5p directly acted on oncogene hnRNPD which was overexpressed in cancerous MSCs. SiRNA targeting hnRNPD could significantly inhibit the proliferation of cancer cells and arrest the cell cycle at G2/M phase, and significantly increased the early apoptosis of cells. In summary, deficiency of miRNA-146a-5p contributes to the malignant transformation of host bone marrow derived mesenchymal stromal cells in the intracerebral xenograft tumors by overexpressing the tumorigenesis gene, hnRNPD.
Keywords: Malignant transformation, Mesenchymal stromal cell, MiR-146a-5p, Glioma stem cell, Fluorescent tracing

OP-EXP.02-10

Hypoxic Preconditioning Induced Angiogenesis Through HIF-1α Accumulation and VEGF expression in Permanent Middle Cerebral Artery Occlusion Rat Model

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Background: Brain microvascular endothelial cells (BMVECs) are critical for maintain brain homeostasis and cerebrovascular remodelling. This study investigated whether hypoxic preconditioning (HP) induces angiogenesis in established experimental model of pure BMVECs isolation and permanent middle cerebral artery (MCA) occlusion model using rats, both in wild type (WT) and hypoxic response element (HRE) transgenic rats.
Methods: Modification of isolation method was using bovine serum albumin gradation, not Dextran-70 that generally used, to separate clusters into single and pure BMVECs. HP performed under normobaric conditions (7% O2 for 2 h), 2 weeks before focal cerebral ischemia induction. Rats were divided into 4 groups, (A group) WT rats without HP, (B) WT rats with HP, (C) HRE rats without HP and (D) HRE rats with HP. Infarct volume evaluated by quantitative histopathology. Further, the mechanisms was evaluated using hypoxia inducible factor-1 (HIF-1) α and vascular endothelial growth factor (VEGF).
Results: The B group ischemic volume significantly smaller Vs. A group (B: 66.0±7.3, A: 87.6±14.8, mm3±SD, respectively). The D group volume significantly smaller Vs. C group (D: 28.8±7.9, C: 79.9±14.3; p<0.01, respectively). infarct volume of hemisphere in HP group was significantly smaller than in non-HP. Primary culture of the BMVECs showed that growth rate of the cells treated with HP is approximately 2x faster than that of non-HP group. At the protein level revealed, HIF-1α and VEGF with hypoxic micro- environment were significantly increased compared with those without one.
Conclusion: HP shrinked the infarct area in MCA occlusion rat model. The phenomenon of induction of angiogenesis might linked HP with vascular remodeling which resulted in the accumulation of HIF-1α and production of VEGF as its downstream target.
Key Words: Angiogenesis, HIF-1α, VEGF, BMVECs, MCA occlusion rat model

OP-EXP.03-01

Study of Macro- and Microelements Composition in the Biological Media, Clinical and Neurological Changes in Patients with Outcomes of Traumatic Brain Injury

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The data of 83 patients with consequences of TBI. All patients were carried out laboratory investigations to determine the macro- and microelements (K, Na, Cl, P, Mg, Fe) in the blood serum (BS) and in CSF. Among the examined patients in 37.3% it has been diagnosed with cerebral arachnoiditis, in 25.3% it has been diagnosed chronic subdural hematoma, in 15 patients 18.1% it has been diagnosed epilepsy, in 13 patients 15.7% it has been diagnosed arachnoid cyst and in 3 patients 3.6% it has been diagnosed chronic vegetative status. Prior to treatment in the BS of patients it has been identified the following changes of macro- and microelements, i.e. reduction of Ca – at 86,7% of patients, K at 21.7% of patients and Cl at 45.8% of patients. It has been revealed an increase average of P at 48.2% of patients, Fe at 71.1% of patients, Mg at 77.1% of patients and Na at 71.1% of patients. In the CSF tests of these patients it has been observed some distinctive changes compared with those in the BS, i.e. amounts Ca has been decreased in 89,2% of patients and amounts of elements such as K and Cl were low in all patients. Minimal and maximal amounts of P, Fe and Na in the CSF were normal, but the average amounts of P and Na were high (41% and 86.7% accordingly). An increased amount of Mg in the CSF has been noted in 38.6% (32) of patients in comparison with maximal indexes.
Keywords: Macroelement, Microelement, CSF, Cosequences of TBI

OP-EXP.03-02

Effects of Quercetin and Mannitol on Erythropoietin Levels in Rats Following Acute Severe Traumatic Brain Injury

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Aim: To investigate the normal values of EPO and neuroprotective effects of quercetin and mannitol on EPO and hematocrit levels after acute severe TBI in rat model.
Method: A weight-drop impact acceleration model of TBI was used on 40 male Wistar rats. The animals were divided into sham (group I), TBI (group II), TBI + quercetin (50 mg/kg intravenously) (group III), and TBI + mannitol (1 mg/kg intravenously) (group IV) groups. The malondialdehyde, glutathione peroxidase, catalase, EPO, and hematocrit levels were measured 1 and 4 h after injury. Two-way repeated measures analysis of variance and Tukey's test were used for statistical analysis.
Results: The malondialdehyde levels decreased significantly after administration of quercetin and mannitol compared with those in group II. Catalase and glutathione peroxidase levels increased significantly in groups III and IV. Serum EPO levels decreased significantly after mannitol but not after quercetin administration. Serum hematocrit levels did not change significantly after quercetin and mannitol administration 1 h after trauma. However, mannitol administration decreased serum hematocrit levels significantly after 4 h.
Conclusion: This study suggests that quercetin may be a good alternative treatment for TBI, as it did not decrease the EPO level.
Keywords: Traumatic brain injury, Quercetin, Mannitol, Erythropoietin, Hematocrit

OP-EXP.03-03

Histopathological Analysis of Tamoxifen on Epidural Fibrosis

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Background: Epidural fibrosis is a challenging topic in spinal surgery. This phenomenon constitutes the main etiology behind "post-laminectomy syndrome" or "failed-back surgery", which leads to persistent back and leg pain in association with compression and/or stretching the nerve root or the dura. The exact mechanism of action in epidural fibrosis is complex and remains uncertain. Excessive deposition of collagen, fibronectin, and dermatan sulfate known as "extracellular matrix", and decrease of tissue cellularity results in epidural fibrosis are blamed. The most investigated and important actor in epidural fibrosis as well as in other forms of aberrant wound healing is assumed to be the transforming growth factor-1ß (TGF-1ß) formation. Tamoxifen (Tam), a synthetic nonsteroidal antiestrogen used in breast cancer is also effective in inhibiting fibroblast proliferation via downregulation of TGF-ß.
Method: Thirty adult male rats were randomly divided into three groups. Laminectomy was per-formed in the control group. Spongostan was placed in the operation lodge after laminect-omy in the second group. In the treatment group, TAM was administrated orally after lami-nectomy. Fibroblast count, epidural fibrosis and arachnoidal involvement were evaluated and graded histopathologically.
Results: Results revealed fibroblast count, epidural fibrosis grade and arachnoidal involvement in the rats treated with TAM were significantly less than the control and spongostan group and the differences were statistically significant. Although, arachnoidal involvement was observed in a subject in tamoksifen group, the differences between all groups weren't statistically significant.
Conclusion: Tamoxifen reduced epidural fibrosis and arachnoideal involvement after laminectomy in rats.
Keywords: Epidural fibrosis, Laminectomy, Tamoxifen, Rats

OP-EXP.03-04

Preliminary Results of an in Vivo Intervertebral Disc Regeneration and Degeneration Study in a Rabbit Model

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Aim: To examine the effect of bioactive peptide amphiphile nanofiber gels in a rabbit in vivo disc degeneration model.
Method: Fifty New Zealand rabbits were used in the in vivo animal model and its suitability for IVDD (intervertebral disc degeneration) and regeneration studies were investigated. In one group, immediately after degeneration and in the other group 2 weeks after degeneration peptide gels were injected. Degeneration were analyzed histopathologically and radiologically according to the intervertebral disc heights after 1 month.
Results: IVDD model was successfully developed. Level of degenerated discs and disc heights were confirmed by MR images. According to the preliminary results, in terms of radiological results, peptide gels were shown to be effective to decrease or preventing the disc degeneration.
Conclusion: Peptide gels can be used safely via injection without any adverse effect such as immunogenic reaction. Due to the preliminary results of our study, extracellular matrix mimetic peptide nanofiber gels can be used as a novel treatment method for the IVDD.
Keywords: Disc degeneration, Rabbit model, In vivo study, Peptide gel

OP-EXP.03-05

Inhibition of Phosphatase and Tensin Homolog Deleted on Chromosome 10 Decreases Rat Cortical Neuron Injury and Blood-Brain Barrier Permeability, and Improves Neurological Functional Recovery in Traumatic Brain Injury Model

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Background: Recent evidence has supported the neuroprotective effect of bpV (pic), an inhibitor of phosphatase and tensin homolog deleted on chromosome 10 (PTEN), in models of ischemic stroke. However, whether PTEN inhibitors improve long-term functional recovery after traumatic brain injury (TBI) and whether PTEN affects blood brain barrier (BBB) permeability need further elucidation. The present study was performed to address these issues.
Method: Adult Sprague-Dawley rats were subjected to fluid percussion injury (FPI) after treatment with a well-established PTEN inhibitor bpV (pic) or saline starting 24 h before FPI. Western blotting, real-time quantitative PCR, or immunostaining was used

to measure PTEN, p-Akt, or MMP-9 expression. We determined the presence of neuron apoptosis by TUNEL assay. Evans Blue dye extravasation was measured to evaluate the extent of BBB disruption. Functional recovery was assessed by the neurological severity score (NSS), and Kaplan-Meier analysis was used for survival analysis.
Results: PTEN expression was up-regulated after TBI. After bpV (pic) treatment, p-Akt was also up-regulated. We found that bpV (pic) significantly decreased BBB permeability and reduced the number of TUNEL-positive cells. We further demonstrated that PTEN inhibition improved neurological function recovery in the early stage after TBI.
Conclusion: These data suggest that treatment with the PTEN inhibitor bpV (pic) has a neuroprotective effect in TBI rats.
Keywords: Traumatic brain injury, Phosphatase and tensin homolog deleted on chromosome 10, Neurological function, Blood-brain barrier

OP-EXP.03-06

The Effects of Dantrolene and Methylprednisolone on Motor Evoked Potentials in Experimental Spinal Cord Injury

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Background: Spinal cord injury (SCI) continues to be a serious medical and social problem that results in major losses in neuromotor functions. Methylprednisolone (MP) is the most frequently used pharmacological agent in the treatment of acute SCI. Neuroprotective effects of dantrolene (DNT) which is a ryanodine receptor agonist of Ca++ channels has been shown in previous studies. This study aimed to investigate and compare the effects of DNT and MP alone and in combination in SCI.
Method: Experimental study was performed in 30 New Zealand rabbits in 5 groups. Group 1**:** Sham (n=6), laminectomy. Group 2**:** Trauma (n=6), laminectomy + Traumatic injury. Group 3**:** DNT (n=6), Trauma + intraperitoneal administration of DNT (10 mg/kg). Group 4**:** MP (n=6), Trauma + intraperitoneal administration of MP (30 mg/kg). Group 5**:** DNT+MP (n=6), Trauma + intraperitoneal administration of DNT (10 mg/kg) and MP (30 mg/kg) Trauma was formed by placing a balloon angioplasty catheter after T10 laminectomy and waiting for 5 minutes at 2 atm. Consecutive primary stimulations with transcranial magnetic stimulator were measured with needle EMG from lower extremities, and highest MUP values were recorded.
Results: Paraparesis was developed in all groups with traumatic injury. MUP responses increased in the treatment groups. In all three treatment groups apoptotic cell count and TOS levels decreased compared to sham group.
Conclusion: Both drugs have favorable effects of MUP responses. We recommend studying multiple drug treatments instead of searching for a single magical drug and employing experimental neurophysiological methods in SCI.
Keywords: Spinal cord injury, Dantrolene, Motor evoked potentials

OP-EXP.03-07

Preventive Role of Trigeminal Ganglion Ischemia on Activated Trigemnocardiac Reflex Induced Heart Rhythm Disorders Following Subarachnoid Hemorrhage: Experimental Study

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Background: It is widely perceived that trigeminocardiac network is essential for the regulation of intracranial pressure and heart rhythms. This study examine the effects of ichemic insuts of trigeminal ganglion on heart rates and cardiac arrest following subarachnoid hemorrhage.
Method: Twenty-four hybrid rabbits were used in this study. Five rabbits (n=5) were used to determine Normal structures of the trigeminal ganglion was observed five animals; five rabbits of received an 1cc saline injection into the cisterna magna for SHAM and the remainigs 13 animals received 1cc autolog arterial blood into the cisterna magna for study group. Heart rhythm values of all were recorded ECG monitorisation. Painfull stimulations were applied with a needle to upper labium of animals and EKG changes were recorded. The number of normal (NN) and degenerated neuron (DN) density of TGGs and heart rhythm values were analysed statistically.
Results: The mean heart rate values and DN were measured as 245±25/Min and 13±3/mm3 in control (G1), 198±21/Min and 42±9/mm3 in SHAM (GII), 220±13/Min and 1265±102/mm3 in slight neurodegeneartion (GIII, n=6) and 294±22/Min and 2345±321/mm3 in prominent neurodegeneration developed animals (GIV, n=8). Interestingly, in the dead rabbits, the degenerated neuron density of the TGG was lower and heart rhythms normal animals ($p<0.001$).
Conclusion: There is an inverse relationship between DN density of the TGG and heart rate variabilities. The less DN density of the TGG could permit the more increased intracranial pressure induced bradicardia and cardiac arrest.
Keywords: Trigeminocardiac reflex, Trigeminal ganglion ischemia, Subarachnoid hemorrhage

OP-EXP.03-08

Neuroprotective Effects of Intrathecal Administered Riluzole in Rat Hemisection Spinal Cord Trauma Model

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Background: Spinal cord injury is a result of mechanical disruption of spinal cord tissue. Although there are many drugs studied in SCI to provide neuroregeneration, an effective method of treatment has not yet been identified. The aim of this study is to examine the effect of riluzole administred intratecally on neuronal protection and regeneration.
Method: Fourty rats were divided into 8 groups so that each group of 5 rats. In group 1, only total laminectomy was performed. In group 2, no drug was administred. In group 3, Following spinal cord injury; riluzole was administred intraperitoneally 4 mg/kg in group 3, intratecally 4, 6 and 8 mg/kg in group 4, 5 and 6 respectively. Beattie and Bresnahan were followed up for 1 month with test subjects. At the level of the spinal cord by light microscopy after the subjects were graded according to the grading system semiquantitative, myelinated axons, neurons, glial cells were calculated number.
Results: After the first month, according to the BBB test scores, between groups 4, 5 and 6 and 3 the Kruskal-Wallis test revealed a statistically no difference between the values ($p < 0.05$).
Conclusion: This study is important in terms of that both the neuroprotective and regeneratve effect of Riluzol was firstly examined in animal SCI model created by hemisection and it is used intratecally. No significant statistically difference was observed between groups that riluzole was used intratecally and intraperitoneally. Thus, intratecal administration of riluzol can be encountered as a first line or alternative treatment modality.
Keywords: Riluzole, Spinal cord trauma, Neuroregeneration, Neuroprotection, Hemisection model

OP-EXP.03-09

Glioblastoma Stem Cell Differentiation into Endothelial Cells Evidenced Through Live Cell Imaging

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Background: Glioblastoma cell initiated vascularization is an alternative angiogenesis called vasculogenic mimicry (VM). However, current knowledge on the mechanism of de novo vessel formation from glioblastoma stem cells (GSCs) is limited.
Methods: Sixty-four glioblastoma samples from patients and 10 fluorescent glioma xenograft samples were examined by immunofluorescence staining for endothelial marker (CD34 and CD31) and glial cell marker (GFAP) expression. Then, we isolated GSCs from human glioblastoma tissue and established CD133+/SOX-2+ RFP-GSC-1 cells. The ability of these cells to form vascular structures was examined by live cell imaging of three-dimensional cultures.
Results: CD34-GFAP or CD31-GFAP co-expressing glioblastoma-derived endothelial cells (GDEC) were found in 30 of 64(46.9%) clinical glioblastoma samples. In those 30 samples, GDEC were found to form vessel structures in 21 (70%) samples. Among 21 samples with GDEC vessels, the CD34+ GDEC vessels and CD31+ GDEC vessels account about 14.16% and 18.08% of total vessels, respectively. In the xenograft samples, CD34+ GDEC were found in 7 out of 10 mice and 4 out of 7 mice had CD34+ GDEC vessels. CD31+ GDEC were also found in 7 mice and 4 mice had CD31+ GDEC vessels (10 mice in total). Through live cell imaging, we observed gradually CD34 expression when cultural with VEGF in some glioma cells, and a dynamic increase in endothelial marker expression in RFP-GSC-1 in vitro was recorded. Up to 6 hours of cultural, CD34-positive cell reach to 9.46%.
Conclusions: The results demonstrated that GSCs may differentiate into endothelial cells and promote angiogenesis in glioblastomas.
Keywords: Live cell imaging, Differentiation, Primary brain tumor, Glioblastoma

OP-EXP.04-01

Important Casual Association Between Physical-Algebraic Natures of Impulse Noise Waves and Neurodegenerative Abilities: Experimental Study

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Background: The hazardous effects of impulse noise on the brain is well known; but, the algebraic and physical characteristics of waves has not been understood. Although, there are many types of noise in daily life, the effects of different kinds of waves has not been investigated. This study investigates if there are different effects of monoform and poliform impulse noise waves at the same decibel level on the the dentate gyrus which have not previously been studied.
Method: Thirty-four Sprague-Dawley rats were used and divided into three groups as follows**:** the control group (n=6; G0), the monoform wave listening group (n=14; GI), and the poliform wave listening group (n=14; GII), both with an intensity of 100 dB. The rats in G-I and G-II exposed to impulse noise eight times a day in 15-minutes per intervals for one month. The dentate gyruses of the rats were examined stereologically and compared with each other by Mann Witney – U test.
Results: There were clear signs of important neuronal apoptosis in dentate gyrus in group II in comparison with group I ($p<0.005$). Also significant neuronal apoptosis and neuron loss were observed

in the amygdala and dentate gyrus of rats in group I in proportion to the control group (p<0.001).
Conclusion: This study presents the destructive effects of noise on the amygdala and dentate gyrus. Noise with poliform waves has a more harmful effect than noise with monoform waves. Avoiding impulse noise is require especially forms of poliform waved noise is suggested.
Keywords: Poliform wave, Monoform wave, Apoptosis, Hippocampus, Amygdala

OP-EXP.04-02

Focal Enhanced Delivery of Systemically Administered Therapeutic Human Mesenchymal Stem Cells (hMSCs) Using Non-Invasive and Transient MRI-Guided Disruption of the BBB with Focused Ultrasound

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Background: Blood-brain barrier (BBB) poses a striking impediment to CNS clinical intervention. Since BBB provides remarkable protection, the majority of therapeutics in the circulation is prevented from entering the brain. Preclinical and clinical interventions have required local administration to increase therapeutic concentration and reduce systemic toxicity. To circumvent BBB barrier during systemic administration of cellular therapy, we investigated the delivery of mesenchymal stem cells (hMSCs) for the first time, using MRgFUS. This study allows for the systemic administration and delivery of hMSCs to pre-selected areas of the CNS with sub-millimeter precision.
Method: hMSCs, isolated from our own patients, were injected intracardially in animals as proof-of-principal for the local delivery of hSMCs with MRIgFUS. With the guide of MRI,4MPa-1MPa estimated in situ pressures, 1ms bursts and 1Hz pulse repetition frequency for 60-120 second duration were administered to pre-selected regions. The contralateral side served as control to investigate localization of systemically administered hMSCs with MRIgFUS vs. non-pulsed regions.
Results: MRgFUS augments permeability of BBB by creating small transient pores in the endothelial lining of BBB vessels allowing for hMSCs to be administered in precise areas without permanently compromising the BBB. There was no hMSC delivery in non-pulsed regions demonstrating precise localization and no off-target delivery, toxicity or uptake.
Conclusion: We demonstrate a novel approach to deliver hMSCs to delicate or inoperable areas of the brain without compromising adjacent tissue. FUS mediated BBB disruption could fundamentally change how CNS diseases are treated averting the need for risky surgical interventions and invasive procedures.
Keywords: BBB, Disruption, Stem cells, Systemic therapy, MRIgFUS, hMSC

OP-EXP.04-03

Prelimbic Cortex Deep Brain Stimulation Reduces Binge Size in a Chronic Binge Eating Rat Model

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Background: Binge eating (BE) involves the consumption of a large amount of food in a short period of time and a loss of control during the binge episode. It is a key feature of the major subtypes of eating disorders like bulimia nervosa, binge eating disorder, anorexia-nervosa binge/purge type. Alterations in the mesocorticolimbic pathway has a crucial role in its pathophysiology. We hypothesized that BE rats receiving low-frequency deep brain stimulation (DBS) in the prelimbic cortex, which is a functional analog of dorsolateral prefrontal cortex in humans, would have reduced binge sizes compared with sham stimulation.
Method: 8 male Sprague-Dawley rats were implanted with a DBS electrode in each rat's left prelimbic cortex. A limited access to sweet-fat diet protocol was used to achieve a chronic BE state in the rats. After reaching a stable binge size level, each rat had experienced sham, low frequency (60 Hz) and high frequency (130 Hz) stimulation for three sessions each and two consecutive treatments were separated by at least 2 empty sessions to allow a washout of the effects. c-Fos immunoreactivity was assessed as a marker of DBS-mediated neuronal activation.
Results: Low frequency (60 Hz) stimulation of the prelimbic cortex significantly reduced the binge size compared to the sham stimulation. (p<0.0001) High frequency DBS (130 Hz) had no significant influence on this behaviour (p=0.9).
Conclusion: This study suggests low frequency prelimbic cortex stimulation would be useful for correction of prefrontal hypofunction which is strongly associated with addiction pathogenesis
Keywords: Deep brain stimulation, Prefrontal cortex, Prelimbic cortex, Binge eating, Rat model

OP-EXP.04-04

The Effect of Tirofiban in Ventricular Dilatation and Vasospasm After Subarachnoid Hemorrhage in Rabbit Model

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Background: There are several ongoing studies to prevent vasospasm and ventricular dilatation seen after subarachnoid hemorrhage. This study aims to examine the effect of tirofiban

in ventricular dilatation and vasospasm seen after subarachoid heamorrhage in the rabbit model.
Method: 20 New Zealand type albino rabbits were used and divided into two subgroups as "control" and "tirofiban". In the control group only autologous blood and in the tirofiban group autologous blood and tirofiban were injected intracisternally. At day nine, magnetic resonance imaging were used to asses ventricular dilatation. At day ten, rabbits were sacrified to measure ventricular dimentions and basilar artery diameters in order to find evidence of ventricular dilatation and vasospasm respectively.
Results: In the magnetic resonance imaging study; the lateral, third and fourth ventricle dimensions were larger in control group but not significant statisticly. In the anatomic examination, the dimensions of lateral and third ventricles were large in control group in comparison to tirofiban group however in statistical analysis it was not significant. Basilar artery dimensions were smaller in control group which is in favor of vasospasm; also it was not significant.
Conclusion: Tirofiban was given intracisternally to examine the effect on vasospasm and ventricular dilation in subarachnoid heamorrhage. The complications were seen less in the tirofiban group however they were not significantly important. More experiments have to be done in this topic in larger models.
Keywords: Subarachnoid heamorrhage, Vasospasm, Ventricle dilation, Tirofiban

OP-EXP.04-05

Neurotoxicologically Outcomes of Perinatal Chlordiazepoxide Exposure on the Fetal Prefrontal Cortex Pyramidal Cells in Rat Pup

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Background: Few data are available on teratogenic effects of chlordiazepoxide. Although some congenital anomalies have been linked to chlordiazepoxide, some others have eliminated the risk of congenital anomalies. Thus the aim of the current experimental study was to determine the effects of prenatal exposure to chlordiazepoxide on development of the prefrontal cortex (PFC).
Method: In this experimental study we included a total number of 9 pregnant Wister rats that were randomly assigned to three groups receiving standard rat food and drinking water ad libitum (n=3) or chlordiazepoxide (40 mg/kg) (n=3) and an equal volume of vehicle (0.9% NaCl) (n=3) intraperitoneal (i.p.) injection once daily from first to 21st day of gestation, respectively. Fourteen-day-old neonatal rat pups were sacrificed and their PFC cells were extracted. Mitochondria were extracted and their level of reactive oxygen species (ROS), protein density, Glutathione (GSH) content, mitochondrial membrane potential (MMP), swelling, cytochrome c release and ATP level was identified. We also performed the Nissl staining, DNA fragmentation assay and RNA extraction and real-time polymerase chain reaction (PCR) on PFC cells.
Results: Isolated mitochondria from rat pups receiving chlordiazepoxide (E), had significantly higher ROS formation, decreased GSH, lower MMP, higher mitochondrial swelling, decreased ATP level, increased cytochrome c release and higher Bax, p53, cytochrome c and caspase 8 mRNAs. Maternal chlordiazepoxide administration significantly induced the caspases-3 activity in the PFC of pups in E group.
Conclusion: The results of this in vivo study provide evidence regarding negative effects of prenatal exposure to chlordiazepoxide on PFC.
Keywords: Chlordiazepoxide, Prefrontal cortex (PFC), Prenatal, Neonatal, Pyramid cells

OP-EXP.04-06

Evaluation of the Effect of Sildenafil After Severe Head Trauma in Experimental Rat Model

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Aim: To investigate the effects of sildenafil in rats with severe head trauma and to compare the effects of sildenafil and mannitol which is widely used in head trauma management.
Method: 28 Wistar Albino type female rats divided into four groups. The groups were like this**:** Group 1, Sham**:** rats anesthetized but not induced to trauma, Group 2**:** rats induced to trauma, no treatment has given. Group 3**:** rats induced to trauma, intraperitoneal %20 mannitol 1 gr/kg has given as treatment, Group 4**:** rats induced to trauma, intraperitoneal sildenafil citrate 10 mg/kg has given as treatment. One hour after trauma, the treatments were given to group 3 and 4. Four hours after trauma the rats were sacrified. Then the tissues resembling prefrontal cortex and hippocampus were sampled from the right hemisphere of each brain.
Results: Number of pycnotic neurons and the ratio of pycnotic neurons/ all of neurons in both prefrontal cortex and hippocampus were significantly increased in trauma group compared to sham group. Number of pycnotic neurons and the ratio of pycnotic neurons/ all of neurons in both prefrontal cortex and hippocampus significantly decreased in group 3 and group 4 treated groups compared to trauma group. However, there was no significant difference between group 3 and group 4 histopathologically.
Conclusion: We demonstrated that mannitol and sildenafil citrate had similar neuroprotective effects. We think sildenafil citrate may be a useful option in the treatment of secondary brain injury due to acute traumatic brain injury.
Keywords: Severe head trauma, Sildenafil, Mannitol

OP-EXP.04-07

Comparison of the Effects of Nimodipine, Papaverine and Anethole on Local Treatment of Cerebral Vasospasm Occuring After the Experimental Model of Spontaneous and Traumatic SAH

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Cerebral vasospasm can be defined as regional or widespread constriction in the cerebral arteries. Although it is most commonly observed after subarachnoid haemorrhage, it can also occur in association with other causes such as arteriovenous malformation, head trauma, surgery, and infections. The cause of vasospasm has not been fully understood despite clinical and laboratory studies. In the present study we compared the vasodilator effects of nimodipine and papaverine in local treatment that have proven efficiency in the literature with that of anethole. Genes such as p53, bcl2, and bax become activated in the brain parenchyma as a result of ischemia and induction of apoptotic process after vasospasm and proteins encoded by these genes are released. In addition to local effects of the drugs, increased tissue hamartin levels has been proved to protect brain parenchyma against ischemia. The present study shows that hamartin levels increase in proportion to ischemia occurring after vasospasm. Low hamartin levels are considered to be associated with lower mortality and morbidity in patients developing cerebral vasospasm following SAH.
Keywords: Anethole, Nimodipine, Papaverine, Hamartin, Vasospasm

OP-EXP.04-08

Chronic Subdural Hematoma –A Retrospective Study to Establish Role of VEGF and Craniotomy In Pathophysiology and Prevention of Recurrence

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Current body of evidence suggests that the maintenance or enlargement of chronic Subdural Hematoma (cSDH) is caused by multiple factors. Inflammatory and Vascular Endothelial Growth Factor induced accumulation of hematoma plays an important role in pathophysiology of cSDH. If neomembrane is implicated in the propagation of inflammatory mediators then excision of the culprit membrane becomes essential to treat and prevent recurrence of cSDH.
This retrospective study was conducted in a service hospital where 48 cases of cSDH were operated in period of two years. Patients were evaluated clinically and radiologically. Surgical procedure offered were, Burr hole craniostomy (BHC), Twist Drill Craniostomy (TDC) or craniotomy (Cr) with excision of neomembrane. Craniotomy was offered whenever there was suspicion or evidence of re-accumulation, solid or calcified hematoma formation, non-obliteration of the subdural space, or numerous thick membranes as were demonstrated in imaging. In craniotomy, maximum part of outer neomembrane was excised and margins coagulated. The excised outer neomembrane was sent for Immuno histochemical examination to assess the VEGF expression Depending on the VEGF expression as seen on the microscope they were grouped into those as showing weak, moderate or strong VEGF Expression. The study showed that cSDH patients with neomembrane formation benefit from craniotomy. The strong Vascular Endothelial Growth Factor(VEGF) expression from the excised neomembrane further strengthens the pro inflammatory VEGF theory propagation of cSDH. It further proves that excision of the culprit membrane is essential to prevent recurrences.
Keywords: Chronic subdural hematoma, Vascular endothelial growth factor, Neomembrane

OP-EXP.04-09

FTY720 Reduces Neurological Deficits Following TBI by Inducing Autophagy and Modulating Microglia Polarization

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Growing evidences have favored the neuroprotective effects of FTY720 (Fingolimod) on multiple central nervous system (CNS) diseases, including traumatic brain injury (TBI). One of the underlying mechanisms involved is attributed to the reduction of neuronal apoptosis through the autophagy pathway promoted by FTY720. Given the close relationship between autophagy and inflammation, we were devoted to investigate the role of FTY720-induced autophagy in influencing microglial function after TBI, since microglial cells are the main immune cells residing in brain. Generally, the common microglial cells exert their own function by transforming into activated phenotypes, which can be dived into M1 type (classical activation, as pro-inflammatory polarization) and M2 type (alternative activation, as anti-inflammatory polarization), when undergoing either endogenous or exogenous pathological stimuli. Thus, we focused on the polarization of microglia in conditions of autophagy induction or autophagy inhibition. Also, expression levels of microglial inflammation associated cyto-mediators, such as iNOS/NO (M1-related), TNF-α (M1-related) and IL-10 (M2-related), were examined. Our findings demonstrated that FTY720-induced autophagy contributed to the recovery of neurological impairment by inhibiting M1 polarization and simultaneously promoting M2 polarization, which subsequently alleviated neuronal apoptosis and suppressed microglial inflammation.
Keywords: FTY720, Traumatic brain injury, Autophagy, Apoptosis, Microglia polarization

OP-EXP.04-10

Can Lactate Fuel the Human Brain? A Comparison of Oxidative Lactate Metabolism in Normal and Traumatically Injured Brain

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Cerebral chemistry is not fully understood and metabolic abnormalities contribute to secondary injury after traumatic brain injury (TBI). Glucose is conventionally regarded as the major energy substrate, although lactate can also act as an energy source. We compared lactate metabolism in TBI brain, normal brain and muscle, in patients. We delivered 3-^{13}C lactate via microdialysis catheters and analysed by NMR the ^{13}C-labelled metabolites collected from the same catheters. ^{13}C fractional enrichment (FE) in glutamine C4, C3 and C2 demonstrated that both TBI and normal brain can oxidatively metabolise 3-^{13}C lactate via the tricarboxylic acid cycle, but we found no evidence in muscle. Greatest ^{13}C FE was at glutamine C4, with 5.1(0–11.1)% in TBI and 5.7(4.6–6.8)% in normal brain.

OP-FN.01-01

Electrode–Brain Interface in Globus Pallidus Internus Deep Brain Stimulation

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OP-FN.01-02

Selective Peripheral Denervation in Spasmodic Torticollis in the Era of DBS? Retrospective Study in Charleroi, Belgium

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Background: Twenty-five patients suffering from spasmodis torticollis resistant to botulic toxin were operated. The risks are low as selective peripheral denervation is only peripheral. The alternative is deep brain stimulation. Is this unexpensive technique still valid?
Method: Operation is done after clinical evaluation, TWSTERS scoring and EMG examination, under general anesthesia, without curare for monitoring. Two incisions are made, one latero-cervical to find spinal nerve, to section branches dedicated to spasmodic SCM, but preserving trapezius innervation, the other to section posterior branches from C1 to C6, dedicated to dystonic posterior group, (splenius capitis and longissimus capitis). No implant is necessary.
Results: Patients are filmed before surgery, after and three months later. Follow-up vary from 14 years to 7 months. Head position is improved in all cases, but amplitude of movements might stay limited on one side (16%) as in DBS. Pain decrease but do not disappear, activity and autonomy is improved in 88% of cases. Unsatisfactory head position is assessed by EMG, and can lead to a second look surgery (20%). 12% had a weakness of trapezius, 1 patient (4%) had a cervical hematoma surgically evacuated, another complained about pharyngeal hypoesthesia without problem of swallowing mobility with a posterior sagittal shift. No cognitive or speech complication. The cost include the surgery (about one fifth of the price of a DBS device), three to four days at hospital and physical post-op treatment.
Conclusion: Selective peripheral denervation is a valid alternative to DBS in spasmodic torticolis involving one to three muscles.
Keywords: Selective peripheral denervation, Cervical dystonia, Spasmodic torticollis, Results, Complications

OP-FN.01-03

Deep Brain Stimulation in Dystonia

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Background: Dystonia is a syndrom characterized by involuntary sustained muscle contractions that result in twisting, repetitive movement and abnormal posture. Dystonia is typically classifed by age of onset, origine, and affected body region When the cause is not defined or unknown, the dystonia is referred to as idiopathique or primary dystonia. Primary dystonia can be familial. Deep brain stimulation is an effective treatment of generalized dystonia.
Method: 30 patients (17 males and 13 females) underwent this surgical technique. Electrodes were bilaterally implanted under stereotactic guidance and connected to neurostimulator. Efficacy was evaluated by comparing scores on the clinical and functional Burke-Marsden-Fahn dystonia rating Scales before and after implantation (3 and 6 months and 1 year postopertively). The operation was performed under standard general anesthesia.
Results: After 3 months the improvement of the clinical score was 45%, the functional score was improved by 30%. After that, at 6 months was respectively**:** clinical**:** 56% and functional**:** 41%. Finally at one year**:** the improvement concerned the clinical score**:** 80% and the functional score**:** 85%.
Conclusion: Bilateral chronic electrical stimulation can be proposed as first line treatment generalized dystonia. It is conservative, adaptable, reversible and well tolerted by the pediatric population. It must be applied as soon as possible, especially in primary dystonia. Tolerance is excellent and the complication's rate remains low. The dystonic syndrom partiel contrôle and the significant improvement of pain symptomatology justify this treatment for secondary dystonia in selected patients.
Keywords: Dystonia, Deep brain stimulation, Globus pallidus internus

OP-FN.01-04

Management of Gait-Freezing: Low-Dose vs. High-Dose STN-DBS Stimulation in Patients with Intractable Parkinson's Disease

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Aim: To study whether lower dose stimulation improves gait-freezing (GF) in patients with Parkinson disease (PD) who undergo bilateral subthalamic nucleus (STN) deep brain stimulation (DBS).
Method: We studied 11 patients with PD who experienced GF that persisted despite routine 130-Hz stimulation and dopaminergic medication. Each patient was studied under 3 DBS conditions in the medication-on state**:** 130 Hz, 60 Hz, or DBS off. The Unified Parkinson's Disease Rating Scale, Part III motor score, axial subscore, tremor subscore, and GF by a questionnaire and stand-walk-sit test were also assessed. The best DBS condition (60 Hz here) producing the least GF was maintained for 12 weeks, and patients were assessed again. Changes in measurements between the 60 Hz and 130 Hz were analyzed using paired t test, with GF as primary and the remainder as secondary outcomes.
Results: Compared with the routine 130 Hz, 60-Hz stimulation significantly reduced GF, and axial and parkinsonian symptoms. The benefits at 60-Hz stimulation persisted over the average 12-week assessment.
Conclusion: Compared with the routine 130 Hz, the 60-Hz stimulation significantly improved GF, and axial and parkinsonian symptoms in patients with PD treated with bilateral STN-DBS, which persisted over the 12-week study period.
Keywords: Intractable Parkinson's Disease, Gait-freezing, Low-dose STN-DBS Stimulation, High-Dose STN-DBS Stimulation

OP-FN.01-05

Intraoperative Microrecording as Potential Factor Responsible for Early Postoperative Mental Status Alteration After Implantation of Bilateral Subthalamic DBS Electrodes

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Background: Early postoperative mental changes are the most frequent problem in the early postoperative period after bilateral subthalamic electrode implantation. The study aims to find an association between early postoperative mental changes and intraoperative monitoring.
Method: 80 patients with bilateral subthalamic electrodes implanted for motor complications of Parkinson's disease were included in the study. The clinical data regarding the incidence of early mental status changes were obtained from hospital records, medical and nursing ICU charts. The position of the definitive electrode as related to the individual ports of the MicroDrive system was obtained from the electrophysiology protocol.
Results: Early postoperative mental status alterations requiring treatment were observed in 25.0% of patients (duration 0.5 -7 days). The higher age was statistically significant predictor. The position of definitive electrode in the Microdrive ports were on the right side in uncomplicated patients anterior 10%, central 70%, lateral 1.7%, posterior 18.3% and in patients with early mental changes anterior 25%, central 55%, lateral 0%, posterior 20% (p value 0.367). The position of definitive electrode in the Microdrive ports were on the left side (second operated on) in uncomplicated patients anterior 11.7%, central 56.7%, lateral 5.0%, posterior 26.7% and in patients with early mental changes anterior 35%, central 35%, lateral 20%, posterior 10% (p value 0.012 – anterior electrodes).
Conclusion: The percentage of definitive electrodes implanted in anterior trajectory on the left side potentially passing the limbic subthalamus is significantly higher in patients with early mental changes.
Keywords: Deep brain stimulation, Parkinson disease, Microrecordings, Subthalamic stimulation, Early mental changes

OP-FN.01-06

Deep Brain Stimulation Surgery in Movement and Psychiatric Disorders, Twele Years Experience in Iran

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Background: DBS is one of the most advanced practices in the treatment of some neurological and psychiatric disorders. Although the exact mechanism of the effect of this method is challenging but what has been seen in the clinic of patients demonstrated significant efficacy.
Method: During the last 12 years, 394 DBS surgeries have been done by the functional neurosurgery team at IUMS. The surgery was performed on four groups of patients**:** Parkinson's disease, Dystonia, Tourette's syndrome and Tremor.
Results: Of these, 271 patients with Parkinson's disease, Dystonia in 113 patients, 8 patients had Tourette syndrome, one patient with Rubral tremor and one case with Essential Tremor. In Parkinson's group, 165 patients with a mean age of 54 years and 106 females with a mean age of 50 years had been operated. In 113 patients with dystonia 59 cases were male and 54 female, with a mean age of 27 years and 32 years respectively. Eight patients with Tourette's syndrome 5 males and 3 females with an average age of 25 years. Two cases with Essential tremor and rubral tremor also operated. All patients had been operated Bilateral DBS surgery except one case with rubral tremor.
Conclusion: All patients after DBS surgery had improvement of symptoms or a significant reduction in medications had been used before surgery. Improvement in dystonia, tremor and Tourette's symptoms whose medications had no benefit were significant. Complications after surgery were few**:** Two non-fatal ICH, one lead infection, two lead fracture and one case with seizure after surgery which controlled with medication.
Keywords: DBS, Parkinson, Dystonia, Tourette's syndrome, Tremor

OP-FN.01-07

STN Deep Brain Stimulation for Parkinson's Disease: Analysis of 27 Cases

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Presently deep brain stimulation along with medical treatment stays the most effective treatment modality for patients with medically intolerant Parkinson's disease. A prospective case series was conducted at Neurosurgery Unit II, Lahore General Hospital from Oct 2014- Sep 2016. Total 27 patients were enrolled with 26 cases of Parkinson's disease and a case of dopa-responsive dystonia. STN was the target for electrode implantation in all cases. Clinical diagnosis and the merit to undergo Deep brain stimulation was done by Neurologist. Patients were assessed using UPDRS score preop and postop at 6 weeks,3 months, 6 months,12 months and 6 monthly thereafter for 2 years. Of 27, 20 patients were male and 7 females. Age group ranged from 22-75 years. These patients had varying severity of symptoms ranging from 5-30 years. Scoring on UPDRS showed significant improvement in its various domains. In on-stimulation & on-medication state, UPDRS part II was reduced by 50%, part III (motor score) was reduced by 68% and part IV reduced by 70%. Daily dosage of antiparkinsonian medications was reduced by 60% and therefore was able to achieve adequate control of dyskinesia's & motor fluctuations. Daily off-time was reduced by 67%. One patient had small ICH, 1 developed seroma in IPG pocket, one suffered from pneumonia, and 2 had reversible stimulation related problem. Thus, in carefully selected advanced Parkinson's disease patients, bilateral STN stimulation can yield favorable outcome. These results are very encouraging for us in extending this procedure to other variety of movement disorders.

Keywords: Deep brain stimulation, DBS, Parkinson's disease, Subthalamic nucleus, STN

OP-FN.01-08

Noble Art of Lesioning to Deep Brain Stimulation (DBS): Current and Future Applications

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Background: Deep Brain Stimulation (DBS) has been established as a safe and effective surgical option for various chronic treatment refractory conditions like Parkinson's Disease, Essential Tremor and Dystonia. Historically, DBS developed as a substitute for classical lesioning procedures previously used in Functional and Stereotactic Neurosurgery.
Method: DBS Neuromodulation has proven its efficacy based on its reversibility and adaptability which are the two factors responsible for its low morbidity. It is an extremely intricate and team based surgery needing close coordination between movement disorder neurology and neurosurgery. DBS surgery is mostly performed Stereotactic frame based using Micro Electrode Recordings (MER). More experience being reported with frameless and direct targeting techniques also.
Results: More recent experience supports Early DBS surgery being superior to medical management especially if done in the first 10 years of Parkinson's diagnosis. Currently DBS for Parkinson's Disease involves high frequency stimulation of primarily Subthalamic Nucleus STN or Pallidum GPi. Thalamic Vim Stimulation is established for Essential Tremor and GPi for Dystonia. Neuromodulation mechanisms of action still unknown as there are potential mechanisms described but better understanding needed.
Conclusion: DBS surgery for several other disorders are under investigation and may become new approved indications in the near future. Emerging indications for DBS include Epilepsy, Tourette's sydrome, Obsessive Compulsive Disorder, Depression, Chronic Pain and possibly Obesity. Technological development will enhance and refine the effects of high-frequency stimulation allowing new targets for these emerging indications.
Keywords: Lesioning, DBS, Neuromodulation, Stereotactic

OP-FN.01-09

Subthalamic Nucleus (STN) Deep-Brain Stimulation (DBS) in the Management of Idiopathic Parkinson's Disease: Results of Our First 20 Cases

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Background: Several drugs are available that can effectively treat the symptoms of the Parkinson's disease, but long term medical management is often complicated by the appearance of levodopa-induced motor complications. In the past years there has been an increasing interest in the surgical therapies for Parkinson's disease. The most common functional stereotactic neurosurgical procedures that are currently performed worldwide for PD are surgical lesioning and deep-brain stimulation (DBS).
Method: 20 patients with idiopathic Parkinson's disease (iPD) were treated with STN-DBS in this study. Operative details, outcome, and complications are recorded and analyzed.
Results: 20 patients (11 males & 9 females) were treated with subthalamic nucleus (STN) deep brain stimulation (DBS). The efficacy of STN-DBS was calculated as the percentage improvement of UPDRS-III total score from baseline to postoperative conditions. 15/20 patients (75%) had good outcome (50-75% improvement in off UPDRS III) and 5/20 patients had fair outcome (25-50% improvement in off UPDRS III). There were no cases that exhibited excellent or poor outcome. Postoperative mean L- Dopa equivalent dose (LED) was reduced by 69.7% postoperatively. The mean rate of improvement of postoperative L Dopa induced dyskinesia score was 79.2%. The mean rate of improvement of off duration subscore was 76.8%. Operative complications were noted in 4/20 patients (20%). They were transient in 2/4 patients (50%).
Conclusion: STN-DBS is a very effective therapy for Parkinson's disease. In appropriate patients, motor improvement is accompanied by a significantly improved quality of life and a reduced necessity for medication.
Keywords: Idiopathic Parkinson's disease, Subthalamic nucleus, Deep brain stimulation

OP-FN.01-10

Robot-Assisted Implantation of Depth Electrodes for Stereoelectroencephalography

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Background: Since the first implementation of a stereotactic robot for a brain biopsy by Kwoh in 1985, robots in neurosurgery have been further developed; among them, the NEUROMATE (RENISHAW), an image-guided, five degrees-of-freedom, computer-controlled robotic system is currently the most widely used. In the field of neurosurgery, one of its multiple applications entails the implantation of depth electrodes for stereoelectroencephalography (SEEG), but only few clinical studies have highlighted its advantages.
Methods: The transition from 'manual' stereotactic Leksell frame-based to robot-assisted SEEG at the London Health Science Centre Epilepsy Program was analyzed with the main focus on databank-acquired operative time and complications.
Results: A cohort of N=101 patients with drug-refractory epilepsy undergoing depth electrodes implantation were reviewed (n=91 before and n=10 after the introduction of the robot). Baseline characteristics were well-balanced between groups. Operative time was significantly reduced from 142.9±44.5 to 98.3±36.3 min (15.3±4.5 to 9.3±2.5 min per electrode format; both $p<0.01$). Dose area product (16.8±28 vs. 10.38±3.6 rad*cm2 per electrode) and fluoroscopy time (41±67.5 vs. 36.8±13.8 sec per electrode) remained similar. There was no increase in the rate of complications, however, the first robot-assisted cases were challenged by inaccurately placed electrodes due to technical difficulties.
Conclusions: In our preliminary institutional series, robot-assisted SEEG reduces human error, enhances patient safety, and is less time-consuming than 'manual' Leksell frame-based SEEG after the learning curve has been overcome.
Keywords: Robot, Implantation, Electrodes, Stereoelectroencephalography

OP-FN.01-11

Stimulation of the Tractography-Defined Motor Subthalamic Nucleus Correlates with Clinical Outcomes

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Background: Deep brain stimulation (DBS) of the motor subthalamic nucleus (mSTN) is an effective treatment for patients with Parkinson's disease (PD). Moreover, the stimulation in non-motor areas of the STN (nmSTN) is thought to be clinically suboptimal or produce significant side effects. In this paper, we aimed to determine whether the change in motor outcomes and neuropsychological (NPS) side effects correlate with the overlap of the volume of activated tissue (VAT) and the mSTN or nmSTN.
Method: In thirteen patients with PD treated with STN-DBS, we delineated the mSTN based on fibers from precentral gyrus and posterior part of the superior frontal gyrus (M1 and SMA respectively). Secondly two segments of the STN were defined: smaSTN and m1STN, and the nmSTN was defined as the rest of the STN. Then, we get overlap coefficients between STN regions and the patient-specific VAT. These coefficients were then correlated with motor outcomes, the reduction of levodopa equivalent daily dose (LEDD), and the percentage of change in NPS performance. Furthermore, we computed the VAT outside the STN and this was also correlated with the motor and NPS outcomes. Finally, we used probabilistic tractography to describe the connections of the different segments obtained by deterministic tractography.
Results: Significant clinical improvement was verified after DBS in all patients. The Spearman's rank correlation coefficients showed statistically significant correlations between VAT∩mSTN and the contralateral motor improvement, the VAT∩smaSTN was also correlated with motor improvement mainly with bradykinesia. Cognitive decline was also associated with stimulation of the nmSTN and mood changes were correlated with the stimulation outside of the STN.
Conclusion: The stimulation of the tractography-delineated mSTN and specially smaSTN is positively correlated with a greater motor improvement, mainly bradykinesia, and lower requirements of LEDD. The stimulation of the nmSTN is correlated with a worsening of the cognitive performance. The stimulation outside of the STN seems to be responsible for mood changes during STN-DBS. Thus, the use of tractography-defined targets may help improve the clinical efficacy and reduce the side effects associated to DBS in PD.
Keywords: Tractography, Subthalamic nucleus, Stimulation, Parkinson Disease

OP-FN.02-01

Strategy and Neurosurgical Ablatives Procedures in the Treatment of Spastic Foot (About a Series of 164 Patients)

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Background: Spastic desorders are sometimes disabling and their treatment can be very challenging. The basic phenomenon underlying spasticity is hyperexcitability of the stretch reflex. When the spasticity is refractory to optimal oral medication, refractory to physical therapy, the neurosurgical procedures aims to reestablish the tonic balance between agonist and antagonist muscles by reducing the excess of spasticity.
Method: The aim of our study was to objectify the functional effects of the tibial neurotomy in the spastic foot. Our material included 165 patients who underwent 197 partial and selective neurotomies of the tibial nerve (33 patients were operated bilaterally). The age of our patients varied between 04 and 56 years. Causes of spasticity were dominated by the cerebral palsy in 78 patients (47.56%), followed by head trauma in 42 cases (25, 60%). Other etiologies are found in the remaining cases. All patients were selected by a multidisciplinary team according to a clinical evaluation and analytical assessment after a physical rehabilitation protocol well conducted.
Results: After a mean of 15 years, our results were rated "goog to excellent" in 65% of cases walk and run with correct plantigrade

support. We observed a clear improvement in confort in 25% of our patients.
Conclusion: Selective tibial neurotomy leade to long- term satisfactory improvement in function and /or comfort, with a low morbidity rate in appropriately selected patients suffering from severe harmful spasticity localized to the lower limb.
Keywords: Spatisity localized, Lower limb, Selective neurotomy, Tibial nerve

OP-FN.02-02

Accuracy of Varioguide Frameless Stereotactic System Against Frame Based Stereotaxy: Prospective Randomized Single-Centre Study

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Background: Frameless stereotactic brain biopsy systems became widely used nowadays. Varioguide is a relatively novel frameless system. Its accuracy was studied in laboratory setting, but has not yet been studied in the clinical setting. The purpose of this study was to determine its accuracy and diagnostic yield and to compare this with frame-based stereotaxy.
Method: Overall 53 patients (33M and 20F,age 60±15y) were enrolled into this prospective randomized single-centre study. Twenty-six patients were randomized into the frame-based (FB) and 27 patients into the Varioguide (VG) group. Real trajectory was pointed on intra-op MR. The distance of the targets and angle deviation between the planned and the real trajectories were computed. The overall discomfort of the patient was subjectively assessed on VAS scale.
Results: The median lesion volume was 5ml [IQR:2-16ml] (FB) and 16ml [IQR:2-27ml] (VG),p=0.133. The mean distance of the targets was 2.65±1.12mm (FB) and 2.90±1.26mm (VG),p=0.456. Mean angle deviation was 2.62±1.31deg (FB) and 3.49±2.05deg (VG), p=0.074. Diagnostic yield was 93% (25/27) in VG and 96% (25/26) in FB, p=1.000. Mean operating time was 47±26min (FB) and 59±31min (VG),p=0.140. One minor bleeding was encountered in the VG group. Overall patient discomfort was significantly higher in the FB group at VAS of 2.5±2.1 vs. 1.2±0.6, p=0.004.
Conclusion: The Varioguide system proved to be comparable in means of the trajectory accuracy, rate of complications and diagnostic yield compared to the "gold standard" represented by the traditional frame-based stereotaxy for patients undergoing brain biopsy. The Varioguide system is better accepted by patients.
Keywords: Accuracy, Brain biopsy, Diagnostic yield, Frame-based stereotaxy, Frameless stereotaxy, Intra-op MR

OP-FN.02-03

Confirmation of Electrode Localization by Fusion Between Preoperative T2W MRI and Postoperative CT Scan on Parkinson Cases Who Underwent STN DBS

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Background: Subthalamic nukleus (STN) deep brain stimulation (DBS) is successfully used procedure on appropriate Parkinson cases. The success of procedure is related to appropriate patient choice, as well as careful planning and administration. We can target the dorsolateral (motor) STN, thanks to working station with preoperative T2W MRI. Postoperatively, permanent electrode localization can be confirmed with T2W MRI but most of DBS systems are incompatible with MRI machines so that includes some risks. İn our study, on seven Parkinson cases whom underwent STN DBS, we showed that, fusion between preoperative T2W MRI and early postoperative CT could be used for confirmation of permanent electrode localization.
Method: All cases' electrode tracks planned on Framelink 5 (Medtronic) working station by merging preoperative T2W and postcontrast T1W MRI. Dorsolateral STN had been targeted on all cases. All STN DBS procedures has been done under local anesthesia with microelectrode recording and test stimulation. In the early postoperative period, all patients were administered CT scan, and stimulator implantation was performed under general anesthesia following confirmation of permanent electrode localization by CT-MR fusion, at the working station.
Results: The fusion between preoperative T2W MRI and postoperative CT scans showed that electrode localization was appropriate on x,y,z axes on all patients.
Conclusion: On STN DBS procedures, placing permanent electrode on the region that has been targeted is directly related to good clinical outcome. The fusion between early postoperative CT and preoperative T2W MRI can be used for confirmation of permanent electrode and contacts localization easily, rapidly and safely.
Keywords: Deep brain stimulation, Electrode localization, Parkinson disease, Subthalamic nukleus

OP-FN.02-04

Ultrasound Neuronavigation vs Conventional Neuronavigation vs Intraoperative Ultrasound – A Decade of Experience at a Single Institution

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Background: Since 2008 in our institution we have the chance to use two different neuronavigation systems – one conventional and the other – ultrasonic, in our everyday work. This article summarizes

our experience with both systems in different fields of neurosurgery. Our aim is to assess the advantages and disadvantages of ultrasound neuronavigation, compared to conventional neuronavigation and non-registered intraoperative ultrasound in several neurosurgery areas.
Method: Over a period of almost 10 years the ultrasound neuronavigation system was used in more than 400 cases. As the system allows working in different modes, the cases were divided into three groups**:** 1. ultrasound neuronavigation with or without preoperative images; 2. intraoperative ultrasound imaging; and 3. conventional neuronavigation, based solely on preoperative image studies. More than 260 cases in which the other navigation system was used were added to the group of conventional neuronavigation. The surgical results (extent of surgery, postoperative complications, postoperative stay, mortality) were compared for the three groups in respect to different neurosurgical entities (HGGs, LGGs, metastases, meningiomas, aneurysms, etc.).
Results: The analyzed results are quite close for the three groups, not giving enough evidence to scientifically distinguish or recommend one of the intraoperative guidance methods over the other. Nevertheless, in some entities the ultrasound neuronavigation seems more advantageous and adds confidence for the surgeon.
Conclusion: No final judgment could be made on the value of the ultrasound neuronavigation in the neurosurgery practice. A multi-center randomized prospective study may throw more light on the question.
Keywords: Conventional neuronavigation, Ultrasound neuronavigation, Intraoperative ultrasound, Surgical results, Comparative analysis, Intraoperative image guidance

OP-FN.02-05

Frame-Based Pinless Stereotaxy

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Background: Frame-based stereotaxy aims at accurate intracranial targeting through fixing a frame to the skull with rigid pins and referring the intracranial targets to this frame followed by frame directed surgery. Pin fixation is a painful step in the operation and, in some situations like in young children having resilient or small skulls and in patients having unsuitable skull defects or previous craniotomies, it may be difficult to be done. Frameless stereotaxy, on the other hand, is not available in many centers. The aim of this study is to evaluate our new technique of frame-based stereotactic surgery without pin fixation to the skull using a personal software calculator, Naviplan.
Method: Three small radio-opaque spherical marks are attached to the skull and the intracranial target is referred to a cartesian coordinate system based on them. Intra-operatively, the marks are registered to the frame and the target references are transferred from the mark-based to the frame-based cartesian coordinate system using a personally designed database file (Naviplan).
Results: 31 patients were subjected to this method. In all patients, either intra-operative evidence or postoperative radiology was used for accuracy confirmation. In 15 cases, the aspiration of intracranial cysts and the postoperative CT scans confirmed the accuracy of the procedure. In 16 cases with solid lesions, postoperative CT scan as well as the histopathology yield showed the lesions to be targeted with acceptable accuracy.
Conclusion: Pinless frame-based stereotaxy with Naviplan is easy, save and accurate and can be useful in situations where rigid pins can't be applied.
Keywords: Naviplan, Frameless, Pinless, Stereotaxy, Image-guided neurosurgery, Computer-assisted surgery

OP-FN.02-06

Comperative Results of Plastic Cap and Bone Cement Usage in Permanent Electrode Fixation of Deep Brain Stimulation

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Background: Different deep brain stimulation (DBS) centers are used different methods included plastic cap and bone cement to fix the permanent electrodes on the cranium. In this study, we present preliminary results of the comparison of these methods about duration of intraoperative period and effects of postoperative complications on the clinical outcome.
Method: This study is included 24 advanced Parkinson's Disease (PD) patients who underwent DBS of the subthalamic nucleus (STN). All DBS surgeries with microelectrode recording were performed under local anesthesia. Bone cement (ImplantCast®) was used in 12 patients and plastic cap (StimLoc®) was used in 12 other patients for permanent electrode fixation. The time spent for each method in the intraoperative period was noted in all patients. All patients underwent CT scans in the early postoperative period and at the 3rd months controls. Electrode migration, electrode fracture, infection and pneumocephalus rates were noted separately. Clinical outcomes were assessed by UPDRS III (Unified Parkinson's Disease Rating Scale) test at 3rd months control.
Results: The surgery time increased with plastic cap 6 min ± 2 min, with bone cement 21 ± 3 min. There was no significant difference between early postoperative period and 3rd months controls; about electrode migration, electrode fracture, pneumocephalus, infection rates and UPDRS III results.
Discussion: DBS electrode fixation took about 14 min longer when made with bone cement. According to our results; we would like to say that the two methods we compared are reliable techniques for electrode fixation in DBS surgeries.
Keywords: Deep brain stimulation, Bone cement, Plastic cap, Electrode, Fixation

OP-FN.02-07

May Stereotactic Intracavity Administration of Antibiotics Shorten the Course of Systemic Antibiotic Therapy for Brain Abscesses?

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Background: Despite advances in the management of the brain abscess, continuous systemic long-term antibiotics are necessary

and crucial. This study was designed to evaluate the effect of intracavity administration of high-dose antibiotics on the course of antibiotic therapy.
Method: 55 patients with bacterial brain abscesses (83 abscesses) were treated with stereotactic aspiration and intracavity injection of high-dose antibiotics combined with a short course systemic antibiotic therapy. Antibiotics of one eighth daily systemic dosage were injected into abscessed cavity after stereotactic aspiration and intravenous antibiotics were given in all patients for 3-4 weeks. The results were compared with that of our previous patients treated by conventional stereotactic aspiration.
Results: 39 males and sixteen females(mean age 38.7 years) were included. During the follow-up(mean 26.2 months, ranging from 6 to 72 months), all the abscesses subsided with no recurrence. No adverse effects related to topical use of antibiotics occurred. Thirty-eight patients had good outcomes, eleven had mild neurological deficits, three had moderate deficits, one was in vegetative state and two died of accidents not related to brain abscesses. Compared with conventional stereotactic aspiration and drainage, intracavity injection of antibiotics shorted the course of consecutive systemic intravenous antibiotics by average 10.8 days without the increasing recurrence rate of abscess.
Conclusion: Topical application of antibiotics in brain abscess cavity could reduce the length of systemic antibiotic therapy, decrease the abscess recurrence rate, avoid the side effects of long-term high dose antibiotics, shorten the hospitalization and reduce the cost of medical care.
Keywords: Brain abscess, Stereotactic aspiration, Antibiotics, Medication route

OP-FN.02-08

Image-Guided Stereotactic Ventricular Catheter Placement for Refractory Idiopathic Intracranial Hypertension. Accuracy and Effectiveness

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Background: Lumboperitoneal shunting is the mainstay of surgical management for idiopathic intracranial hypertension (IIH). However, many studies document a high failure rate and complications for this procedure. Ventricular shunts have not been widely used for IIH because of the difficulty of placing a shunt into normal or small-sized ventricles. Also, stereotactic surgery not available in every hospital. Background**:** The article aims to evaluate the implication of using stereotactic image–guided ventricular catheter placement in patients with IIH as an alternative to lumboperitoneal shunting and to assess its outcome.
Method: The authors reviewed the clinical records of all patients in whom stereotaxy was used to guide the placement of a ventricular catheter for IIH. Stereotactic ventricular catheter placements were performed on sixteen patients presenting with signs and symptoms of idiopathic intracranial hypertension that was refractory to traditional medical or previous surgical treatment to target the frontal horn of the lateral ventricle.
Results: All patients were cannulated with a single pass, and satisfactory catheter placement was confirmed on a postoperative CT scan with concordant patient's symptoms improvement. All patients improved clinically at the last follow-up compared to their preoperative condition. None of the patients experienced intra- or perioperative complications. Four of them underwent stereotactic ventriculoatrial shunts due to defective CSF absorption following multiple lumboperitoneal shunt revision. Two patients required shunt revision.
Conclusion: Image-guided stereotactic ventricular catheter placement is an effective, safe and durable treatment option in management of IIH that are refractory to the traditional medical and surgical approaches.
Keywords: Idiopathic intracranial hypertensio, Stereotaxy, CSF diversion, Ventriculoperitoneal shunt

OP-FN.02-09

Framless Neuronavigation Assisted Brain Biopsy: Safety, Efficiency and Our Experience

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Background: Brain biopsy is a commonly used method for diagnosing deeply located or generalized intraparenchymal brain lesions and determining the further treatment options. A number of comparative studies have been performed with open surgical biopsy, framed or frameless biopsy methods. In this study, we shared the results of the framless neuronavigation assisted biopsy in our clinic and sensitivity of diagnosis with our experience.
Method: 24 of frameless neuronavigation assisted biopsy cases were retrospectively reviewed. Seven cases had thalamic and 1 case had hypothalamic deep lesion. Four patients had deeply located eloquent area lesions. The mass of 6 patients was diffuse and passed the opposite cerebral hemisphere. Five cases had multiple cerebral masses and 1 case had exophytic mass originating from brain stem.
Results: Histopathologic diagnosis of 14 of 24 cases were Grade IV glial tumor, 1 case was reported as diffuse Grade III glial tumor and 2 cases were reported as diffuse Grade II glial tumor. Histopathologic diagnosis of five cases were reported as B-cell lymphoma, whereas 1 case was reported as gastrointestinal system metastasis. In one case, the diagnosis could not be made despite the biopsy performed twice. The mitotic index (Ki-67) showing tumor aggressiveness was 28.43 and the range was 1-90%. Thirteen of the 24 patients had a definite histopathological diagnosis and 1 patient had no histopathological diagnosis.
Conclusion: Frameless neuronavigation assisted brain biopsy is one of the most sensitive, safe and easy-to-perform steriotactic biopsy method. Due to method selection with high accuracy diagnosis, biopsy planning requires surgical experience.
Keywords: Biopsy, Brain, Neuronavigation

OP-FN.03-01

Effects of Surgical Approaches to Epilepsy Quality of Life, Depression and Anxiety Levels

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Background: Epilepsy, affecting the patients' quality of life negatively is commonly accompanied by such psychiatric disorders as anxiety and depression. One treatment option is the epilepsy surgery. We aim to find out the changes in quality of life andpossible accompanying psychological disorders within the post – op period.
Method: In this study, 41 cases with intractable epilepsy were examined prospectively. Demographic data, characteristics of clinical seizures, frequency of seizures, antiepileptic drugs, cranial magnetic resonance imaging, positron emission tomography and pathology results of the cases were studied. On a regular basis Beck Depression Inventory Beck Anxiety Inventory and Patient Weighted Quality of life in Epilepsy QOLIE-89 version 1.0 were applied both before and after the surgical treatment.
Results: The ratio of depression and anxiety in the pre-op period is found as 39.5%. Increase in seizures and amount of drugs being used results in increase in the levels of depression and anxiety (respectively $p<0.05$ and $p=0.001$). A significant recovery in depression and anxiety after epilepsy surgery is found out. This recovery is directly related to the attainment of seizure-free status ($p<0.001$). A significant improvement in all anxiety, depression and life quality scales is observed after the surgical treatment.
Conclusion: It is crucial to question the frequency of seizures, amount of antiepileptic drugs, accompanying psychiatric comorbidity, and to administer an early surgical treatment in order to increase the success in epilepsy treatment and provide a higher life quality. With the epilepsy surgery not only patients' life quality will increase significantly but also they will lead a healthier life.
Keywords: Anxiety, Depression, Epilepsy, Surgery

OP-FN.03-02

Epileptic Zone Resection for MRI-Negative Refractory Epilepsy Originating from Primary Motor Cortex

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Background: Because of the balance between achieving complete seizure freedom and minimizing the postoperative neurological deficits, surgery for refractory epilepsy originating from primary motor cortex is difficult. Here, we reported the outcomes of surgery for MRI-negative refractory epilepsy originating from primary motor cortex in a case series.
Method: Nine patients with refractory epilepsy originating from primary motor cortex underwent intracranial electrodes implantation after preoperative evaluation. Subdural grid electrodes and depth electrodes were implanted through craniotomy assisted by stereotactic technique. We delineated epileptic zone and executed tailored resection according to results of intracranial electroencephalography and mapping. The patients were followed up for at least one year. Muscle strength was respectively evaluated at different postoperative time (the first day, 2 weeks and 1 year).
Results: With regard to seizure outcome at the last follow-up, Engel class I outcome was achieved in five patients, class II in three patients and class III in one patient. All cases had postoperative hemiparesis in different degree on the first day after operation. Three patients experienced distal muscle strength of single limb with grade 3 or lower and had obvious dysfunction at 1 year after operation. Six patients experienced distal muscle sterngth of grade 4 or 5 (Medical Research Council six-point scale) and had no obvious dysfunction at that time.
Conclusion: Most patients of refractory epilepsy originating from primary motor cortex were seizure free and had no obvious neurological deficits in the follow-up. Epileptogenic zone resection may not be always contraindication for non-lesional refractory epilepsy patients originating from primary motor cortex.
Keywords: Refractory epilepsy, Primary motor cortex, Surgery, Paralysis, Muscle strength

OP-FN.03-03

Peri-Insular Hemispherotomy: Indications and Outcome in a Single Institution

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Background: Peri-insular hemispherotomy is a disconnective procedure that functionally isolates epileptogenic regions in one hemisphere. We present a consecutive series of 41 patients affected by intractable epilepsy treated with peri-insular hemispherotomy.
Method: A retrospective review of 41 hemispherotomies performed by the senior author was performed.
Results: Causes of epilepsy included**:** Rasmussen's encephalitis (5 cases), hemimegalencephaly (4), cortical dysplasia (12), perinatal stroke/stroke (14), Sturge-Weber (1), viral infection (2), and posttraumatic (3). Fifteen patients were female, 26 were male. Mean age was 80 months (min 6 - max 248). Fourteen patients underwent surgical intervention before hemispherotomy. A postoperative ventriculostomy was placed in all patients but one (mean duration**:** 4.6 days, 2-14). Mean length of ICU stay was 1.7 days (1-7), and the mean hospital stay was 12 days (5-50). Mean estimated blood loss was 145 mL (20-300), 11 patients were transfused. Mean follow-up was 47 months (1-122). The Engel classification for postoperative seizure control was broken down as follows**:** class 1 in 31 patients (1A**:** 25, 1B**:** 4, 1C**:**2), class 2 in 2, class 3 in 1, and class 4 in 3. Four patients required a ventriculoperitoneal shunt (min 5 weeks post-hemispherotomy, max 5.5 years later). Two patients with persistent seizures underwent further surgical disconnection (1 hemimegalencephaly, 1 cortical dysplasia).
Conclusion: Peri-insular hemispherotomy in the appropriately selected patient yields favorable results with regard to seizure control.
Keywords: Peri-insular, Hemispherotomy, Intractable, Epilepsy, Pediatric

OP-FN.03-04

Refractory Epilepsy Secondary to Calcified Granuloma-A Surgical Series

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Background: Association between epilepsy and acute CNS granulomatous infection is known. However the association between the calcified spots in brain as a sequel of calcified granulomatous lesion (CGL) and epilepsy is uncommon as well as the role of surgery in them. The aim of this study is to study the outcome of CGL leading to medically refractory epilepsy which has been treated surgically.
Method: From our epilepsy surgery database we reviewed all cases which we operated for refractory epilepsy due to CGL. All underwent a standard presurgical evaluation. Clinical, neuroimaging, and electroencephalography (EEG) findings were used to select candidates for surgery.
Results: There were 12 cases in this surgical series. 4 had a temporal and 8 had extratemporal pattern on electroencephalogram. All these cases had a small rcalcification on imageology in. 2 were located in the mesial temporal region with hippocampal sclerosis (HS), 2 were located on the lateral temporal lobe with HS, 2 frontal, 3 temporoparietal and 3 occipital. In 4 cases anterior temporal with amygdalohippocampectomy was done along with lesionectomy under ECoG guidance. Rest 8 cases had lesionectomy of which one needed a prior invasive monitoring and one under awake craniotomy. On a mean follow up of 14 months, 11 are in Engel 1 and 1 had seizure during antiepileptic withdrawal.
Conclusion: CGL are potential cause for AED-resistant and surgically remediable epilepsy. Presence of perilesional gliosis contributes to epileptogenicity of these lesions. CGL with hippocampal sclerosis resection together favours better chance of seizure-free outcome.
Keywords: Epilepsy, Refractory, Calcification, Granulomatous

OP-FN.03-05

Can Vagus Nerve Stimulation Decrease the Risk of Bone Fracture?

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Background: Most epilepsy treatments are associated with low bone mineral density (BMD) and increased risk of bone fracture. Recent studies have demonstrated that cholinergic activity has an anabolic effect on bone metabolism. Vagus nerve stimulation (VNS) is a promising treatment of epilepsy that, as a side effect can increase cholinergic activity. Accordingly, we hypothesize that VNS can increase BMD in epilepsy patients.
Method: A series of 16 epilepsy patients (6 females and 10 males; 5 to 46 years old) scheduled for VNS insertion were assessed for BMD before and after the VNS insertion. VNS insertions were performed between May 2012 and October 2015. Paired t-test was used to compare BMD vales before and after VNS.
Results: Initial BMD z score values were - 1.1 ± 0.741 (mean ± SD) gr/cm^2 for femoral neck and -1.027 ±1.129 for L1-L4. BMD was assed 446.5 ±151.2 days after VNS insertion. BMD vales were significantly higher after VNS insertion for L1-L4 (p=0.033) with mean BMD increasing from -1.027 to – 0.897. VNS had no effect on the BMD of the femoral neck (p=0.62).
Conclusion: Epilepsy patients undergoing VNS might benefit from an improvement in lumbar spine BMD thereby decreasing the risk of bone fractures. Further studies are warranted to confirm this finding,
Keywords: Epilepsy surgery, Vagus nerve stimulation, Bone mineral density, Bone fracture

OP-FN.03-06

Surgical Treatment of Drug-Resistant Epilepsies in Russian Federation

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Aim: To evaluate seizure outcomes in patients with drug-resistant epilepsy surgically treated in Moscow.
Method: The study population included 117 patients who underwent epilepsy surgery between 01.01.2014 and 01.02.2017. Duration of epilepsy before surgery was 17.59 years. Invasive EEG monitoring was made for 46 patients (39%).
Results: Temporal lobe epilepsy was in 56 (48%) patients, generalized forms - 3 (3%), temporal plus - 57(49%), parietal form in 1. 31 (26.5%) had bilateral lesions. 117 patients had 117 surgical procedures**:** 97(83%) patients had AMTLE, 6 (5%) - AMTLE plus extra temporal resections, 3 (2.5%) - temporal tumor resections, 1 patient – amygdalohippocampectomy (SAH), 1 patient – DNET plus SAH, 4 (3.5%) – VNS and 3 (2.5%) – gamma-knife and 2 - endoscopic transnasal tumor resections. Right resections were made in 39 patients (35%), left – in 71 (65%). 45 patients evaluated 12 months after surgery**:** 31 patients (67%) became seizure free**:** 21 patients (45%) – Engel Ia, 6 (13%) - Engel Ib, 4 patients (9%) – Engel Id. 12 patients (26%) had - Engel II. The unsatisfactory results of treatment were noted at 4 patients (9%)**:** one patient – Engel IIIa, and 3 (6%) - outcome Engel IVa. According to histological study the most common seizure-causing lesion was FCD (92%). In 40% of cases we saw a combination of focal cortical dysplasia with hippocampal sclerosis (FCD IIIa).
Conclusion: The three-year results in the surgical treatment of

drug-resistant epilepsy demonstrate its efficacy and safety. 67% patients become seizure free.
Keywords: Epilepsy, Surgery, Moscow, Russia, Engel

OP-FN.03-07

WITHDRAWN

OP-FN.03-08

ECOG Assisted Epilepsy Surgery in Nepal

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Background: Cortical scarring is one of the common causes of intractable seizure among young adults in Nepal, the primary cause of which is scarring secondary to neurocysticercosis. Some of these patients come in status partialis continua. We share our experience on intraoperative mapping of the lesion by electrocorticography (ECOG) and subsequent resection of the defined area.
Method: Patients with intractable seizure with calcified lesion/ cortical scarring as the cause of seizure were included in this study. Patients underwent video EEG monitoring for few days till we preferably catch 2 ictal EEG or enough information on interictal onset zone mapping by scalp EEG so that semiology, EEG findings and imaging were concordant. All patients underwent ECoG based surgery where lesionectomy was done along with the resection of ictal or interictal onset zone around the lesion.
Results: In some cases, the lesion was located quite deep so, stereotactic localization of the lesion was performed to avoid unnecessary brain damage. In few cases with lesion around the motor cortex sleep-awake-sleep surgery was performed to avoid neurological deficit. In cases with multiple scars with one focus, the ECoG helped us to find the active lesion and thereby its resection.
Conclusion: ECoG based lesionectomy along with resection of interictal onset zone helped enormously in deciding the extent of the brain resection. We strongly recommend this technique during excision of other lesions like Glioma, Meningioma, AVM and other non-scarring lesions as well when the presentation of the lesion is seizure in order to give best surgical outcome.
Keywords: Epilepsy, Intractable, Cortical scarring, Electrocorticography

OP-FN.03-09

Seizure Control and Global Improvement After Selective Posterior Callosotomy

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Background: In 2016, Paglioli et al. published a paper proposing the use of selective posterior callosotomy, sparing prefrontal connectivity, as an approach to control drop attacks in cases of severe, multifocal epilepsy. Some of the patients included in the study not only had an improvement in the rate of drop attacks, but also in other seizure types, which correlated with a global electroencephalography (EEG) improvement.
Method: Case report of a 7 years old patient with Lennox Gastaut syndrome, submitted to selective posterior callosotomy in our service, who had an unexpected, global improvement on the ictal and interictal EEG, correlated with a drastic decrease in seizures occurence. Clinical, radiological and electroencephalographic pre and postoperative data are presented.
Results: The patient presented a drastic decrease in drop attacks rate, as expected, but also a global EEG improvement correlated with a decrease in seizure rates until a seizure free state which has lasted for over two years.
Discussion: The case presented is one of many among the patients included in Paglioli's study who developed such a favorable postoperative outcome. The rationale for such a phenomenon is open to debate, and its repercussions may widen the range of the procedure's indications.
Keywords: Epilepsy surgery, Lennox gastaut syndrome, Drop attacks, Selective posterior callosotomy

OP-FN.04-01

Trigeminal Schwannoma: Importance of Dural Reflection of Middle Fossa

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Background: This is a retrospective analysis of 97 consecutive patients with trigeminal schwannoma surgically managed from January 1984 to 1st Feb 2017.
Method: While 49 tumours were located in a single compartment Meckel's cave (MF) 30, posterior fossa (PF)19, 44 were dumbbell-shaped PF-MF in 37, MF-extracranial 7. In one case, the tumour was totally extracranial and in three others it occupied all 3 compartments. All 8 patients managed until 1992 were operated on

by conventional approaches. With the exception of the 19 patients with posterior fossa tumors and ten with dumbbell PF-MF tumors which were treated by the retromastoid route and three with MF tumor treated by the standard subtemporal approach, all other 57 cases managed since 1993 were operated on by the skull base approaches.
Results: Tumour could be radically removed in 84 patients and decompressed in thirteen. The only operative mortality was in a patient with residual/recurrent tumour who developed meningitis. Seven patients were operated for symptomatic recurrences.
Conclusion: Most multi-compartmental trigeminal schwannomas can be radically removed using a single-stage fronto-temporal interdural skull base approach.
Keywords: Meckel's cave, Middle fossa, Interdural, Retrosigmoid

OP-FN.04-02

Outcomes in Patients with Vestibular Schwannoma After Subtotal Resection and Adjuvant Radiosurgery

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Background: Debate continues with a limited number of publications describing outcomes in patients with vestibular schwannoma (VS) treated with planned subtotal resection (STR) plus radiosurgery (SRS). Here we present our experience.
Method: This is a retrospective review of 23 patients with Koos grade III and IV VS who were treated with subtotal resection followed by SRS. Tumor volumes, facial nerve function, hearing preservation, and the presence of trigeminal neuropathy were noted. Spearman's rank test was used to correlate facial nerve grade with postoperative tumor residual tumor volume.
Results: Tumor control was achieved in 21/23 patients (91.3%) with a mean follow up of 25 months. No patient required other treatment beyond the original surgery and adjuvant SRS during this period. Only in 2 patients did the 6 months post SRS MRI show a slight increase in volume as is commonly seen within first year after SRS. After a mean postoperative period of 28 months, 91% of patients had excellent (H&B I or II) and good (H&B III) facial nerve function grading. Improved facial nerve function was positively correlated with larger residual tumor volume (rs= 0.65). Kaplan Meier curve showed around 50% probability for regaining facial nerve function after initial deterioration. Four patients reported postoperative facial numbness at the site of surgery, with 3 cases showing improvement within a month. Temporary caudal cranial nerve dysfunction was observed in 2 patients.
Conclusion: Hybrid strategy of subtotal resection and adjuvant SRS provide patients with large VS excellent tumor control and a good clinical outcome.
Keywords: Vestibular schwannoma, Acoustic neuroma, Subtotal resection, SRS and gamma knife

OP-FN.04-03

Mechanical Allodynia Predicts Better Outcome of Microvascular Decompression for Trigeminal Neuralgia

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Aim: To determine whether mechanical allodynia (MA) acts as a predictor of outcome after microvascular decompression (MVD) for trigeminal neuralgia (TN) and discuss the potential pathological mechanisms involved.
Method: A series of 246 patients who underwent MVD for TN were involved in the study. The classifications were based on the characteristic of pain (shock-like or constant), and the presence of MA was defined from the chart review, retrospectively. The surgical outcome is defined as excellent, good, and poor. Immediate and long-term outcomes were compared to provide the information on recurrence and delayed relief. The relationship among the groups was investigated, and the strength was determined.
Results: Both presence of MA and type of TN pain are significant predictors of surgical outcome ($p< 0.05$). MA was proven to be an independent predictor of surgical outcome and also a significant predictor of existence of neurovascular compression ($p<0.05$) and lower rate of recurrence ($p< 0.05$). No statistically significant predictors of delayed relief were detected in this study.
Conclusion: The presence of MA is a reliable predictor of immediate and long-term outcome after MVD for TN. Compared to the patients without MA, the incidence rate of intraoperative neurovascular compression (NVC) was higher in MA-positive patients, who were more likely to achieve a better outcome and lower rate of recurrence after MVD for TN. Application of the information in this study will be helpful in patient selection of MVD for TN.
Keywords: Trigeminal neuralgia, Microvascular decompression, Mechanical allodynia, Neurovascular compression, Pathological mechanism

OP-FN.04-04

Auditory Brain Stem Implant in Neurofibromatosis Type 2 Patients; Review of 11 Patients

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Background: Neurofibromatosis type 2 (NF2) is an inherited disease cause benign Schwann cell tumors on many cranial nerves, in particular on the vestibular portions of the VIIIn bilaterally. In these patients bilateral hearing loss is frequently caused by the disease or results from its treatment. Auditory brain stem implant (ABI) have been developed to restore serviceable hearing in these patients. We report our experience and results using of ABI in 11 patient with bilateral vestibular shwanowa causing deafness.
Method: Patients underwent surgery for resection of tumors via retrosigmoid approach and after resection of second tumor ABI was placed in the lateral recess of forth ventricle. We evaluated demographic data including age at implantation, number of tumor resections before implantation, tumor size, surgical approach, and

postoperative surgical complications. The ABI auditory results were then evaluated for number of functioning electrodes and channels, hours per day of use, nonauditory side effect profile and hearing results.
Results: No surgical complications caused by ABI implantation were reveale and Electrode paddle migration did not occurred in our patients. A range of auditory performance is reported.
Conclusion: ABIs are safe, do not increase surgical morbidity, and allow most patients to experience improved communication as well as access to environmental sounds. Although the factors leading to improved performance are not completely clear, these new results show that excellent hearing is possible for NF2 patients with the ABI
Keywords: Auditory brain stem implant, Neurofibromatosis, Deafness

OP-FN.04-05

Endoscope-Assisted Microvascular Decompression in Hemifacial Spasm

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Aim: To evaluate the value of endoscope assistance in microvascular decompression for hemifacial spasm.
Method: 281 patients (177 females, 104 males, mean age 55 years) suffering from hemifacial spasm underwent an endoscope-assisted microvascular decompression via a lower retrosigmoid approach. The spasm was left in 169 patients and right in 112 patients.
Results: The use of the endoscope was safe. There was no endoscope-related nerve or vessel injury and morbidity respectively. In 48 patients, the AEP were affected while retracting the cerebellum under microscopic exploration. In contrast, all vascular compression sites were identified without any retraction with the 30° or 45° endoscope. More than half of the patients (151) were spasm-free immediately after surgery. In 145 patients (87 %), the spasm disappeared (follow-up time of 12 months in 167 patients). In 16 patients, the spasm improved by at least 50 %. In 4 patients, there was no significant improvement. In all of these patients, we found anatomic anomalies or a severe compression with morphological damage of the facial nerve. One patient died due to herpes encephalitis 14 days after surgery. In 84 patients (30 %), neurological deficits occurred after surgery, but these were permanent only in 9 patients (4 %) (5 anacusis, 6 hypacusis, 1 dizziness).
Conclusion: The endoscope-assisted microsurgical technique to decompress the facial nerve is a safe technique. The use of endoscopes improves the visualization of the nerve in its entire course through the subarachnoid space without any retraction.
Keywords: Hemifacial spasm, Microvascular decompression, Endoscope-assisted microvascular decompression, Endoscope-assisted microsurgery, Neuroendoscopy

OP-FN.04-06

Microsurgery of Vestibular Schwannoma After Radiosurgery: Challenges and Treatment

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Background: Microsurgery of Vestibular Schwannoma after Radiosurgery is uncommon. In this study, we plan to analyze neurological outcomes and the technical challenges associated with microsurgery following radiosurgery.
Method: Fifteen patients underwent microsurgery at an average of 35 months (range 3-96 months) after radiosurgery by the first author. Twelve of these had never undergone microsurgery before radiosurgery, 3 had partial excision before radiosurgery. Three patients had giant (>4 cm) and 11 had large (2.5-4cm) tumors. Post radiosurgery clinical course, neurology and imaging were analyzed.
Results: The indications of surgery included tumor progression or clinical worsening. The tumors found at surgery were firmer, with an avascular core but increased vascularity near the surface, with thickened arachnoid and often adhesions with surrounding structures making total excision difficult. Near total excision was employed in such cases. Eleven patients underwent gross total/ near total resection. No major morbidity or death was reported. Post-surgery, eight patients had grade I/II HB facial function, four had grade III, three had grade IV/V. Of the latter three, two had the same deficit preoperatively. At the last follow-up (average 42 months), all patients had a stable facial function. None of the patients have undergone any other radiosurgery/ microsurgery since the last intervention.
Conclusion: For the few patients who required microsurgery after radiosurgery, excellent tumor resection with an acceptable outcome can be achieved with proper techniques and neuromonitoring. Leaving tiny residue attached to critical structure is the key to optimal outcome.
Keywords: Vestibular schwannoma, Microsurgery, Radiosurgery, Failed radiosurgery, Growth, Outcome

OP-FN.04-07

Frame-Based Stereotaxy Using Egyplan File for Voxel-Based Target Calculation

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Background: Stereocalc software (for Radionics stereotactic system) depends on pixel-based radiological data (X and Y values only) to calculate the target co-ordinates. This caused technical difficulty with our new voxel-based CT scanner which gives X, Y and Z values. The aim of this study is to evaluate the accuracy of stereotactic target co-ordinates using voxel-based radiological data calculated with Egyplan.
Method: I designed a computer-based database file (Egyplan) to calculate the stereotactic target co-ordinates depending on voxel-based radiological data. 41 targets in 18 patients previously calculated by Stereocalc software were recalculated by Egyplan file providing the same input values with a fixed Z value. Test targets

were calculated before application in new patients. Postoperative brain imaging and the pathological results were used to assess the accuracy of Egyplan file in 25 new patients.
Results: Egyplan targets were shifted 0.22 - 1.41 mm from those of Stereocalc software with an average vector of 0.59 mm. Test targets and postoperative imaging showed accurate targeting. Histo-pathological results in 25 new cases were 100% positive.
Conclusion: Egyplan is accurate and valuable in calculating stereotactic targets using voxel-based radiological data.
Keywords: Egyplan, Targeting, Image-guided neurosurgery, Computer-assisted surgery, Stereotaxy

OP-FN.04-08

Narrow Foramen Ovale and Rotundum: A Role in the Etiology of Trigeminal Neuralgia

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Primary trigeminal neuralgia (TN) may occasionally occur in absence of neurovascular compression. A mechanism other than nerovascular compression may play a role in TN. High resolution CTs of 21 consecutive TN patients without vascular compression during surgery and 30 healthy volunteers were retrospectively performed. Measuring parameters (length, width, and aspect ratio) were obtained in the axial plane for foramen ovale,and in the reconstructed coronal plane for foramen rotundum on both sides in each subject. The right-sided foramen ovale are slightly narrower than the left-sided, but no difference was observed between the sides. No correlation was found between the foramen size and the gender in both groups. The affected side with a narrower ovale foramen (greater than 0.5mm) and a significantly greater aspect ratio compared with the unaffected side may contribute to TN. Meanwhile, no significant correlation, but more likely a tendency, was found between the right and left sides in size of foramen roundum (p=0.09). This study has speculatively suggested that a narrow skull foramen may be etiologically important in a small percentage of TN patients. If recurrent or residual TN was encountered in cases of TN without vascular compression during surgery, high resolution CT may help to evaluate the anatomical morphology of skull foramen in great detail.
Keywords: Foramen, Skull base, Nerve entrapment, Trigeminal neuralgia

OP-FN.04-09

Comparison of Efficacy of Percutaneous Procedures and Microvascular Decompression in the Management of Essential Trigeminal Neuralgia

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Background: There are no randomized controlled trials comparing TC, PTGC, and MVD for idiopathic TN at a single institution. The aim of the study was to assess the long-term outcome of treated patients with one of these techniques in the same institution.
Method: The authors present a retrospective study of 262 patients from 1983 to 2015 with drug-resistant idiopathic TN. Three groups were set up according to the techniques used**:** Group I (n=103), treated by TC; Group II (n=84), treated by PTGC; Group III (n=75), treated by MVD. The main judgment criterion was pain relief, $\chi 2$ or Fisher test, Kaplan-Meier, and log-rank were used for statistical analysis.
Results: The 3 groups were homogeneous according to age, duration of evolution, and pain topography. The immediate efficiency for the 3 groups was, respectively, 96%, 94%, and 95% (NS). At 6 years follow-up, 70%, 77%, and 72% of the patients, respectively, remained pain-free (NS). There was no difference between the 3 groups (log-rank, P=.867). Hypoesthesia was more frequent for PTGC (89%).
Conclusion: We did not find MVD to be more effective than the other techniques. However, it had the lowest long-term complication rate, which is a strong argument in choosing this technique for young and healthy patients. Percutaneous techniques, however, are still recommended in specific circumstances.
Keywords: Trigeminal neuralgia, Microvascular decompression, Balloon compression, Thermocoagulation

OP-FN.05-01

The Early Changes in Protein Expression in the Rhesus Optic Nerves Injured by a Single Dose/Fractionation Stereotactic Radiosurgery

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Background: Radiation-induced optic neuropathy (RION) is a severe complication of using stereotactic radiosurgery (SRS) to treat anterior visual disease. This study is designed to obtain and analyze the early changes in protein expression in rhesus optic nerves injured by SRS.
Method: The unilateral intraorbital optic nerves of 3 rhesus monkeys were injured by gamma knife surgery (GKS) with a single dose/fractionation scheme (marginal dose of 15 Gy, 50% isodose curve), while the contralateral optic nerves served as the control. The bilateral intraorbital optic nerves of 3 rhesus monkeys were dissected and performed a non-marker quantitative proteomic analysis at 72 hours after GKS. The function information of differential expression protein were obtained through BLAST sequence alignment with human protein.
Results: A total of 41 proteins fit the criteria for differential expression (change>2.0-fold, P value<0.05 or exclusive expression). Of the differentially expressed proteins, 7 proteins were significantly down-regulated (change>2.0-fold, P value<0.05) at the injured optic nerves, 18 proteins were exclusively expressed in the contralateral optic nerves, and 16 proteins were exclusively expressed in the injured optic nerves. The major functions of the low-expression proteins in the injured optic nerves were related to cytoskeleton, endocytosis, proteolysis, bicarbonate homeostasis, cell proliferation, growth and differentiation. The major functions of the high-expression proteins were related to inflammation and immunization.
Conclusion: This study indicated that at 72h after GKS, the intrinsic function of the cell were impaired in the injury side optic. The cell's endocytosis and pinocytosis were declined and shown a significant inflammation and immunization.
Keywords: Radiation, Proteomics, Optic nerve, Rhesus monkey

OP-FN.05-02

Extended DREZ-Lesioning for Alleviating Intractable Pain Following Brachial Plexus Avulsion Injuly

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Background: Dorsal root entry zone (DREZ) lesioning has been the most effective surgical treatment for the relief of intractable pain due to root avulsion injury; however, residual pain and a decrease in pain relief in the follow-up period have been reported in 23-70% of patients. Based on the most recent studies on neuropathic pain, we modified the conventional DREZ lesioning procedure to improve clinical outcomes.
Method: Fourteen patients underwent surgery between 2011 and 2017. The detailed surgical procedure will be reported in the presentation.
Results: All patients achieved excellent (n=10, pain relief without medication) or good (n=4, pain relief with medication) pain relief post-operatively, and the recurrence was not reported in any patients (median of 28 months after surgery,6-84 months). Twelve patients (88%) achieved total pain relief (0 or 1 on the VAS) with or without medication. No motor deficit was observed. A sensory deficit was observed in 2 patients and disappeared within one month in 1 patient. New pain at the adjacent level of DREZ lesioning was observed in 3 patients and disappeared within one month in 2 patients. In the other patient, new pain persisted and required analgesics.
Conclusion: Our preliminary results demonstrated that total and persistent global pain relief was achieved with the modified DREZ lesioning procedure in 90% of patients without major neurological deficits. Our results clearly suggested that the wide dynamic range neuron in Rexed layer V played a cardinal role in pain formation in case of brachial plexus avulsion injury.
Keywords: DREZ-lesion, Intractable pain, Brachial plexus avulsion

OP-FN.05-03

Early Results of Pallidotomy in Parkinsons Disease in Nepal

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Background: Surgical treatment of Parkinsons disease (PD) is already an established mode of treatment. Both Deep brain stimulation(DBS) and Lesioning (pallidotomy) surgeries may be used in PD.
Method: All the patients who underwent pallidotomy for idiopathic PD in Annapurna Neurological institute and Allied Sciences from 2014 to 2016 were included in this study. The preoperative and postoperative Unified Parkinsons Disease Rating Score(UPDRS) was compared and analysed. All surgeries were done in awake state. The standard functional coordinates for GPi was used. We used ZD Fisher Frame and used inbuilt Shaltenbrant Atlas. Intraoperative MER (inmito) was also done in these cases. We used Cosman RF generator with 1mm diameter and 2 mm exposed tips and the temperature was 70 degree Celsius for 40 second. In most of the cases we did stagged pallidotomy with three months gap in between.
Results: There were total of eight patients with six males and two female patients. The mean age of patients was 54 years. The mean preoperative UPDRS was 63 and mean postoperative UPDRS was 16 in ($p<0.05$). The mean change in UPDRS was 71% and it has not decreased much in our follow up. One patient of pallidotomy developed Parkinsons crisis but eventually recovered.
Conclusion: Though DBS is more popular than pallidotomy nowadays, we still believe that pallidotomy has a definite place in PD and it is cheaper and does not require time consuming battery adjustment. We believe that in context of developing country like Nepal pallidotomy may surpass DBS in long term.
Keywords: Parkinsons disease, Pallidotomy, UPDRS

OP-FN.05-04

Using 7-Tesla Magnetic Resonance to Target the Globus Pallidus Internus in Patients with Pakinson's Disease

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The globus pallidus internus (GPi) was an effective target in treating motor systems in patients with Parkinson's disease (PD). It was not a visual nucleus in 3-or less tesla magnetic resonance images (MRI), and therefore it would be indirect target in deep brain stimulus (DBS) surgery. For individual variations, the GPi target would be missed in some DBS surgery. 7-tesla MRI (7T-MRI) could improve the image resolution and contrast, and make GPi visual. It could directly target the GPi nucleus in patients, and improve the the accurary and reliability of the DBS targeting technique. 3 patients with PD disease were targeted on GPi nucleus with 7T-MRI. After the procedure, intraoperative MRI proved all the electrodes in exact GPi. After being operated on, the motor symptoms relieved. At the first programming(post 2 weeks of DBS), motor scores of Movement Disorders Society-Unified Parkinson's Disease Rating Scale (MDS-UPDRS) decreased obviously, the patients improved significantly on PD motor symptoms. 7T-MRI could be a good choice for direct target of GPi in Parkinson's disease.
Keywords: Globus pallidus internus(GPi), 7-tesla magnetic resonance images(7t-MRI), Deep brain stimulation(DBS), Parkinson's disease(PD)

OP-FN.05-05

Immediate Pain Relief After Microvascular Decompression in Patients with Idiopathic Trigeminal Neuralgia

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Aim: To determine the efficacy of microvascular decompression for idiopathic trigeminal neuralgia in terms of immediate pain relief.
Method: We retrospectively reviewed the record of 139 patients

who underwent microvascular decompression (MVD) for idiopathic trigeminal neuralgia(TGN) in our Department Lady Reading Hospital from Jan 2013 to Jan 2017. Patients with space occupying lesion at CP angle like tumors, multiple sclerosis, those responding to medical treatment, unfit and unwilling for surgery were excluded from the study. Injectable ketorolac as analgesic was given for 48 hours post-operatively. Carbamezapine postoperatively was stopped. Patients were assessed after 72 hours post-operatively for pain relief by Visual Analogue Scale.
Results: In this study, mean age was 63 years with standard deviation ± 12.249. 37% patients were male and 63% patients were female. More over microvascular decompression was effective in 88% patients and was not effective in 12% patients.
Conclusion: Our study concludes that microvascular decompression was 88% effective in idiopathic trigeminal neuralgia in terms of immediate pain relief.
Keywords: Microvascular decompression, Idiopathic trigeminal neuralgia, Immediate pain relief

OP-FN.05-06

Outcome of 5 Years Experience of Dorsal Root Entry Zone Lesioning for Neuropathic Brachial Plexus Pain

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Background: We sought to assess efficacy, surgical morbidity, and postoperative quality of life in patients who have undergone dorsal root entry zone (DREZ) lesioning for intractable brachial plexus and spinal cord injury pain.
Method: We analysed 14 patients who underwent DREZ lesioning since 2011 by a single surgeon. All our patients data was analysed on pre and post op SF12, pain scores, psychometric analysis and outcome scores. The mean age was 49 years (ranging from 23 to 69 years) and we had 13 males and 1 female. Average follow up was 1.8 years.
Results: Of the 14 patients, 4 patients experienced "excellent" postoperative (complete) pain relief with another 10 reporting "good" improvement. One patient had a revision surgery previously operated at a different institution. All the 14 patients (100%) stated they would recommend DREZ lesioning procedure to anyone with similar symptoms. Their quality of life changed dramatically. Four patients had objective evidence of a new, mild motor deficit post operatively. New onset of undisturbed paresthesia was seen in 50% of patients.
Conclusion: With appropriate patient selection, DREZ lesioning is an efficacious and durable procedure that can be performed with low morbidity and very good patient outcomes for patients with Brachial Plexus Avulsion and Spinal cord Injury pain. Awareness among doctors and patients is necessary.
Keywords: Dorsal root entry zone rhizotomy, Brahial plexus injury, Neuropathic pain

OP-FN.05-07

Early Results of Deep Brain Stimulation in Parkinsons Disease in Nepal

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Background: Surgical treatment of Parkinsons disease (PD) is already an established mode of treatment. Both Deep brain stimulation(DBS) and Lesioning (pallidotomy) surgeries may be used in PD. The targets for DBS are either Subthalamic nucleus(STN) or Globus pallidus internus (GPi).
Method: All the patients who underwent DBS for idiopathic PD in Annapurna Neurological institute and Allied Sciences from 2014 to 2016 were included in this study. The preoperative and postoperative Unified Parkinsons Disease Rating Score(UPDRS) was compared and analysed. All surgeries were done in awake state except for IPG(implantable pulse generator) implantation which was done under general anesthesia. The standard functional coordinates for STN and GPi was used. We used ZD Fisher Frame with its software and rechecked the targets with inbuilt Shaltenbrant Atlas. Intraoperative Microelectrode recording(MER) recording (Inmito) was also done in these cases. We used Brio rechargeable system with 10 years battery life.
Results: There were total nine cases of DBS with six male and three female patients. Two cases had their DBS in Gpi and remaining seven had their DBS in STN. The mean preoperative UPDRS was 61 and mean postoperative UPDRS was 22 (p value<0.05). Mean change in UPDRS was 65%. This change in UPDRS has not decreased much in the follow up. One patient of DBS developed postoperative hematoma which had to be evacuated but eventually recovered.
Conclusion: DBS is more popular nowadays and its result is also promising. However it is very expensive for developing country like ours where there is no health insurance system.
Keywords: Parkinsons disease, DBS, UPDRS

OP-FN.05-08

Challenges in Surgical Treatment of Cerebral Palsy (Spastic Diplegia); Selective Dorsal Rhizotomy (SDR) with Intraoperative Neurophysiology (IOM)

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Background: Need to understand neurosurgical surgical treatment of Cerebral Palsy (CP) is relevant in developing countries. CP manifests in >70% patients with limb rigidity in lower-extremities or Spastic-Diplegia (SD). Selective Dorsal Rhizotomy (SDR) with Intraoperative neurophysiology (IOM) is using surgical rhizotomy skills with advanced electrophysiology techniques/modalities to treat Spasticity in patients with Spastic Diplegia.
Method: Sherrington reported that underlying mechanism in SD was hyperactive reflexes. In SDR, sensory-roots are separated from motor-ones at the Conus/Cauda-Equina. These spastic roots are

selectively identified via EMG and separated into rootlets (3-8) at each level bilaterally (L2-S1/S2). These rootlets are tested using an advance-EMG-technique with rootlets producing hyper-activity are selectively-lesioned using certain grading criteria. These over-firing nerve rootlets are considered to be the source of patient's hypertonia.
Results: SDR relies to a major extent on the information provided by the electro-neurophysiologist. Most common concern for surgeons is S-2 roots and division/lesioning of S-2 rootlets. Some surgeons prefer not to open S-2 roots at all. Anal Sphincter needs to be diligently monitored using emg techniques. Correct patient selection is integral along for better results. Post-operative changes in spine and prevention of Quadriceps function with L3 and L4 roots is also a major concern. A functioning physiotherapy department needs to be integrated for post-operative strengthening of motor functions.
Conclusion: Most authors report spasticity stayed reduced 10 years post-op in all patients. 80% patients showed significant motor improvement. In-short, SDR is an extremely useful treatment option but requires a concerted team effort for successful outcomes.
Keywords: Intra-operative neurophysiology, Selective dorsal rhizotomy, Spasticity

OP-FN.05-09

Polietiological Trigeminal Neuralgia. Surgical Treatment Approach

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Aim: To analyze surgical treatment of polietiological trigeminal neuralgia.
Method: 2013-2016 we had 24 patients with trigeminal neuralgia. In 19 cases the etiological reason was a neurovascular conflict, in 3 - postherpetic neuralgia and in 2 cases – multiple sclerosis. We made 16 neurovascular decompressions and 8 radiofrequency ablations of Gasser's ganglion. We chose the way of surgery by etiological reason, anestesiological risks of treatment and the patient's choice. For microvascular decompression we used classic retrosigmoid approach without using retractors. Radiofrequency ablation of Gasser's ganglion we made by Radionics RFG 3C Plus. The ganglion puncture was made by 100mm needle RF-Neurotherm. After the sensitive stimulation and conformation of correct needle tip positioning, then we made a drug dream for patient and made 4-6 ablative cycles during 90-110 sec by 72-75° C.
Results: The patient's catamnesis was from 1 month to 3 years (in average 21 months). The average VAS before surgery was 9.47, after surgery – 0.9. 1 patient had a partial pain recurrence after microvascular decompression. Also 1 patient got a radiofrequency ablation of Gasser's ganglion after microvascular decompression because of pain recurrence. 2 patients after ablation got chewing muscles weakness on the manipulation side and 1 patient got dry eyes. Those symptoms regressed spontaneously from couple weeks to 1-2 months.
Conclusion: Surgical treatment results showed high efficiency of chosen surgeries. The possibility of performing those surgical techniques allows to provide qualified medical care to patients with such pathology in neurosurgical departments.
Keywords: Trigeminal neuralgia, Janetta procedure, Radiofrequency ablation

OP-FN.06-01

Effect of Microstructural Changes on the Recurrence of Trigeminal Neuralgia Treated with Percutaneous Balloon Compression

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Aim: To analyze 3-Tesla magnetic resonance imaging (MRI) findings and clinical features of patients with trigeminal neuralgia who underwent percutaneous balloon compression (PBC) procedure, and to determine whether these findings had an impact on the prognosis of the disease.
Method: A retrospective review of patients with trigeminal neuralgia who underwent PBC in Istanbul Faculty of Medicine Neurosurgery Department between January 1st 2007 and January 1st 2016 was undertaken. Of the 105 patients who underwent balloon compression, 27 patients received surgical treatment for the first time for typical trigeminal neuralgia were included in the study. Follow-ups, clinical features, and MRI findings were analyzed retrospectively. MRI findings and clinical features of patients with and without recurrence were compared. Correlation between fractional anisotropy (FA) values and recurrence was investigated.
Results: Nine (33%) patients had recurrence during follow-up. The patients with recurrence had longer duration of symptoms (p=0.032), higher FA difference (ΔFA) (p=0.042) and higher FA difference rate ($\hat{p}$FA) (p=0.023). A trend towards early recurrence was found in patients with higher $\hat{p}$FA, although not significant (p=0.051, R=0.319).
Conclusion: Symptom duration were longer and the microstructural changes were more apparent in patients with recurrence. Symptom duration and FA values obtained with 3-Tesla MRI might be a valuable input in surgical decision besides age, co-morbidities and other clinical and radiographic features.
Keywords: Trigeminal neuralgia, Percutaneous balloon compression, Fractional anisotropy

OP-FN.06-02

Pulsed Radiofrequency: A Management Option for Recurrent Trigeminal Neuralgia Following Radiofrequency Thermocoagulation

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Pain relief comparable to radiofrequency thermocoagulation (RFT) alone and fewer side effects have been achieved by combination treatment with pulsed radiofrequency (PRF) and short-duration RFT in trigeminal neuralgia (TN). We report the successful management of recurrent TN following RFT with single PRF in two patients. The RFT treatment was performed in 2-3 cycles for each division with the lesion setting at 75-80°C for 90 s. The PRF treatment was applied for 120 s with a generator output of 45 V, not exceeding

a temperature of 42°C at the tip of the electrode. In case 1, pain relief was immediately achieved by RFT (75°C for 90 s) with moderate hypesthesia. Relapse of the triggered pain occurred 6 months later, and PRF was then applied. Long-term (18 months) pain relief without any additional pharmacological or other treatment was reported. In case 2, a second RFT treatment at a higher temperature (80°C) was performed after recurrence following the first RFT within a week. Accompanied by worse hypesthesia, complete pain relief lasted for 6 months until the recurrence of pain triggered by tooth brushing. PRF was then applied, and complete analgesia with long-term follow-up (28 months) was achieved. The PRF treatment for recurrent TN following RFT in this study could be viewed as a combination of PRF and RFT treatments in succession. Therefore, PRF and RFT should be considered to be complementary rather than alternative in the management of TN.

Keywords: Trigeminal neuralgia, Radiofrequency thermocoagulation, Pulsed radiofrequency

OP-FN.06-03

Endoscope-Assisted Microsurgery for Microvascular Decompression for Trigeminal Neuralgia

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Aim: To discuss the results of endoscope-assisted surgery in microvascular decompression (MVD) of trigeminal nerve.

Method: Neuroendoscopy was used as an adjunct to the surgical microscope in the MVD of the trigeminal nerve in 7 cases. After a standard microsurgical approach to CNs V, VII, and VIII, the endoscope was used to inspect all aspects of neural anatomy, to assess vascular compression, and to check the results of the decompression. Endoscope use was graded in four categories**:** Grade I, used but no definite role; Grade II, visualization assisted; Grade III, procedure assisted; and Grade IV, primary role. The usefulness of the endoscope was evaluated in each case.

Results: The endoscope was useful in visualizing the anatomy in all cases. It was especially useful in establishing trigeminal vein compression of CN V in Meckel's cave; observing multiple sources of vascular compression; ensuring adequate decompression; and permitting observation of the compression of CN V at the root exit zone by small arteries and veins.

Conclusion: The endoscope is a useful adjunct to MVD in the treatment of trigeminal neuralgia.

Keywords: Microvascular decompression, Neuroendoscope, Trigeminal neuralgia

OP-FN.06-04

Endoscope Assisted MVD in Trigeminal Neuralgia: Are the Advantages Still Worthy Towards More Advantages

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Background: Still many patients prefer non-or minimally-invasive techniques than major procedures for the treatment of trigeminal neuralgia. Our aim is to evaluate the advantages of the use of endoscope in microvascular decompression for treatment of trigeminal neuralgia and gradually being used as a primary role.

Method: Twenty-five patients with trigeminal neuralgia undergone microvascular decompression (MVD) using endoscope as inspection and final confirmation.

Results: The vessels identified during surgery as a cause of nerve compression were the SCA in 70% followed by (AICA) in 15% of patients then followed by venous compression in 10% of patients. Endoscope could detect the offending vessel not detected in FIESTA MRI in 3/25 patients. Endoscope was useful in minimizing the cerebellar retraction with a range of 3-10 mm in 23/25 patients, compared with the microscope. It enabled wider areas of exploration specially behind bony ridges. With the endoscope, a true close up view could be achieved and better identification of the course of the vessel. In the immediate postoperative period, 95% have been reported to have immediate pain relief, and only 5 % showed delayed pain relief with slightly improved in comparison to his preoperative condition. Postoperative temporary hypothesia occurred in 5 % of patients who were completely recovered after three months.

Conclusion: It is possible to lessen the size of the standard retrosegmoid craniotomy. The panoramic view in the endoscope that is not obtainable by the microscope enabled detection of the offending vessel even if not clearly seen in FIESTA MRI.

Keywords: Endoscope, MVD, Trigeminal, Offending vessel

OP-FN.06-05

Trigeminal Nerve Compression Technique for the Treatment of Idiopathic Trigeminal Neuralgia

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Aim: To determine the outcome of trigeminal nerve compression treatment for the idiopathic trigeminal neuralgia without decompressing the nerve compressed by the offending vessel.

Method: This is a descriptive study. Conducted in the departments of neurosurgery Hayatabad Medical Complex and Lady Reading Hospital Peshawar, Pakistan from Jun.2004 to Feb.2017. All cases of idiopathic trigeminal neuralgia were included in the study. Informed consents were taken from the patients.

Results: Total number of patients were 120. Male patients were 56.3% and female were 43.7%. Age ranges from 30-- 70 years, mean age was 50+_20 years. MRI brain were performed in all cases. The diagnosis of Trigeminal neuralgia was mainly clinical. Maximum follow up of the patients were up to 12 years. Complete pain free were 96.2% and recurrence were noted in 3.8%. Three patients developed ottorrhea, rhinorea and 7th nerve palsy one each.

Conclusion: The compression of Trigeminal Nerve by Vascular loop is not the cause of Trigeminal Neuralgia. Trigeminal Nerve Compression TGNC technique for the trigeminal Neuralgia TGN is less invasive, safe and effective.

Keywords: Trigeminal neuralgia, Trigeminal nerve compression technique, Treatment of choice

OP-FN.06-06

Fusion Images as a Diagnostic and Neurosurgical Planning Tool in MVD

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Background: The precise preoperative assessment of the complex nerve-vessel relationship at the root exit zone (REZ) of the facial and trigeminal nerves is important when planning microvascular decompression (MVD) in patients with hemifacial spasms or trigeminal neuralgia. We used the fusion Images as a diagnostic and neurosurgical planning tool preoperative —that allows clear visualization of the spatial relationship between the vessels and the rootlet of the facial and trigeminal nerves at the brainstem.
Method: We retrospectively reviewed our clinical database. Fusion Images was used for 20 cases (mean age 61.5). The complex anatomical relationship between the offending vessels and the facial and trigeminal nerves REZ was inspected preoperatively by examining the fusion images from various perspectives within the cerebellopontine angle cistern, within the affected facial and trigeminal nerves, and through the simulated surgical route. The reconstructed 3D findings of the nerve-vessel relationship were compared with the intraoperative findings. Postoperatively, the fused 3D MR imaging technique was used to confirm that microsurgical dissection and the interposed prosthesis had succeeded in maintaining the causative vessels in a position away from the REZ.
Results: We achieved 100% remission of symptoms in trigeminal neuralgia and 50% total remission and 50% partial remission in hemifacial spasm.
Conclusion: The fusion image depicted contours of the brainstem, nerves and vessels clearly, and that allowed precise assessment of the pathogenic compression of the facial nerve or trigeminal nerve by the offending vessels, comparative to the operative findings. Fusion images can be routinely used in all cases of MVD.
Keywords: Fusion image, Femifacial spasm, Trigeminal neuralgia, REZ, MVD

OP-FN.06-07

Surgical Treatment of Trigeminal Neuralgia

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Background: Trigeminal neuralgia (TN) is the pathology which characterized by paroxysmal homolateral facial pain. The basic pathogenetic method of trigeminal neuralgia treatment is vascular decompression of trigeminal root, which allows to eliminate the cause of disease and reach full recovery. A substantiation of indications for vascular decompression and estimations of its efficiency at TN.
Method: 44 patients with trigeminal neuralgia were operated in High technology medical center University clinic in the period from 2011 till 2016.
Results: Among which women rate was 27 (61%) patients, men 17 (39%). Mean age was 51 years. Right sided pain syndrome was in 31 patients, left sided – 13. MRI data with signs of neurovascular conflict was observed in 91% of cases. Diagnosis of TN was definite when the patient had 4 of 5 criteria that were proposes by international Pain Society IN 1994. Regression of pain syndrome in the nearest postoperative period was achived in all patients. Recurrence of pain syndrome within one year after surgery had two patients. Two patients underwent additional surgery – readjustment of the displased pad. There was no mortality in our study and the overall complication rate in the late postoperative period was less than 1.5%.
Conclusion: Vascular decompression of the trigeminal nerve is the most effective pathognomonic method of treatment of the trigeminal neuralgia.
Keywords: Trigeminal neuralgia, Vascular decompression, Trigeminal root

OP-FN.06-08

Recurrence of Pain Syndrome After Microvascular Decompression of the Trigeminal Nerve

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Background: Trigeminal neuralgia (TN) with severe pain syndrome occurs in elderly and senile age. The intensity and the sudden appearance of pain, repetitive episodes leads to physical and mental exhaustion and gives reason to believe trigeminal neuralgia disease most hard to stand. Our aim is to analyze the causes of pain recurrence after microvascular decompression of the trigeminal nerve in the late postoperative periods.
Method: In our clinic, the last 10 years has conducted more than 500 operations for trigeminal neuralgia. All the patients had produced microvascular decompression of the trigeminal nerve with various buffer materials. In the near term to 90% of patients were discharged home in satisfactory condition with complete regression of pain.
Results: The patients' catamnesis in the period from 2 to 8 years after surgery, 12 patients had a recurrence of pain on the side of the operation. We have analyzed these cases with a complete analysis of the operation course. And it was found that a recurrence of pain was more frequently in group of patients whom arterial neurovascular conflict wasn't found, but vascular conflict due to the small veins was found.
Conclusion: Thus, we assume that greater risk of recurrence of pain after surgery of microvascular decompression of the trigeminal nerve is in the group of patients whom clear arterial neurovascular conflict wasn't found at the time of the operation.
Keywords: Recurrence of pain, Microvascular decompression, Trigeminal nerve

OP-FN.06-09

Retrospective Analyse of 64 Cases with Trigeminal Neuralgia Which has been Applied Microvascular Decompression Surgery

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Background: Trigeminal neuralgia is a disease which is characterised with pain in the region of 5th nerve on face. This pain is triggered by cutaneous stimuli, such as a breeze on the face, chewing, talking, or brushing the teeth. Typical feature of trigeminal neuralgia pain is shock-like characteristic without neurological deficiency. Microvascular decompression is one of the surgical treatment options trigeminal neuralgia.
Method: In this presentation we evaluated and analysed 64 Trigeminal neuralgia patients which underwent microvascular decompression surgery between 2008-2016.
Results: The ages of patients was between 20 and 80. Their mean age was 56,15. 34 of patients was female and 30 was male. 35 patients had right, and 29 had left side pain. It was observed vasculer contact in all patient perioperatively. It was mostly superior cerebellar artery. Besides we detected venous and the other arterial structures. Surgically the surgeons saw root entry zone, dissected arachnoid bonds, and layed a teflon corpuscule between 5th nerve and vascular structures.
Conclusion: We analyzed clinical recovery rates, complations, and recurrences.
Keywords: Trigeminal neuralgia, Microvascular decompression, Superior cerebellar artery

OP-GK.01-01

The Effects of Prophylactic and Late Onset Usage of Bevacizumab on Radiation Injury After High Dose Stereotactic Radiosurgery: Experimental Rat Study

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Background: Stereotactic Radiosurgery (SRS) is recently used in treatment of brain pathologies alone or with other treatment modalities. But, there are some side effects as radiation injury characterized with edema and necrosis at peripheral normal tissue that should be coped with. The new treatment of this side effect is bevacizumab which targets increased vascular endothelial growth factor (VEGF), one of the most prominent etiology of radiation injury. In our study, we aimed to form a rat experimental model to describe the effects of bevacizumab, an anti-VEGF monoclonal antibody, following Gamma knife surgery (GKS) with different doses, and to compare results of prophylactic and delayed onset use of bevacizumab.
Method: 54 adult Wistar rats are divided into nine groups according to two different SRS doses (%50 isodose 50 Gy and 100 Gy) targeting their right frontal lobes and two different protocols of bevacizumab treatment (prophylactic and delayed onset). Rats were examined with Magnetic Resonance Imaging (MRI) in certain times and sacrificed after 12 weeks of observation and then their right frontal lobes are used for immunohistochemistry with Haematoxylin and Eosin (H&E) staining and VEGF and CD31 antibodies.
Results: In the results of the study, radiation necrosis occurred in all irradiated animals in between 3 and 10 weeks with various degrees seen both on MRI section and macroscopically.
Conclusion: These findings showed that the existing time and degree of radiation injury was depended on the protocol of bevacizumab receiving. Although bevacizumab decreased the signs of radiation injury, this effect was existed only after prophylactic onset.
Keywords: Bevacizumab, Gamma-knife, Radiation injury, Stereotactic radiosurgery, Vascular endothelial growth factor (VEGF)

OP-GK.01-02

Draining Vein Shielding in Intracranial AVM's During Gamma-Knife: A New Way of Preventing Post Gamma-Knife Edema and Hemorrhage

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Background: Following gamma knife (GK) therapy for intracranial AVM's, obliteration of the nidus occurs over several years. During this period there is a risk of edema and hemorrhage. We hypothesized that decreasing radiation dose to the draining vein(s) may prevent early draining vein obliteration leading to a decrease in edema and hemorrhage rates in the post GK period.
Method: This retro-prospective study over 5 years (Jan2009 to Feb2014) included patients with intracranial AVM who underwent gamma knife therapy (Leksell Perfexion®, Elekta, Stockholm) at our center. All patients who underwent draining vein shielding (DVS) were included in the test group and patients who did not undergo DVA were put in the control group. All patients were followed up 6 monthly clinically as well as radiologically CT/MRI brain to see for edema. DSA was done at 2 years for all patients.
Results: 185 patients were included in this study of which 96were in the control group and 89 in the test group. The mean age, sex distribution, co-morbidities and adjuvant treatment were comparable in both groups. The lobar distribution of the AVM, angio-architecture and radiation dose were comparable between the two groups. Due to shielding, the test group patients received significantly less radiation to the draining vein (0.0001). On follow up, significantly less number of patients in the test group had new neurological deficits (p=0.001). Importantly, significantly more number of patients in the control group had post-radiosurgery intracranial hemorrhage (p=0.03) and brain edema (p=0.002).
Conclusion: Shielding of draining vein is a potent new strategy in minimizing edema and hemorrhage as well as clinical deterioration following gamma knife therapy for intracranial AVM's.
Keywords: Intracranial AVM, Gamma-knife, Edema, Hemorrhage

OP-GK.01-03

Gamma Knife Radiosurgery of Cavernous Sinus Meningiomas: Analysis of Long-Term Outcomes in 151 Patients

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Background: In this study, by reviewing 11-year experience of gamma knife radiosurgery (GKS) of cavernous sinus meningioma (CSM), long-term outcomes are presented and different role-playing factors are compared to get some criteria to decide between either surgical or primary GKS treatment modalities.
Method: Retrospectively, 151 patients with CSM excluding tumors with secondary extension to the CS were studied. There were 115 women and 36 men including 40 post-operative and 111 primary (notoperated) GKS cases. Mean follow-up time was 33.5 (range**:** 3-120) months. Mean marginal dose was 13.2 Gy (range**:** 9.1-18 Gy).
Results: The actuarial 5- and 10-year progression-free survival rates were 94.3% and 67.9%, respectively. Radiologic regression observed in 87 patients (57%) and tumor remained stable in 57 patients (37.7). History of previous conventional radiotherapy worsened symptomatic improvement. Time interval between onset of symptoms and GKS was significantly lower in patients who had at least one symptomatic improvement. Percent of radiosurgical tumor coverage has also a significant effect on radiologic prognosis. tumor volume above of 6.75 cm3 is associated with worse radiologic prognosis. The other was marginal dose of 13.1 above of which there was more probability of symptomatic relief.
Conclusion: This study showed, again, the high efficacy and safety of GKS in both post-operative and non-operative patients. We discussed against routine surgical treatment for CSM and regarding the patient selection for exclusive treatment of CSM by GKS, we suggest to evaluate achievability of adequate marginal dose (>13-14 Gy) instead of tumor size or volume.
Keywords: Cavernous sinus, Meningioma, Gamma knife, Radiosurgery

OP-GK.01-04

Factors Associated with Hearing Preservation After Gamma Knife Radiosurgery for Vestibular Schwannomas in Patients with Serviceable Hearing: An Indian Study

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Background: Gamma Knife surgery (GKS) has been a safe and effective treatment for small- to medium-sized vestibular schwannomas (VSs) over relatively long-term outcomes.. The purpose of this study was to evaluate the hearing preservation rate as well as factors related to hearing preservation in patients with VSs and serviceable hearing who were treated with GKS.
Method: Among patients with Gardner-Robertson (GR) Class I or II serviceable hearing and VSs treated with GKS between 2006 - 2014, 77 were evaluable via periodic MR imaging and audiometry.
Results: The median age at the time of GKS was 39.46 years. Forty two patients (42.5%) had GR Class I hearing and 35 (54.5%) had GR Class II hearing at the time of GKS. The median tumor volume was 4.27 cm3 (0.4-10.5). The median maximum and tumor margin radiation doses were 24 and 12 Gy, respectively. The overall tumor control rate was 96.1%. Sixty one patients had serviceable hearing at follow up while 16 patients lost their hearing. Hearing preservation rate at the last follow up was 79.2%. Mean of mean dose of cochlear was 3.89(2.3-6.5) gy and mean of maximum cochlear dose was 6.6(3.8-10) gy. Three patients had tumor volume more than 6 cc lost their hearing during 6 months follow up only. Out of 16 patients eight patients had received higher dose to cochlea(>4.5gy).
Conclusion: Factors related to hearing preservation included a GR Class I hearing pre-GKS and a lower mean cochlear radiation dose.
Keywords: Vestibular schwannoma, Radiosurgery, Hearing loss

OP-GK.01-05

Effectiveness of Gamma Knife Radiosurgery in Patients with Trigeminal Neuralgia

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Gamma Knife Radiosurgery (GKR) is a non-invasive technic compared to microvascular decompression in treatment of patients with trigeminal neuralgia (TN). The purpose of this study was to to evaluate the safety and effectiveness of GKS in TN. Between June 2014 and January 2017, 24 patients with diagnosis of TN were treated with GKS. Patients' data were retrospectively evaluated. All patients were treated on the Leksell Gamma Knife Unit, Model C (Elekta Stocholm, Sweden), and the target dose was 40 Gy with 50% isodose. The patients were discharged in the same day of the treatment and clinical follow-up was performed using Visual analog scale (VAS) at first week of the treatment and then every 3 months. Twenty-four patients (14 Female/ 9Male) who underwent GKR for TN were evaluated. The median age was 62,5 years (range, 34-91 years); 14 patients (59%) have pain on the right side, nine patients (37%) have pain on the left side and one (%4) has pain on bilateral side. The median follow-up time was 11 month (range, 3-27 months). The pain improved and VAS decreased in 16 patients (%67); there was no change in 5 patients (%21) and three patients (12%) lost follow-up. Only one patient (%4) developed facial paralysis, which resolved in 3 weeks of steroid treatment. Our results suggest that GKR is an effective treatment for patients with TN and a good option for patients with surgical comorbidities.
Keywords: Gamma knife, Pain, Trigeminal neuralgia

OP-GK.01-06

Gamma Knife Radiosurgery for Cerebellopontine Angle Meningiomas

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Background: Ninety three patients with cerebellopontine angle (CPA) meningioma who have been treated by Gamma Knife stereotactic radiosurgery (GKS) between 2005 and 2013, are retrospectively studied and the role- playing factors are analyzed.
Method: There were 75 females and 18 males with a mean age of 52.2 years. Sixty four patients (69%) were treated solely by GKS and 29 patients (31%) had one to three previous surgeries. Mean follow-up time was 31.5 months. The median tumor volume was 6 cm3. The mean values for maximal dose and marginal dose were 20.2 and 13.6 Gy respectively.
Results: Tumor control (lack of progression) was achieved in 96.8% of the patients and 55.9% of the patients showed tumor regression at follow-up MRI. The actuarial 5-year progression-free survival (PFS) rate was 89%. Neurologic improvement occurred in 49.5% of the patients and 11.8% had some symptomatic worsening. Adverse radiation effects were seen in 4.3% of the patients. A worse symptomatic outcome, male sex, a lower tumor coverage and Marginal doses <13.5Gy were associated with worse radiologic outcomes. A worse radiologic outcome, a higher tumor volume and specifically tumor volumes ≥8.5cc were associated with worse symptomatic outcomes. Male sex was associated with a lower PFS.
Conclusion: Gamma Knife radiosurgery, either primarily or post- operatively, offers a decent long-term tumor control in CPA meningioma and is associated with an acceptable complication profile especially in tumors with lower volumes.
Keywords: Gamma knife, Radiosurgery, Cerebellopontine angle

OP-GK.01-07

Olfactory Status after Gamma Knife Radiosurgery of Olfactory Groove Meningioma

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Background: Olfactory change is an expected defect in patients with olfactory groove meningioma that can occur before and/or after various treatment modalities. In this study we tried to show olfactory status in patient with olfactory groove meningioma (OGM) after primary or postoperative Gamma Knife Radiosurgery (GKRS).
Method: The medical records of 8 patients with OMG who underwent GKRS were reviewed. The patients were asked to report their sense of smell subjectively and have a simultaneous Sniff Magnitude Test (SMT) for evaluation of current olfactory status.
Results: In 4 patients with primary GKRS, 1 patient reported deterioration of olfaction. However, the SMT showed moderate hyposmia in all of these cases. In 4 patients who had a history of previous surgery, no one reported deterioration after GKRS. Although all of these patients were subjectively reported their olfaction as normal, the SMT revealed mild, moderate and severe hyposmia in 1, 1 and 2 patients, respectively. The sense of smell was not significantly different between patients who received primary or secondary GKRS.
Conclusion: Olfactory impairment was showed in all patients with OGM after GKRS. As these patients did not subjectively mention olfactory impairment, objective tests are needed to evaluate any changes in olfactory statue after GKRS.
Keywords: Meningioma, Olfaction, Hyposmia, Gamma knife radiosurgery

OP-GK.01-08

Gamma Knife Radiosurgery for 78 Consecutive Patients

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Gamma knife radiosurgery (GKR) has been in use for over 4 decades and is currently being extensively used in more than 300 centers worldwide. While the indications and the effectiveness of GKR in acoustic schwannomas, deep seated tumors, AVMs and trigeminal neuralgia are fairly well-established; the other potential indications including intractable pain, epilepsy, movement disorders and psychiatric diseases are still evolving. The data of 78 consecutive patients are presented and discussed in the context of the current GKR literature.
Keywords: Gamma knife, Radiosurgery, Indications

OP-GK.01-09

Evaluating the Effect of Gamma Knife Radiosurgery in Patients with Recurrent High Grade Glioma

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Background: High-grade glioma is extremely aggressive tumor and associated with poor survival despite aggressive surgical resection and external beam radiation with concomitant chemotherapy. Gamma Knife delivers precisely defined radiation to the target lesion with minimum toxicity to surrounding normal brain tissue. However, the role of Gamma Knife in treatment of high-grade glioma has not been well established. Therefore, we reviewed patients who treated with Gamma Knife for high-grade glioma in our institution.
Method: Twenty-eight patients treated Gamma Knife for recurrent high-grade glioma after surgical resection and standard chemo-radiation therapy between September 2014 and December 2016 were analyzed. Patient characteristics, treatment variables,

progression free survival time and overall survival were assessed.
Results: Thirteen patients were male and 15 were female. The median Karnofsky performance scale (KPS) was 80 (range, 50-90). Histology was glioblastoma in 23 patients(82%), anaplastic astrocytoma in one (4%), anaplastic oligodendroglioma in three (10%) and one anaplastic oligoastrocytoma (4%). Treatment was performed with Leksell Gamma Knife 4C (Elekta AB, Stockholm). The median target tumor volume was 17.4 cc (range, 0.15-105.7 cc). The median number of fractions was 1 (range, 1-5) with a median prescription dose of 15 Gy (range, 10-30 Gy). Eight patients were treated with hypofractionated radiosurgery. The median progression free survival and overall survival times after Gamma Knife were 4 months (range, 1-20 months) and 8 months (range, 3-13 months), respectively.
Conclusion: The predictive factors for improved survival were target volume and KPS. Our results suggest that Gamma Knife is an effective and safe treatment in patients with recurrent high-grade glioma.
Keywords: Hypofractionated radiosurgery, Gamma knife, Glioma

OP-INF.01-01

Approaching to "Zero" Incidence in Shunt Infections

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Background: This experimental study on shunt patients was designed to determine the effect of the usage of 2% chlorhexidine gluconate + 70% alcohol in skin cleaning, full compliance with the asepsis principles and not changing the dressing for 48 hours, on infection rates.
Method: The subjects of the study consisted of 38 patients who received a shunt in the Department of Neurosurgery at the Hospital of Cerrahpaşa Medical Faculty between November 2012 and November 2013. 44 patients, who received for the first time a shunt in the same department between October 2012 and October 2013, included in the retrospective control group of the study. In the study, regarding the experiment group the collected data consisted of demographics, monitoring records and information about the infection prevention and its follow-up and in the control group consisted of demographics and follow-up information. These data was obtained during the monitorization in the pre-, peri- and postoperative periods.
Results: Regarding the study results, infection rate per patient was 2.6% in the experiment group and 6.8% in the control group. Infection rate per operation was 1.8% in the experiment group and 4.8% in the control group. There was no statistical difference between the groups in respect of both of the infection rates ($p>0.05$).
Conclusion: Although there was no statistical difference, we observed that preventive measures provide a decrease in infections. We believe that the aim of "zero" case can be achieved by increasing the sampling size and new interventions.
Keywords: Shunt infections, Ventriculoperitoneal shunt, Cerebrospinal fluid, Infection surgical site, Quality

OP-INF.01-02

Kinect Based Automated Assessment of Hand Hygiene Compliance in Health Care Setting (Neurosurgery ICU)

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Background: Infection is the most important cause of morbidity &mortality in hospitals. It is well known that hand hygiene compliance is the single most critical variable affecting infection rates in the emergency &critical care setting. The aim for this study was to develop a system for automated measurement of hand washing compliance in healthcare setting.
Method: The study was done at neurosurgery intensive care unit(NICU)at JPNATC, AIIMS, New Delhi from 2014-2016. Commercially available Kinect sensor by Microsoft™ and GYLPH codes were used and a integration software developed to create a prototype for automatic hand washing compliance detection and recording. The Kinect sensor is a camera with depth sensor which provides full-body 3Dmotion capture and was used for Bed tracking, hand sanitizer tracking and also hand washing tracing. Face recognition was done with the GYLPH tagging. Software was developed so as to document the number of times a particular healthcare professional hand washed in a specific time period and automatic logging of this activity with face recognition was done so that data could be available on a web based dashboard in real time.
Results: Successful recognition of hand washing was seen at the individual level. The real-time web based dashboard developed which shows nurse/doctor wise, bed wise and shift Wise Hand Wash compliance report. On comparing with direct observation, the real-time web based dashboard estimated the number of hand hygiene with >80% sensitivity.
Conclusion: Kinect based automatic hand washing compliance system has the potential to revolutionize hand hygiene compliance and patient outcomes
Keywords: Kinect camera, Hand hygiene compliance, Infection

OP-INF.01-03

Post-Operative Wound Infection Following Cranial Surgery at a Tertiary Regional Neurosurgical Centre: A Retrospective Study of 815 Operations

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Background: Post-operative wound infections affect 5% of craniotomies and are associated with significant morbidity and mortality. Identifiable pre-morbid risk factors can determine individuals at highest risk of infection. The aim of this study was to calculate the incidence of wound infection following cranial surgery at a tertiary regional neurosurgical centre and analyse risk factors which may pre-dispose these patients to infection. All cranial procedures conducted in theatre by the neurosurgical team at Queens Hospital, Romford over a 15 month period were retrospectively identified using theatre records. The incidence of

post-operative wound infection was determined using the Centre for Disease Control (CDC) criteria. Cranial procedures with a primary infective source were excluded from this figure. Potential pre-operative risk factors for infection were sourced using electronic patient records.
Method: A total of 866 cranial procedures were performed on 715 patients during this period.
Results: Following application of exclusion criteria, 815 procedures were analysed with a post-operative wound infection rate of 4.7%. Operations for EVD insertion or cranioplasty were statistically significant for a higher rate of infection (relative risk 5.44, 3.59 respectively, P<0.05). There was no statistically significant increased risk of infection with concurrent diabetes or steroid use.
Conclusion: This study identifies a wound infection rate that is comparable with the published literature. We have shown that the incidence of infection is significantly affected by type of procedure, particularly when a foreign body is introduced into the cranium. Early identification of this subset of high risk patients may improve patient outcome and reduce associated morbidity and mortality.
Keywords: Craniotomy, Post-operative wound infection, Risk factors for infection

OP-INF.01-04

Effect of the Bundle Approach on the Frequency of EVD-Associated Infections

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Background: EVD is one of the most frequent operations in neurosurgery. But it is associated with infection up to 40% according to the literature. To minimize these infections, polypragmatic measures called "Bundle Approach" were introduced in our clinic in 2006, which include disinfection of hands and skin, wound care, bandage exchange and liquor extraction. This study examines the effect of these measures on the incidence of EVD-associated infections.
Method: The patients were divided in two groups**:** group A (2000 until 2005) before the bundle approach and group B (2006 until 2010) with the bundle approach. Patients who had had a EVD in other hospitals or who suffered already from ventriculitis, were excluded. The incidences, the different risk factors of EVD-associated infections as well as microbiological findings and pre-operatively use of antibiotics were evaluated.
Results: From 349 patients (group A**:** n=141; group B**:** n=208) 41 patients (29%) of group A and 10 patients (4,8%) of group B have an EVD-associated infection (p<0.0001). Microbiological findings of CSF in both groups is mainly staphyloccocus.
Conclusion: The bundle approach resulted in a significant reduction of EVD-associated infections.
Keywords: Ventriculostomy, Infections, Bündle-Approach

OP-INF.01-05

The Management of Hydatidosis of the Central Nervous System

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Hydatidosis is a frequent disease, which has been endemic and remains a real health problem in Morocco. Localization in the central nervous system (CNS) is rare. Our retrospective study, which reports 46 cases of hydatidosis of the central nervous system, has 32 cases of cerebral localization and 14 cases of vertebro-medullary localization collected in the department of neurosurgery at the Mohammed 6 University hospital of Marrakech over a period of 10 years. Vertebro-medullary hydatidosis can be of heavy load price especially in view of the significant risk of recurrence then cerebral level ablation of the hydatid cyst by the technique of hydraulic dissection by injection of a saline solution according to the technique of "Arana Iniguez" Remains the treatment of choice in our patients. Through this work, we will analyze the different epidemiological, clinical, paraclinical, therapeutic and evolutionary characteristics of this parasitic affection, and we insist on a preventive policy with the aim of eradicating this pathology
Keywords: Central nervous system hydatidosis, CT scan, MRI, Treatment

OP-INF.01-06

Pre-Operative Anti-Fungal for 2 Weeks Provides Mortality Benefit in Fungal Infections of Brain. An Institution's Neurosurgical Experience

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Background: Fungal infection of the Central Nervous System (CNS) is a rare entity. Different treatment strategies and modalities are used around the world but despite modern neurosurgical advances, mortality rates of these infections remains very high. Our objective was to identify factors influencing the outcome of these patients.
Method: We retrospectively reviewed charts of all consecutive cases of CNS fungal infections operated between January 2000 and December 2015, at the Aga Khan University Hospital. All patients with histopathologically or microbiologically confirmed CNS fungal infection were included.
Results: Data was collected and analyzed for 47 patients. Headache was the most common presenting symptom, reported in 38 (80.9%) patients. Most commonly involved location was the anterior fossa and frontal lobe, seen in 16 (34%) patients. All patients underwent surgical intervention. Of these, sub-total resection was carried out in 15 (31.9%), gross total resection was performed in 5 cases (10.6%) and biopsy only performed in the rest. 18 (38.3%) patients received pre-operative anti-fungal therapy. 20 (42.5%) patients expired either

during hospital stay or in post-operative period due to reasons such as poor neurologic status, disseminated fungal infection or renal failure. Amongst the survivors, 19 (40.4%) patients showed improvement or complete resolution.
Conclusion: Fungal infections of the CNS can occur in both immune-compromised and immune-competent patients. Neurosurgical interventions whenever feasible, radical surgery, and antifungal treatment especially Voricanozole, pre and post operation improves outcome. Pre-operative anti-fungal for at least 2 weeks provide more favorable outcomes
Keywords: Central nervous system, Fungal infection, Craniotomy, Voriconazole, Pakistan

OP-INF.01-07

Spinal Infection: Epidemelogy and Treatment

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Background: Spinal infections concern a broad spectrum of pathologies. The vertebrae bone, disc space, epidural area and the cord may be involved solely or more commonly in combination. The Infection is caused by bacteria or fungal organisms that affect the vertebral column after spine surgery or by hematogenous dissemination. The evolution to severe compression of the neural structures and pathological disorders are at the origin of permanent paralysis, spinal deformities or death.
Method: The etiology of spinal infections is multifactorial and varied and can be summarized as follows**:** Pyogenic vertebral osteomyelitis is frequently caused by Staphylococcus aureus (50 to 65% of cases), Escherichia coli (20%), Streptococcus (8%) S. epidermidis (5%), Pseudomonas, acineto-bacter… and Specific infection (Mycobacterium tuberculosis or (tuberculosis), Echinococcus granulosus (E. granulosus) hydatic and larval cyst, brucella …)
The goals of treatment;
- Early diagnosis with identification of the causative agent.
- Complete eradication of the infection.
- Preservation of neurological function.
- Stability of the spine.

Conclusion: Spinal infection can be developed after spinal surgery, direct open spinal trauma and infections in adjacent structures. Due to many factors, in some areas of Africa, the frequency is very high and also 11% of all patients with back pain were diagnosed with diskitis and osteomyelitis
Keywords: Infection, Spondylitis, Biopsy

OP-INF.01-08

Presenting Experience of Managing Tuberculosis at Our Institutions in Medan

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Cerebral and spinal tuberculomas are a rare and serious form of tuberculosis (TB) due to the haematogenous spread of Mycobacterium Tuberculosis (MT). IGRAs are most costly and technically complex to do than tuberculin test in order to diagnose Tuberculosis in Low and Middle income countries. A 51-year-old female patient complaining of severe headache followed by fever. Patient had no history with tuberculosis symptoms. On examination, patient showed decreased of vision. Another case, A 14-year-old male patient complaining of weakness severe pain and on both his legs since 3 month ago. Patient had history of TB extrapulmonary known since 6 month ago. On examination, patient showed paresthesias on his back. Investigations**:** MRI showed mimicking result with Glioblastom Multiform accompanied with IGRAs positive. Second case MRI showed spinal cord compression on thoracal 7th. Anti Tuberculosis drugs (ATD) was given followed by Subtotal resection and Laminectomy+Partial Posterior Copectomy+Posterior Fusion. The pathology report revealed necrotic areas surrounded caseating granulomatous reaction typical of tuberculosis and many multinucleated giant cell Langhans was present. Patient was relieved of her symptoms and improved neurologically. A rare case of cerebral and spinal tuberculomas was treated with ATD and two step surgery requiring stabilization.
Keywords: Cerebral, Spinal tuberculomas, IGRAs

OP-INF.01-09

Management of Intracranial Suppurations: About 170 Cases in Neurosurgery Department, IBN Tofail Hospital, University Hospital Mohammed 6-Marrakesh-Morocco

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Intracranial abscesses and empyema are rare intracranial suppurations but severe prognosis. Therapeutic attitudes are controversial with disparate results. In order to standardize this study, the authors analyzed retrospectively the case of 170 patients treated for intracranial suppurations(IS) during the period from January 2004 to December 2015, 113 cases of abscesses, 50 cases of sous dural empyema and 7 cases of epidural empyema. and The epidemiological, etiopathogenic, clinical, para-clinical, therapeutic and evolutionary aspects are discussed with a review of the literature.
Keywords: Intracranial suppurations, Abscess, Empyema, CT scan, Brain MRI, Treatment

OP-MSC.01-01

Minimally Expensive Neurosurgery

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Background: National minimum salary is $ 208, and the cost of a standard craniotomy is approximately $ 1,500. We introduce the concept of minimally expensive neurosurgery as an initiative to reduce the cost of surgery using conventional techniques, homemade or improvised alternative materials in the operating room in order to maintain the "state of the art". The aim of this study is to reduce cost of a standard craniotomy. Use of conventional techniques, tips and tricks to perform a standard craniotomy with minimal supplies.

Method: More than 300 Patients low-income and non uninsured treated at a public hospital since March 2011. We perform standard craniotomies using Gigli saw, cranioplasty with non-absorbable sutures, burr holes reconstruction with bone dust, alternative handmade surgical patties and polyethylene bags to drape the surgical field and the surgical microscope. Cost of a surgery with these resources and the rate of postsurgical infections are compared. Low cost virtual craniotomy and clipping and computerized neurosurgical planning were developed with free software.
Results: We reduce the waiting time for surgery from 1 week to 3-4 days if programmed and less than 12 hours in case of emergency surgeries. The rate of infection at the surgical site was 3.1%. We reduced the cost of a standard craniotomy from $1530 to $306.
Conclusion: It is possible to reduce the costs of a standard craniotomy up to 80% making the minimally expensive neurosurgery initiative an easy, useful, and reproducible alternative to perform a neurological surgery in current standards with the use of minimal supplies.
Keywords: Low cost, Neurosurgery, Supply

OP-MSC.01-02

Neurosurgeons' Socioeconomic Status Across the World and Compared to Other Specialties

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Background: Due to the sensitive nature of the topic, there is a paucity of data regarding wages of European neurosurgeons. Thus, the primary aim of our study was to collect information regarding financial compensation of neurosurgeons from European countries.
Method: A 28-item online questionnaire was sent to 49 neurosurgical departments across Europe (one in each country). Overall response rate was 77.5% (n=38).
Results: Our results showed that neurosurgeons in Europe are earning an average net income of €45'829 and €33'258, for Senior and Junior consultant respectively. 71% of respondents reported their salary to be the same as other specialties. A clear factor influencing wages in Europe is the infrastructure, where a country with a lower socioeconomic status have less income than a country with a more advanced centers. Secondly, we compared European neurosurgeons' salaries with those of their colleagues from the USA, Canada, Arabian Gulf, and Australia. We found consultants in Europe to be the least paid, with an average annual net salary less than the United State's by 87.7%, 80.8% less than Canadians, 79% less than Australians' and 69.8% less than Arabian Gulf countries.
Conclusion: We looked into this sensitive topic with an aim to highlight incentives that could attract the best and the brightest to the field. We found a disparity in neurosurgeons' annual wages across the world, with European salaries to be trailing behind. Although Neurosurgery is one of the top paid specialty in North America, the situation differ in Europe where it is mostly the same compared to other specialties.
Keywords: Neurosurgeons, Socioeconomics, Salary, Wages, Europe, Specialties

OP-MSC.01-03

Management of Intracranial Epidermoids: Experience at a Tertiary Care Centre in North East India

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Background: Epidermoid tumours are benign lesions representing 1% of all intracranial tumours. Surgical treatment is challenging because of its slow growth along the natural neurovascular and cisternal planes.
Method: 16 cases of intracranial epidermoids confirmed by computed tomography (CT) and magnetic resonance imaging (MRI) of brain in plain, contrast and other relevant studies were enrolled in the study conducted between January 2010 to December 2015. Demographic data, details of clinical presentation, surgical management and follow up were documented for each patient. All the patients were operated in Gauhati Medical College and Hospital. All patients were followed-up routinely by clinical examination and neuroimaging.
Results: 11 patients presented with cerebellopontine angle (CPA) epidermoids extending to various basal cerebrospinal fluid (CSF) cisterns, there were 3 cases of para and suprasellar epidermoids and 2 cases of sylvian fissure epidermoids. The mean age at presentation was 34.32 years with maximum age of 49 years and minimum 17 years in our series. Total excision was achieved in 12(75%) cases. In 4(25%) cases parts of the cyst capsule were left behind because they were adherent to the brainstem and other critical neurovascular structures. One patient died post operatively following aspiration pneumonitis and infection. No recurrence was recorded till writing this paper.
Conclusion: Intracranial epidermoid are rare benign tumours. Total resection should be the goal to minimize the risk of postoperative aseptic meningitis, hydrocephalus, and tumour recurrence. Modern neurosurgical tools and microsurgery techniques have considerably improved the completeness of cyst resection without neurological deficits.
Keywords: Intracranial epidermoid, Brain tumor, Benign intracranial tumor

OP-MSC.01-04

Is It Ethical to Practice on Living Emergency Patients?

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Background: Nowadays scientific rational thinking is often dispensed and forgotten. Autopsy must be performed for criminal, clinical, scientific, and educational purposes. In developed countries practically the last two reason have been cancelled. The clinical reasons are also rare because of perfect diagnostic possibilities. It causes a lot of difficulty in all surgical fields especially in neurosurgery. Radio- and endovascular surgery breaktrough decreased a great number of just those relatively easier microsurgical operations, affording opportunities for microsurgeons' development in practice. At the same time, the most difficult operable microsurgical pathology have remained for open surgery. Supraregional centralization in elective

cases prove good solutions, but in acute cases in mid centers, not only experts have to operate acute difficult cases.(acute vascular or tumor pathology). Cadaver workshops are very useful, but cannot compensate the daily training which necessary like in every sport. Nobody is talking about this growing practical training dificulty. The aim of our innovation was to solve this ethical and training problem.
Method: We introduced daily fresh cadaver practice (1 hour) in our department.
Results: The results of difficult microsurgical operations dramatically improved.
Conclusion: The daily inductive fresh cadaver practice in local autopsy room should be introduced into neurosurgical practice. The conserved cryogenic human specimens (like in workshops) cannot prove the same life like situations like fresh cadavers.
Keywords: Fresh cadaver excersises, Microsurgery, Bypass

OP-MSC.01-05

UK Survey on Parental Leave Among Neurosurgeons: Have We Got the Balance Right?

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Background: Shared Parental Leave (SPL) policy allows parents to share up to 52 weeks of leave. Facilitation of return to work post-maternity and utilisation of paternity leave remain variable with no data published on parental leave amongst neurosurgical trainees in the UK. Online anonymised survey approved by the Society of British Neurosurgeons (SBNS) committee. Neurosurgical doctors in the UK are the subjects of this study.
Method: The questions established the stage of training at which parental leave was taken, available support upon return to work, consideration of job share or part time employment and suggestions to improve implementation of SPL policy within the demands of a neurosurgical career.
Results: 44/81 (54%) respondents were parents (8 female, 36 male) of which all mothers and 27/35(77%) fathers took parental leave. 4/7 mothers and 10/27 fathers would consider shared parental leave in the future. 8/27 fathers and 2/7 mothers would job share. 6/7 mothers were offered no support for return to work. A recurring concern was decline in surgical skills.
Conclusion: Our results suggest limited support is available for neurosurgeons taking parental leave. Potential improvements as suggested by respondents include cultural acceptance and facilitation of job sharing or part time work, staged return, mentorship, choice of rotation, location and accrual of annual leave. Open discussion is needed in order to offer options that balance the rigorous standards required to become a competent neurosurgeon with the realities of family life in line with other surgical specialties and other countries
Keywords: Parental leave, Maternity leave, Neurosurgical trainees

OP-MSC.01-06

Basic Microsurgical and Endoscopic Training in Neurosurgery

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One of the key moments of learning curve during neurosurgical residency is training of manual skills. Lack of human cadaveric specimen and simulators determins use of handy and effective models for surgical training. Neuroendoscopy, transsphenoidal endoscopic surgery and endoscopic assistanse recently has gained popularity and is becoming a standard technique. Neurosurgical residents have practically no endoscopic experience when they reach the training stage for endoscopic procedures.
We have developed an affordable training model "from microsurgery to endoscopy" for neurosurgeons starting from the scratch. 5 training courses were held. Three of them last for 2 days, two - for 1 day. Each courese was held for 8 persons on the base of Karl-Storz training center. In all, 40 young neurosurgeons and residents have been trained. The headline was to provide consecutive microsurgical procedures in 2D using exoscope (such as dural suturing, vascular anastomosis, nerve suturing) followed by two- and four-hand endoscopic training procedures (included drilling, working with fresh and boiled eggs etc.). It is notable that the master class attracted not only residents, but also experienced neurosurgeons. High demand of this course showed lack of similar training courses for young neurosurgeons. These training courses became a first step not only in surgical self-enhancement for young surgeons, but also a beginning in constructing a compleet neurosurgical practical course.
Keywords: Surgical training, Neurosurgical training, Microsurgery, Endoscopy

OP-MSC.01-07

Hands-on Training in Neurosurgery Residency and Patient Safety

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Background: With the emergence of competency-based residency education worldwide, supervised operative experience is essential for residents to demonstrate competency in requisite neurosurgical procedures prior to board certification. This study explores the implications of such operative exposure to patient safety.
Method: Using a pro- and retrospectively maintained databank at two teaching hospitals, we compared complications, revision surgery rates, and outcome of consecutive patients undergoing lumbar microdiscectomy (n=102), lumbar decompression (n=471),

anterior cervical discectomy and fusion (n=281), cranioplasty (n=240), shunt implantation (n=200), and epidural steroid injections (n=354) by a supervised resident versus a board-certified faculty neurosurgeon as primary surgeon using logistic regression.
Results: Intra- (OR 0.68, 95%CI 0.33–1.41, p=0.305) and postoperative complications (OR 1.14, 95%CI 0.78–1.65, p=0.49), revision surgeries (OR 1.23, 95%CI 0.78–1.93, p=0.36), operating time (p=0.87), blood loss (p=0.57) and the likelihood to be considered treatment responder (OR 0.91, 95%CI 0.65–1.28, p=0.62) was similar for both groups. Specifics of European and North American neurosurgery training are compared and discussed.
Conclusion: Hands-on surgical education within the framework of a structured residency-training program is safe in cervical and lumbar spine surgery and for standard cranial procedures.
Keywords: Complications, Education, Residency, Safety, Training, Working time

OP-MSC.01-08

Integrated Neurosurgical Education System

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Aim: To develop and improve neurosurgical residents' education using technology enhanced learning.
Method: With the unlimited reading resources, it's becoming tough for neurosurgical resident to keep up with the overwhelming information and basic knowledge of the specialty. So, we propose to integrate several aspects of medical education including curriculum development, learning, teaching, knowledge and surgical skills assessment, Immediate feedback via technology-enhanced learning and case-based techniques to enable residents to enter each case in a logbook system format except it will be sent to the attending consultant for feedback. Then The system will immediately provide the resident with interactive questions related to the case from the diagnosis and procedure name in an efficient manner to cover the most important details of the case. The system will be able to calculate the marks and give immediate feedback. So, resident can monitor his progress.
Results: Such system require extensive resources and effort to be developed, but it worth the efforts. The advantages of such a system as complementary to current education methods include direct resident teaching case by case via a well-developed curriculum and technology enhanced learning that will provide guidance in a very challenging easy way and eliminate personal bias. The downside of such system includes the time and budget required to build such a system. Also, the system still need to be tested and validated.
Conclusion: With the current internet diversions, such a system might help guiding the residents to learn the necessary information based on their level and ensure that they have the required knowledge to be competent.
Keywords: Feedback, Assessment, Technology enhanced, Education

OP-MSC.01-09

Islamic Golden Age &Neurosurgey

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The science in different branches developed remarkably Under the Islamic civilization, during what is known as the Islamic Golden Ages (5th-15th century), not all scientists during this period were Muslim or Arab, as there were a number of notable non-Arab scientists (most notably Persians), as well as some non-Muslim had great contribution to science in the Islamic civilization. We will present the contributions of the scientists to this field who lives under the umbrella of Islamic civilization and will be divided in to**:**

1- Era before Avicenna**:** we have scientist such as, Hunayn ibn Ishaq (809-873 AD) who is Christian physician born in Iraq and has a great role in translation of 129 works of ancient Greek physician Galen into Arabic. And others such as Rhazes (865–925 AD)
2- Avicenna Era(980-1073AD), which include also Abulcasis(936-1013).
3- Era After Avicenna**:** which include Esmail Jorjani (Ad 1042–1137), Ibn Ilyas (c. 1380–1422 AD), Serefeddin Sabuncuoğlu (1385--1468 AD)
4- Present time**:** Mahmut Gazi Yaşargil (born on July 6, 1925 in Lice, Diyarbakır, Turkey) had a great contributions to the development of neurosurgery and was honored as "Neurosurgery's Man of the Century 1950-1999" at the Congress of Neurological Surgeons Annual Meeting, and Madjid Samii was born in Tehran on June 19, 1937, pioneer in skullbase surgery and was elected the neurosurgeon of the year 2013

Keywords: Islamic golden age, History of neurosurgery, Dark ages

OP-NA.01-01

Neuroanatomy and Art - What is Its Relevance to a Neurosurgeon?

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Background: Neuroanatomy has been studied in detail since centuries not only by anatomists but also by others with varying interests. There is a strong connection between Renaissance artists and Neuroanatomy and the author would like to explore this in detail.
Method: Four different European artists' work with regard to neuroanatomy has been studied in detail and examples with interesting findings are selected to highlight their understanding. Its correlation in life outside medical science is also exhibited.
Results: Most fascinating facts are revealed as we study their work. The evolution of our knowledge about neuroanatomy is traced back to Renaissance.
Conclusion: Neuroanatomy has been the subject of interest for longtime and understanding it from a different perspective is intellectually stimulating.
Keywords: Neuroanatomy, Art, Renaissance

OP-NA.01-02

Microsurgical Anatomy of the Foramen Magnum Region

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Background: Lesions involving the anterior border of the foramen magnum (FM) and lower clivus are classically considered between the most challenging to treat. A deep knowledge of the anatomy of this region is paramount to perform tailored and safe microsurgical trans-cranial and endoscopic approaches to the posterior and postero-lateral skull base, also minimizing the risk of complications. The aim of this study is to review the microsurgical anatomy of the foramen magnum region and the surgical approaches directed to it or through it.
Method: Five dry skulls and 5 formalin-fixed adult heads were used. The skulls were studied under naked eye before and under microscope afterwards. Some measurements were obtained between structures considered to be important bony landmarks. The heads were secured in a head-holder to perform a stepwise microscopic dissection of the foramen magnum region from posterior, postero-lateral and anterior perspectives according to the most common surgical approaches.
Results: FM is bounded by the clival, condylar and squamosal part of the occipital bone. It involves the lower clivus and transmits the lower brainstem and upper cervical spinal cord, pre-medullary cistern and cistern magna, vertebral artery, anterior and posterior spinal arteries, hypoglossal and accessory nerve, dentate ligament, cranio-vertebral dura and related marginal sinus. FM also has intimate relationships with inferior petrosal sinus, sigmoid sinus and jugular bulb, jugular foramen and hypoglossal canal with their contents.
Conclusion: A deep knowledge of the anatomy of the FM region and neighboring neurovascular structures is mandatory to perform safely all the surgical approaches to this complex area.
Keywords: Microsurgical anatomy, Foramen magnum, Skull base, Cranio-vertebral junction

OP-NA.01-03

Anatomical Features of Endoscopic Endonasal Transpterygoid Approach to Lateral Skull Base: Cadaveric Study

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Background: Endoscopic skull base surgery constantly updates its specific indications and surgical techniques on the basis of new anatomical data. The aim of this study was to delineate the surgical limits of endoscopic endonasal transpterygoid approach (EETPA) to lateral skull base and to demonstrate, step by step, peculiar anatomical features of the approach by obtaining 3-dimensional (3-D) images during dissections.
Method: EETPA to lateral skull base was performed in 6 formalin-fixed human cadavers bilaterally in the Surgical Neuroanatomy Laboratory of the Cerrahpasa Faculty of Medicine. A neuroendoscopy unit, a computer based neuronavigation system and necessary endoscopic instruments were used during the procedures. During pure endoscopic approaches towards different parts of lateral skull base, a novel technique for obtaining 3-D images via 2-D endoscope was implemented to display the surgical steps and targets.
Results: Diverse target-related approaches were performed to reach cavernous sinus, Meckel's cave, petrous apex, temporal lobe, infrapetrous juguler tubercle and condylar fossa regions. In all of the target-related approaches, exposing the maxillary sinus and removal of the pterygoid process created the most direct surgical corridor available. Vidian canal, foramen rotundum and Eustachian tube were identified as the main landmarks of the EETPA.
Conclusion: EETPA enables visualization of substantial parts of lateral skull base and has the potential to provide direct surgical access to lesions arising from this area. EETPA requires a thorough understanding of complex 3-D endoscopic skull base anatomy, in addition to surgical experience gained by interdisciplinary team work.
Keywords: Endoscopic, Transpterygoid, Skull base, Meckel's cave, Petrous apex

OP-NA.01-04

Microscopic and Endoscopic Approaches to Thalamus

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Background: Deep-seated location of thalamus adjacent to important neurovascular structures imparts a surgical challenge in terms of accessibility. Our primary aim is to reveal the microsurgical anatomy of the thalamus, in addition to revise the surgical approaches with respect to important neurovascular structures, encountered within the surgical corridor for each approach.
Method: A total of 20 formaline-fixed hemispheres and 5 silicone-injected whole heads were examined under x6-40 magnifications and with the 0° rigid straight neuroendoscope. The thalamus was examined from the lateral, medial, superior and inferior sides to define its fiber connections and the relationships with adjacent cortical and subcortical structures from the angles of the approaches.
Results: A modification of a surgical neuroanatomy based thalamus ramification into six regions has been proposed in this study. Accordingly, the supracarotid infrafrontal and transrostral translamina terminalis approaches were used to reach anteroinferior thalamus, the anterior interhemispheric transcallosal and suprapineal approaches to medial thalamus, the contralateral interhemispheric transcallosal approach to lateral thalamus, the occipital interhemispheric transcallosal, distal transsylvian,

transprecuneus and parieto-occipital transventricular approaches to posterosuperior thalamus, the subtemporal and paramedian supraserebellar transtentorial approaches to lateral posteroinferior thalamus, and the supracerebellar infratentorial and suboccipital transtentorial approaches to medial posteroinferior thalamus.
Conclusion: Neurosurgeons should be familiar with the connectional anatomy of the thalamus, its association to other surrounding neurovascular structures from an angle of approach to be utilized. Knowledge of related fiber arhitecture, in addition to pros and cons of each surgical approach for thalamic lesions may help in more accurate and safe surgery in and around the region.
Keywords: Thalamus, Anatomy, Surgical approaches, White matter tracts

OP-NA.01-05

Neuronavigation Guided Detailed Endoscopic and Microscopic Investigation of the Anatomy of the Cerebellopontine Angle on Human Cadaver Heads with Colored-Silicon-Filled Vasculature

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Cerebellopontine angle (CPA) is one of the important areas in the neurosurgery practice. Retrosigmoid suboccipital approach (RSA) is the most favored approach among all CPA approaches. In this study, neuronavigation guided detailed endoscopic and microscopic investigation of the anatomy of the CPA on human cadaver heads with colored-silicon-filled vasculature, and evaluation of the endoscopic versus microscopic approaches in regard to surgical exposure and visualization are aimed. Four formalin-fixed-cadaver heads were used. Colored silicon was injected in the vasculature of the cadaver head specimens. For neuronavigation, magnetic resonance imaging studies were performed. Anatomies of a total of eight CPAs on four cadaver heads were examined using both endoscopic and microscopic RSA under neuronavigation guidance. Upper, middle and inferior neurovascular complexes that were described by Rhoton according to anatomic relations of these structures were exposed via endoscopic and microscopic RSA. The farmost medio-lateral exposure angles in the axial planes, and angles between uppermost and lowermost surgical exposure in the sagittal planes (working angles) were measured. Microscopic and endoscopic average exposure-angle measurements in axial and sagittal planes for the three complexes were evaluated statistically. It was shown that endoscopic RSA procured a wider working angle from the vantage point of the surgeon both in axial and sagittal planes and thus provided wider working room for operative hand tools. To conclude, we evaluated that the use of endoscope in CPA lesions helped to recognize anatomic structures faster, yielded more anatomic details, and revealed the hidden remaining tumor tissue.
Keywords: Endoscopy, Retrosigmoid approach, Microscopy, Cerebellopontine angle

OP-NA.01-06

Transcallosal Transsplenial Pineal Approaches: Anterior and Posterior Routes

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Pineal approaches has always been a challenge for neurosurgeons. Although, the infratentorial supracerebellar and occipital transtentorial routes supplies enough coverage of mostly the infratentorial lesions, they still fall short for the lesion expanding supratentorially, anteriorly, and into the body or splenium of the corpus callosum. The interhemispheric transcallosal route inherits a procedure prone to seqelea caused by retraction, callosotomy, navigating through the third ventricle. This study explores the inter hemispheric transsplenial routes, both anterior and posterior, and provides visual anatomical guide and considerations for approaching the pineal region.
The purpose of this study is 1) provide an anatomical step by step guide for anterior and posterior interhemispheric transsplenial approach to the pineal region and falcotentorial junction and 2) further discuss the considerations for approaches to help choose the most suitable approach for an intervention to the region.
Three adult cadaveric specimens were studied, using 3 to 40 magnification, after perfusion of the arteries and veins with colored silicone. Intraoperative views of the approaches were examined in stepwise dissections. In addition, our clinical experience in regard to the approaches are discussed. Furthermore, magnetic imaging venography study of 50 patients were included for the discussion of the anatomical considerations.
Keywords: Pineal, Microsurgical anatomy, Surgical approach, Transsplenial

OP-NA.01-07

A Natural Corridor to Reach the Lesions Around the Fourth Ventricle: The Tonsillouvular Fissure Approach

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Background: Dissection of the natural corridors of central nervous system provides a better exposure and less neural tissue damage. Tonsillouvular fissure approach (TUFA) was first described by Yaşargil. This study aims to provide a detailed description of surgical technique and microsurgical anatomy along with cadaveric dissections and clinical cases for the first time in the literature.
Method: In this study, four human cadaveric heads, in which the arteries had been perfused with red silicone and the veins with blue silicone, and ten cerebellar hemisphere of formalin-fixed were dissected in a stepwise manner. Also the records of twelve patients that operated via the tonsillouvular fissure approach in University of Wisconsin-Madison Department of Neurological Surgery were studied.

Results: The importance of cerebellar structures described in detail. Gross total removal was achieved in eleven cases, and subtotal (residual less than 5% of tumor) removal was achieved in one case. No complications were noted in any patient during the perioperative period. No patient had new neurological deficit in the early postoperative period.
Conclusion: The TUFA provides a direct route and excellent surgical view for the small lesions around fourth ventricle without splitting vermis. Lesion is reached through a natural anatomic corridor without a cortical incision. Preoperative MRI scans should be carefully assessed to select appropriate cases. In order to increase the utility of natural anatomic corridors in neurosurgical practice and to get better clinical results, in-depth knowledge of the anatomy and laboratory training in microsurgery are necessary.
Keywords: Fourth ventricle, Microsurgical anatomy, Tonsillouvular fissure approach, Cerebellomedullary fissure, Cerebellar tonsil

OP-NA.01-08

Interhemispheric Precuneus Retrosplenial Transfalcine Approach for the Falcotentorial Junction Meningiomas. Laboratory Investigation

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Background: Here, we proposed an alternative supratentorial approach to the posterior tentorial incisural space; interhemispheric precuneus retrosplenial transfalcine approach (IPRTA) as an alternative to lesions well suited for other approaches without performing a callosotomy.
Method: Study was completed at the Surgical Neuroanatomy Laboratory in the Department of Neurological Surgery, University of Pittsburgh School of Medicine. In order to define the approach step-by-step, six craniotomies were performed on 6 fresh adult cadavers Also thin slice CT-venography scans of 20 patients were evaluated.
Results: CT scans of 20 patients showed parieto-occipital sulcus is a reliable landmark to define parieto-occipital sulcus. Anterior to the torcula, occipital vein was identified as posterior limit of IPRTA. Space between posterior and anterior bridging veins were defined as a feasible corridor. Dissections demonstrated a joint drainage pattern of anterior parietal vein with veins anterior to it causes more available surgical space for IPRTA. All the 6 specimens (100%) and 20 patients (100%) had a 30 mm space between occipital and posterior parietal veins or between posterior and anterior parietal veins at least on one hemisphere.
Conclusion: In providing access to the posterior tentorial incisural tumors, IPRTA provides a relatively safer corridor in selected cases. Having the shortest distance both anterior and posterior limits of posterior tentorial incisural tumors, it offers a convenience. For pineal tumors and falcotentorial meningiomas we recommend IPRTA if there is enough space between bridging veins and if deep venous structures are not displaced superiorly.
Keywords: Falcotentorial, Interhemispheric, Meningioma, Pineal, Parietal, Retrosplenial

OP-NA.01-09

Three-Dimensional CT Study on the Anatomy of Vertebral Artery at Atlantoaxial and Intracranial Segment

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The atlantoaxial and intracranial segments of vertebral artery (V3-4) are winding around their peripheral structures. CT angiography (CTA) shows adventages to reveal the three dimentional (3D) anatomy related to V3-4 and prepare for clinical diagnosis and help for clinical diagnosis and treatment. In different patologies (trauma, tumors, or infection), diffrent ways of approaches like craniovertebral approaches, lateral condillar approaches can be used. İn these approaches we need detailed knowledge of the osseus anatomy of C1 in addition to the vertebral artery. 200 cases were selected from head-neck CTA examination at the Department of Radiology in Ege University. All the 3D images were formed with multiplanar reconstruction, volume rendering together, On the 3D images, The courses of V3-4 were observed and measured. The anatomical measurements obtained from C1 vertebra and its relation to the vertebral artery were statisticaly analized. We evaluate the insidence of anatomical variations of the V3 and V4 segment of the vertebral artery and the posterior arch of the atlas. 88 case were female and 112 case were male, The prevelance of posticus ponticus was %14 (28cases). %53 of these cases were bilateraly posticus ponticulus (15 case).İn one case right V3 entering the dura passing under the atlas. We determined one left V4 aneurysm (9.8 mmx7.6mm). In one case there was a fusion defect of posterior arc of atlas. In 5 case right and left V4 segments of vertebral artery didn't join together to form the basillar artery. In one case there was a fusion anomaly of occiput and C1.
Keywords: Vertebral artery, Computed tomography, V3 segment,V4 segment, Craniocervical junction

OP-NA.02-01

Fiber Dissection Technique: Deep Cerebellar Nuclei and Cerebellar Peduncles

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Background: The fiber dissection technique involves peeling away the white matter tracts of the brain to display its three-dimensional anatomic organization. Nevertheless, the fiber dissection technique is a very relevant and reliable method for neurosurgeons to study the details of brain anatomic features. The objective of the study was to dissect the deep cerebellar nuclei and the cerebellar peduncles using this technique.
Method: Using operating microscope, five previously frozen, formalin-fixed human cerebellums were dissected from the superior surface and five were dissected from the inferior surface. Each stage of the process is described. The primary dissection tools

were handmade, thin, wooden spatulas with tips of various sizes and wooden tooth-picks.
Results: We exposed and studied all the deep cerebellar nuclei (dentate, interpositus and fastigial) and the cerebellar peduncles (inferior, middle and superior) and acquired a comprehensive understanding of their configurations and locations.
Conclusion: The complex structures of the cerebellum can be more clearly defined and understood when the fiber dissection technique is used. This knowledge can be incorporated into the preoperative planning process and applied to surgical strategies. Fiber dissection is time-consuming and complex, but it greatly adds to our knowledge of brain anatomic features and thus helps improve the quality of micro-neurosurgery.
Keywords: Deep cerebellar nuclei, Dentate nucleus, Nucleus interpositus, Fastigial nucleus, Fiber dissection

OP-NA.02-02

The Relationship of Ventral Amygdalofugal Pathway with Subthalamic Nucleus

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Aim: To investigate microsurgical anatomy of the ventral amygdalofugal pathway (VAP) and delineate its relationship with subthalamic nucleus (STN).
Method: Fiber dissections were performed in six hemispheres.
Results: VAP was found emerging from dorsal anterolateral portion of amygdala and coursing horizontally ventral to the lentiform nucleus and internal capsule (IC). This portion of the VAP was defined as ansa peduncularis (AP), traversed posteroinferior to the anterior commissure (AC) and terminated at its separation(trifurcation) point– resembeling a goose-foot. The initial dorsal fibers of AP formed the diagonal band of Broca and extended towards the septal area, after passing below AC. Ventral anterior fibers of AP formed the extracapsular thalamic peduncle, which extended to the anterior thalamus. Ventral posterior fibers of AP constituted the medial forebrain bundle(MFB) that reached the preoptic area and mesencephalon. The MFB and was located medial to IC, lateral to nucleus ruber and inferomedial to STN.
Conclusion: VAP is a shortcut limbic connection of amygdala with septal area, thalamus and hypothalamus. Fiber dissection technique can demonstrate all components of VAP. To avoid any limbic complications due to the STN targeting during deep brain stimulation, close inferolateral location of the MFB should be noted, in addition to the awareness of complex 3D anatomy of the other components of AP.
Keywords: Amygdala, Subthalamic nucleus, Fiber dissection

OP-NA.02-03

Microsurgical Anatomy of the Subthalamic Nucleus: Correlating Fiber Dissection Results with 3-T Magnetic Resonance Imaging Using Neuronavigation

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Background: Despite the extensive useage of the STN as a DBS target, understanding of the three-dimensional anatomy of the subthalamic region remains challenging due to the variable shape, oblique orientation, and relatively small size, and extensive connectivity of the nucleus. We aimed to reveal the 3D anatomy of the STN and related structures using fiber dissection technique, 3D reconstruction of high resolution MRI, and tractography.
Method: 20 hemispheres and 3 heads have been disscted in accordance with the Klingler method. The dissections were performed in a stepwise manner from lateral to medial, medial to lateral, superior to inferior, and inferior to superior to reveal the 3D anatomy of the STN. 3 T MRI with 1 mm slices was taken of head specimens for MR navigation before starting the cranial dissections. In addition, three brains were cut into 5 mm coronal, axial and sagittal slices to show the sectional anatomy.
Results: As a result, we built a 3D terrain model of the subthalamic area encircling the STN, which includes the putamen, GPi, GPe, IC, caudate nucleus laterally, substantia nigra inferiorly, and ZI and red nucleus medially. And also we described relationship of the medial lemniscus, oculomotor nerve fibers and the MFB with the STN by using MR tractography with 3D STN model. We correlated our anatomical dissection data with those obtained by the MRI of the same specimen with the aid of a neuronavigation system.
Conclusion: Understanding the complex 3-D anatomy of the STN and peri-subthalamic area may provide a better perspective for STN targeting.
Keywords: Subthalamic nucleus, Parkinson disease, Globus pallidus interna, Neuroanatomy, Functional neurosurgery

OP-NA.02-04

Microsurgical Anatomy of Hippocampal Commissure (Psalterium): Accessory Callosal Bundle and Alveus

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Aim: To examine the anatomy of hippocampal commissure (HC) in the intracrural triangle of fornix and to investigate the relationship between HC and accessory callosal bundle (ACB).

Method: Four adult human hemispheres were examined from multiple aspects using fiber dissection technique.
Results: The alveus, a sheath that covers the hippocampus except for the inferomedial part, was observed to join the HC while heading towards the crura of fornix. Fiber dissection of the atrium revealed forceps major fibers from splenium leading to cuneus, and the ACB fibers heading to the lingula. The ACB fibers passed posteriorly from the infrasplenial region to the atrium and predominantly traversed beneath the "sledge runner" bundle at the level of calcarine fissure. ACB fibers were joined by the alveus under the isthmus of the cingulum and then both merged to form HC in the intracrural triangle superomedially. HC was composed by the alveus anteriorly and the ACB posteriorly, in addition to callosal fibers located within the anterior part of the intracrural triangle.
Conclusion: Our study presents the relationship between the alveus, the ACB and the callosal fibers to compose the HC at the infrasplenial region within the intracrural triangle. Studies so far have emphasized the importance of fornix, in dementia related illnesses. Hence, our study might be a pioneer to further investigate the role of HC, the ACB and the alveus in the process of dementia, such as Alzheimer's disease.
Keywords: Hippocampal commissure, Psalterium, Accessory callosal bundle

OP-NA.02-05

Surgical Anatomy of Perihippocampal Area: Definition of Infrasubicular Fascicle

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Aim: To delineate microsurgical anatomy of hippocampal-formation and explore fiber connections of hippocampus and subicular area from a neurosurgical point of view.
Method: Hippocampal formation and subicular area were dissected by applying Klingler's fiber dissection technique in six formalin-fixed human hemispheres from superolateral and inferomedial aspects.
Results: This study identified a distinct fiber bundle, the infrasubicular fascicle(ISF), which traversed along inferomedial part of subicular area and extended anteriorly below the amygdala to the ambient gyrus. Fibers from alveus, fasciolar gyrus, cingulum and predominantly from cornu-ammonis (CA1) converged and formed the ISF. ISF displayed a counterclockwise rotation at level of uncus. Complete fiber dissection of CA1, dentate gyrus and ISF from above revealed alveus, surrounding all parts of hippocampus except for the inferomedial aspect.
Conclusion: Our study is first to examine relationship between hippocampal-formation and subicular area through fiber dissection. We are introducing a new fiber bundle, the ISF, running along medial base of hippocampus. It has been proposed that cortical inputs reach hippocampus by temporo-ammonic system via the angular bundle of Cajal and constitue perforant pathway. This system exists between entorhinal cortex and hippocampus, most likely through dentate gyrus. We believe that a century old angular bundle can only be appreciated through fiber dissection of hippocampal formation and subicular area, since its fibers converge from several distinct areas and deviate at different angles. We speculate that the new fascicle(ISF) may be related, at least in part, to angular bundle and temporo-ammonic system, although further investigation is warranted in this matter.
Keywords: Hippocampus, Subiculum, Fiber dissection

OP-NA.02-06

Morphological Variations of Collateral Sulcus on the Mediobasal Region of the Temporal Lobe: An Anatomical Study

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Background: The collateral sulcus (CS) is an important landmark on the mediobasal region of the temporal lobe. The aim of this study was to investigate the anatomic features of the CS and provide a contribution for a safe course of temporal lobe surgery.
Method: Sulcal variations and and their relations were examined in 38 formalin-fixed, adult cadaveric cerebral hemispheres. The distance between anterior and posterior transvers CS and, the distance between occipito-temporal sulcus and fusiform apex were measured for morphometric analysis. The topographic anatomy of CS was identified in details and four sulcal patterns were used to classify the sulcal arrangement of mediobasal region in each hemispheres**:** Type 1, single-branch and unbroken CS with no connection; Type 2, CS connected with the rhinal sulcus; Type 3, CS connected with the occipito-temporal sulcus and; Type 4, CS connected with both rhinal and occipito-temporal sulcus.
Results: Type 1 was the pattern seen most frequently (42.1%, 16/38) while Type 4 was the least (7.9%, 3/38). Overall, 63.2% (12/19) of the cadaveric brains had the same sulcal pattern in both temporal lobes. The morphometric analysis showed that the mean distance between anterior and posterior transverse CS was 50±16.2 mm and the mean distance between occipito-temporal sulcus and fusiform apex was 26±8.4 mm.
Conclusion: Understanding of the sulcal patterns of CS complex is of benefit to neurosurgeons, providing necessary guidance for neurosurgical approaches to the mediobasal surface of the temporal lobe.
Keywords: Collateral sulcus, Mediobasal region, Temporal lobe

OP-NA.02-07

Evaluation of Temporal Lobe White Matter Fibers' Anatomy and Functions with Microsurgery Technique for Safety Surgery Approaches

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Aim: To evaluate three- dimensional architectural structure and microsurgical anatomy of human brains' temporal lobe white matter pathways, and functions of the temporal regions. This study also contribute to the literature for doing safety temporal region surgery approaches.
Method: This study was performed between December 2015- June 2016 in İzmir Katip Celebi University Neurosurgery Department and Izmir Forensic and Legal Medicine Institution. Ten postmortem human brain hemisfer specimens were prepared in accordance with Klingler's method. Brain hemispheres were dissected step by step from lateral to medial and medial to lateral under operating microscope and 3D images were captured at every stage.
Results: In this study, our data consisted with literature in dissections of lateral to medial and medial to lateral. We defined whole details of temporal lobe white matter pathways with three-dimensional architectural structure of microsurgical anatomy and emphasised that importance of the temporal stem and Meyer loop in temporal regions surgery. We defined fiber pathways and their relationships between each other clearly except compounds of superior longitunidal fasiculus (SLF). We can not defined all of the compounds; just defined horizontal and vertical segments of SLF.
Conclusion: Before presurgical planning and surgical strategy, white matter fiber pathways of temporal lobe should be dealt with in a multimodal system, there by potentially decreasing surgical morbidity and mortality.
Keywords: Cerebrum, Fiber dissection, Function, Temporal lobe, White matter

OP-NA.02-08

Microsurgical and Tractographic Anatomy of the Supplementary Motor Area Complex in Humans

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The SMA complex is a significant anatomical area that is defined with it's functions and it's connections. Therefore, the resection and damage of this region causes significant clinical deficits known as SMA syndrome. This study aims to evaluate the microsurgical anatomy of the fiber tract connections of the supplementary motor area (SMA) and pre-SMA, and examine its potential functional role with reference to clinical trials in the literature. Ten postmortem formalin-fixed human brains (20 sides) and 1 cadaveric head were prepared following Klingler's method. The fiber dissection was performed in a stepwise fashion, from lateral to medial and also from medial to lateral, under an operating microscope, with 3D images captured at each stage. Our findings were supported by in vivo magnetic resonance imaging tractography in 2 healthy subjects. The connections of the SMA complex, composed of the pre-SMA and the SMA proper, are composed of short "U" association fibers and the superior longitudinal fasciculus I, cingulum, claustrocortical fibers, callosal fibers, corticospinal tract, frontal aslant tract, and frontostriatal tract. The claustrocortical fibers may play an important role in the integration of motor, language, and limbic functions of the SMA complex. The frontostriatal tract connects the pre-SMA to the putamen and caudate nucleus, and also forms parts of both the internal capsule and the dorsal external capsule. The SMA complex has numerous connections throughout the cerebrum. An understanding of these connections is important for presurgical planning for lesions in the frontal lobe and helps explain symptoms related to SMA injury.
Keywords: Cerebrum, Fiber dissection, Fiber tract, Frontal aslant tract, Frontal lobe, Supplementary motor area

OP-NA.02-09

Significance of Tapetum and Corona Radiata During Ventricular Surgery via White Matter Dissection and Magnetic Resonance Tractography

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Background: Ventricle surgery is still a challenge because of deep location of ventricles and white matter tracts on surgical route. Corona radiata has ascending and descending axons and continues ventrally as internal capsule and dorsally as sentrum semiovale. Tapetum is the decussating fibers in the splenium of corpus callosum. Demonstrating fiber tracts on surgical route with Klingler method and Magnetic Resonance(MR) Tractography is a pioneer touch for ventricle surgery to avoid complications.
Method: Five cadaver brain hemispheres that prepared with Josef Klingler's method dissected to reveal tapetum and corona radiata in Ankara University Neurosurgery and Anatomy Departments. MR tractography images revealed in Radiology Department.
Results: Anterior transcortical aprroach has injury risk for anterior segment of corona radiata and distal slyvian approach has risk for posterior segment of corona radiata. Tapetum is under risk with posterior interhemispheric transcallosal, trans middle temporal gyrus and superior parietal lobule approaches. The mentioned approaches can cause language disorders, spatial and auditory disconnexion syndromes and apraxia.
Conclusion: Fiber tract knowledge is essential for neurosurgeons to prevent complications during ventricular surgery. Anatomical dissections and MR technologies are supportive for this purpose.
Keywords: Corona radiata, Tapetum, Fiber dissection, White matter

OP-NA.03-01

The Microsurgical Anatomy of the Sublenticular Portion of Internal Capsule and Inferior Thalamic Peduncle: Neural Relations for Transventricular Mesial Temporal Approach

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Aim: To expose course and localization of fibers by investigating microsurgical anatomy of sublentiform portion of internal capsule (IC-SL) and inferior thalamic peduncle (ITP) for mesial temporal approach (MTA).
Method: Ten hemispheres were dissected laterally after fixation and freezing processes.
Results: IC-SL fibers were observed superomedially to anterior-commissure (AC) and related with it. They were passing under AC and ansa-peduncularis (AP); then running towards inferomedial side to join Meyer's-Loop (ML) which is located at anterior portion of the roof of the temporal horn (ROTH). Posterior thalamic peduncle (PTP) fibers, of which some of them have continuity with tapetal fibers, were defined after lifting IC-SL fibers step by step. Pulvinar originated PTP fibers were also joining ML with lateral geniculate body (LGB) originated optic radiation (OR) fibers. Lifting PTP has revealed ITP and temporopulvinar fibers of Arnold which is a part of it. Temporopontine fibers of ITP (Türck's Fascicle) that is located anteromedially to Arnold's Fascicle were dissected which were originating from temporal and running through lateral portion of pons. Tail of caudate nucleus joining to amygdala and starting part of stria-terminalis were observed by lifting ITP at the deepest level of the ROTH.
Conclusion: Containance of splenium joined PTP beside OR too for ML must be considered while explaining uncertainity about incidence of visual deficits. Complicate structured IC-SL that is related with PTP and temporopulvinar and temporopontine fiber contained ITP is mostly sacrificied during surgery while approaching to temporal horn from roof. MTA from roof could be applied safely by knowing about relation of IC-SL and ITP with peripheric neural structures.
Keywords: Sublentiform, Internal capsule, Mesial temporal approach

OP-NA.03-02

Using Far Lateral Approach Resecting the Ventral Aspect of Brain Stem and Occipital Magnum Area

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Background: Far lateral approach is used in the lesion which locates in the ventral aspect of brain stem and occipital magnum area (OM-C1-2), for example the meningioma, schwannoma and vertebral and PICA aneurysms. We used the revised far lateral approach to evaluate the surgical outcome in the ventral aspect of brain stem and occipital magnum area lesions.
Method: We collected 12 patients from 2013 Jan to 2015 Dec and analyse the mortality and morbidity of the cases. The complete surgical procedure is presented in this article including the presurgical Diffused Tensor image (DTI), intraoperative electrophysiological monitoring and anatomical exposure and repair. The data was analysed to find out the relationship between the revised surgical procedures and mortality.
Results: The Female and Male ratio is 8/4 in our series. The 12 cases include 10 Meningiomas, 1 Arachnoid cyst, 1 Chondroma. All the patients recovered well after surgery without severe complications through the revised far lateral approach. Only two cases existed the mild symptoms of IX-XII cranial nerves.
Conclusion: Revised far lateral approach requires the carefully anatomy in the head-neck junction area. This approach is optimal depending on its ZERO traction and adequate exposure to the ventral aspect of brain stem area. It supplies the utmost protection to the brain stem, nerves and blood vessles. Less heat injury is the key during the whole surgery. Perioperative DTI evaluation and intraoperative electrophysilogical monitoring are necessary to judge the outcome of surgery.
Keywords: Far lateral approach, Ventral aspect, Brain stem, Occipital magnum area lesions, Surgery

OP-NA.03-03

Using Combined Supra-Infra Tentorial Approach Resecting the Giant Petrosal Apex Involving Middle and Posterior Skull Base Lesions

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Background: Combined supra-infra tentorial approach usually means combination of the subtemporal and presigmoid approach. It is used in the lesion which locates in the petroal apex involving middle and posterior skull base, for example the meningioma, trigeminal schwannoma. We used the combined supra-infra tentorial approach to evaluate the surgical outcome in the giant petrosal apex involving middle and posterior skull base lesions.
Method: We collected 14 patients from 2013 to 2016 Dec and analyse the mortality and morbidity of the cases. The complete surgical procedure is presented in this article including the intraoperative electrophysilogical monitoring, anatomical exposure and repair. The data was analysed to find out the relationship between the surgical procedures and mortality.
Results: The Female and Male ratio is 10/4 in our series. The 14 cases include 6 Meningiomas, 8 trigeminal schwannomas. All the patients recovered well after surgery without severe complications through the revised far lateral approach. Two cases existed the moderated symptoms of V cranial nerve and one case existed the mild symptom of VII cranial nerve.
Conclusion: Combined supra-infra tentorial approach requires the carefully anatomy in the subtemporal and presigmoid area. This approach is optimal depending on its ZERO traction and adequate exposure to the petrosal apex involing middle and posterior skull

base. It supply the utmost exposure to the cavernous sinus and internal carotid artery and protection to the brain stem, nerves and blood vessles. Intraoperative electrophysilogical monitoring are necessary to judge the outcome of surgery. Less heat injury is the key during the whole surgery.
Keywords: Combined supra-infra tentorial approach, Petrosal apex, Skull base, Surgery

OP-NA.03-04

The Sitting Position in Neurosurgery: A Clinical Study in 160 Cases

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Background: Sitting position for operation of posterior fossa lesions, occipital and posterior parietal lesions, foramen magnum, upper cervical spinal lesions provides an excellent visualization because of slack of brain due to gravity drainage of CSF and blood. Hence gross total tumor removal relatively easy and less complicated.
Method: From January 2008 to December 2016 total 160 cases underwent neurosurgical procedure in sitting position. Physical characteristics including patient age, sex, size of the tumor and histological diagnosis were collected. The post operative image were studied to see the extent of tumor removal and early detection of complications. All most all patients required C.V. line or peripheral inserted central venous line, precordial Doppler sound, ETCO2, O2 saturation and close monitoring of blood pressure.
Results: Venous air embolism were detected in 3 cases (6.66%). Total tumor removal was possible in 112 (70.0%) cases and subtotal in 34 (21.25 %) cases. There is 7 (4.38%) mortality in 160 cases, Four cases from CP angle tumor and two case from petroclival meningioma, one case from thalamic glioma. There were pneumocephalus in all most cases and post operative new facial paresis in 35 (21.88 %) cases. 5th nerve palsy developed in 5 (3.12%) cases. Postoperative tumor bed haematoma developed in 6 (3.75%) cases.
Conclusion: Sitting position can be safely done with good preoperative physiological, peroperative close monitoring of the patient regarding blood pressure, ETCO2 and oxygen saturation. However postoperative complication like tumor bed haematoma, pneumocephalus, cranial nerve palsy have to be bring in mind.
Keywords: CP angle Tumor, Sitting position, Vestibular schwannoma, Retrosigmoid craniectomy

OP-NA.03-05

Preservation of the Olfactory Function Using Frontolateral Approach for the Treatment of Suprasellar Lesions

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Background: Postoperative olfactory dysfunction may have a great effect on the quality of life. Olfactory nerve is at risk during routinely used neurosurgical routes such as interhemispheric or frontotemporal approach. We investigate olfactory function outcome in patients undergoing frontolateral approach.
Method: In this prospective study we analyzed the olfactory nerve function of 20 patients affected by suprasellar mass. Every patient underwent tumor removal via frontolateral approach. The 12-items "Sniffin' Sticks" screening test was performed before the surgery and at discharge and the results were statistically analyzed.
Results: Tumor removal could be successfully achieved in all cases (11 craniopharyngiomas, 7 meningiomas and 2 pituitary adenomas) via frontolateral route (2 left and 18 right side). The olfactory nerve could be anatomically preserved in all patients and "Sniffin' Sticks" screening demonstrated unchanged olfactory function in 16 (80%) surgeries. Ipsilateral hyposmia was present in three cases (15%) and only one patient (5%) showed postoperative anosmia.
Conclusion: Preservation of the olfactory function is challenging in anterior skull base approaches. The use of a frontolateral approach with adequate preparation of the olfactory nerve and minimal frontal lobe retraction allows the anatomical preservation of the nerve with low incidence of functional deficit.
Keywords: Olfactory, Nerve, Frontolateral approach

OP-NA.03-06

Factors Affecting the Treatment Decision on Patients with Cerebrospinal Fluid Leaks

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Aim: To evaluate the clinical results of cerebrospinal fluid leaks in our clinic.
Method: We retrospectively reviewed 23 cases which had treated with rhinorrhea between 2008-2015 at Dokuz Eylül University Hospital. There were 12 men (52.2%) and 11 female (47.8%). The age range was 10 to 67 years, with a mean age of 39.65±14.83 years. 7 patients (30.4%) had spontaneous, 11 patients had traumatic (47.8%) and 5 patients (21.7%) had iatrogenic cerebrospinal fluid leak.
Results: In our study, cribriform plate was the most common site being involved in 5 cases (20.8%); anterior etmoidalis 3 cases (12.5%) and frontal sinus 3 cases (12.5%). Mean defect diameter of the fistula was 130.40 mm^2 ± 190.47. Spontaneous cerebrospinal fluid leaks mostly originated from the cribriform plate, traumatic cerebrospinal fluid leaks were cribriform plate and anterior etmoidalis; iatrogenic cerebrospinal fluid leaks were sella. The mean duration of rhinorrhea before diagnosis was 318.28 ± 987.10 days. The mean hospital stay of the patients was 19.6 ± 23.24 days. 14 patients underwent surgery (60.9%).12 patients were treated by transcranial approach. Primary surgical repair rate was 78.3%. In our study, 6 patients of 7 spontaneous cerebrospinal fluid leaks were treated with surgery.
Conclusion: In our study, spontaneous cerebrospinal fluid leaks did not spontaneously stop by conservative treatment. But there was no significant diffrence between etiology types. Further studies should be done for the first choice of the treatment option with patients with spontaneous cerebrospinal fluid leaks.
Keywords: Cerebrospinal fluid leaks, Defect size, Spontaneous, Transcranial approach

OP-NA.03-07

Different Surgical Approaches for Orbital Tumors

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Aim: To study the versatile surgical approaches, per operative and histopathological findings of patients presenting with orbital lesions.
Method: The study was conducted at Department of Neurosurgery, KEMU/Mayo Hospital, Lahore from Nov 2014 to Oct 2016. Patients operated for orbital lesions were included. CT scan and/or MRI orbits were done. Patient demographics, surgical approach, operative findings and histopathological findings were recorded and analyzed.
Results: 38 patients were included. Mean age was 28.5 years with 15 males and 23 females. Supraorbital orbitotomy was the most common approach used in 17 (44.7%) patients. 14 patients required lateral orbitotomy while five patients needed fronto-temporo-zygomatic approach. Removal of inferior orbital rim was performed in two patients. Histopathology revealed infective lesions in 16(42.1%) patients (chronic non specific inflammation in nine, fungal granuloma in three and tuberculoma in four). Benign lesions were seen in 19(50%) patients (benign spindle cell lesion in seven, meningioma in four, neuroma in two, ossifying fibroma in two, fibrous dysplasia, rhabdomyoma, epidermoid cyst, rhabdomyoma in one patient each). Malignant lesions (Adenoid cystic carcinoma, metastatic adenocarcinoma and lymphoma in one patient each) were detected in 03(7.9%) patients.
Conclusion: Lesions involving the orbits pose a unique challenge because of the complex surgical anatomy and different approaches required. A sound knowledge of the tumor location according to radiology as well as the appropriate approach is essential for proper surgical excision. Neurosurgeons being more familiar with bony anatomy of the skull base and more confident in doing bony work are better off dealing with orbital tumors.
Keywords: Surgical approach, Orbital tumor, Orbit

OP-NA.03-08

Supraorbital Subfrontal Trans-Laminar Endoscope-Assisted Approach for Tumors of the Posterior Third Ventricle: Our Preliminary Experience

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Background: Different surgical approaches have been developed for dealing with third ventricle lesions all aimed at obtaining a safe removal minimizing brain manipulation. The supraorbital subfrontal trans-lamina terminalis route, commonly employed only for the anterior third ventricle, could represent, in selected cases with endoscopic assistance, an alternative approach for posterior third ventricular lesions.
Method: Seven patients underwent a supraorbital subfrontal trans-laminar endoscope-assisted approach for posterior third ventricle tumors (two craniopharyngiomas, one papillary tumor of the pineal region, one pineocytoma, two neurocytomas, one glioblastoma). Moreover, a conventional third ventriculostomy was performed via the same translaminar approach in four cases.
Results: Complete tumor removal was accomplished in four cases, subtotal removal in two cases, and a simple biopsy was performed in one case. Adjuvant radiotherapy and/or chemotherapy was administered, if required, on the basis of the histological diagnosis. No major complications occurred after surgery except for an intratumoral haemorrhage in a patient undergoing a biopsy for a glioblastoma, which simply delayed the beginning of adjuvant radio-chemotherapy. No ventriculoperitoneal shunt placement was needed in these patients at the most recent clinical and radiological session (average 39.57 months, range 13 - 85 months).
Conclusion: The supraorbital subfrontal trans-laminar endoscope-assisted approach may provide, in selected cases, an efficient and safe route for dealing with posterior third ventricular tumors.
Keywords: Translaminar, Endoscope assisted approach, Third ventricle

OP-NA.03-09

Single Piece Cranio-Orbito-Zygomatic Approach, Trans Key Burr Hole Orbital Roof Osteotomy; A New Modification. Surgical Technique and Report of Eight Cases

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Background: Cranio-orbito-zygomatic (COZ) approach is a common skull base approach. Many modifications for this approach evolved describing different cuts of the osteotomies and tailoring according to the lesions. The aim of this study is to describe the general steps of the cranio-orbito-zygomatic craniotomy approach, and to give a detailed description of the trans key burrhole orbital roof osteotomy modification of the approach.
Method: The new surgical modification is applied to eight patients with skull base lesions in which cranio-orbito-zygomatic approach was indicated. Seven cases are of sphenoid wing meningiomas with different extensions and one case of tentorial meningioma extending to the middle cranial fossa. Trans key burrhole orbital roof osteotomy is described in details within the general steps of the cranio-orbito-zygomatic approach.
Results: There were no complications related to the modification, one case of mortality due to massive pulmonary embolism and another case of stiffness of temporomandibular joint. There were minor frontal base dura and periorbita tears with no consequences. No relation between the modification and technique of surgery or the degree of exposure.
Conclusion: Trans key burr hole orbital roof osteotomy in single piece cranio-orbito-zygomatc approach is surgically easy step that avoid excessive traction on the globe with no major. complications. The osteotomy helps to preserve the orbital roof preventing potential complications related to defective orbital floor like pulsating exophthalmos.
Keywords: Orbital, Zygoma, Frontal, Meningioma

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Interaction Between MELK and EZH2 Regulates Medulloblastoma Cancer Stem-Like Cells Proliferation

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Background: Medulloblastoma (MB) is the most common malignant brain tumor in children. Although accumulated research suggests that cancer stem-like cells may play a key role in medullolastoma tumorigenesis, the molecular mechanisms of proliferation still remain elusive and further investigation can provide a novel application for therapeutic target in MB patients.
Method: The expression of MELK and EZH2 was detected by tissue microarray analysis with 88 MBs and its association with prognosis was identified. Co-location of MELK and EZH2 in MB CSCs and tissues was studied by using confocal and immunostaining. Immunoblotting analysis following co-immunoprecipitation was performed to check the interaction between MELK and EZH2. Through the loss-of-function study by siRNA, CSCs-drived tumor growth was detected. Then we studied the targeted treatment of MB with MELK and EZH2 inhibitor in vivo to confirm the molecular basis of MELK and EZH2.
Results: MELK and EZH2 co-located in the nuclei of MB CSCs and MB with extensive nodularity and large cell/anaplastic differed the staining levels as measured using microarray analysis when compared with the other two subgroups. The proportion of MELK positive staining cells was the potential indicator for the survival. MELK bound and phosphorylated EZH2 and its methylation was induced by EZH2 in MB, which regulated the proliferation of CSCs. MELK and EZH2 depletion by siRNA or treatment of inhibitors attenuated the MB CSCs-derived tumor growth in vivo.
Conclusion: Interaction between MELK and EZH2 is essential for MB CSCs-drived tumor proliferation, thereby identifying a potential therapeutic strategy for MB patients.
Keywords: Medulloblastoma, MELK, EZH2, Prognosis, Proliferation

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TERT Mutations and B7-H4 Expression Predict Responses to DC Vaccines in GBM

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Background: Dendritic cell (DC)-based vaccine is promising but of limited efficacy. Thus we assessed the safety and effectiveness of DC vaccine (DCV) loaded with glioblastoma stem-like cell (GSC) antigens in glioblastoma multiforme (GBM) patients and looked for biomarkers to stratify patients.
Method: In this triple-blind, placebo-controlled phase 2 clinical trial, 43 GBM patients were randomized after surgery at a 1:1 ratio to receive either DCV (n=22) or physiological saline placebo (n=21). Overall survival (OS) and progression-free survival (PFS) were analyzed.
Results: DCV treatment was not associated with serious adverse effects. Multivariate Cox regression analysis revealed that DCV treatment significantly prolonged OS (p=0.03) after adjusting for IDH1 and TERT promoter mutations (MT) and B7-H4 expression. Among IDH1wild type (WT)TERTMT patients, DCV treatment significantly prolonged OS and PFS, and increased the levels of cytokines MDC and IFN-γ compared with placebo treatment. There were lower expression of B7-H4 but not PD-L1 in specimens of the IDH1WTTERTMT group than that in specimens of other groups before treatment. Consistently, DCV treatment could significantly prolong OS of the patients with low expression of B7-H4.
Conclusion: DCV is safe for GBM patients. The molecular profiles of IDH1WTTERTMT and low expression of B7-H4 could identify more responsive subgroups of GBM to DCV-based specific active immunotherapy.
Keywords: Dendritic cell, Immunotherapy, Glioblastoma multiforme

OP-NO.01-03

Down-Regulation of Long Non-Coding RNA FOXD3 Antisense RNA 1 (FOXD3-AS1) Inhibits Cell Proliferation, Migration, and Invasion in Malignant Glioma Cells

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Growing evidence indicates that long non-coding RNAs (lncRNAs) play key roles in cancer initiation and progression. However, little is known about the therapeutic significance of lncRNAs in glioma. In this study, we explored the tumorigenic role of a classical lncRNA,

FOXD3 antisense RNA 1 (FOXD3-AS1) in glioma. Systemic analysis of the patient specimens and clinical data showed that FOXD3-AS1 was markedly up-regulated in high-grade glioma tissues compared with that in low-grade glioma and normal brain tissues (both p<0.01), and patients with low FOXD3-AS1 expression had grater survival probability. Multivariate regression analysis showed that increased FOXD3-AS1 expression was a significant independent indicator of poor prognosis in glioma patients (p=0.034). To understand the tumorigenic mechanism of FOXD3-AS1, the expression pattern and functional role of FOXD3-AS1 in glioma were detected using real-time PCR and Smart Silencer-mediated knockdown study. In related cell biological assays, we discovered that FOXD3-AS1 knockdown significantly inhibited cell prolif-eration, induced cell cycle S-phase arrest, and impaired cell migration and invasion in malignant glioma cells. As expected, we also found that the expression of FOXD3-AS1 was positively correlated with FOXD3 mRNA. Knockdown of FOXD3-AS1 reduced the protein level of FOXD3 in cultured U251 and A172 cell lines. These results suggest that FOXD3-AS1 is an oncogenic lncRNA, which may promote the occurrence and development of glioma through tran-scriptional regulation of FOXD3.
Keywords: Long non-coding RNA, FOXD3-AS1, Glioma, FOXD3

OP-NO.01-04

IDHwt & Low Grade in Gliomas: A Chimera Created by Neurosurgeons

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Background: In contrast to IDH mutation analysis, which is homogenous within a tumor, diagnostic errors in histological WHO grades could be due to small tissue samples as a result of histological heterogeneity. We wanted to assess whether the size of tissue samples influences the tumor grading in IDH wildtype gliomas.
Method: Demographics, WHO°, tissue sample volume and pre-operative volume of 116 patients who received a resection of IDH-wt gliomas between January2011 and December2015 at the University Hospital in Bern were evaluated. The differences between absolute and relative pathological sample sizes stratified by WHO° were conducted using Mann-Whitney-U-Test and One-Way-Permutation-Test.
Results: With a mean tissue sample size of 10.7cc (0.02-92.9) 97patients (83.6%; mean age 60.2 years) were histologically diagnosed as WHO°IV, while 19patients (16.4%; mean age 53.7years) with a mean tissue sample size of 2.52cc (0.1-9.0) were diagnosed as WHO°III/II (15 WHO°III, 4 WHO°II). One-Way-Permutation-Test showed a significant difference between absolute tissue samples stratified by WHO° (p=0.0374). The distribution of preoperative tumor volumes with WHO°IV vs. WHO°III/II showed no significant difference (p=0.7825). Of all 116 tumors with a sample size >10cc 100% were pathologically diagnosed as WHO°IV and of all with sample size >5cc 93.5% were diagnosed as WHO°IV.
Conclusion: Small tissue sample sizes are associated with a higher risk of under-estimating malignancy in histological grading in IDH-wt gliomas. This study suggests a standard minimum tissue sample size (>5cc) in every resection. Modalities of adjuvant treatment for IDH-wt WHOII°/III° gliomas need to reflect a prognosis that is only marginally better than that of a glioblastoma.
Keywords: Glioma, Molecular pathology, Histology, Sampling error

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Alu Hypomethylation and MGMT Hypermethylation in Serum as Biomarkers of Glioma

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For the early diagnosis and treatment to improve prognosis of glioma patients, serum cell-free DNA methylaiton levels of Alu, MGMT, P16, RASSF1A from 124 glioma patients and 58 healthy controls were detected by the bisulfite sequencing (BSP). The median methylation level of Alu was 46.15% (IQR, 36.57-54.00%) and 60.85% (IQR, 57.23-65.68%) in patients and healthy controls, The median methylation level of MGMT in patients was 64.65% (IQR, 54.87-74.37%) compared to 38.30% (IQR, 34.13-45.45%) in healthy controls, they all showed significant differences as well as P16, they were 31.35% (IQR, 22.58-36.93%) in patients and 26.65% (IQR, 17.15-36.05%) in controls, while the median methylation level of RASSF1A haven't showed any significant results. The methylation level of Alu and MGMT in serum had a good diagnostic value and was higher than P16, combination of Alu and MGMT could identify additional patients which were missed by either diagnosis alone. In Alu group, the patients with high level had higher survival rate than those who with low level, the similar results were found in MGMT group. In the present study, it showed that the methylation level of Alu and MGMT in serum had better diagnostic value than P16. What's more, combined analysis of Alu and MGMT showed higher sensitivity for glioma diagnosis. Both serum Alu and MGMT methylation level could predict prognosis of glioma patients well.
Keywords: Serum, DNA, Methylaion, Glioma

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The Relationship Between Tumor Necrosis Factor Alpha -TNF-α-308 (G/A) Gene Polymorphism and Glial Tumors

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Background: Glial tumors are the most common tumors in brain. Genetic predisposition is a risk factor of developing malignancy. TNF-α is a cytokine that has an important role in immune system,

and inflammation. Alterations in TNF-α production is involved in pathological processes like malignant diseases. The aim of the present study was to investigate whether TNF-α-308-(G/A) promoter gene polymorphism might be involved in the pathogenesis of gliomas.
Method: The study group included 67 glioma patients and 108 healthy controls. The genotypes were designed as AA-(high), AG-(heterozygous) and GG-(low expression).
Results: AA mutant genotype was detected as n=4/67 (6%) in gliomas while n=17/108 (15.7%) in controls (p=0.094). AG genotype was n=30/67 (44.8%) in patients and n=51/108 (47.2%) in controls (p=0.031). When detected in low-(LGG) and high grade gliomas-(HGG), AA was n=1/22 (4,5%) in LGG patients, while n=3/45 (6.7%) in HGGs (p=0.465). Also AG was n=8/22 (36,4%) in LGG patients, while n=22/45 (48.9%) in HGG (p=0.031). AA genotype had 1.95 and AG genotype had 1.79 times more risk in HGGs (p>0.05). According to these results high TNF-α expression might be a risk factor in HGG.
Conclusion: TNF-α-308-(G/A) polymorphism has been associated with increasing secretion levels of TNF-α which behave like a necrotic and promoting factor in cancer. During the progression of LGG tumors into HGG, several genetic factors may govern this transformation. Our study revealed that a possible association of high TNF-α expressed genotypes with HGG tumors. However, further work is required in larger series to explain the possible role of TNF-α in gliomas.
Keywords: TNF-α, Gene, Glioma, Cytokine

OP-NO.01-07

Actin Cytoskeleton Regulator Arp2/3 Complex is Required for DLL1 Activating Notch1 Signaling to Maintain the Stem Cell Phenotype of Glioma Initiating Cells

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Glioblastoma (GBM) is the most common and lethal primary intracranial tumor. Actin cytoskeleton regulator Arp2/3 complex stimulates glioma cell motility and migration, and thus triggers tumor invasion. However, little is known regarding the role of actin cytoskeleton in maintaining the stem cell phenotype. Here, we showed that Arp2/3 complex improved stem cell phenotype maintenance through sustaining the activated Notch signaling. ShRNA targeting Notch ligand Delta-like 1 (DLL1) decreased CD133 and Nestin expression, and impaired the self-renewal ability of CD133+ U87-MG and U251-MG glioma cells, indicating DLL1/Notch1 signaling promoted stem cell phenotype maintenance. Interestingly, inhibiting Arp2/3 complex also induced the similar effect of shDLL1. Silencing DLL1 in the Arp2/3 inhibited CD133+ cells did not further abrogate the stem cell phenotype, suggesting DLL1 function requires Arp2/3 complex in glioma initiating cells (GICs). However, exogenous soluble DLL1 (sDLL1) instead of endogenous DLL1 rescued the Arp2/3 inhibition-induced stem cell phenotype suppression. The underlying mechanism was that Arp2/3 inhibition impeded DLL1 vesicular transport from cytoplasm to cell membrane, which resulted in DLL1 unable to activate Notch pathway. Furthermore, we illustrated that Arp2/3 inhibition abolished the tumorigenicity of CD133+ U87-MG neurosphere cells in the intracranial model. These findings suggested that cytoskeleton maintained the stem cell phenotype in GBM, which provide novel therapeutic strategy that anti-invasive targeted therapies may help eliminate GICs.
Keywords: Glioma initiating cell, Notch signaling, Delta-like1, Cytoskeleton, Arp2/3 complex

OP-NO.01-08

Glutathion-S-Transferase and Cytochrome P450 Enzyme Expressions in Brain Tumors

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Background: Most of the exogenous and endogenous chemical compounds are metabolized by enzymes of xenobiotic processing pathways, including the phase I cytochrome p450 (CYP) species. Carcinogens and their metabolites are generally detoxified by phase II enzymes like glutathione-S-transferases (GST).
Method: This study was approved by ethical committee of Kecioren Education and Research Hospital and supported by Turkish Neurosurgical Society. The expression profile of metabolizing genes CYP1A1, CYP1B1 and GSTP1, GSTM1 was, therefore, studied in a cohort of 57 brain tumor patients and controls using Immunohistochemistry. Expressions GST Mu-1 (GSTM1), GST Pi-1 (GSTP1), and CYP1A1, CYP1B1 were assessed by immunohistochemistry in brain tumors of 57 patients. The differences between the expressions of GSTs and CYPs in normal and tumor tissues were analyzed by Mann-Whitney U Test.
Results: GSTP1, CYP1A1, and CYP1B1 expressions in brain tumor cells were significantly higher than those in normal cells (p<0.05). However, there was no difference in GSTM1 expression between tumor and normal tissues. Immunostaining of GSTP1, CYP1A1, and CYP1B1 was found to be a marker of malignancy in brain tumors. The expressions of GSTP1, CYP1A1, and CYP1B1 were, for the first time, shown to be significantly altered in brain tumors as compared to controls.
Conclusion: The present findings suggest that GSTP1, CYP1A1, and CYP1B1 enzymes can also play a role in the pathogenesis of brain tumors. Thus, altered expression of these xenobiotic metabolizing genes may be involved in brain tumor development in Turkish population. Investigation of expression of these genes may provide information not only for the prediction of individual cancer risk but also for the prevention of cancer.
Keywords: GST, CYP, Brain tumor

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Thymoquinone is an Effective Treatment Through Induction of Apoptosis in U87 Human Glioma Cells

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Background: Glioblastoma multiforme is the most invasive and aggressive primary tumor of the central nervous system. In order to increase the life span, new treatment methods have been investigated but the ideal has not been reached. The antitumor property of Thymoquinone, the active ingredient of *Nigella sativa* (black cumin) oil, has been shown in different types of malignancies. However, the effect of Thymoquinone on GBM has not been investigated. The purpose of this study was to evaluate the efficacy of Thymoquinone in glioma in vitro.
Method: U87 human glioma cells were incubated with different concentrations of Thymoquinone (0-200 μM) for 24 hours. To assess the effect of Thymoquinone on U87 cells, ATP cell viability assay for cytotoxicity, Comet Assay for genotoxicity, fluorometric 2,7-dichlorofluorescein diacetate (DCFH-DA) staining for the level of intracellular reactive oxygen species (ROS) and Acridine orange/ethidium bromide staining by fluorescence microscopy for apoptosis were performed.
Results: A dose-dependent cytotoxic effect of Thymoquinone was observed In U87 glioma cells. Thymoquinone increased DNA damage and apoptosis in U87 cells in a dose-dependent manner. Furthermore, it was observed that Thymoquinone increased the intracellular ROS in increasing doses, and consequently induced apoptotic cell death.
Conclusion: Our results suggest that Thymoquinone is effective in U87 human glioma cells through direct cytotoxicity, induction of apoptosis and increased level of intracellular ROS in vitro. Further investigation is warranted to make Thymoquinone available for glioma treatment.
Keywords: Apoptosis, Cytotoxicity, DNA damage, Glioma, Thymoquinone

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Extended Endonasal Endoscopic Approach for the Resection of Craniopharyngioma an Analysis of 49 Cases

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Background: Extended endonasal endoscopic approach for the non-pituitary lesions of the seller and suprasellar regions are not new in the field of neurosurgery. Common sellar suprasellar lesions are pituitary adenoma, craniopharyngioma, tuberculumsellae meningioma and supra sellar germinoma. Extended approach provides exposure to the optic nerve, chiasm, acom complex and basal frontal lobe, mammillary body, mid brain, 3rd nerve, basilar artery, and circle of Willis and laterally to the cavernous sinuses.
Method: From November 2007 to December 2016 there were 49 cases of craniopharyngioma operated by the extended endonasal endoscopic approach.
Results: The patients varied from 10 to 60 years. Male were 24 (48.98%), female were 25(51.02%).Gross total removal was achieved in 29 cases (59.18%) and subtotal in 12(24.5%) cases. Visual acuity and field of vision improved in 26 cases (53.06%). One case (2.0%) of craniopharyngioma had prolonged period of unconsciousness probably from hypothalamic disturbance. CSF leak developed in 10 (20.4%) cases. Three patients required permanent CSF diversion via a ventriculoperitoneal shunt after documentation of post-op hydrocephalus (HCP). There was one case of chemical meningitis, and 5 cases of confirmed bacterial infections. Ten cases (20.4%) died from operation related complications.
Conclusion: Extended transspehnoidal approach is an excellent alternative of skull base approach for the removal of most of the craniopharyngiomas. The endoscopic endonasal route provides a good visualization, especially of the subchiasmatic and retrochiasmatic areas, as well as of the stalk–infundibulum axis, the third ventricle chamber. CSF leak and DI are known common complications which have to be managed promptly and appropriately.
Keywords: Extended endonasal endoscopic approach, Craniopharyngioma

OP-NO.02-02

Craniopharyngiomas: Risk and Challenges of the Extended Endonasal Endoscopic Approach to the Skull Base

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Background: The craniopharyngiomas, are frequent tumors and although they are histological benign lesion, they outline therapeutic important problems for their nature and morbidity associated to the surgery, being a defiant lesion for neurosurgeons.
Method: In this article, we present the results using Extended Endonasal Endoscopic Approach trans-tuberculum trans-planum in patient with craniopharyngioma in "Hermanos Ameijeiras" Hospital between 2009 and 2012.
Results: 40 patients were operated, (24 F/ 16 M). We achieve gross total resection in 37 patients. The most frequent complication was insipid diabetes presented in 17 patients. We had 3 deaths, 2 of them were for postoperative medical complication.
Conclusion: The extended endonasal endoscopic approach trans-tuberculum trans-planum allows performing the surgical treatment with a wide resection in this type lesion. With technology even in development this approaches represents an alternative for patients with craniopharyngioma.
Keywords: Craniopharyngioma, Endoscopic approach, Skull base

OP-NO.02-03

Surgical Treatment of Craniopharyngiomas in Children: Utility of Intraoperative Magnetic Resonance Imaging

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Background: Many reports have been published about the use of high field intraoperative magnetic resonance imaging (iMRI) for the treatment of sellar lesions in adult patients. In this study we investigate the safety, advantages and limitations of high field iMRI for the treatment of craniopharyngiomas in children.
Method: Fifteen patients under 16 years of age affected by craniopharyngioma (22 surgeries) were analyzed. All cases were surgically treated using iMRI. Pre- and postoperative neurological and endocrinological status, presence of residual tumor, number of intraoperative scans and complications were evaluated.
Results: Of the 22 surgeries, 9 cases underwent the first surgery while 13 had previous surgery. Regarding the 9 patients operated for the first time, a total removal of the lesion has been preoperatively planned and could be achieved in all cases. Considering the 13 procedures with recurrent tumors we could achieve a total removal in 10 and subtotal in 3 cases. In the 10 cases that underwent complete resection, 7 needed only 1 iMRI imaging that confirmed the total excision while residual tumor was detected in the other 3 cases at the iMRI imaging and required further removal. We had no intra- or postoperative complications due to the use of iMRI.
Conclusion: Use of iMRI for the treatment of pediatric craniopharyngiomas proved to be safe and effective in achieving complete tumor resection. No complications due to intraoperative imaging. The important drawback of high-field iMRI was the difficult operative positioning, especially in younger children, due to the structure of the surgical table.
Keywords: Intraoperative mri, Craniopharyngiomas, Pediatric

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Surgical Management of Craniopharyngiomas: Experience with 45 Patients

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Aim: To assess the surgical outcomes of 45 consecutive patients with craniopharyngioma treated between 1998 and 2015.
Method: Of all ages ranging 3 to 56, 25 (55.5 %) were less than 18 years of age. The localizations of the tumors were intrasellar in 3 patients, intra-suprasellar in 12, parachiasmatic in 16 and intra-extraventricular in 14. Twenty-three patients had hydrocephalus. Transsphenoidal approach was used in 8 patients and modified pterional approach in 37 patients. Total removal was achieved in 39 patients (86.6%). Neurological, ophthalmological and endocrinological outcomes were analyzed with a mean follow up of 73.5 ± 55.2 months (range 12 to 222 months).
Results: Surgical mortality was 6.6%. Four of the six patients with subtotal resection have developed regrowth of the remnant, and recurrence of the tumor has been observed in 3 patients. There were 37 survivors with detailed ophthalmological examination before surgery. Among them, disturbance of the visual field was observed in 27 patients. Of those, amelioration was observed in 18 patients, deterioration in one patient, and no change in 8 patients postoperatively. Thirty-one patients had pituitary insufficiency preoperatively. Of all the 42 survivors, 38 patients have pituitary disturbance. According to the Glasgow Outcome Scale, 35 patients have been followed up with a score of 5, 6 patients with a score of 4 and 1 patient with a score of 3.
Conclusion: Radical microsurgical removal of craniopharyngiomas allows good quality of life with an acceptable mortality and morbidity rates.
Keywords: Craniopharyngioma, Pituitary insufficiency, Pterional approch, Transsphenoidal approach, Visual disturbances

OP-NO.02-05

Surgical Management of Craniopharyngiomas

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Craniopharyngiomas have bimodal age distribution during childhood and adult life. There are no evidence-based guidelines for best treatment of primary or recurrent craniopharyngiomas a radical approach with complete tumor resection and potential cure has to be balanced with a more conservative approach to avoid substantial treatment-associated long- term morbidity. This prospective study includes 30 consecutive cases. These patients were grouped into 2 main groups**:** children and adults according to the age at presentation and were operated at neurosurgery department, Alexandria University. 30 patients were operated at neurosurgery department Alexandria University (age range 4-58 years, 9 aged < or =16 and 21 aged > 16). Suprasellar extraventricular type were the most common tumors in children group in 55.6% while mixed intra and extraventricular tumors was the most common type in adults found in 42.9%. Four cases were recurrent tumors treated elsewhere before gross total removal was achieved patient of the current study underwent 33 procedures, interhemispheric approach was done 20 times, pterional approach was done 7 times, subfrontal approach was used 2 times, transsphenoidal approach done one time and free hand cyst aspiration was done 3 times. Gross total removal was achieved in 14 cases, subtotal removal in 11 cases and partial tumor removal 5 times. 10 cases (33.3%) experienced tumor recurrence with lower recurrence incidence was more associated with gross total resection. The mortality rate was 3.3% while the morbidity rate was 50%.
Keywords: Craniopharyngioma, Microsurgery, Diabetes insipidus, Recurrence

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Endoscopic Endonasal Surgery for Suprasellar Craniopharyngiomas

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Aim: To explore the endoscopic endonasal approach assisted with various new technique and vascularized skull base reconstruction in the surgical treatment of suprasellar craniopharyngiomas.
Method: Eighty-one patients (47 male, 34 female) with suprasellar craniopharyngiomas were recruited from September 2012 to August 2016, retrospectively. According to Kassam classification, 46 cases were preinfundibular type, 22 cases were transinfundibular type, 12 cases were retroinfundibular type, and one case was totally in third ventricle. Endoscopic endonasal-tuberculum approach were applied in all patients, with clear view of pituitary stalk, optic chiasma and third ventricle. Multiple assistive technologies were also used, including neuro-navigation, electrophysiological monitoring and intraoperative Doppler monitoring.
Results: 46, 25 and 10 cases reached gross-total, subtotal and partial resection, respectively. After tumor resection, the vascularized skull base reconstruction was applied, including biodegradable artificial dura, autologous fat, fascia lata, fibrin glue, vascularized nasal septal flap and tela iodoformum. Post-operative cerebrospinal rhinorrhea occurred in only 3 cases. All 3 cases were repaired by secondary surgery. Other complications included intracranial infection (3 cases) and electrolyte disturbance (3 cases).
Conclusion: The advantage of endoscopic endonasal approach includes**:** the approach leads to the most optimal and safe tumor exposure under direct vision; The impact on vessels was little. Most procedure was separation, which can ensure the blood supply and protect the function of hypothalamus; The traction injury caused by craniotomy can be avoided. Neuro-navigation can make precise location of important structures of skull base. Electrophysiological monitoring protects the cranial nerves. Arterial hemorrhage can be avoided by intraoperative Doppler monitoring.
Keywords: Endoscope, Endonasal approach, Craniopharyngioma, Reconstruction of skull base

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Endoscopic Transnasal Approach to Craniopharyngioma

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Harvey Cushing has described craniopharyngiomas as the most forbidding of the intracranial tumors, its benign in histology but malignant in behavior Mass is in the sellar or suprasellar location. Require different treatment algorithms in adults versus children, best procedure depends on the basis of the anatomy of the tumor and the surgeon's experience. Surgery approaches are Anterolateral transcranial, Midline transcranial, Lateral transcranial, Extended endoscopic endonasal and Intraventricular. The transcranial route has a higher rate of seizures and injury through brain retraction. Visual deterioration after surgery may also be more frequent following a transcranial approach. Transsphenoidal route has a higher rate of CSF leak in less experienced hands. This rate of leakage has significantly improved with advances in closure technique and surgeon experience.
The main restriction for the endoscopic transsphenoidal approach at this time is significant lateral extension beyond the carotid arteries. In this article we want report 40 cases of craniopharyngiomas that treated by ETSS approach, in our cases were many huge tumor with diffrent extention (suprasellar, ventricle and etc.), that only 6 of them need to second surgery by craniotomy in orther to complete resection. In our case, after average of 2 years follow-op there were no major complication and no recurrence of tumor that we we will report it completely in full text article or presentation.
As a conclusion it seems that if patient selection be correct ETSS can be safe for treatment of this types of tumors and total resection of tumor as success key for prevention of tumor recurrence.
Keywords: Endoscopic, Transnasal, Craniopharyngioma

OP-NO.02-08

Craniopharyngioma Management, Our Mediterranean Experience (26 Cases)

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Background: Craniopharyngioma is a rare sellar region tumor more common in the young age group but it can occur in all ages. It represents 1% of all intracranial tumor masses in adults and about 5% in Children. Despite its benign nature it poses significant management difficulty due to its adherence to vital neurovascular structures. We would like to report our experience in craniopharyngima management and compare with that in other centers reported in the literature.
Method: Combined retrospective and prospective analysis of 26 cases of craniopharyngioma cases managed in our department of neurosurgery between 2010 and January 2017.
Results: The mean age in our series was 24 years with an age range of 5 to 60 years. The male female ratio was 1.2**:**1. The sex ratio was 2.5**:**1 in the pediatric subgroup and 0.5**:**1 in that for adults. Twenty four patients (92%) underwent microsurgical. The two remaining cases were observed. No cases underwent intracystic Bleomycin nor adjuvant radiotherapy. The tumor recurrence ranged from 20% in the gross total resection to 65 % in the partial resection group. Post operative complications were estimated at 25 % in the immediate postoperative period. Diabetes insipidus was the most frequent. Others included postoperative meningitis and hematoma.. The mortality rate was at 7.7%.
Conclusion: Surgery constitutes the main treatment modality with satisfactory rate of total tumor removal and moderate rate of complications. The mortality rate was still minimal at 7 year follow up.
Keywords: Craniopharyngioma, Benign, Diabetes insipidus, Bleomycin

OP-NO.02-09

Outcomes in Craniopharyngioma Surgery: Endoscopic Versus Microscopic Approach

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Background: We aimed to compare the endoscoic and microscopic approaches for craniopharygiomas to evaluate the technical advantages and disadvantages regarding total resection, preserving visual functions beside hypothalamic-pituitary functions.
Method: Two groups of 10 Craniopharyngioma patients each in whom microscopic or endoscopic approach was chosen were analyzed retrospectively. Mean age was 29. Patient data was collected from the database of between 2012-2016. Main evaluated data included demographic information; topographic localization of the lesion; presenting complaints and symptoms; primary or recurrent formation of the tumor; the histopathological diagnosis; the used technique; duration of the operation, intensive care service and total hospitalization; postoperative diabetes insipidus or any complications like CSF leakage; pre and postoperative visual function and the result of surgery regarding total resection.
Results: Twenty patients were evaluated retrospectively in two groups of microscopic and endoscopic approaches, 10 patients each. The population consisted of 8 pediatric and 12 adult patients. Two patients had recurrent formation of the tumor and were treated with the two techniques in different multiple times. Eight patients were treated with pure endoscopic; and the remaining 10 patients were treated with microscopic approach. There was one rhinorrea via endoscopic approach and one patient had anaphylaxis after operation during medical treatment. Gross total tumor resection was achieved via endoscopic approach in all patients.
Conclusion: The transspheonidal endoscopic approach is a safe and reliable method in the name of gross total resection rate, less postoperative complications, much visual functional gain, and shorter hospitalization.
Keywords: Craniopharyngioma, Endoscope, Microscope, Transsphenoidal, Transcranial

OP-NO.02-10

Intraoperative Magnetic Resonance Imaging: An Analyze on Effectiveness and Time Consumption in Glioma and Pituitary Surgery

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Background: In this study we aim to evaluate beneficial effect and time consumption of intraoperative magnetic resonance imaging (IOMR) for glioma and pituitary surgery.
Methods: Radiological and perioperative data of patients who underwent IOMR guided surgery between May 2014 and January 2017 were retrospectively analyzed. All surgical procedures performed with 3T- IOMR (Siemens 3-T with a NORAS MRI Products intraoperative head coil). IOMR unit is hybrid type which the patient is carried to the MRI unit. We analyzed demographic data, pre-operative and post-operative neurological status, primary pathology, consumed time for IOMR transfer, IOMR study and results of surgery.
Results: Thirty-five patients (16 males and 19 females) underwent surgery with IOMR. Mean age was 42.8 (range 18-68). Nineteen patient operated for supratentoraial glioma and 16 patients operated for pituitary tumor through transsphenoidal approach. The mean time for first IOMR preparation including temporary wound closure, draping, transport and radiological examination was 54.7 minutes (21-80 min.). In the 7 patients residual tumor was found but surgery was not continued because of relation with eloquent area. In the 3 patients surgery was continued because of residual tumor and second IOMR examination performed. The mean time for second İOMR preparation was 48.3 minutes (42-61). Total resection rate was 45.4 for single IOMR examination performed patients and 66.6 for the second IOMR examination performed patients.
Conclusions: IOMR examination reduces residual tumor risk and also prevent eloquent area damage. As the team experience increases, the time lost for IOMR is reduced.
Keywords: Intraoperative MRI, Extent of resection, Pituitary adenoma, Residual tumor

OP-NO.03-01

Clinical Implications from the Genomic Profile of High-Grade Meningiomas

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High-grade meningiomas demonstrate a high recurrence rate despite aggressive surgery and adjuvant radiation. Recent next-generation sequencing has unveiled several oncogenic mutations related to meningioma development that may be candidates for targeted pharmacotherapy. However, most of these are observed in grade I meningiomas, leaving grade II-III meningiomas with few alternative therapies. We analyzed the genomes of 274 grade II-III meningiomas and compared them to the genomes of 456 grade I meningiomas. High-grade meningiomas had a higher mutation burden than low-grade meningiomas but did not harbor any statistically significant mutated genes aside from NF2. High-grade meningiomas possessed significantly elevated rates of chromosomal gains and losses, especially among tumors with monosomy 22. Across serial recurrences, genomic disruption preceded the emergence of nearly all mutations, remained largely uniform across time, and when present in low-grade meningiomas, correlated with subsequent progression to a higher grade. We observed a striking degree of mutational heterogeneity across tumor recurrences as well as between different regions of the same meningioma. This suggests a propensity to develop resistance to any targeted therapies, for which counter-strategies should be considered. Although we observed significantly fewer mutations amenable to targeted inhibition among high-grade meningiomas, we found that they contained numerous mutations predicted to be neoantigens, suggesting that efforts to harness the power of the immune system may be beneficial.
Keywords: Meningioma, Genomics, Immunotherapy, Targeted therapy

OP-NO.03-02

Intracranial Meningioma in Patients Younger than 35 Years of Age: The Evolution of the Disease in the Era of HIV-1 Infection in KwaZulu-Natal, South Africa

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Background: Intracranial meningiomas constitute 1.5% of all neoplasms in patients younger than 20 years and 13.5% of all neoplasms in patients aged between 20-30 years of age. Our aim was to establish whether HIV-1 infection confer higher histological grade (WHO grade II/II) in patients with intracranial meningiomas younger than 35 years of age.
Method: A retrospective review of clinical notes of all consecutive patients ≤35 year, diagnosed with intracranial meningiomas treated at the department of neurosurgery in KwaZulu-Natal, South Africa, between May-2003 until May-2015. Variables analyzed were demographics, anatomical location of the meningiomas, histopathological results; HIV status results and CD4 counts levels, commencement and duration of antiretroviral therapy. Histological grades of HIV-1 seropositive patients were compared to those of HIV negative patients.
Results: A total of 75 meningioma patient ≤35 years were identified. The median age was 29 (IQR, 25-33) years. Male**:** Female ratio of 1**:**1.3. HIV seropositive patients were 25 (33%). The median CD4+ count was 332 (IQR, 159-625). WHO grade 1 represented 68%, WHO grade II constituted 28% and WHO grade III represented 4% of the cases. Subgroup analysis of HIV-1 positive patients revealed that; WHO grade I, II and III represented 52%; 36% and 12% respectively. The odds of HIV-1 positive patient of developing high grade (WHO grade II/III) meningiomas is 3-folds that of a HIV negative patient (OR=2.9; 95%CI**:** 1.05-3.8.); p=0.04.
Conclusion: HIV-1 infection may be directly responsible for the increase in high grade meningioma among the young adult population.
Keywords: Intracranial meningioma, HIV-1, High grade, Young adult, Less than 35 years

OP-NO.03-03

Is Matrix Metalloproteinase-12 as a Predictive Factor for Prognosis and Biological Behaviour of Meningiomas?

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Background: To analyse the effect of Matrix Metalloproteinase Enzyme-12 (MMP-12) on the prognosis and biological behaviour of meningiomas.
Method: Seventy-nine cases of meningioma that were operated in our clinic between 2005 and 2010 were retrospectively analysed according to age, sex, blood group, alcohol and cigarette consumption, neurological examination, tumor localisation, preoperative peritumoral edema, histological subtype, grade, Ki-67 index, MMP-12 staining pattern, complications and recurrence rates. Samples were stained with MMP-12 and Ki-67 antibody and graded according to the World Health Organisation 2007 system.
Results: Mean age was 52.9 and male/female was 1/2.4. 66 cases (83.5%) were MMP-12 positive**:** 47 cases (71.2%) were Grade I, 19 cases (28.8%) were Grade II. Also 19 of 20 (%95) cases of Grade II meningiomas were MMP-12 positive. MMP-12 expresion was detected in 15 of 16 (93.75%) atypical meningiomas. MMP-12 positivity was detected in 37 of 44 (84%) cases who had peritumoral edema. Also peritumoral edema was more obvious in MMP-12 positive cases. MMP-12 expression rates were high as 19 of 20 cases (95%) whose Ki-67 index rates were high. MMP-12 was positive in 8 of 9 (88.8%) recurrence cases.
Conclusion: MMP-12 can be a useful marker in biological behaviour of meningiomas. High Grade meningiomas were shown to be in close association with MMP-12 and may play a role to acquire an aggressive character, high recurrence risk and prognosis.
Keywords: Matrix metalloproteinase enzyme-12, Meningioma, MMP-12, Predictive factor

OP-NO.03-04

Surgical Management of Intraventricular Meningioma; 20 Years Experience

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Background: Intraventricular meningioma is a rare tumor, about only 2% of intracranial meningiomas in adults and about 10% in children. Located mostly in trigone of the lateral ventricle with left Side preponderance 60%. There is many surgical approaches for management of these tumors including**:** transcallosal parietooccipital, transcortical superior parietal, transcortical middle temporal and transcortical inferior temporal approaches.
Method: In the period between 1991 and 2011 we operated 39 patients with intraventricular meningioma 24 females, 15 males. Age ranged from 9 to 76 years. Size ranged from 2.5 to 7 cm, 34 located in lateral ventricle, 3 in III ventricle and 2 in IV ventricle. Most patients presented with headache followed by signs of increased ICP, visual defects and hemiparesis.
Results: Total excision is 97%. No recurrence and no mortality. Karnosky score worse postoperatively in 2 patients. Improvement of preop. Symptoms occur in 80% In 15% of patients there was no improvement.
Conclusion: Surgery is the best manegement when indicated. Judicious preoperative plan, adequate knowledge of anatomy, and use of correct microsurgical techniques are fundamental in achieving complete resection with low morbidity
Keywords: Meningioma, Intraventricular, Tumor

OP-NO.03-05

Fractal Analysis May Improve the Preoperative Identification of Atypical Meningiomas

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Background: There is no objective and readily accessible method for the preoperative determination of atypical characteristics of a meningioma grade. The aim of this study is to evaluate the feasibility of using fractal analysis as an adjunctive tool to conventional radiological techniques in visualizing histopathological features of meningiomas.
Method: A group of 27 patients diagnosed with atypical (WHO grade II) meningioma and a second group of 27 patients with benign (WHO grade I) meningioma were enrolled in the study. Preoperative brain magnetic resonance (MR) studies (weighted, post- gadolinium) were processed and analyzed to determine the average fractal dimension (FDa) and maximum fractal dimension (FDm) of the contrast-enhancing region of the tumor using box-count method. FDa and FDm as well as particular radiological features were included in the logistic regression model as possible predictors of malignancy.
Results: The cohort consisted of 34 women and 20 men, mean age of 62 ± 15 yr. Fractal analysis showed good inter-observer reproducibility (Kappa >0.70). Both FDa and FDm were significantly higher in the atypical compared to the benign meningioma group (p<.0001). Multivariate logistic regression model reached statistical significance with p=.0001 and AUC = 0.87. The FDm, which was greater than 1.31 (odds ratio [OR], 12.30; p=.039), and non-skull base localization (OR,052; p=.015) were confirmed to be statistically significant predictors of the atypical phenotype.
Conclusion: Fractal analysis of preoperative MR images appears to be a feasible adjunctive diagnostic tool in identifying meningiomas with potentially aggressive clinical behavior.
Keywords: Meningioma, Fractal analysis, Atypical, Preoperative imaging

OP-NO.03-06

Parasagittal and Falcine Meningiomas. Surgical and Multidisciplinary Treatment in a 100 Cases

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Background: The management of parasagittal and falcine meningiomas centers around the relationship between the tumor and the venous anatomy of the superior sagittal sinus(SSS) and the bridging veins. The present study aims to address neurosurgical outcomes in a cohort of patients with parasagittal and falcine meningiomas greater than 2.0 centimeters(cm) in the largest diameter, in which a neurosurgical/multidisciplinary treatment was considered.
Method: The clinical outcomes of patients undergoing neurosurgical management for parasagittal and falcine meningiomas at the authors' institution over a 15-year period were analyzed. Tumor control was assessed using Kaplan-Meier analysis, and specific attention was paid to the relationship between the tumor and the SSS, and its impact on tumor control and outcome.
Results: The authors identified 100 patients with parasagittal/falcine meningiomas greater than 2,0 cm in their largest diameter, who underwent neurosurgical treatment at their institution between 1999 and 2013. The median lenght of follow-up was 6.9 years. There was no difference in rates of tumor control in patents who received subtotal resection for a WHO Grade I tumor, followed by close observation, compared with those undergoing gross-total resection, primarily because no cases were observed in which the tumor remnant in the SSS demonstrated interval growth on serial imaging studies.
Conclusion: These data provide a more judicious optimization of the expected outcome that can be obtained with treatment of these tumors, in which a combination of image guidance, advanced microsurgical techniques, and conformal radiation treatments is used.
Keywords: Falcine meningiomas, Microsurgical resection, Parasagittal meningiomas, Radiosurgery

OP-NO.03-07

Lateral Supraorbital Approach Versus Classic Pterional Approach in Suprasellar Meningiomas Regarding Accessibility & Safety

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Background: Minimally invasive LSO approach is a modification of classic pterional approach with advantages of short skin incision and small craniotomy as compared with pterional approach. Our aim is to present our surgical experience in comparing between lateral supraorbital approach (LSO) and classic pterional approach regarding accessibility and safety in suprasellar meningioma.
Method: Retrospectively 41 cases of suprasellar meningiomas were operated between march 2011 to june 2015 divided into two groups, group A (18 cases) operated via LSO, and group B (23 cases) operated via classic pterional approach with follow up period from 6 to 20 months.
Results: Gross total resection was in 15 cases (83%) group A, while it was in 19 cases (82.6%) group B, improvement of visual acuity in group A were in 12 cases (66.6%), in group B was in 15 cases (65%). Vision unchanged in 4 cases (22%) group A, and in 5 cases (21.7%) group B. Vision deteriorated in 2 cases (11%) group A, and in 3 cases (13%) group B. CSF rhinorrhea was in one case group A (5%) and in one case group B (4%). Transient diabetes insipidus was in one case (5%) group A, and in one case (4%) group B.
Conclusion: LSO approach is safe, less invasive and provide same accessibility to suprasellar meningiomas as compared to classic pterional approach.
Key words: Lateral supraorbital, Pterional, Meningiomas

OP-NO.03-08

Retractorless (Dynamic Retraction) Microneurosurgery for Tentorial Meningiomas

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Aim: To investigate the clinical significance of CT bone window neuro-navigation, intraoperative ultrasound-guided and retractorless (dynamic retraction) microneurosurgery for the treatment of tentorial meningiomas.
Method: We performed a retrospective analysis of 25 patients with tentorial meningioma undergoing microneurosurgery performed by the sub-specialty group of posterior fossa of our department from June 2012 to June 2016. Refinements of patient position, repositioning of patient and microscope during surgical procedure, and utility of gravity-based retraction of brain tissues in the operative field from cerebral falx and tentorium of cerebellum all served to allow us to minimize, in many cases, even eliminate the use of self-retaining retractor or employ dynamic retraction with handheld instruments, such as suction devices, to reduce insult to the brain or surrounding tissues.
Results: There were 15 cases with lateral tentorial meningiomas, 8 cases with medial tentorial meningiomas, 2 cases with falcotentorial meningiomas. Of the 25 patients, 3 patients had a Simpson grade I resection(12%), 18 patients had a Simpson grade II resection(72%), and 4 patients had a Simpson grade III-IV resection(16%). No surgical hematomas observed through CT scan after operation, no one need postoperative decompressive craniotomy, and no hydrocephalus occurred in this series of patient.
Conclusion: We sought to improve the prognosis of patient with tentorial meningioma postoperatively by minimizing, in many cases, even eliminating the use of self-retaining retractor during procedure, instead of employing dynamic retraction, which provides access to reducing the damage of surrounding structures to the great extent and increasing the resection degree of tentorial meningioma effectively.
Keywords: Retractorless, Dynamic retraction, Tentorial meningiomas

OP-NO.03-09

Surgical Strategy and Experience of Anterior Clinoidal Meningiomas

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Background: Clinoidal meningiomas remain a major neurosurgical challenge. The purpose of this study was to investigate the surgical strategy and microsurgical nuances for anterior clinoidal meningiomas.
Method: A retrospective analysis of the clinical, radiographic, operative, and follow-up data was performed on 49 patients with anterior clinoidal meningiomas.
Results: In this series, the mean size of the tumors was 4.4cm (range 2-7cm). Conventional pterional approach was used in 44 cases, and a cranial base technique that is a modification of the original "Dolenc approach" and involves extradural clinoidectomy was used in 5 cases. Simpson grade II resection were achieved in 3 cases (6.1%), Simpson grade II resection in 25 cases (51%), Simpson grade III resection in 12 cases (24.5%) and Simpson grade IV resection in 9 cases (18.4%). The mean follow-up period was 31.1 months (range 3-111nonths). Among the 30 patients with preoperative visual impairment, visual acuity improved in 12cases (40%), was unchanged in 15 cases (50%), and worsened in 3 cases (10%). New permanent postoperative neurological deficits were observed in 10 cases**:** 1 patient with new visual deficit, 3 patients with worsening of preexisting visual deficits, 4 patients with hemiparesis and 2 patients with partial oculomotor nerve paresis.
Conclusion: Anterior clinoidal meningiomas consistently involve the unilateral arteries of the anterior cerebral circulation and optic apparatus, constant microsurgical surveillance of the arterial tree and maintenance of the cerebrospinal fluid interface between the tumor and involved artery and nerve are the most important operative nuances for safe tumor dissection.
Keywords: Meningioma, Anterior clinoidal process, Microsurgical techinique

OP-NO.03-10

An Integrated Genomic Analysis of Anaplastic Meningioma Identifies Prognostic Molecular Signatures

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Anaplastic meningioma is a rare and aggressive brain tumor characterised by intractable recurrences and dismal outcomes. Here, we present an integrated analysis of the whole genome, transcriptome and methylation profiles of primary and recurrent anaplastic meningioma. Over 80% of low grade meningiomas segregate into 5 distinct subgroups based on driver mutation profiles, however, we found a more uniform driver landscape dominated by deleterious in NF2 mutations present in over 70% 50 anaplastic meningioma samples. Relative to lower grade meningiomas, anaplastic tumors harbored frequent driver mutations in SWI/SNF complex genes present in 16% of anaplastic meningiomas. These were confined to the poor prognosis subgroup. The key finding was the delineation of two distinct molecular subgroups that were associated with diametrically opposed survival outcomes with potential prognostic and therapeutic significance.
Keywords: Meningioma, Anaplastic, Tumor

OP-NO.04-01

Discrepancies Between Intraoperative MRI FLAIR and T2 Tumor Volumes Compared with Immediate and 3 Month Postoperative Volumes Correlated with Glioma Tumor Biology and Patient Outcome

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Background: Intraoperative MRI is a useful tool in the operative management of human gliomas. T2 and FLAIR signals are often used as resection margins. We hypothesized that intraoperatively obtained MRI T2 and FLAIR signal volumes might not reflect corresponding post-operative volumes due to tumor edema after resection and brain manipulation.
Method: We examined 160 patients, average age 48.0 (range 16-82) 71 females and 89 males, who underwent intraoperative imaging during glioma surgery. We excluded patients with a new vascular injury identified on diffusion-weighted imaging. Volumetric assessment of T2 and FLAIR signals were made with OSRIX image analysis program and ratios calculated for intraoperative, immediate and 3 month post-operative images for each patient. This was correlated with tumor histology and various molecular markers including IDH-1 mutation and MGMT methylation status as well a patient progression-free and overall survival.
Results: We examined 13 grade I gliomas (DNET, ganglioglioma, JPA) with postop/intraop FLAIR and T2 ratios of roughly 3. In a similar fashion we found that ratios of FLAIR and T2 images for grade 2 tumors (29 LGA, 16 oligo) averaged around 3-4 times larger for immediate and 3 months post op images. A similar ratio was found for high-grade gliomas, (17 AA, 10 AO and 75 GBM). Molecular markers did not predict imaging volume ratios.
Conclusion: Postoperative FLAIR and T2 signal volumes are significantly higher than intraoperatively obtained corresponding volumes for most gliomas studied. Further work will be required but this study questions the validity of T2 and FLAIR images obtained intraoperatively.
Keywords: Intraoperative MRI, FLAIR, T2-weighted, Outcome, Imaging, Molecular markers

OP-NO.04-02

Influence of Topography, Phylogeny, Function and Architecture of the Cerebral Cortex on the Occurrence of Brain Gliomas

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Background: The cerebral cortex can be subdivided according to architectonic, phylogenetic, functional and topographic criteria. The aim of the present study is to study the influence of these factors on the incidence and on the histological grading of gliomas.
Method: We retrospectively reviewed MR images of all naïve cases of glioma operated on at our institution between 2014 and 2016. Incidence and grading of gliomas in the different areas were compared with the Omnibus Pearson chi-squared test, reporting Cramer's V as a measure of effect size. If the result of omnibus test was significant, observed WHO grade frequencies in the subcategories were compared to expected frequencies using one-sample goodness-of-fit Chi-squared tests. Null hypothesis was that the incidence and WHO grading of brain gliomas were homogeneous in all cortical areas.
Results: 262 cases were included in the analysis. The incidence of glioma was not homogeneous in all cortical areas and varied significantly among areas with different function, phylogeny, architecture and topography. WHO grading differed among areas with different phylogeny, architecture and topography. Post-hoc analysis revealed that the diencephalon shows a higher incidence of low-grade tumors (p= 0.003) whereas isocortical areas have a higher incidence of high grade gliomas (p=0.01). Gliomas in insula tended to be more often grade II or III than gliomas in other lobes (p= 0.023).
Conclusion: Our results show that incidence and grading of gliomas are affected by intrinsic characteristics of the cerebral cortex. Phylogenetically older areas seem to be less affected from higher grade lesions.
Keywords: Glioma, Incidence, Topography, Phylogeny, Cortex

OP-NO.04-03

Potential Role of Peritumoral ADC Values for the Differentiating Between Glioblastoma Multiforme and Solitary Metastatic Lesions of the Brain

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Background: Differentiation between glioblastoma multiforme and solitary metastatic lesions, two of the most common malignant brain neoplasms, is often a diagnostic dilemma with conventional MRI. The use of diffusion weighted imaging to better characterize peritumoral edema has been invastigated for this matter but the results has been variable and inconsistent. The aim of this retrospective study was the evaluate the potantial role of peritumoral minimum ADC values and ADC gradient values for the differentiating glioblastoma multiforme and solitary metastatic lesions of the brain.
Method: Forty three patients, 12 with glioblastoma multiforme and 31 with solitary brain metastasis underwent diffusion weighted MR imaging before surgical resection. The ADC values were calculated in peritumoral edema in three locations**:** near, an intermediate distance from and far from the enhancig mass. ADC gradients were calculated as the substractions of this three values. Minimum ADC values of tumoral lesions and peritumoral edema, ADC values of normal appearing contralateral and ipsilateral white matter and ADC values of CSF were also recorded for each lesion.
Results: The evaluation of the ADC gradient values revealed a statistically significant difference between glioblastoma multiforme and solitary metastatic lesions. The minimum peritumoral and tumoral ADC values and peritumoral and tumoral ADC ratios were not statistically significant between these groups.
Conclusion: Peritumoral ADC gradient values can be powerful and useful tool in the diagnosis of solitary brain metastasis and glioblastoma multiforme.
Keywords: Diffusion weighted imaging, Apparent diffusion coefficient, Magnetic resonance imaging, Glioblastoma multiforme, Solitary brain metastasis

OP-NO.04-04

WITHDRAWN

OP-NO.04-05

Re-Operation for Recurrent Glioblastoma Multiforme (GBM) in the Era of Modern Chemotherapy

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Aim: To assess the overall survival of patients with recurrent GBM who were treated by chemotherapy alone (Temozolamide as first line or/and Bevacizamb plus Irinotecan as second line) (group 1) or by second surgery plus chemotherapy (group 2).
Method: Retrospective study for all patients with GBM who were treated in a tertiary level hospital between January 2010 and December 2015. Our inclusion criteria were adult, primary GBM, and patients who received full therapy. We exclude patients who had biopsy only or had palliative treatment. Re-operations for recurrent GBM were offered for GBM cases with single, focal (lobar) lesions outside eloquent areas, and in patients with a good general performance.
Results: 60 were reviewed. Of those 25 patients (42%) had palliative treatment. 23 patients (38%) were in group 1 versus 12 patients (20%) in group 2. Mean age was 49 in group 1 and 43.5 in group 2. Male/ female percentages were 56.5/43.5 in group 1 and 66.6/33.3 in group 2. Second line chemotherapy was given in 6 patients (26%) in group 1 and 7 (58%) in group 2.The Initial analysis for overall survival (OS) showed significant differences**:** 15 months in group 1 and 26.9 months in group 2. Final statistical analysis will be done in June 2017 to achieve a longer follow up.
Conclusion: Second surgery for recurrent GBM in some selected cases is beneficial and can improve overall survival
Keywords: GBM, Reoperation, Recurrence

OP-NO.04-06

Role of MRI PET Brain in Differentiating Glioma Recurrence from Pseudo-Progression

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Background: There is considerable overlap in the MRI findings of glioma recurrence and pseudo-progression or radiation necrosis. It is imperative that this distinction is made so as to decide further management as well as for clinical trials. The relatively newer modality of Simultaneous MRI PET using 18F FET radionuclide may be of benefit in this endeavour. The present study evaluates the role of Simultaneous MRI PET brain in distinguishing glioma recurrence from pseudo-progression.
Method: Thirty two patients with gliomas (13 low grade & 19 high grade) with a new lesion on follow-up were evaluated using MRI PET. Multiparametric evaluation was done including pre and post contrast scans, MR diffusion imaging with ADC maps, MR perfusion imaging, FET PET imaging and MR spectroscopy based on PET localisation. These patients underwent repeat imaging every three months for a mean follow-up of 11.75 months. 25 patients were determined to have a recurrent tumour based either on histologic confirmation or on follow up imaging and 7 were diagnosed with pseudo-progression. The predictive value of different MRI parameters in establishing the correct diagnosis was then calculated using the area under curve method.
Results: Individually the diffusion imaging was the least predictive whereas the FET PET imaging and MRS were the most predictive. Predictability was further improved by combining the three MRI parameters. Combining the MRI and the PET parameters gave the best predictability of 93.7%.
Conclusion: The multiparametric evaluation with Simultaneous MRI PET using 18F PET was highly predictive in differentiating glioma recurrence from pseudo-progression.
Keywords: Simultaneous PET MRI, Glioma recurrence, Pseudo-progression, Radiation necrosis, 18F PET

OP-NO.04-07

Predicting Brain Glioma Grade by a High-Field 3Tesla MRI

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Background: The malignancies of glioma, as the prevalent adult primary brain tumor, ranges from low- to high- grade. Besides histopathology, which is the standard for glioma grading, contemporary radiological imagining techniques like multi-sliced computed tomography (MSCT) and high-field 3Tesla magnetic resonance imaging (3T MRI) are also prized in detection and classification of such tumors. The aim of this article was to evaluate the accuracy of these radiological techniques in comprehensive diagnostics of brain glioma.
Method: A group of brain glioma patients was analyzed in a pilot study. A diagnostic protocol included high-resolution MSCT and high-field 3Tesla T1 and T2-weighted non-enhanced and post-contrast MR brain scanning. The two-tier imaging grading system was introduced dividing the tumors into low-grade versus high-grade gliomas. Radiological grading was based on analyzing intracranial mass effect, tumor borders, perifocal edema, signal intensity heterogeneity, tissue contrast enhancement, tumor hemorrhage and central necrosis. The difference between the glioma groups was statistically analyzed.
Results: A high-resolution MSCT brain scanning did not discriminate malignant glioma from other glioma grades accurately, due to its reduced sensitivity and specificity. A high-field 3T MRI discriminated infiltrating tumor from surrounding perifocal edema and/or normal tissue, presenting an increased tumor cell density and vascularity within enhancing lesions better.
Conclusion: Better predicting of tumor grade is achieved by high-field 3T MRI in comparison to MSCT brain scanning. Executing a high-field 3T MRI protocol may provide brain glioma management with supplementary beneficial diagnostic information prior to surgery. To endorse our results, additional learning is compulsory.
Keywords: Imaging techniques, Glioma grading, Prediction

OP-NO.04-08

Very Short-Term Survival in Glioblastoma Patients: Factors Associated with Poor Outcome – A Subgroup Analysis

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Background: Newly diagnosed cerebral glioblastoma usually entails the perspective of a dire prognosis, not withstanding all efforts developed in the last decades to prolong survival. With combined surgical resection, radiotherapy and chemotherapy, median survival is in the range of 12 to 15 months. Long-term survivors are not frequent, but very short-term survivors are common, although not always well characterized.
Method: A retrospective study of 100 patients with cerebral glioblastoma and very short survival was performed. The whole group was characterized and 2 subgroups selected**:** of 2 month and 4 month survival, comparing their clinical and imaging features.
Results: We found a clear male preponderance (75%), a median age of 68 years (without relevant age differences between groups). Tumors located mainly to the temporal and frontal lobes; deep-seated lesions were also more frequent than in the general glioblastoma population. Pathology revealed overwhelmingly IDH wildtype tumors. Patients in the 2 month group presented more frequently with motor deficit, had deeper lesions (p=0.0047), lower initial KPS (p=0.001) and greater lesion size than the 4 month survival subgroup. Lesion biopsy was the preferred surgical approach in the first group, the second group having more surgical resections, although without statistical significance.
Conclusion: Short survival in glioblastoma patients is associated with unfavorable tumors characteristics, but the dismal prognosis and modern technical advances seem to justify a more aggressive therapeutic approach in order to improve survival and quality of life.
Keywords: Glioblastoma, Short, Survival, Outcome

OP-NO.04-09

Surgery for Recurrent High Grade Glioma: The Dilemma of Debate

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Background: Treating recurrent gliomas is a big dilemma in the literature and no uniform protocol is approved to treat such disappointing problem. Although improvement in the RT techniques, new CTX techniques and new techniques including targeted therapy and gene therapy; all fail to dramatically improve the outcome and solve the problem of significant mass effect when the recurrent tumor is big. So, resurgery play a role in treating such challenging problem. The aim of the study**:** to assess the goal and outcome of surgery in treatment of recurrent malignant glioma.
Method: We retrospectively analyzed the data of 56 patients who were operated upon for recurrent or progressed high grade gliomas in the Mansoura neurosurgery department allover 2007 to 2016. We have excluded patients with recurrent thalamic gliomas and patients with Kps score less than 70.
Results: 12 patient underwent sterotactic biopsy for tumor and were sent for adjuvant radiotherapy, 29 patients underwent partial tumor resection and gross total resection was done in 15 patients. The median time to progression was 5 months. All patients were sent after surgery for poster radiotherapy and chemotherapy. The median overall survival was 4 months.
Conclusion: Recurrent high grade glioma is one of unsolved problem and optimal management is no longer available. Redo surgery is quiet challenging with higher minorities and no add to overall survival. Surgery is indicated to relieve significant mass effect. Outcome of surgery is better for those who did aggressive surgical resection at initial surgery than those who did only partial resection.
Keywords: RT radiotherapy, CTX chemotherapeutic, Kps Karnofsky performance status

OP-NO.05-01

Spheno-Orbital Meningiomas: A Clinical Review of 31 Cases

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Background: Spheno-orbital meningiomas (SOM) are defined as predominantly intraosseus meningiomas of the sphenoid wing, roof and lateral wall of the orbit associated with an "en plaque" soft tissue intracranial component. Tumors usually involve the anterior clinoid process, the superior orbital fissure, the optic canal and the sphenoid or ethmoidal sinuses. This group of tumor should be strictly separated from sphenoid wing meningiomas or primary orbital meningiomas.
Method: 31 patients with SOM were treated at the neurosurgical department in Usti nad Labem from 2000 to 2016. 25 patients underwent operation. 4 cases were operated for tumor recurrence after previous surgery at different institutions. All patients underwent microsurgical removal of the tumor through a pterional, orbito-pterional or orbito-zygomatic approach under electrophysiological monitoring and frameless navigation control to achieve maximal resection.
Results: The median follow-up period was 8.5 years. Forty-eight percent of patients had tumor residuals (orbital apex, superior orbital fissure, cavernous sinus). Out of these residual tumors three patients (25%) had significant progression. Proptosis improved in all patients, 44% of the patients had improved visual acuity. Postoperatively, 9 patients showed temporary cranial nerve deficit and one patient showed permanent deficit. There was no postoperative limiting diplopia or surgical mortality.
Conclusion: Radical resection of SOM is frequently impossible because of the involvement of the orbital apex and cavernous sinus. The goal of the surgery is to relieve the symptoms while preserving neurological function with excellent cosmetic reconstruction.
Keywords: Meningioma, Spheno-orbital, Surgery, Skull base

OP-NO.05-02

Choosing the Side of Approach in Tuberculum Sellae Meningiomas Surgery

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From 2013 to 2016 in the Department of Neurooncology of Novosibirsk Federal Center of Neurosurgery 33 patients with tuberculum sellae meningioma were operated on. Men were 5 (15%), women - 28 (85%). The average age of patients was 54,5 years (34 - 71 years). The size of meningioma ranged from 16 to 54 mm in diameter (in average - 28mm). Decrease of visual acuity was encountered in 32 patients (97%). The absolute majority of patients (29) were operated through the lateral supraorbital approach, one case - using bifrontal approach (3%), 3 patients - via transciliary supraorbital minicraniotomia. In most cases, the choice of approach side corresponded to the side of the most serious deterioration of visus. We also used the contralateral approach in 5 cases (16%).
In 28 (85%) cases a gross total resection (Simpson II) was achieved, in 5 (15%) cases meningioma was removed subtotaly (Simpson IV). Visual function was improved in 41% of cases on the contralateral eye relatively to the side of approach, and only in 28% - at the eye of approach side. The worsening of visual functions were observed more often from the unilateral side of approach than from the contralateral (in 16% and 6% of cases respectively). Thus, the use of unilateral approaches in tuberculum sellae meningiomas surgery is safer and less traumatic. But in some cases the use of the contralateral approach is reasonable and have less percentage of visual deterioration on the side of approach and on the opposite side.
Keywords: Meningioma, Tuberculum sellae, Approach

OP-NO.05-03

Indication of Endoscopic Endonasal Approach for Tuberculous Sell Meningiomas - Characteristic of Optic Canal Invasion

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Background: Optic canal invasion by tuberculum sellae meningiomas (TSMs) has been reported, but the characteristics of invasion remain unclear. This study was performed to clarify the incidence and characteristics of optic canal invasion by TSM and to determine whether optic canal invasion could be predicted preoperatively by magnetic resonance imaging (MRI).
Method: Between February 2002 and August 2014, 31 patients with TSM underwent tumor resection in our institute. In all cases, the optic canal was explored to identify any tumor invasion. We classified the characteristics of optic canal invasion from intraoperative findings. Invasion was classified into four types**:** type 1**:** no invasion; type 2**:** secondary invasion; type 3**:** partial wall invasion (two subtypes); and type 4**:** invasion into the supero-medial-inferior walls of the optic canal. Thirty of 31 cases showed optic canal invasion.
Results: Of these 30 cases, 9 (30 %) showed bilateral optic canal invasion. The most common finding was type 1 (23 sides). Among cases with optic canal invasion (39 sides), type 4 was the most common pattern (17 sides), followed by type 3-infero-medial (13 sides), type 2 (5 sides), and type 3-supero-medial (4 sides). Blinded prediction of tumor invasion was accurate in 61 % of cases, but characteristics of tumor invasion were undeterminable from preoperative MRI.
Conclusion: Optic canal invasion was frequently seen in our consecutive series of TSM, characteristics of which were unpredictable preoperatively. Neurosurgeons should be aware of the high incidence and variety of optic canal invasion in planning strategies for TSM treatment
Keywords: Tubercullum sellae meningioma, Endoscopic endo nasal approach, Optic canal invasion

OP-NO.05-04

Visual Improvement and Stabilization by Surgical Resection of Optic Sheath Meningiomas

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Background: Although meningiomas can frequently involve the optic nerve, primary optic nerve sheath meningiomas (ONSM) are very rare, accounting of 1 to 2% of all meningiomas. Surgery as initial treatment is nearly abandoned, given its purported high morbidity in regards to visual function. We describe the peculiarities of these tumors and the visual outcomes of a series of patients who were treated with surgery aiming at maximal resection.
Method: We retrospectively analyzed the data of 10 patients harboring ONSM surgically treated by the senior surgeon from 1998 to 2016. Diagnosis was based on radiographic and intraoperative findings and typical histological features. Preoperative and postoperative visual assessments were performed by neuro-ophthalmologists in all cases.
Results: There were 9 females and 1 male. The mean age at diagnosis was 48.4 years (range 25-70). Mean follow-up was 40 months (range 0.2-88). The most frequent presenting sign was visual loss (70%). Gross total resection was obtained in 7 cases. When comparing preoperative and postoperative visual function, 5 patients showed improvement of their vision at last follow-up, 3 patients showed stable vision, 2 patients had slightly decreased vision and 1 patients had markedly worse vision postoperatively.
Conclusion: Contrary to conventional teaching, surgery can play a fundamental role in the primary treatment of ONSM. Gross total removal can be achieved with vision preservation, and improvement, without major surgical complications, especially at early stages of the disease. Patients with good preoperative vision have higher chances of a favorable outcome when compared to those with poor vision.
Keywords: Optic nerve, Optic sheath, Meningioma, Skull base, Brain tumor

OP-NO.05-05

Sphenoid Wing Meningioma in a Sub-Saharan African City

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Background: Sphenoid wing meningiomas (SWMs) constitute about 14% to 20% of intracranial meningiomas. In sub-saharan Africa, very late presentation is common with involvement of the cavernous sinus, internal carotid artery (ICA), and visual pathway. Total excision is challenging, resulting in high morbidity and a high rate of regrowth or recurrence.
Method: Patients diagnosed with sphenoid wing meningioma within the study between February 2008 and December 2016 in Lagos, Nigeria were included in this study. Demographic, clinical, radiological parameters and outcome data were collected and analyzed.
Results: A total of 35 patients seen (26F, 9M), 8 of whom rejected treated or opted for treatment elsewhere. Twenty seven patients underwent surgical treatment, 21F, 6M (3.5**:**1). Four of the patients had recurrent or progressing disease after previous surgical therapy before referral. Over 70% of operated cases had varying degrees of calcification or ossification. Age range was 18yrs to 76yrs, with a mean age of 52yrs. Tumor was right sided in 9 cases and Left sided in 18 cases. Simpson Grade I&II was achieved in 19 patients (81.5%). The histological subtypes were Meningiothelial 22/27 (81.5%) and Fibroblastic 5/27 (18.5%). There were 3 perioperative deaths (11.1%), and 19 of the operated patients (70.4%) had complete resolution of symptoms.
Conclusion: By aiming for extensive resection, good disease control with minimal morbidity, good cosmetic and functional results can be achieved in the majority of cases. Patients with medial type and incomplete resection should be followed up with MRI to recognize recurrence early.
Keywords: Meningiomas, Sphenoid wing, Skull base, Outcome

OP-NO.05-06

Personal Experience in the Management of Anterior Skull Base Meningiomas

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Background: The author reviewed surgical approaches and outcomes of anterior skull base meningiomas.
Method: Twenty two suprasellar meningiomas and 21 olfactory groove meningiomas that were operated on between 2003 and 2016 were retrospectively analyzed in regards with surgical approaches and outcomes.
Results: The clinical presenting symptoms of suprasellar meningiomas were progressive visual impairment in 21 patients, headache in 5 patients and mental changes in 2 patients. The author used pterional approach with fronto basal extension to all cases. Visual improvement were observed in 10 patients (tumors located at tuberculum and planum sphenoidal) and post operative visual worsening were observed in 3 patients (tumors located at tuberculum and optic foramen). Gross total removal was 60%. The author used different surgical approaches to remove olfactory groove meningiomas such as frontal craniotomy combined with anterior rhinotomy (work together with ENT surgeon), unilateral sub frontal approach with orbitotomy, bifrontal craniotomy and supraorbital sub frontal (with eyebrow skin incision). Postoperative complication were new anosmia in 3 patients, new visual impairment in 3 patients, temporary mental disturbance in 3 patients, CFS leak in 2 patients, intracranial hematoma in 1 patients and mortality in 1 patient. Gross total removal was 80.1%
Conclusion: Pterional approach with frontobasal extension was proper approach to all size of suprasellar meningiomas. Post operative visual improvement was dependent on location of the

tumors. Olfactory groove meningiomas need different approaches, which most likely depend on size of the tumors.
Keywords: Anterior skull base meningioma, Surgical approach, Surgical outcomes

OP-NO.05-07

Technical Strategy and Pitfall in Surgery for Juxtasellar Skull Base Meningioma

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To clarify the technical strategy and pitfall of functional preservation in surgery for juxtasellar meningioma, I reviewed 86 surgical cases retrospectivery. I evaluated surgical result of 87 patinets with parasellar menigiomas. There are woman predominant (62 vs. 25). Age of average is 58.2. Tumor origins are medial sphenoid wing in 24, tuberculum sellae in 22, anterior clinoidal in 17, olfactory groove in 16, cavernous sinus in 6, posterior clinoidal in 2. We choose basal interhemispheric approach for midline located tumors and lateral approach, mainly zygomatic approach for tumors located laterally. Among 31 patients with visual impairment before surgery, Improving of visual acuity was seen in 17, no change in 12, deteriorating in 2. In all of 7 patients with blindness before surgery, their visual function was not improved, except for one patient who suffering extradural compression. There were 3 patients with complication related perforators. An appropriate surgical strategy, knowledge of detail surgical anatomy and meticulous microsurgical technique could produce good functional outcome in patients with juxtasellar skull base meningioma.
Keywords: Anterior skull base, Juxtasellar meningioma, Visual function, Perforator

OP-NO.05-08

Anterior Skull Base Meningiomas: Surgery Related Hypothalamic Sequalae; How to Avoid?

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Background: Surgical morbidities related to anterior skull base meningiomas are widely addressed in the literature. However; there is infrequent complications related to hypothalamic insult either from direct affection or via manipulation of vascular supply of this area. The aim of this study is to address hypothalamic complications occurred after surgery for anterior skull base meningiomas, pitfalls in our surgical technique and the way to minimize such morbidities.
Method: Retrospective study was conducted on all patients who did surgery for anterior skull base meningiomas in the neurosurgery department, Mansoura University during the period from 2011 to 2016. All the patients clinical and radiological data before and after surgery were analyzed. All patients who developed transient or permeant hypothalamic manifestation were included in this study and data regarding their tumor morphology, surgical technique and late imaging were assessed.
Results: Among 93 patients who did surgery for anterior skull base meningiomas; 12 patients developed post-operative sequalae related to hypothalamic function. In 7 patients; tumor was recurrent and in 4 patients; conformal radiotherapy was given after the initial surgery. Complication was transient in 3 patients and permeant in 9 patients. 8 patients died from their hypothalamic sequalae. Early post-operative imaging showed hypothalamic infarction in 8 patients.
Conclusion: The importance of many factors in the tumours morphology, recurrence who increase hypothalamic insults. factors in surgery include preservation of arachnoid plain, perforators, meticulous dissection for minimize this complication
Keywords: Skull base, Meningioma, Hypothalamus, Coplication

OP-NO.05-09

Foramen Magnum Meningiomas Classification and Surgical Management

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Background: Foramen magnum meningiomas (FMMs) are rare meningeal benign tumors in 85% of the cases. We report a classification system based our study on worldwide experience and the royal medical services experience in surgical management. Foramen magnum meningiomas represent a common histological tumor in a rare and difficult and sensitive location. In this study we showed the clinical presentation, important anatomical structures of the foramen magnum space, neuroimaging features, surgical approaches for resection, and outcomes.
Method: In the surgical resection of foramen magnum meningiomas, the surgical corridor involves the space between the lateral margin of the medulla oblongata, spinal cord and the medial aspect of the occipital bone condyle.
Results: Foramen magnum meningiomas resection were associated with a surgery-related mortality rate of 4 to 9% and morbidity rate of 25%. The intra dural compartment (94.4%) and extradural is less frequently (2.8%) or both intra-extradural. (2.8%). FMMs were divided into posterior (5.8%), lateral (54.8%), and anterior (39.4%). Lower cranial nerves were shifted above in FMM growing below the vertebral artery position cannot be suspected in other situations.
Conclusion: Foramen magnum meningiomas (FMMs) classification system helps surgeons to do the best surgical approach but also for anticipating the position of the lower cranial nerves and therefore for decline the surgical complication. The clinical results for foramen magnum meningiomas at Royal medical services are within the developed countries multi-centric range in morbidity and mortality.
Keywords: Meningioma, Foramen magnum, Surgical approach

OP-NO.06-01

Therapeutic Outcomes in Patients Undergoing Surgery After Diagnosis of Cushing's Disease: A Single-Center Study

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Aim: To investigate early and late outcomes of patients who underwent neurosurgical procedures for the preoperative diagnosis of Cushing's disease (CD).
Method: Clinical, endocrine, imaging, and histologic data from 252 patients undergoing pituitary surgery at Toranomon Hospital through the end of 2012 were entered into a database and statistically analyzed.
Results: In 22 of these patients (8.7%; positive venous sampling in 15 and negative venous sampling in 7 patients), tumors were invisible on magnetic resonance imaging (MRI) and 42.9% of them achieved remission. In the remaining 230 patients, 93.5% of those with microadenomas (n=154) and 71.1% of those with macroadenomas (n=76) achieved early postoperative remission, with recurrence rates of 2.7% and 14.8%, respectively, during a 72.5-month median follow-up. In multivariate analyses, cavernous sinus invasion (CSI; odds ratio [OR], 13.0), type of surgery (OR, 4.0), and tumor size (OR, 2.7) were significant preoperative factors affecting early postoperative results, whereas peak cortisol levels ≥9.4 μg/dL in response to corticotropin-releasing hormone (CRH) and CSI were significant factors predicting recurrence.
Conclusion: Tumor recurrence was more common in patients with non-densely granulated adenomas than in patients with densely granulated adenomas. We propose that the higher remission and lower recurrence rates in this series are due to our surgical strategies, including extracapsular tumor removal, aggressive resection of tumors with CSI, extended transsphenoidal surgery (TSS), or a combined approach for large/giant adenomas. Appropriate multimodal treatments, including radiotherapy, medication, and repeated surgery in patients with persistent or recurrent CD, could result in better overall outcomes than previously achieved.
Keywords: Cushing's disease, Transsphenoidal surgery, Long-term results, Temozolomide, Radiosurgery, Venous sampling

OP-NO.06-02

Analysis of Corregister of High Field MRI (3T) and Methionine and FDG PET in the Management of Cushing´s Disease Recurrence

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Aim: To establish the diagnostic capacity of the simultaneous use of high field MRI (3T) and Methionine and FDG PET in the management of recurrence in Cushing´s disease.
Method: A total of 23 studies of MRI and Methionine and FDG PET in 18 patients with confirmed recurrence of Cushing disease were performed. The series includes four men and 19 women (ages between 19 and 66 years, mean 36,7 years). The measurement of PET was done through the SUVmax and SUVmax/SUVclgm index, considering abnormal those values above 1.5. Lateralization and location of uptake were also determined. The MRI was performed in a 3T (Phillips Giroscan Intera 3-T) with 3D T1 and spin echo-T1 sequences with and without contrast, as well as turbo spin echo-T2 sequences.
Results: Time to recurrence**:** in two cases between 3-6 months (8,7%), in three patients between the 6 and the 12 month (13%), in four cases (17,4%) between 12 and 24 months, in eight patients (34,8%) between 24-48 months and in six patients (26,1%) after 48 months. Three patients (13%) received adjuvant radiotherapy. MRI showed recurrence in 50%. There was a coincidence in a total of 14 (70%) studies after the corregistration of 3T MRI and PET. There were no false positives after the correlation with the surgical finding in relation with location/lateralization.
Conclusion: The recurrence in Cushing´s disease is really challenging, however the simultaneous use of 3T MRI and Methionine & FDG PET will be a very a useful tool for its diagnosis and management.
Keywords: Cushing´s disease, Methionine PET, FDG PET

OP-NO.06-03

Postoperative Complications of Transsphenoidal Pituitary Adenectomy in a Tertiary Center in Underdeveloped Country

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Background: Trans-sphenoidal approach is preferred method for pituitary adenoma excision, however it is not without postoperative complications as the pituitary gland has important hormonal function as well complex anatomical location. We examined and categorized the postoperative complications according to various tumor pathologies.
Method: A retrospective study of patients who had undergone trans-sphenoidal pituitary adenectomy in past 5 years was conducted at a tertiary level neurosurgical center and various postoperative complications during hospital stay were noted and analyzed.
Results: In our series of 54 patients, various groups showed different postoperative complications out of which, diabetes incipdus (DI) was the commonest. Other electrolyte abnormalities excluding DI was the second most common followed by CSF leak. Seizure and meningitis was among the rear complication. One patient succumbed to meningitis. Complications was not associated with analyzed variables like the type of adenoma, size or age of the patient. These complication were comparable to various publications of developed world.
Conclusion: Knowing about complications of any surgical procedure is the first step in preventing them. Various postoperative complications can be anticipated in transsphenoidal pituitary surgery even though, it is considered to be relatively safe.
Keywords: Complications, pituitary tumors, Postoperative, Transsphenoidal surgery

OP-NO.06-04

Reliability of Cavernous Sinus Sampling in Management of Cushing's Disease

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Aim: To find out the accuracy of bilateral simultaneous cavernous sinus sampling (CSS) in predicting tumour lateralisation within the pituitary for patients with Cushing's disease (CD).
Method: 65 consecutive CD patients who had undergone transsphenoidal surgery (TSS) following CSS between 2000-2016 at our institution were studied retrospectively. Indications for CSS was magnetic resonance imaging (MRI) both normal or showing suspect pituitary adenoma <6 mm. All patients underwent bilateral CSS with corticotropin releasing hormone (CRH) stimulation and heparinization. 1.4 ratio was considered a lateralization for CSS; Its correlation with radiological, surgical and pathological findings and remission status was analysed.
Results: Remission rate was 84% for 65 patients and CSS indicated the correct lateralization related with either remission or pathological confirmation of ACTH-secreting adenoma in 52 patients (82%). There was no lateralisation in 3 patients who had central adenoma and false positive lateralization in 3 patients with no microadenoma in the lateralized side resulting in no remission. There were no mortality and morbidity related to CSS.
Conclusion: Our results showed that CSS is a safe and reliable method for detection of a pituitary ACTH-secreting microadenoma. CSS has a high diagnostic accuracy with high rates (84%) in indicating the correct lateralization in CD.
Keywords: Adrenocorticotropic hormone, Cushing's disease, MRI, Microadenomas, Cavernous sinus sampling, Inferior petrosal sinus sampling

OP-NO.06-05

Decision Making for Efficient Management of Cushing Disease (CD)

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Background: Cushing disease is a rare entity caused by ACTH producing pituitary adenoma and accounts for almost 15% of all pituitary adenomas. The evolution of pertinent biochemical and Neuro-imaging investigation during the past decades enhance diagnostic reliability of Cushing disease. The introduction of microadenoma' concept and the refinement of transphenoidal surgery made by Hardy are the corner stone in the management of Cushing disease.
Method: A retrospective review of patient material diagnosed to have Cushing Disease was performed including review of the medical literature. The author has selected several cases of Cushing disease from own series in order to highlight the diagnostic and therapeutic challenges that face the treating physician with focus on surgical approach, special diagnostic tests, the role of new technology as well as decision making and strategic plan of management of recurrences and use of alternative treatment options.
Conclusion: The direct endonasal transsphenoidal approach coupled with experience in microsurgical dexterity and assisted by the use of Neuro-Navigation, Endoscope and Intraoperative Imaging; has promoted minimal-invasiveness& patient safety as well as contributed to improve of treatment outcome. However, difficult diagnostic confirmation, tumor invasiveness, absent curative/ alternative medical treatment and variable response to stereotactic radiation therapy continue to be the great challenges that, the treating physicians have to deal with and aspire to find solution for.
Keywords: Cushing disease, Pet scan, Endoscopy, Radiosurgery

OP-NO.06-06

The Value of Endoscopic Endonasal in Pituitary Adenoma

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Aim: To compare between a standard microscopic trans sphenoidal approach (MTSA) and endoscopic endonasal approach (EEA) in pituitary adenoma.
Method: The study includes 80 patients 45 Females 35 Males. Age ranged between 25-70 years. They were divided into 2 groups; Group A**:** 40 patients underwent endoscopic endonasal approach (EEA) Group B**:** 40 patients underwent microscopic trans sphenoidal approach (MTSA). CT and MRI were applied for all patients. Follow up from 2009 to 2013.
Results: Visual improvement is reported as 76% and 72% in Endoscopic group (EEA) and Microscopic group (MTSA) respectively. Total resection is recorded as 85% and 75% in EEA and MTSA respectively. CSF leak was observed as 0% and 5% in EEA and MTSA respectively.
Conclusion: EEA offers a very spatial and wide Panoramic visualization. Steep learning curve for endoscopic orientation is essential. EEA is a safe and effective method to remove pituitary adenomas. However the comparison between EEA and MTSA was statistically insignificant.
Keywords: Pituitary adenoma, Endoscopic, Microscopic

OP-NO.06-08

Late-Onset Pneumocephalus Following Transsphenoidal Pituitary Surgery: Treatment and Clinical Follow-Up Dilemmas

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We report a case of pneumocephalus following transsphenoidal pituitary macroadenoma excision. The contradictions about treatment and clinical follow-up are discussed in the light of available literature. 53-year-old male admitted with headache, and visual impairment. The magnetic resonance imaging (MRI) revealed giant pituitary adenoma including organized hematoma. Clinical evaluation showed panhypopituitarism and bitemporal hemianopsia. Gross total tumor excision was made via endoscopic transsphenoidal approach. Intraoperative cerebrospinal fluid (CSF) leakage was visualized. Base of sella was repaired with the adipose tissue, fascia, and pediculated middle concha. Two days after discharge, the patient was re-hospitalized for hyponatremia. During hospitalization, he started to complain about a sense of sound that the air bubbles blowing into his skull at post-op 11th day. Computerized tomography (CT) revealed the pneumocephalus in the subarachnoid space. Neurologic status was stable. Endoscopic examination revealed no CSF leakage. The nasal pads were applied and the patient was followed. Among the macroadenomas with the suprasellar extension, the intraoperative CSF leakage is seen in 19-57% of the cases while the postoperative leakage ratio is 5-10%. Despite the lumbar external CSF drainage is the most known intervention increasing the risk of pneumocephalus, it also helps to decrease the CSF leakage. After sellar repair, there are various clinical applications such as the laying angle (straight or upright), the time of mobilization (early or late), anterior nasal pad application, laxative and antihistaminic administration (to prevent sneeze, blow). There is no consensus about the timing of sella repair for pneumocephalus if there is no CSF leakage. In this case, hypovolemia might play role in the late pneumocephalus after a decrease in the CSF production caused by the fluid restriction for the treatment of hyponatremia. Treatment is often patient and symptom oriented.

Keywords: Pituitary adenoma, Macradenoma, Transsphenoidal surgery, Pneumocephalus, Cerebrospinal fluid leakage

OP-NO.06-09

Surgical Outcome of Pure Endoscopic Transsphenoidal Surgery; Report of 16 Cases

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Aim: To asses the outcome of a consecutive series of patients undergoing pituitary surgery using a pure endoscopic endonasal approach and to evaluate the efficacy and safety of this procedure.

Method: A total 16 consecutive patients of which 7 were male and 9 were female with pituitary adenoma who underwent purely endoscopic transsphenoidal resection were studied. This study was done in a private hospital and a single surgical procedure of endonasal transsphenoidaly surgery was observed in all patients. Mean follow up was 6 months.

Results: 8 patient developed transient DI, 2 patient had csf leak, 1 had recurrent tumor and there was no mortality in this procedure.

Conclusion: A purely endoscopic approach for pituitary adenoma treatment is a safe and effective alternative to the traditional microscopic procedure. Although the result is satisfactory additional studies with longer follow-up periods are required to confirm whether this approach should be considered the preferred procedure for pituitary surgery.

Keywords: Pituitary adenoma, Endoscopic

OP-NO.06-10

Surgical Management of Giant Pituitary Adenomas: Single Center Experience

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Background: Giant Pituitary Adenomas (GPA) (> 4 cm) accounts for 5-14% of ADH. Radical resection is achieved in 50% of patients and morbidity ranges from 10 to 20%. The objective of this study was to describe epidemiology, endocrinological, visual and surgical complications.

Methods: Thirteen patients with GPA were analyzed between 27/12/2016 and 04/25/2017. Demographic variables are described and endocrinological, visual dysfunction, tumor volume, percentage of pre and post-surgical resection and associated morbidity and mortality are compared.

Results: Of the population (n = 13), 53.8% were men with a mean age of 53.6 years; 92% GPA were non-functional and one case was ACTH-producing; The average diameter was 51.2 mm and the volume was 42.4 cc. Presentation symptoms included visual deficit (84%) and headache (53.8%); In the magnetic resonance they presented intraventricular extension (61.5%) and invasion to the cavernous sinus (84.61%). The chosen approach was trans-septum-esphenoidal (TSE) 15.38%, endoscopic endonasal approach (EEA) 61.53%, pterional 7.69% and 15.38% by craniotomy and endoport. The mean percentage of resection was 81%. 88.8% showed visual improvement. Complications were vascular injury (23.07%), hormonal deficit (61.53%), CSF fistula (7.69%) and 1 death.

Discussion: Transcranial resection or TNE has been proposed in one or multiple surgical stages. The tumor volume we report surpasses other series. The degree of resection and visual improvement is comparable to that reported in the literature (1-5).

Conclusions: The aim of the surgery is to achieve maximum resection, visual improvement and prevent morbidity associated with surgery and endocrinological deficit.

Keywords: Giant pituitary adenomas, Trans-sphenoidal resection, Trans-cranial resection

OP-NO.07-01

3D Bioprinted Glioma Stem Cells for Brain Tumor Model and Applications of Drug Susceptibility

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Glioma is still difficult to treat because of its high malignancy, high recurrence rate, and high resistance to anticancer drugs. An alternative method for research of gliomagenesis and drug resistance is to use in vitro tumor model that closely mimics the in vivo tumor microenvironment. In this study, we established a 3D bioprinted glioma stem cell model, using modified porous gelatin/

alginate/fibrinogen (GAF) hydrogel that mimics the extracellular matrix. Glioma stem cells achieved a survival rate of 86.92%, and proliferated with high cellular activity immediately following bioprinting. During the in vitro culture period, the printed glioma stem cells not only maintained their inherent characteristics of cancer stem cells (Nestin), but also showed differentiation potential (glial fibrillary acidic protein (GFAP) and β-tubulin III). In order to verify the vascularization potential of glioma stem cells, tumor angiogenesis biomarker, vascular endothelial growth factor (VEGF) was detected by immunohistochemistry, and its expression increased from week one to three during the culture period. Drug-sensitivity results showed that 3D printed tumor model was more resistant to temozolomide (TMZ) than 2D monolayer model at TMZ concentrations of 400μg/ml to 1600μg/ml. In summary, 3D bioprinted glioma model provides a novel alternative tool for studying gliomagenesis, glioma stem cell biology, drug resistance, and anticancer drug susceptibility in vitro.

Keywords: 3D bioprinting, Glioma stem cells, Brain tumor model, Drug susceptibility

OP-NO.07-02

Establishment and Characterization of New Recurrent Clivus Chordoma Cell Line: YU-Chor1

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Background: Chordoma is a rare bone tumor is thought arise from remnant of embryonic notochord. They can occur anywhere of spine especially in clivus (%32) and sacrum (%29). They are both chemo- and radio- resistant. Main treatment is radical surgery followed by radiotherapy.
Method: YU-Chor1 chordoma cell line was derived from 76-year-old patient with recurrent clivus chordoma. The patient provided informed consent. Tissue was pathologically confirmed for chordoma. DNA was isolated from both cell culture and patient's blood for Short Tandem Repeat (STR) analysis. Expression of chordoma, Epithelial-Mesenchymal Transition (EMT) and Mesenchymal-Epithelial Transition (MET) markers was determined through qPCR. CD90, CD24, CD133, CD44, CD338 and CD15 antibodies were used to identify molecular characterization through BD FACS Aria III. After that Affymetrix Human Gene 2.1 ST Array was used to identify expression of mRNA. U-CH1 and MUG-Chor1 were used as positive control.
Results: Molecular karyotyping analysis revealed that YU-Chor1 cell line has several loss and gains such as loss in q arm of chromosome 10 and gain in p arm of chromosome 7. Both cell culture and blood of patients had same STR results. Brachyury expression was upregulated in YU-Chor1 cell line when compared with U-CH1, whereas downregulated with MUG-Chor1. 500 different genes were differentially expressed in YU-Chor1.
Conclusion: 9 different chordoma cell lines were universally accepted from Chordoma Foundation. However, there were no chordoma cell line which is recurrent clivus chordoma. chordoma. This finding may lead to the development of new approaches toward treatments of chordomas.

Keywords: Chordoma, Brachyury, EMT, Molecular karyotyping, Microarray

OP-NO.07-03

Over-Expression of TERT Plays Tumor Promoting Roles in Malignant Transformation of Bone Marrow Mesenchymal Stem Cells After Interaction with Human Glioma Stem-Like Cells

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The roles of bone marrow mesenchymal stem cells (BMSCs) in tumorigenesis of gliomas are still controversial and have attracted more and more attention in recent years. Some believe that BMSCs can be used as a therapeutic vector cells to inhibit the progression of tumors, while some others believe that BMSCs can promote the malignant progression of glioma. In this study, nude mice were treated with irradiation for bone marrow ablation, and then BMSCs expressing enhanced green fluorescence protein (EGFP) were injected into the tail vein of irradiated mice to establish the bone marrow transplant model. In the transplant model mice, glioma stem-like cells (GSCs) expressing red fluorescent were transplanted in the brain to establish an intracranial in situ tumor model. After tumorigenesis, BMSCs expressing green fluorescence were harvested from tumor tissues. Strikingly, these BMSCs have had a malignant transformation with over-expression of TERT. Then, transferring of TERT gene into normal BMSCs in vitro lead to the malignant transformation of the normal BMSCs to certain extent. These results suggest that GSCs can induce malignant transformation of BMSCs via activation of TERT gene in BMSCs, which helps to elucidate the role of TERT in tumor remodeling initiated by GSCs.

Keywords: Glioma stem-like cells, Bone marrow mesenchymal stem cells, TERT, Malignant transformation, Over-expression

OP-NO.07-04

Combination Immunotherapy in Comprehensive Treatment of Patients with High Grade Brain Gliomas

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The results of epidemiological and statistical data relating to malignant brain gliomas make us continue to search for a new adjuvant treatment from year to year. Consequently, we still find ourselves in the search for solutions of this problem, and one of the outputs is the application of immunotherapy using dendritic cells. Our main target was to assess the safety and efficacy of

combined immunotherapy for the treatment of the new protocol with the using of autologous dendritic cells. This abstract describes the study at the Clinic of Neurosurgery of Novosibirsk RIITO since 2006 to 2013, which statistically confirms the efficiency of this method in 49 patients with malignant gliomas treated with the use of combined immunotherapy, comprising of two stages**:** locoregional administration of cytotoxic lymphocytes in the bed of the removed tumor and subsequent 5-6 injections of the anti-tumor vaccine based on IFN-alpha-induced dendritic cells, which were used as antigen presenting cells and as the cells potentially possessing by a direct cytotoxic effect on tumor cells. The results of our investigation showed that this course is a safe method of treatment, having a certain efficiency, which was characterized by an increase in survival duration in patients with malignant gliomas, that allows us to make a concludion about the combination immunotherapy which justifies methods of adjuvant treatment of this pathology.

Keywords: Malignant gliomas, Dendritic cells, Immunotherapy, Tumor vaccine, Long-term follow up

OP-NO.07-05

Isolation Process of Human Astrocytes

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To study mechanisms of neurotrauma and neurodegeneration, in vitro organ culture systems with live neural cells are highly appealing. Astrocytes are especially a focus in research. Mostly, these cells are isolated from animal tissue. We established a relatively quick and easy protocol for isolation of astrocytes from the brain biopsies with a high yield and low risk for contamination. Human astrocytes can be obtained following cranial operations, especially in neurotrauma patients after brain necrectomy. In sterile conditions, fragments of viable tissue that was removed during the operation were collected. The tissue was cut, grinded and seeded through mesh system. After sequential centrifugation and separation, sediment was harvested and cells seeded in suspension, supplemented with special media (DMEM Advanced) containing high nutrient level (FBS) and antibiotics (streptomycin, penicillin). Characterization was made and sub-isolation cells followed. In appropriate environment, isolated cells retained viability and proliferated quickly. Attachment was observed after 8 to 10 hours and proliferation after 5 days. Time to confluence was 21 days. Cell proliferation, apoptosis and cell senescence were examined after 21 days in culture. The cells were stable. Under standard culture conditions, cell proliferation and cluster formation was observed. Cell viability was 90%. GFAP and DAPI immunohistology was made for characterisation and the cells were highly positive, confirming the astrocyte markers. The availability of such system will permit the study of cell properties, biochemical aspects and the potential of therapeutic candidates for traumatic and neurodegenerative disorders in a well-controlled environment on a human astrocyte cell culture.

Keywords: Cell isolation, Human, Brain, Astrocyte

OP-NO.07-06

Self-Assembling Camptothecin Hydrogel: Interstitial Therapy for Gliomas

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Background: The efficacy of chemotherapy in Glioblastoma (GBM) patients is limited due to the blood brain barrier (BBB). We have developed a self-assembling proprietary camptothecin (SAC) system for local therapy, with high penetration into the brain.
Method: 18 nunu mice were injected into the cortex with GBM-GFP Luc cells from our patients. Tumor growth was assessed using bioluminescence (BLI), and tumor resection was performed. We had 2 groups (n=9)**:** 1) Resection+SAC control 2) Resection+SAC. SAC (5µl) was placed in the cavity. Mice were followed over time with BLI. Tumor area, drug penetration and survival were determined.
Results: SAC hydrogel remained in the resection cavity, the SAC released from the hydrogel diffused into the brain parenchyma and decreased tumor growth resulting in prolonged survival. Control animals showed a significant increase in BLI signal compared to the SAC group after resection (276 fold-change in the control group vs 8.9 times in the treated group after 3 weeks of resection, $p<0.005$). A significantly increased in survival in SAC vs control group was found (64d vs 36d respectively, $p= 0.0142$). A 2.5-fold change reduction in tumor re-growth on the SAC group was found compared to control ($p=0.003$). Deep drug brain parenchyma penetration with a mean of 0.7312 ± 0.088 mm2 was found in SAC group.
Conclusion: SAC hydrogel is an excellent strategy for drug delivery in brain cancer that exhibits high penetration and survival benefit to effectively treat the infiltrating part of the tumor, essential for cancer recurrence, disability and death.

Keywords: Glioblastoma, Local therapy, Hydrogels

OP-NO.07-07

Blockade of Inhibitors of Apoptosis Proteins in Combination with Conventional Chemotherapy Leads to Synergistic Antitumor Activity in Medulloblastoma and Cancer Stem-Like Cells

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Medulloblastoma (MB) is the most common pediatric primary malignant brain tumor. Approximately one-third of MB patients succumb to treatment failure and some survivors suffer detrimental side effects. Hence, the purpose of this study is to explore new

therapeutic regimens to overcome chemotherapeutic agent resistance or reduce chemotherapy-induced toxicity. We detected the expression of inhibitors of apoptosis proteins (IAPs) in MB and CD133+ MB cell lines and MB tissues using immunoblotting and immunohistochemical staining. The antitumor effects of inhibitors against IAPs on MB or CD133+ MB cells were evaluated by MTT assay, Annexin V/PI analysis, and caspase-3/7 activity. Autophagy was assessed by the conversion of light chain (LC) 3-I to LC3-II and Cyto-ID autophagy detection kit. MB cells showed higher expression of IAPs compared to normal astrocytes and normal brain tissues. Conventional chemotherapeutic agents combined with small-molecule IAP inhibitors (LCL161 or LBW242) showed a synergistic effect in MB cells. Combined treatments triggered apoptosis in MB cells through activation of caspase-3/7 and autophagic flux simultaneously. In addition, we found that CD133+ MB cells with features of cancer stem cells displayed higher levels of X-linked inhibitor of apoptosis (XIAP) and cellular inhibitor of apoptosis 1/2 (cIAP1/2), and were hypersensitive to treatment with IAP inhibitors. These results shed light on the biological effects of combination therapy on MB cells and illustrate that IAP inhibitors are more effective for CD133+ stem-like MB cells.

Keywords: CD133, Inhibitors of apoptosis protein, Medulloblastoma

OP-NO.07-08

Comparison of Glutamate Transporter Activity in Glioblastoma Multiforme Cells with Astrocytes Using Invitro Voltammetry Technique and Examination of Glutamate and Glutamate Receptor Expression Levels

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Aim: To investigate the physiological and genetic differences of glioblastoma multiforme (GBM) cells and astrocytes.
Method: Both cell lines were exposed to glutamate (10-7, 10-6, 10-5, 10-4 μM) toxicity for 24 hours. We used MTT (3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide) assay to evaluate cell viability on both cell lines. In addition we determined the glutamate reuptake duration by using in vitro voltammetry technique. Furthermore the expression results of glutamate transporter (GLT-1) and receptors (NMDA, AMPA, KA) were analyzed by revers transcription polymerase chain reaction (RT-PCR).
Results: The in vitro MTT results indicated that 10-5 and 10-4μM concentrations of glutamate decreased cell viability (15-20% in rate) in astrocytes while this two concentrations didn't show cytotoxic effect on GBM cells. According to in vitro voltammetry results, glutamate reuptake durations (T80) were 2.5-3 seconds in astrocytes and about 4 seconds in GBM cells. In addition, RT-PCR results that GLT-1 gene expression ratio in astrocytes was 740 times higher than GBM and NMDA gene expression ratio in astrocytes was 1230 times higher than GBM. Moreover AMPA receptor gene expression ratio in astrocytes was 1.5 times higher than GBM.
Conclusion: This study is an important study for detecting the activity changes in GBM cells for glutamate reuptake. And we did the RT-PCR studies for showing the etiology of this stuation. We found this activity changes are related with the expression levels of glutamate transporters.

Keywords: In-vitro voltammetry, Glioblastoma multiforme, Glutamate

OP-NO.07-09

Effects of Glycogen Synthase Kinase Inhibitor on Glioblastoma Multiforme Cell Line Via Apoptosis and Cell Signaling Pathways

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Glioblastoma multiforme is known as the most common and agressive primary brain tumor that approximately 9000 new people are diagnosed every year over the world. Grade IV/V types of gliomas are known as glioblastoma multiforme. Despite the totally surgical procedure and following chemoradiotherapy, patients diagnosed with glioblastoma survive less than 24 months and the recurrence of the tumour is almost a rule. This failure in treatment, has led researchers to understand the molecular pathogenesis of the disease and cellular signaling pathways. In accordance with this purpose; GSK3 inhibition of GBM cell lines planned and the results of this inhibition to the apoptosis process via epidermal growth factor Receptor (EGFR) and nuclear factor kappa Beta (NF-κB) are studied. Glioblastoma (U-87 mg) and normal brain (svgp12) cell lines used and said pathways were subjected to immunofluorescence analysis and cell viability tests. With the use of GSK3 inhibitor on GBM cell line results as decreased expression of NF-κB. Although increased apoptosis has been shown both brain cell line and GBM cell line with the addition of GSK3 inhibitor. With the help of this study, a common malignant brain tumor that could not be taken too much way about the kind of treatment, light is shed on the literature to investigate the potential therapeutic model that would inactivate the level of cellular signaling pathways

Keywords: Glioblastoma multiforme, Cell signaling, Apoptosis, Glycogen synthase kinase 3

OP-NO.08-01

Serum rs5050 AGT Polymorphism is Related with Poor Prognosis in Astrocytoma: Potential Biomarker in Blood

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Background: Glioma is the most common intrinsic primary tumor of the central nervous system in the adult population worldwide. Several biomarkers in glioma have been studied, mostly in tumor

tissue. The Renin-Angiotensin System, in addition to its systemic function, has been found to exhibit local and paracrine functions. The rs5050 polymorphism of the human AGT gene has been shown to lead to differences in promoter activity and gene transcription in vitro. The localized expression of RAS components and AGT polymorphisms has been linked to some types of cancer. My neurosurgery thesis project determined the relation between the rs5050 polymorphism of the AGT gene in blood and astrocytoma prognosis in a prospective analytical study.
Method: We analyzed blood samples from 48 adult patients diagnosed with primary astrocytoma at the National Institute of Neurology and Neurosurgery, without prior treatment and before surgery. Our study assessed the rs5050 polymorphism of AGT as a serum prognosis biomarker for astrocytoma.
Results: Kaplan-Meier survival analysis curves revealed a significant correlation between the recessive heritance pattern of rs5050 and poor survival, indicating that the G-allele could serve as a prognosis factor (p 0.018). A lower survival rate in the recessive heritage group was found compared to both the dominant and co-dominant heritage groups (2 vs 11 months).
Conclusion: This was the first study to identify a serum RAS component as a practical, safe and less invasive biomarker for poor prognosis in astrocytoma. This serum biomarker could potentially help in neurosurgical decision-making and to better predict patient survival.
Keywords: Glioma, Serum biomarker, Renin angiotensin system, Angiotensin, Prognosis

OP-NO.08-02

Surgical Excision of Tumours Affecting the Left Supplementary Motor Area (SMA); A Prospective Series of SMA Syndrome Incidence, Features and Surgical Outcomes

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Background: Tumours affecting the SMA may deter surgeons from intent of maximum resection to avoid development of motor or language component of SMA syndrome. We present our experience with resection of tumours affecting the left SMA, and features of the SMA syndrome.
Method: All data collected prospectively. Tumour location on SMA proper, pre-SMA, and cingulate gyrus were determined radiologically. Incidence and timing of SMA syndrome with motor and/or language components were recorded. Tumour type and MRI-based extent of resection (EOR) were analysed.
Results: During an 18-month period (February 2015 to June 2016) 17 patients with tumours affecting the left SMA had surgery by a single surgical team in our institution. Six male, 11 female; mean age 53 years (range 31-73). SMA proper was involved in 17 cases; pre-SMA in 10 and cingulate gyrus in 9 cases. Awake cortical/subcortical mapping for motor and language testing was employed. Gross total resection (GTR, >95%) was achieved in all 17 cases (100%). SMA syndrome occurred in 7 patients, with hesitancy to initiate speech in 7 patients and motor weakness/hesitancy to initiate movement in 4 patients. All features resolved, < 2 weeks in 5 patients and < 12 weeks in 2 patients.
Conclusion: Complete excision of tumours affecting the SMA proper/pre-SMA is feasible. The SMA syndrome is a real possibility and comprises of both motor and/or language initiation hesitancy. All cases resolved with no permanent deficits. Intraoperative, awake language/motor mapping is essential. SMA location of tumours should not deter surgeons from complete resections.
Keywords: SMA, SMA syndrome, Brain mapping, Glioma

OP-NO.08-03

Complex Intracranial Epidermoids – Navigation and Endoscope Assisted Comprehensive Microsurgical Management

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Background: Intracranial epidermoids are epithelially derived lesions, which may present many challenges for the surgical treatment. Often encasing vital neurovascular structures and extend to multiple cisterns and compartments, making surgical resection difficult. We aimed to treat these lesions with help of endoscope, neuronavigation along with microscope for the better outcome.
Method: At our institute over last 20 yrs we have surgically treated 185 patients with these lesion at various locations in the brain and skull base. Earlier we treated only with microsurgically, since 2009 we started applying endoscope (48 cases) and since 2010 neuronavigation. Initially endoscope was used for visualisation later it is used for guided dissection and removal.
Results: All cases had post operative C.T/MRI scans, gross total removal was done in 164 cases, remaining 21 pateints had near total removal.5 patient had post op meningitis. 18 pts had CSF leakes, there were 3 deaths. 28 patients had transient various cranial nerve deficits.21 patients had transient hemiparesis, all recovered over time.
Conclusion: Endoscope, navigation assisted microsurgical removal of epidermoids will increase the total resection rates, reduces surgical trauma, brain retraction and trauma to neurovascular structures, and achieves complete cure with excellent functional recovery in majority of the complex intra cranial epidermoids.
Keywords: Complex intracranial epidermoids, Microsurgery, Application of endoscope and navigation, Dissection of vital neurovascular structures, Dissection of cranial nerves, Excellent outcome

OP-NO.08-04

Basal Ganglia GCTs: A Single Hospital Series in Taipei VGH

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Background: Germ cell tumors (GCTs) originating in the basal ganglia (BG) are rare. It is notorious for the diagnostic difficulty and the majority of the patients present symptoms similar to multiple

sclerosis or stroke. The authors investigated factors related to the diagnosis of these lesions as well as outcome in order to improve the treatment efficacy.
Method: We retrospectively reviewed the clinical features, neuroimaging studies, tumor markers, management, and outcome of these 55 patients from 1985 to 2016 in Taipei Veterans General Hospital.
Results: 51 of them were boys and 4 were girls. The mean age of diagnosis was 12.6 years. 37 patients presented with progressive hemiparesis, 9 with headache and nausea/vomiting, and 6 with precocioius puberty. 33 Patients have histopathological diagnosis**:** germinoma in 21, teratoma in 3, and other type of tumors in 9. 10 patients had bilateral BG tumors. Postoperative primary adjuvant therapies included radiotherapy, chemotherapy alone, and combined chemotherapy and radiotherapy. 51 patients survived, and 4 patients died. Local recurrence was observed in all of the patients received solitary chemotherapy only.
Conclusion: The BG is a significant locus for intracranial germ cell tumor and can be bilateral. The initial image finding may be subtle and it should be highly suspicious when hemiparesis or precocious puberty presented in children. Although rarely reported in Western countries, it does exist in Taiwan as well. Treatment of GCTs in specific location is similar to GCTs in other intracranial locations.
Keywords: Germ cell tumor, Basal ganglia, Intracranial, Children

OP-NO.08-05

Analysis of Survival in Patients with Brain Metastases Treated Surgically: Impact of Age, Gender, Oncologic Status, Chemotherapy, Radiotherapy, Number and Localization of Lesions and Primary Cancer Site

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Aim: To evaluate the survival of patients with brain metastases treated surgically according to the potentially involved factors.
Method: 71 patients treated surgically were analyzed with the diagnosis of brain metastases during the period from January 2011 to November 2014, totaling 47 months of follow-up. The curve of Kaplan-Meier method was used for survival analysis.
Results: We evaluated 71 patients with brain metastases treated surgically, 44 female and 27 male, mean age of 60.1 years. According to the Karnofsky scale, 44 patients were classified with Karnofsky greater than or equal to 70 and 27 patients with Karnofsky less than 70. Lung was the primary site most commonly found. Death occurred in twenty patients (28%) and lung tumors are responsible for most deaths. Twelve patients had supra and infratentorial metastases, fifty-nine only had supratentorial lesions, and lesions were multiple in twenty-eight patients and single in forty-three. Thirty patients were also treated with chemotherapy, eighteen were treated with chemotherapy and radiation therapy, while only three received radiotherapy alone. Survival analysis by Kaplan-Meier curve showed no statistical significance according to age, histological type, location, Karnofsky, chemotherapy and radiotherapy. There was statistical significante regarding gender.
Conclusion: Factors analyzed did not change survival, except for gender. This fact may probably be explained due to systemic and diffuse behavior of cancer.
Keywords: Metastasis, Survival analysis, Cancer, Prognosis

OP-NO.08-06

Experience with a New Model of Awake-Awake-Awake Craniotomies for Tumours in Eloquent Locations; Technique and Outcomes of a Prospective, Consecutive Series of 50 Cases with Patient Perception Data

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Background: The value of brain mapping in maximum/safe resections is well established. Anaesthetic techniques, mapping paradigms and task interpretation predicated on alert, cooperative patients. We present our initial experience/results with the awake-awake-awake (A-A-A) technique.
Method: During a 14.5 month-period (December 2015-March 2017) 50 consecutive, adult patients with tumours in eloquent areas had surgery using the A-A-A technique. Patients were conscious throughout; no intubation/laryngeal mask used. Data collected prospectively including demographics; MRI-based extend of resection (EOR); temporary (<4 weeks) and permanent (>4 weeks) deficits. Thirty-eight patients (cases 13-50) completed a concurrent questionnaire including pre-operative anxiety; pain during clamp insertion (P1); drilling (P2) and during tumour removal (P3); and willingness to repeat the procedure, if necessary in future. The numeric rating scale (NRS, 0-10) employed to quantify pain.
Results: There were 28 males, 22 females. Forty-one cases (82%) were considered inoperable by other institutions or high surgical risk at local tumour board. Twenty-nine patients (79.3%) had pre-operative anxiety. All patients tolerated the A-A-A with no adverse effects; no failed awakes or stimulation-induced seizures recorded. Mean values of NRS (0 minimum-10 maximum) were 0.4 during clap insertion; 0.25 during drilling; and 1.9 during surgery; 97.3% of patients indicated they would undergo the same procedure in future, if necessary. Gross total resection (≥95%) was achieved in 47 patients (94%) with 3 (6%) mild, and 0 severe permanent deficits.
Conclusion: A-A-A craniotomy is feasible and safe; our series showed no failed awakes; maximum resections in high-risk/inoperable tumours; and high (97.3%) patient-satisfaction rates.
Keywords: Brain mapping, Awake craniotomy, Glioma, Extend of resection, Brain tumour

OP-NO.08-07

Expression of E-Cadherin in Sudanese Meningioma Patients

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Meningiomas are one of the commonest intracranial tumors and

account for 20% of all primary intracranial neoplasm. However, the true incidence is likely to be much higher, since many benign meningiomas do not produce symptoms. A recent study from the National Center of Neurological Sciences Khartoum, Sudan done by Arbab etal. indicated that, the incidence of meningioma was found to be more than 65%. In this pilot study we aimed to detect E-Cadherin in meningioma variants among sudanese patients.
Twenty one of meningioma tumors were randomly selected from the National center of Neurological sciences Khartoum Sudan during March 2015 to May 2015. Tumors specimens were obtained from 21 intracranial meningioma. All tumors were classified according to WHO guidelines (2007). The findings of this study showed that E-Cadherin was detected in 85.7% of the patients mostly in the fibrous and atypical variants. Moreover, in this study the fibrous meningioma was strongly expressed E-Cadherin in75% of the cases.
Keywords: E-Cadherin, Meningioma, Sudan

OP-NO.08-08

The Outcomes and Techniques of Middle Fossa Approach for Intracanalicular Vestibular Schwannomas

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Aim: To discuss the surgical outcomes and techniques of middle fossa (MF) approach for intracanalicular vestibular schwannomas.
Method: Ten patients diagnosed with intracanalicular vestibular schwannoma from Jan 2012 to Dec 2015 received surgery treatment via MF approach. A converse "r"-shape incision was made anteriorly to the tragus. The imagined internal acoustic canal (IAC) was identified by using the bisection of the angle between the greater superficial petrosal nerve (GSPN) and the arcuate eminence. The bone between the imagined IAC and trigeminal nerve impression was drilled from posteromedially to anterolaterally and within the distance of 8 mm anterior to the petrosal ridge. A right-angle detacher was used to identify the anterior and posterior wall of IAC and the drilling was limited to the superior wall. The tumor was resected from medially to laterally after exposure. The effects of surgery on hearing outcome and facial nerve outcome were assessed with American Academy of Otolaryngology-Head and Neck Surgery (AAO-HNS) classification and House-Brackmann (HB) grading respectively.
Results: All patients achieved complete resection of tumor. There is no death case. The MRI results 6-12 months after surgery suggest no recurrence of tumor. The postoperative effective hearing (Class A/B) preservation rate was 80%, while the functional facial nerve (Class I/II) preservation rate was 90%.
Conclusion: For intracanalicular vestibular schwannomas, microsurgery via the MF approach offers good preservation of hearing and facial nerve function. Being familiar with the anatomy and techniques of this approach will help to reduce the operative complications.
Keywords: Middle fossa approach, Internal acoustic canal, Vestibular schwannoma, Hearing preservation

OP-NO.08-09

The Effect of Only Total Surgical Excision of WHO Grade I-II Glial Tumors on Prognosis without Chemo-Radiotherapy

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Twenty seven consecutive patients with pathological result of WHO Grade I-II glial tumors in whom gross total excision was confirmed with immediately postoperative MRI, were included in this study. None of these patients were underwent chemotherapy or radiotherapy. The follow-up period changes from 1 year to 6 years (mean=3.6 years). The localisations of tumors as follows**:** Insuler (4, 14.8%), nonelequent hemispheric cortical-subcortical (4, 14.8%), temporobasal (7, 25.8%), corpus callosum(1, 3.7%), basal ganglia (1, 3.7%), frontobasal (4, 14.8%), motor cortex (3, 11.1%), cingulate gyrus (1, 3.7%), periquadrigeminal sistern (1, 3.7%), pineal (1, 3.7%). The clinical conditions of patients were evaluated according to Karnofsky scale both preoperatively and early postoperatively and also six months after operation. Intraoperative MRI was not used in these operations. On the other hand intraoperative ultrasound and also neuronavigation (particularly in patients with hemispheric cortical-subcortical lesions) were used during the operation.
During the follow-up of our patients no recurrency was observed. In two patients temporary disarthria and in one temporary left upper extremity weakness occured.
Gross total surgical excision confirmed with MRI taken immediately after operation has satisfactory results in patients with WHO grade I-II gliomas without needing chemoteraphy or radiotheraphy.
Keywords: Brain tumor, Low grade glioma, Surgical treatment, Recurrence of glioma

OP-NO.09-01

Do Surgeons with Varying Microscopic Experience Have Similar Learning Curves in the Endoscopic Transsphenoidal Technique for Pituitary Adenomas? Initial Results from an Institutional Review

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Background: Neurosurgeons experienced in microscopy show a resistance in switching over to the endoscopic technique for pituitary adenomas because of its technically challenging nature. The study aimed to identify this learning curve and if the overall improvement in surgical results is similar for different surgeons, regardless of their previous experience with microscopy.
Method: This was a retrospective study analyzing outcomes for endoscopy between November 2009 and September 2013. The three primary neurosurgeons had 20, 10 and 5 years previous experience with microscopy. The series was divided into 2 groups designated early and late and compared for intraoperative and postoperative parameters. Each surgeons' individual cases were also divided into two halves and analyzed.
Results: 110 cases were included in the study. In the second half,

the mean postoperative stay (in days) decreased from 8.67 to 5.55 (p=0.002). Patients having gross total resection were 29% in the first half and 67% in the second half (p<0.001). The mean postoperative size of residual tumor decreased from 1.32 cc to 0.72 cc (p=0.085). There was also significant improvement in the mean percentage excision achieved, with an additional 7.38% tumor resection achieved in the second half (p=0.008). These results were also mirrored in each surgeon's individual assessments as well.
Conclusion: Endoscopy is a relatively novel technique and has a definite learning curve, but with time and experience, operative outcomes show a significant improvement. This technique can be mastered by neurosurgeons of varying experience as all surgeons show similar learning curves regardless of their previous experience with microscopy.
Keywords: Transsphenoidal pituitary surgery, Endoscopic surgery, Learning curve, Multisurgeon surgical audit, Neuro-endoscopy, Pituitary adenoma

OP-NO.09-02

Endoscopic Endonasal Resection of Skull Base Chordoma: Case Series and Review of Literature

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Background: Skull base chordoma is a rare tumor with slow and progressive growth. Significance of this tumor is it's difficult to access location in skull base. This is the reason for various proposed techniques for resection of the tumor. Endoscopic endonasal technique is a minimally invasive approach that gives surgeons opportunity of total resection of tumor and low morbidity. Total resection of the tumor is the main determining factor of prognosis.
Method: In this article we retrospectively studied 18 patients with pathological diagnosis of skull base chordoma treated in Amiralam hospital, Loghman-Hakim hospital and Day general hospital, Tehran, Iran, between 2005 and 2012. All patients underwent endoscopic endonasal surgery. Thirteen patients were primary cases but 3 and 2 cases were referred respectively after radiation failure and recurrence after craniotomy. Mean follow-up time was 23 months. Difficulty in swallowing and speech, diplopia and nasal obstruction was common presenting symptoms.
Results: Gross tumor resection was feasible in 13 cases. Subtotal resection was done in 5 cases. During follow-up, 1 case died from disease and tumor recurred in other 8 cases. Nine patients are disease free. Eight recurrences and 1 mortality were in cases that underwent subtotal resection or referred to us after radiation failure. The major operative complication was a case of pneumocephalus.
Conclusion: Endoscopic endonasal resection of skull base chordoma is a low morbidity approach, advisable in most cases. We think that total resection is the best surgical strategy. We recommend postoperative radiation in all patients.
Keywords: Endoscopic, Endonasal, Skull base, Chordoma

OP-NO.09-03

Differing Pituitary Stalk Dosimetry for Preventing Hypopituitarism After Stereotactic Radiosurgery in Functional and Nonfunctional Pituitary Tumors

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Background: The commonest side effect of stereotactic radiosurgery (SRS) for pituitary tumors is the development of hypopituitarism. The aim was to to find cutoff values of maximum radiation dose to pituitary stalk that could predict development of hypopituitarism in secretory and nonsecretory adenomas.
Method: In this retrospective study, patients with pituitary adenomas, who were treated with SRS from January 2010 to June 2013 and had minimum radiological and hormonal follow-up of 2 years were enrolled. In follow-up, contrast MRI was done annually alongwith 6 monthly visual field charting. Complete hormone analysis was done immediately before SRS and at 6 monthly intervals in follow-up.
Results: 96 patients were included (45 functional and 51 nonfunctional). The incidence of new or worsened hypopituitarism was 40% and 17.6% respectively with a mean follow-up in these patients of 41 months. Maximum stalk dose delivered was found to be an independent predictor of development of post-SRS hypopituitarism (p=0.001). For functional adenomas, based on the ROC curves, a cutoff value of ≥18.4 Gy was obtained which could predict development of post-radiosurgical hypopituitarism, with a sensitivity of 77.78% and specificity of 74.07%. Radiological tumor control rate was 95.6%. Good endocrinologic outcome was achieved in 80.6%, 71.4% and 90% in acromegalic tumors, prolactinomas, and Cushings disease patients, respectively.
Conclusion: Maximum radiation dose delivered to pituitary stalk is an independent risk factor for development of postradiosurgical hypopituitarism. A cutoff of 18.4 Gy in secretory tumors and 11.3 Gy in nonsecretory tumors for maximum radiation dose received by the stalk significantly decreases post-SRS hypopituitarism.
Keywords: Stereotactic radiosurgery, Nonfunctional pituitary adenomas, Secretory pituitary adenomas, Hypopituitarism, Gammaknife, Pituitary stalk

OP-NO.09-04

Utilizing the Adenoma Pseudocapsule, Can Surgery Replace Dopamine Agonists as First Line of Treatment in Prolactinomas?

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Background: Around 15% of patients with prolactinomas do not experience normalization of their prolactin levels in response to dopamine agonists and even higher percentage of patients do not achieve reduction in tumor size due to primary/secondary dopamine agonist resistance and medication intolerance/non-compliance.

Recent literature has demonstrated a high rate of remission in patients with prolactinomas operated upon by transsphenoidal resection.
Method: Twenty patients presenting with hormonal dysfunction due to over secretion of prolactin (>200 mcg/L) were enrolled in this study. Giant adenomas were excluded from this study. All patients were operated upon by endoscopic transsphenoidal extracapsular resection utilizing the adenoma pseudocapsule as a surgical resection plane. Remission was defined as postoperative normalization of hormonal hypersecretion.
Results: Remission was achieved in 90% of patients with normalization of serum prolactin. The remaining 10% (2 patients) experienced only a reasonable reduction in their prolactin level due to a cavernous sinus residual and required adjuvant medical treatment and gamma knife. Intraoperative CSF leak was encountered in 20% of cases, however with appropriate repair none of our patients experienced postoperative leakage. No serious complications were encountered in any of our patients, only 10% (2 patients) experienced transient diabetes insipidus. Length of hospital stay ranged from 2-4 days.
Conclusion: Endoscopic transsphenoidal resection utilizing the adenoma pseudocapsule is a safe and effective method for treatment of prolactin secreating pituitary adenomas. Our results indicate that a higher remission rate can be achieved in prolactinomas with no cavernous sinus invasion than that achieved by lifelong treatment with dopamine agonists.
Keywords: Prolactinoma, Endoscopic, Transsphenoidal, Pseudocapsule

OP-NO.09-05

Clinically Silent but Rapidly Growing Somatotrophinomas: Neurosurgical Management

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Background: Silent pituitary adenomas have been identified in the 1970s. They consists classically in adenomas showing hormone production at the histopatological examination however without clinical signs and symptoms. We report our experience about clinically silent pituitary adenomas with focal invasion of the cavernous sinus describing the neurosurgical treatment strategy.
Method: We identified three patients suffering from clinically silent somatotrophinomas within a series of 142 pituitary adenomas operated consecutively with the aid of intraoperative magnetic resonance imaging (MRI) (Brainsuite 1.5T). Tumor size, invasion pattern and hormonal features were studied preoperatively and at long-term follow-up.
Results: In two of the three cases total tumor removal was possible based on intraoperative MRI, the patients show normal hormonal status and no recurrence at three years follow-up. In the third case due to the different features of the tumor, complete resection was not possible due to invasion of the cavernous sinus and a multimodal treatment, including radiosurgery, was performed that allowed regularization of the hormonal status and control of the residual tumor.
Conclusion: Silent GH-producing adenomas are infrequent tumors. Every case should be evaluated singularly taking into consideration patient´s symptoms, MRI and immunohistochemical features. Total microsurgical removal can be curative, in case of partial removal a tailored adjuvant treatment should be considered. In objectively not resectable tumors preoperative medical treatment remains always an option.
Keywords: Silent, Pituitary, Adenoma, GH

OP-NO.09-06

Multistage Surgical Treatment of Giant Pituitary Adenomas

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Background: Giant pituitary adenoma (GPA) larger than 40 mm, increase the risk of complications in removing the one-stage, taking into account parasellar invasive growth and widespread suprasellar in the third ventricle.
Method: We conducted a retrospective analysis of 31 patients with GPA, including 10 multi-stage surgical treatment (32.3%). The first step is always enforced endoscopic endonasal transsphenoidal (EET) removal of GPA. The second stage of surgical treatment (EET or transcranial) determined the localization of residual tumor, its size and relationship to the third ventricle, supraclinoid part of carotid artery. Average tumor size was 50x37x40mm (in the sagittal size ranged from 30 to 73 mm in coronary - 32-60 mm).
Results: The total removal during multistage surgical treatment was achieved in 8 cases (80%), subtotal in 2 cases (20%). One year after surgery, 80% of patients had excellent functional outcome (Karnofsky Performance Score ≥ 70 and Glasgow Outcome Score 5).
Conclusion: Multi-stage removal of GPA is aimed at reducing the risk of possible complications of surgery GPA and transfer them from the "dangerous condition" in the "safe condition" (small size residual tumor). The second stage was carried out radical removal of the tumor (access with defined ratio of residual tumor to supraclinoid part of carotid artery).
Keywords: Pituitary adenomas, Surgical treatment, Multistage surgical treatment

OP-NO.09-07

Pitutary Adenoma in Yemen

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OP-NO.09-08

Surgical Resection of Pituitary Tumors in Cushing-ETSS Approache

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The diagnosis of Cushing's syndrome is made on the basis of clinical assessment and dynamic hormone testing. The availability of new diagnostic and imaging techniques has improved the sensitivity of microadenoma detection. When an experienced pituitary surgeon performs the operation, the cure rate for smaller tumors (microadenomas) is 80 percent to 85 percent. If the tumor spread into nearby internal structures, the cure rate is 50 percent to 55 percent. Neurosurgeons who specialize in pituitary tumor surgery utilize a technique that removes the tumor as one piece. They find the tumor and dissect it around the edge. The endoscopic endonasal approach is a minimally invasive approach, using your natural nasal passageway. It does not require a head incision. An endoscopic technique can be very effective in safely removing tumor, while at the same time minimizing hospitalization time and discomfort.
In this article we report result of the average 3 years follow-up of cushing patients that treated by ETSS approach. in our 50 follow-op cases we will report all lab data, MRI follow-ups and endocrine result of the surgery.
Keywords: Cushing, ETSS, Endocrine

OP-NO.09-09

Hybrid-Fluorescein Guided Surgery for Functioning and Non-Functioning Pituitary Adenomas

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Background: The use of intraoperative sodium fluorescein (FNa) for resection of central nervous system (CNS) tumors has gained recognition since it's beginnings in the 1990's. Until now its application has only been reported in high-grade gliomas, metastases, primary CNS lymphoma, meningiomas, schwannoma and craniopharyngioma. We present the first series of pituitary adenomas (functioning and non-functioning) treated via a hybrid FNa-guided surgery.
Method: Until today we have included 13 patients with pituitary adenomas (6 non-functioning, 5 acromegaly, 1 Cushing and 1 prolactinoma) treated via a hybrid surgical technique with endoscopic-endonasal resection guided by fluorescence after administration of 8mg/Kg of FNa viewed under the yellow 560 filter (OPMI Pentero 900, Carl Zeiss, Germany).
Results: Total resection was achieved in 11 patients (84%), 1 patient (7%) presented CSF leak, 8 patients (61%) presented transient diabetes insipidus, 0 patients presented allergic reactions to FNa. The mean surgical time was 278 minutes (180 – 365 min), mean blood loss was 488 mL (150 – 2200 mL) and mean length of hospitalization was 6 days (2 – 14 days).
Conclusion: The use of FNa is a safe and useful tool for differentiating tumor from glandular and scarring tissue. Its use may increase the rate of total resection, of special importance in functioning and recurrent tumors. The main disadvantage is the need for direct visualization of the fluorescent tissue under the microscope.
Keywords: Pituitary adenoma, Fluorescence, Sodium fluorescein

OP-NO.10-01

Intraoperative Change in the Fractional Anisotropy of the Optic Chiasma as an Early Predictor of the Visual Outcome After Optic Chiasma Decompression in Patients Operated in the Setting of Intraoperative MRI

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Background: We correlated the intraoperative change in the FA of the optic chiasma after its decompression to the early and delayed visual outcome in patients with suprasellar tumors operated under intraoperative MRI control.
Methods: Thirty sequential patients with suprasellar tumors presented with the chiasma compression syndrome were operated under intraoperative MRI control (Magnetom Espree Siemens AG Medical Solution) between March 2014 and March 2016 and included in this study. The FA of the optic chiasma was measured immediately before and immediately after tumor resection. The visual impairment score (VIS) was used to quantify the extent of ophthalmological disturbances before surgery, within two weeks, and three months after surgery. Wilcoxon Signed-Rank Test was used to compare the VIS before and after surgery and the FA before and after surgery. The correlation between the change in the FA and the early and late improvement of the VIS was tested using Spearman's rank correlation coefficient.
Results: The VIS improved significantly after surgery. The FA values of the optic chiasma decreased significantly after decompression. The early and the delayed improvement of the VIS was correlated to the decrease in the average FA values of the optic chiasma after its decompression.
Conclusion: The intraoperative decrease of the FA of the optic chiasma is directly related the early and the delayed improvement of visual impairment. It could be used as an early predictor of the visual outcome even in patients with unchanged or even worsened early postoperative visual status.
Keywords: Optic chiasma, Fractional anisotropy, Diffusion weighted images, Intraoperative MRI

OP-NO.10-02

Intraoperative Preservation of Motor and Language Fibers by a Simple and Unique Technique

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Background: A rapid and precise technique for intraoperative

identification of the neural pathway is essential to meet the demand of functional preservation in brain tumor patients. For this purpose hand-held deep electrode (NY Tract Finder) was used and evaluated for its role in intrinsic brain tumor surgery in critical brain structures.
Method: 44 consecutive glioma patients who had any risk of important neural tract damage were included in this study. A hand-held bipolar deep electrode (NY Tract Finder) (named after Nippon Medical School Yamaguchi) was used in combination with neuronavigation system.
Results: Motor and Language-related neural fibers were found prior to the resection of tumor tissue adjacent to these neural tracts. This technique enabled the avoidance of any injury of critical neural structures during resection of intrinsic tumor such as glioma and even metastatic brain tumors. This technique has been widely used in major hospitals in Japan, Taiwan and China.
Conclusion: This simple and unique technique provides safe resection of brain tumors and consequently secures patients' quality of life.
Keywords: Brain mapping, Awake surgery, Glioma, Metastatic brain tumor, QOL

OP-NO.10-03

Advanced Intraoperative Ultrasound – A Multipurpose Adjunct in Brain Tumor Surgery

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Background: Intraoperative US (IOUS) has been one of the oldest adjuncts used in the neurosurgical operating room. Advances in technology have overcome the initial limitations of IOUS which has over the recent years emerged as a very powerful and muli-purpose adjunct during tumor resections. We review the status of IOUS based on our 10 year experience in over 400 cases.
Methods: A review of our experience beginning with 2DUS and evolving into the use of coregistered 3D navigated US and Direct 3DUS is presented. We evaluated the utility of the IOUS in different setups and assessed its predictive accuracy and impact on extent of resection (EOR) as well as survival in gliomas.
Results: IOUS was a very useful tool in tumor surgery, providing accurate guidance during various stages of tumor surgery. In our hands it had good diagnostic accuracy (85-90%) in predicting tumor residue. It also helped us improve the EOR in malignant gliomas as well as non-enhancing gliomas which can be challenging to delineate intraoperatively. In the subset of resectable tumors, the gross total resection rate was as high as 88%. Further, we show that it helps extend tumor resection beyond the contrast enhancement zone and can eventually result in improved survivals.
Conclusion: Considering the ease of use, widespread accessibility and low-cost nature, IOUS can be a potentially useful adjunct during a range of neurosurgical procedures, especially tumor resections.
Keywords: Intraoperative ultrasound, Navigated 3D ultrasound, Intraoperative imaging, Glioma resection

OP-NO.10-04

Awake Craniotomies in Intraoperative MRI: A Prospective Study of Feasibility, Safety and Surgical Outcomes

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Background: Intraoperative MRI (iMRI) ensures maximum anatomical tumour resection and awake cortical/subcortical mapping ensures preservation of function. The combination of both techniques can be challenging for patients and surgical/anaesthetic teams, especially during scanning with a coil close to the patients face. There are very few published reports in the literature of the awake/iMRI experience.
Method: All data was collected prospectively, including demographics; tumour location; adverse effects and failed awake rates; iMRI-based Extent Of Resection (EOR) and surgical morbidity including WHO performance status both immediately post-operatively and at 3 months.
Results: During a 22 -month period (March 2015- January 2017) 17 awake craniotomies were performed in iMRI. All patients harbored tumours in motor or language areas. Due to the iMRI head-holder design, tumours in posterior parietal and occipital areas were excluded. 10 patients had high-grade glioma, 5 low grade glioma, 1 meningioma and 1 lymphoma. There were no untoward events, no stimulation-induced seizures and no failed awakes. Gross Total Resection (GTR, >95%) was achieved in 15 cases. 4 patients had new deficits post operatively but all resolved at 3 months.
Conclusion: Performing awake craniotomies with iMRI is feasible and safe. No episodes of hypoxia or patient distress were recorded. In our experience, due to head-holder design, only frontal and anterior temporal lesions can be resected. Patients tolerated the challenging environment with no adverse effects and no need to convert to asleep technique. Bigger series are required in the future.
Keywords: Neurooncology, Awake, Craniotomy, Intraoperative, MRI

OP-NO.10-05

A Pre-Operative Cerebellar fMRI Mapping of Sensorimotor, Language and Working Memory Function to Minimise Post-Operative Dysfunction

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Background: The compartmentation of sensory, motor and cognitive functions within the human cerebellum are not well understood.
Method: Twenty healthy adults underwent fMRI at 3T. Paradigms**:** 1) motor**:** moving right fingers or toes; 2) sensory**:** vibrotactile stimulation of right index finger, first toe or both; 3) language/speech

motor**:** verb generation with overt and covert word production, controlled for auditory/language components of the task; 4) working memory**:** variable length digit span memory and recall (Sternberg task). Following fieldmap unwarping and physiological noise correction, group activity was assessed in FSL software, with cluster forming threshold Z>3.09 and corrected significance level of P<0.05.
Results Somatotopic activity was observed for the motor paradigm**:** lobules V and VIII (fingers); and lobules I-IV and VIIb-VIIIa (toes) ipsilateral to the task. Vibrotactile (sensory) activity overlapped with the corresponding motor map in the anterior lobe (uncorrected, p<0.005). During the language task, articulator movement produced bilateral activity with anterior lobe activity adjacent (caudal) to the finger representation, whereas verb-generation evoked right lateralised activity in lobule VI, Crus I and II and lobule VIIb. Working memory produced a load dependent activation in right lobule VI (encoding) and Crus I (maintenance).
Conclusion: These tasks reliably activated the cerebellum in most participants (typically >15/20), and demonstrated clear functional localisation. This is a first step towards a comprehensive pre-operative mapping of the cerebellum to help avoid damage to eloquent areas and minimise incidence of conditions such as cerebellar mutism syndrome.
Keywords: fMRI mapping, Cerebellum, Sensorimotor, Language, Speech motor, Verbal working memory

OP-NO.10-06

Use of Intra and Extra- Operative Real Time Imaging with Ultrasound in Neurosurgery: More than Just for Biopsy!

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Background: Neuro-navigation helps guide surgery however the cost and certain technical limitations curtails its widespread use in developing countries like ours. We extensively use ultrasound (USG) in our practice and in this paper present an audit of its use and cost effectiveness in neurosurgery.
Method: We study the use of ultrasound both in ICU and OR during the last 3 years in KMCTH. We drafted KUTLS program for use of USG in trauma assessment and management and in ICU care. We use USG to guide and help in difficult scenarios during surgery. Endpoints for the audit were feasibility, reliability, cost effectiveness, extra time taken and overall satisfaction of the users.
Results: We used USG in 1255 patients, of which 850 was for ICU management and 405 for intra operative decision making. In ICU it was used for trauma victims (assessment and management according to KUTLS guidelines), evaluation of lung (BLUE protocol) and shock (RUSH protocol) as well as for interventional procedures. ONSD evaluation help identify raised ICP. In OR, it was used to guide craniotomy, see for cause of brain swelling, navigate resection of deep seated tumor and shunt placement. Use of USG extended the procedures by 15 minutes. We discuss our protocol and limitations of USG.
Conclusion: A structured use of ultrasound in neurosurgical practise helps in managing patients better by providing real time information, however is performer dependent and needs practice and right attitude!
Keywords: Ultrasound, Neurosurgery, ICU, Trauma

OP-NO.10-07

Investigating Comprehension of Narrative Speech Using Functional MRI

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Background: The perisylvian areas of the left hemisphere are critical for fundamental processes underlying language comprehension. Recent studies, however, found that the right hemisphere plays an important role in comprehension. Language comprehension have often been investigated at the level of single words or sentences, though comprehension of naturalistic speech is the real part of daily life. The goal of this study was to investigate comprehension of naturalistic speech using high quality fMRI.
Method: A total of 429 participants from the Human Connectome Project (HCP, led by Washington University, the University of Minnesota and Oxford University) were included. We used high quality fMRI datasets from HCP in which a story-math language task was utilized for the auditory narrative comprehension.
Results: Our results revealed that the narrative comprehension was associated with the classical language regions including superior temporal gyrus (STG), middle temporal gyrus (MTG) symmetrically and left-lateralized inferior frontal gyrus (IFG). We found that the narrative comprehension was associated with activations in areas beyond the classical language regions, e.g. left precuneus, left angular gyrus, left supplementary motor area, and bilateral medial superior frontal gyrus, middle frontal gyrus, and hippocampus.
Conclusion: The results of this study provides new insight for the value of the right hemisphere in auditory narrative comprehension. In particular, epilepsy surgery involved in right anterior temporal lobectomy may be carefully evaluated before surgery to avoid impairment in the language processing not only in simple language task, e.g. object naming, but also in more realistic language tasks, such as narrative comprehension.
Keywords: Narrative speech comprehension, fMRI, Language, Human connectome project (HCP)

OP-NO.10-08

Is Navigated Ultrasound the Most Efficient Intraoperative Imaging Technique?

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Background: Neuronavigation loses power throughout the surgical intervention due to brainshifting, thus not being reliable to assess whether the optimal resection rate has been achieved. One possible solution to this is the acquisition of intraoperative neuroimaging. In this original study, we evaluate the efficiency of navigated ultrasound.

Method: Prospective study including all intracerebral tumors operated with navigated ultrasound at Sant Pau Hospital. Follow up started in July 2015 until present day.
Results: N=70 patients. 38(54,3%) female and 32(45,7%) male. Mean age 56,3(19-79) years. Histology**:** glioblastoma 22(31,4%), metastases 18(25,7%), low-grade glioma 7(10%), anaplasic glioma 6(8,5%), anaplasic oligodendroglioma 5(7,1%), oligodendroglioma 4(5,7%) and others 8(11,4%). All lesions were classified according to the ultrasonographic visibility scale, described in the literature**:** Grade 3**:** Lesion clearly identifiable and clear border with normal tissue, Grade 2**:** Lesion clearly identifiable but no clear border with normal tissue, Grade 1**:** Lesion difficult to visualize and no clear border with normal tissue and Grade 0**:** Lesion not visible. Of all included cases, 51(72,8%) where Grade 3 tumors, 16(22,8%) Grade 2, 2(2,8%) Grade 1 and 1(1,4%) Grade 0. Interestingly, the most frequently operated intracranial lesions (metastases and glioblastoma) present a high degree of adequate intraoperative visualization with a mean 94,4% Grade 3 for metastases and 77,2% for glioblastoma. On 11(15,7%) of all cases, the navigated ultrasound provided imaging information to lead to further tumor resection.
Conclusions: Navigated ultrasound is an effective, economic and secure technique that provides good quality real-time intraoperative images.
Keywords: Navigation, Ultrasound, Brain shift, Barin tumor, Intraoperative imaging

OP-NO.10-09

Excellence and Safer Surgeries Using Technology in Brain Tumor Surgeries; Cortical Brain Mapping, Mapping of Subcortical Pathways and Cranial Nerves Using Neuro-Electrophysiology

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Since its introduction in the operating-room in the latter half of the 20th century; Intraoperative electrophysiology (IOM) has evolved to become an indispensable tool for surgeries on the nervous system. It started with applications during spinal cord tumor/deformity surgeries to current use in surgeries around Sensory/Motor cortices/Brainstem & Cauda Equina (Tethered Cord and Spasticity). Gradually, mapping of the floor of the IVth ventricle for cranial nerve nuclei was also identified. Today in our institution, all these neuro-spinal surgeries are performed using electrophysiology. Many modalities are currently being applied besides traditionally used Somatosensory (SSEP) & Motor Evoked Potentials (MEP). Mapping of primary sensory cortex can be done using phase-reversal location with SSEP recordings. Direct cortical stimulation (DCS) of evoked motor-activity is used for motor cortex mapping. Sub-cortical/Brainstem-nuclei/cranial nerves mapping/monitoring are performed using similar principles. Identifying epileptogenic-activity can be done using electrocorticography (ECoG). The introduction of IOM in the neurosurgical/Spinal OR is fast becoming standard of care in modern day neurosurgery. Many patients with brain tumors can get benefited with minimum/no deficits. In Brainstem tumors as well, correct mapping and monitoring of nuclei/cranial nerves not only assures the surgeon but also provide real time information about underlying neurological structures and helps in decision making about extent/safety of resection with no or fewer deficits. The need can't be higher to enhance and educate neurosciences community on electrophysiology. Properly trained individuals with thoughtful application of such techniques is required for meaningful benefits in brain tumor surgeries.
Keywords: Intra-operative Neuro-electrophysiology, Sensory motor cortical mapping, Cranial nerves mapping and monitoring

OP-NO.11-01

3D Bioprinted Glioma Tumor Model and Its Application

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Background: Glioma is still challenge to treat, one of the reasons being that traditional 2D cell culture model cannot simulate the in vivo tumor microenvironment. A model with 3D spatial structures and capable of simulating tumor microenvironment has advantages in this respect.
Method: We have established a series of glioma models utilizing an extrusion 3D bioprinting platform with preferred biomaterials, verified sensitivity of 3D models to chemotherapeutic drugs and compared to that of 2D model. We further optimized the platform by combining coaxial bioprinting technique and established a multicellular glioma model. Cell-cell interaction (using CRE-LOXP switch gene) and self-assembly of extracellular matrix with in this model were also verified.
Results: Compared to 2D model, 3D bioprinted glioma model highly stimulated glioma tissue morphology and its partial microenvironment; the glioma stem cells maintained not only their characteristic biomarkers, but also their differentiation potentials including angiogenesis. 3D bioprinted glioma model was more resistant to TMZ chemotherapy than 2D model did. Coaxial bioprinted glioma model showed that glioma stem cells efficiently interacted and fused with mesenchymal stem cells (significantly higher activities than the 2D co-culture model), and it also enabled self-assembly of extracellular matrix collagen.
Conclusion: 3D bioprinted glioma models can initially mimic the in vitro glioma microenvironment, and has great potential to become a superior tumor model for studying gliomagenesis, tumor vascularization, and chemosensitivity. With the 3D bioprinting platform, in vitro reconstruction and replication of patients' brain tumors will provide a new field for its research and treatment.
Keywords: 3D bioprinting, Glioma tumor model, glioma stem cell

OP-NO.11-02

Surgical Planning with 3D Reconstruction of Cerebral Surface and of Intrinsic Lesions Using Region of Interest and Cranial Measure Tools with Osirix Software

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Background: Surgical planning for intrinsic brain lesions is of major importance. A deep anatomical knowledge allied with technology can help to perform a safer surgery. The correct site of the craniotomy, identification of cortical anatomy and superficial veins might be a challenge when there is a distortion of the cortical anatomy. In small subcortical lesions it is also difficult to understand the relations with the cerebral surface and the best way to approach it.
Method: Using the free computer software Osirix it is possible to create a 3D reconstruction of the head and cerebral surface showing the gyri and superficial veins. With the aid of region of interest tool it is possible to create a colored image of the lesion showing its relation with the cortical surface and also to calculate the distance between lesion and some easily identifiable structure, making it easier to plan the site of the craniotomy and identify the topography of the lesion.
Results: The reconstructions were compared to the intraoperative view. This is a useful technique to identify the gyri and cortical veins and use these information to find the lesions. The use of region of interest tool to show better the lesion under the cortical surface and in the 3D reconstruction of the head was also helpful.
Conclusion: This is a low-cost and easy to learn technique than can be quickly performed minutes before the surgeries. It helps the surgeon to plan the surgical approach and perform a lesionectomy.
Keywords: Surgical procedure, Gyrus, Medical topography, Neuroanatomy, Sulcus, 3D reconstruction

OP-NO.11-03

T1-Weighted Subtraction Images for Volumetric Assessment of Extent of Resection of Diffuse Low Grade Gliomas

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Background: The extent of resection (EOR) of Diffuse Low Grade Gliomas (DLGG) is often challenging to assess due to post-operative hyperintensity of the resection cavity and artifacts on T2-Weighted (T2W) and Fluid-Attenuated Inversion Recovery (FLAIR) sequences.
Method: Ten patients with DLGG were included in the study. All lesions were hypointense on T1-Weighted (T1W) and hyperintense on T2W and FlAIR sequences. A publicly available post-processing radiographic software "OsiriX" was used to digitally subtract postoperative T2W from T1W sequences. Volumetric analysis for EOR was calculated based on the volume calculated from the subtraction images. The volumes of tumor residual and qualitative EOR calculated by this technique were compared to the volumes based on T2W images only, which were interpreted by a neuroradiologist.
Results: Based on subtraction imaging findings for residual tumor volume, 1 patient was classified as Subtotal Resection (STR) according to T2W volume and Gross Total resection (GTR) according to T1-T2 volume. Three patients were classified as Partial Resection (PR) according to T2W volume and STR according to T1-T2 volume. Two were classified as PR according to T2W volume and STR according to T1-T2 volume. The mean difference between the two groups was 5.6 cm3 [2.3-8.9]. The two groups were statistically equivalent ($p = 0.05$).
Conclusion: Digital subtraction of postoperative T2W from T1W sequences, combined with orientation to T2W sequence proved to be easier, reliable and reproducible in assessing the extent of resection in DLGG. This technique should be helpful in the management and follow-up of this pathology after surgical resection.
Keywords: Glioma, Osirix, Volume

OP-NO.11-04

Folate Receptor-Targeted Cytarabine for Inhibiting the Proliferation of Medulloblastoma and Promoting Its Apoptosis: An Experimental Study in Vitro

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Aim: To investigate the folate receptor-targeted cytarabine (FR-Ara-C) for proliferation inhibition and apoptosis promotion on medulloblastoma.
Method: The immunofluorescence, immunohistochemistry and confocal laser scanning fluorescence imaging were used to detect the expression of folate receptors-α (FRs-α) in Daoy cell-line. Methyl thiazolyl tetrazolium (MTT) colorimetric method was used to analyze the proliferation inhibition rate of Daoy cell-line in the presence of designed FR-Ara-C and ordinary cytarabine (Ara-C) dosage gradient (0.5~100.0×10-3 mmol/L) and time gradient (2 h~24 h) and their differences were compared. The group with the most obvious difference was selected for conducting AnnexinV-FITC/PI apoptosis detection.
Results: FRs-α expressed in both cell membrane and nuclear. When the same concentration of FR-Ara-C and Ara-C acted on Daoy cells in different times, the proliferation inhibition rate of FR-Ara-C was higher than that of Ara-C. When the different concentration of FR-Ara-C and Ara-C acted on Daoy cells in the same time, the proliferation inhibition rate of FR-Ara-C was higher than that of Ara-C. When FR-Ara-C acted on for 8 h, the increasing inhibition rate was the most obvious compared with the Ara-C effect and 50% concentration of inhibition (IC50) at this time point was supposed as the most effective concentration. AnnexinV-FITC/PI assay

showed that when FR-Ara-C and Ara-C with the concentration of 50.0×10-3 mmol/L acted on for 8 h, apoptosis rate was (92.8±2.3)% and (62.3±1.5)%. When the concentration was the same, the apoptosis rate was obviously higher than that of Ara-C.
Conclusion: FR-Ara-C has more significant proliferation inhibition and apoptosis promotion effect on medulloblastoma.
Keywords: Medulloblastoma, FRs-α, Cytarabine,IC50

OP-NO.11-05

Awake Craniotomy for Brain Tumors in Pakistan: An Initial Case Series from a Developing Country

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Background: Awake craniotomy is a surgical technique performed under local anesthesia so that brain tumors, especially those in eloquent area are resected without giving patient any new neurological deficit. It has played key role in modern neurosurgery in the developed world but its use in developing countries is still limited. This study aimed to present our experience of initial sixteen awake craniotomies of the country.
Method: It is a retrospective case series and includes all the cases of awake craniotomy, by a single neurosurgeon, over the period of seven months. Preoperative and postoperative variables were assessed. Frequencies and percentages were reported for the categorical data, and mean was calculated for continuous data. SPSS19 was used for analysis.
Results: Sixteen patients were enrolled in the study, eleven males and five females. The median age was 37 years (range**:** 23-62). The most common presenting complains was seizures, followed by headache. The pathologies observed included oligodendroglioma, GBM, astrocytoma, central neurocytoma and metastasis. Preoperative mean KPS score was 76 ± 10, which increased to 96 ± 7 postoperatively at discharge. Two intraoperative complications were observed, seizure and brain edema, in the cases. Gross total resection was achieved in ten cases, whereas five cases showed residual disease. Median operative time was 176 minutes (range**:** 115-352) and median length of stay of 4 days (range**:** 3-7).
Conclusion: Awake craniotomy is highly effective in maintaining postoperative functionality of the patient following glioma resection. It is also associated with shorter hospital course and lower cost.
Keywords: Awake craniotomy, Developing country, Brain tumors

OP-NO.11-06

Low-Cost Device for Fluorescein Guided Surgery for Malignant Gliomas and Metastasis

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Background: Gross total resection for malignant brain neoplasms is a major part of the treatment and a crucial prognostic factor. It is a challenge due to the heterogeneity of these lesions and its infiltration in eloquent areas. Fluorescence guided surgery is an important tool that improves the rate of total resection.
Method: We have built a 3D printed device with an excitation and a barrier filter to use in surgical microscopes. The patients received an intravenous dose sodium fluorescein before skin incision. Surgical view under white light was compared to the use of the light filters.
Results: In all cases with the use of our device the tumors showed a high fluorescence, but not the normal surrounding brain. This tool makes easier to identify the lesion and to achieve gross total resection.
Conclusion: Fluorescence guided surgery increases the rate gross total resection of malignant brain tumors. This is an important tool with a potential impact on overall survival of the patients. This is a low cost option that could make this technology available in low resources areas.
Keywords: Fluorescein, Brain neoplasm, Glioblastoma, Neurosurgical procedure, Fluorescence guided, Brain tumors

OP-NO.11-07

Determination of N-Acetyltransferase 2 (NAT 2) Gene Polymorphism in Patients with Glioma in Turkey

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Background: Gliomas are the most common brain tumors. Although several risk factors have been associated with gliomas, the contributory risk factors are still uncertain. NAT2 enzymes have a role in detoxification and metabolization of several drugs, chemicals, tobacco contents and carcinogens. The polymorphic expression of NAT2 gene changes the enyzme activity and may be a differantial risk factor in carcinogenesis. In this study we decided to obtain whether the genetic polymorphism of NAT2 plays a role in glioma.
Method: To evaluate the prevalence of NAT2 polymorphism, 60 patients and 104 control subjects were enrolled in the study. Four different polymorphisms of NAT2 were detected. The genotypes were designed as wild type-(fast enzyme activity), heterozygous-(intermediate), mutant-(slow enzyme activity).
Results: The frequencies of NAT2*5A, NAT2*6A, NAT2*7A⁄B and NAT2*14A mutant genotypes were 8,3%, 5%, 0%, 1,7% in gliomas with respectively, and 6,7%, 3,8%, 2,9%, 1% in controls. The heterozygous genotype had 1,91 times more risk in NAT2*7A⁄B ($p<0.05$) and 3,33 in NAT2*14A ($p<0.05$). NAT2 polymorphisms were detected in low and high grade glioma (HGG) patients. NAT2*6A mutant genotype carried a 1,88 fold risk of HGG ($p>0.05$). The heterozygous genotype of NAT2*5A, NAT2*6A and NAT2*7A⁄B had 3,56, 2,86 and 1,79 times more risk in HGG tumors ($p>0.05$).
Conclusion: NAT2 intermediate/slow acetylator status may be a determinant in HGGs. However different activities of NAT2 enzyme have been associated with tumors in different ethnic groups. Further studies are needed to determine whether the changes in NAT2 enzyme activity constitute a risk factor in glial tumors.
Keywords: Glioma, NAT2 gene, Enzyme, Carcinogen

OP-NO.11-08

Awake Craniotomy Procedure

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Background: The purpose of this study was to present the awake craniotomy method in detail, starting from the preoperative period, to report the morbidity and the complications in patients who have undergone awake craniotomy, and to make recommendations for possible problems.
Method: Preoperative radiological examinations were performed and information about the operation was given to patients who had undergone awake craniotomy between September 2011 and January 2015. The safe area for the cortical incision was determined for each patient by brain mapping using the cortical stimulator. The presence of residual tumor was evaluated in the postoperative period, again with control MR images. The preoperative and the postoperative 6th month and 12th month neurological examinations were recorded
Results: As a result of the neurological examinations of the patients who had been operated with the awake craniotomy method, 4 of 46 patients were in hemiplegic status in the postoperative period, while at the 12th month controls, they had begun to mobilize with support.
Conclusion: When the results of the awake craniotomy method were examined, it was observed that the rates of increase in the postoperative neurological deficits were at minimal levels and the permanent neurological deficit rates were very low.
Keywords: Awake craniotomy, Morbidity, Complication

OP-NO.12-01

Endoscopic Procedures in the Treatment of Intraventricular Tumors

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Background: The endoscopic resection of intraventricular tumors represents a unique challenge to the neurosurgeon. These neoplasms are invested deep within the brain parenchyma and are situated among neurologically vital structures.
Method: We analyzed 36 patients with intraventricular brain tumors who underwent mono- and multiportal endoscopical approaches in the treatment. All patients were operated using endoscopic technique (rigid edoscopes, flexible videoscope) and neuronavigation techniques. Follow up period was 4.0 years.
Results: All patients had surgery without intraoperative complications and mortality. We performed an endoscopic biopsy tumor and/or a ventriculostomy (n=16) (medulloblastoma - 4, astrocytoma – 6, ependymoma – 3, cavernoma -2, unknow -1). We performed an endoscopic biopsy and a partial tumor resection (n=4) (ependimoma, astrocytoma, craniopharyngioma, cavernous angioma). And we performed an endoscopic total removal tumor (n=16) (choroid papilloma- 3, astrocytoma -3, colloid cyst – 5, breast cancer metastasis – 1, pineocitoma -1). Multiportal approach we performed in 5 cases (4 - choroid papilloma and 1 tumor of third ventricle roof). After surgery, we observed transient complications in the form growth of ventricular size, paresis of the cranial nerves, seizures.
Conclusion: Mono- and multiportal endoscopical approaches in the treatment of intraventricular brain tumors it is minimally invasive, safe and effective surgical method. Carefully planned access using neuronavigation is extremely important for endoscopic treatment. Surgeons learning curve!
Keywords: Intraventricular tumor, Multiportal endoscopical approaches

OP-NO.12-02

Intraventricular Pilocytic Astrocytomas: Radiology, Surgical Management and Outcome in a Series of 8 Patients

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Background: Intraventricular pilocytic astrocytomas are a rare occurrence, accounting for approximately 4%-15.6% of all pilocytic astrocytomas. The aim of the study was to describe the radiology, surgical management and outcome in 8 patients with intraventricular pilocytic astrocytoma (ivPA).
Methods: Between January 2010 and August 2015, 8 patients with histopathologically proven ivPA were identified. The radiological images were obtained from PACS. Patient and surgical details were obtained from the computerized discharge summary, OT records and operative notes, whereas follow up was obtained from the record section.
Results: Headache with progressive loss of vision was the most common presentation. Duration of symptoms varied from 4 months to 2 years (mean 9.88 months). Except one patient, all patients with preoperative CT scan revealed calcifications in the lesion, with extensive calcification in 3 patients. All the tumors were predominantly hypointense on T1WI and iso to hyperintense on T2WI. Lesion in all patients showed heterogenous contrast enhancement on post gadolinium images. Mean blood loss in the series was 1969 ml (range 250 ml- 4500 ml).There was one death in this series due to meningitis and septic shock. Preoperative diagnosis of ivPA could not be made on the basis of clinical and radiologic profile in any case.
Conclusion: ivPA's are rare tumors and are difficult to diagnose in the preoperative period based on the radiologic profile alone. These tumors can be extremely vascular with potential for massive blood loss. These tumors can be associated with extensive calcification and the calcified tumors have less bleeding as expected.
Keywords: Intraventricular tumors, Tumors with calcification, Pilocytic astrocytomas, Massive blood loss

OP-NO.12-03

Transsphenoidal Endoscopic Surgery of Pituitary Adenomas Invading the Third Ventricle

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Background: The highest risks in transsphenoidal surgery (TS) of pituitary adenomas (PA) are associated with the tumor growth into the III ventricle, regardless of the size and occlusive hydrocephalus although most of them are giant. Aim of this study is investigation of endoscopic TS for PA with invasion into the III ventricle.
Method: 28 cases of PA invaded the III ventricle were operated in 2014-2016. The diagnosis and the invasion into the third ventricle were estimated by enchased MRI and CT, cases of III ventricle compression only, caused by huge suprasellar PA were not included. All operations were performed by transnasal transsphenoidal route endoscopically. In 1 case ventricular shunting was done before removal of the tumor, in 1 case – after removal. Multilayer closure in all cases, lumar drain - 24.
Results: 28 PA with the invasion into the III ventricle were operated in 2014-2016 (4 % of all PA operated during this period, n = 698). In 25 of 28 (89. 3%) - an anterior chiasm position was found. Total and subtotal tumor removal was achieved in 19 cases (57,1%), subtotal and partial - in 9 (32.1%). Hypernatremia observed in 16 patients (85.7%). 3 patients died (10.7%) after total removal of the tumor (1 meningitis, 1 diencephalic dysfunction, 1 pulmonary embolism).
Conclusion: An endoscopic TS provides the possibility for radical removal of PA from III ventricle cavity, avoiding transcranial and shunt operations but remains risky and controversial, creating the worst statistics in pituitary surgery.
Keywords: Pituitary adenoma, III ventricle, Endoscopy, Transphenoidal surgery

OP-NO.12-04

Endoscopic Resection of third Ventricle Colloid Cyst in 120 Consecutive Cases

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Background: Here we report a retrospective review of all patients treated for neuro-endoscopic removal of third ventricular colloid cyst at Loghman Hakim and Day General Hospitals between 2003 and 2015. The patients' notes were reviewed to determine presenting conditions, treatment, morbidity and current functional and medical status.
Method: The total of 120 patients underwent neuro-endoscopic surgery in this interval. Of the patients 69 were male and the other 51 patients were female. These patients ranged in age from 16 to 71 years (mean, 39.76 yr). The operations were practiced in a range of 22 and 135 minutes with mean of 45 min.
Results: Two patients needed permanent shunting after removal of the cyst. Meningitis was seen in 5 patients. 2 of the patients had seizure that could simply be controlled. 32 of the patients showed small intra ventricular hemorrhage on the very first imaging post operation. Memory impairments or focal neurologic deficit were not reported in any of the patients.
Conclusion: Our result shows a great success in neuro-endoscopic removal of 3rd ventricular colloid cyst. The endoscopic approach to the treatment of colloid cysts is safe, effective and well accepted by patients.
Keywords: Colloid cyst, Neuroendoscopy, Third ventricle

OP-NO.12-05

Colloid Cyst of the 3rd Ventricle -Trans Cortical/Sulcal Trans Ventricular Microsurgical Management with Image Guidance

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Colloid cysts of the 3rd ventricle are deep seated, very vital area located benign lesions. Highly challenging for management. Various procedures and approaches to treat these lesions like Stereotaxic aspirations, Microsurgical Trans Cortical Trans Ventricular, Trans Callosal approaches, Endoscopic approaches.Among all these Microsurgical removal are reported to be the curative procedures. Over last 23 years we have treated 145 cases,

- 42 cases Underwent Transcallosal microsurgical management
- 76 cases Underwent Transcortical microsurgical management
- 15 cases Underwent Endoscopic management
- 12 cases Underwent Only shunting
- 18 cases being observed

Since 2007 started applying Navigation to the procedure, which is extremely helpful in planning the craniotomies, trajectory, cortical opening, locating Foramena Monro and Cyst. Significantly reduced procedure time and Neurovascular injury, post op morbidity and complications. With this experience we have devised few newer concepts

1- We use small Trephine Craniotomy 2.5 cmsx 2.5 cms, rather than conventional craniotomy
2- We approach through Trans Sulcal not Cortical, avoiding gyrus injury
3- We use lower part of mid frontal gyrus just above the orbital roof,1 cm,in mid pupillary line
4- Bimanula smooth dissection of the cyst, first opening the pseudo capsule
5- Removing the cyst in total, without decompressing, puncturing the cyst

We achieved 100% removal all cases. Over all 18- 20%. Complications in the form of, hemiparesis, behavioral abnormalities all were reversible over 8-12 weeks
There were 3 deaths one due to infection, two due poor pre operative neurological condition
Intra ventricular, cortical bleeding 7 % all were minor, Seizures 6 %,no patient needed shunt, ventricular drainage
Keywords: Colloid cyst 3rd ventricle minimally invasive newer concepts, Microsurgical Trans sulcal approach, Trephine small craniotomy, Navigation application, Removal in total, Least morbidity complications

OP-NO.12-06

Invasive Minimal Surgery with System of Retractor Tubular for Deep-Seated or Intraventricular Brain Tumors ¨New Technical Surgical¨: Report of 9 Cases

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As the field of the neurosurgery evolves, the approaches of the

treatment surgical of injury tumor in areas brain considered inaccessible are each time more affordable. Little by little, minimal invasive surgery approaches are taken into account for the treatment of such injuries. A new device in form of tube plastic transparent called viewsite brain access system (VBAS), is capable of create a via direct to them areas u objectives within the brain and the cerebellum, with a disruption minimum of them woven surrounding by the guide of system of neuronavigation, allowing a runner or route of work to the injury of the patient with minimum trauma of retraction. In this work will describe the technical surgical and the report of nine cases performed in our institution with this method, 2 Astrocytoma anaplastic, 1 Astrocytoma grade II, 1 ependymoma, 3 metastasis, 1 teratoma immature and 1 case of radionecrosis. The location was**:** occipital deep 1 case, front deep 1, intraventricular 2, basal ganglion and posterior thalamic 3, cerebellar deep 2 and the depth average was 45 ± 2.5 mm. With resection macroscopically total in six case, subtotal two and a biopsy. In any case present of complications postoperative neurological and a case presence of fistula of CSF skin.

Keywords: Invasive minimal surgery, Retractor tubular, Deep brain tumor

OP-NO.12-07

Outcome of Pediatric Fourth Ventricular Tumors Operated Upon Through a Telovelar Approach

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Background: Fourth ventricle tumors have been traditionally approached by opening the cerebellar vermis. Telovelar approach is an alternative approach performed through the cerebellomedullary fissure to gain access to the fourth ventricle, avoiding neural tissue damage. We described our experience with this approach and predictive factors for the extent of resection (EOR), and for outcomes.

Method: We analyzed the data of 44 consecutive pediatric patients who underwent resection of fourth ventricle tumors using a telovelar approach between March 2015 and January 2017, at Cairo University Children hospital. We evaluated the extent of resection, clinical outcome, complication rates, and postoperative cerebellar dysfunction. Univariate and multivariate analyses were performed to identify the predictive factors for EOR and outcome including overall and progression-free survival rate.

Results: Complete tumor resection was obtained in 37 patients (84.1%). All patients had shunt dependency. 6 patients (13.6%) had cerebellar mutism. 4 patients (9.1%) had new-onset lower cranial nerve palsy. 13 patients (30.2%) had disease progression. there was increased risk of Cerebellar Mutism with medulloblastoma (p=0.040). Large cell/anaplastic medulloblastoma and anaplastic ependymoma (p=0.038), subtotal resection (p=0.020), High-Risk group medulloblastoma (p=0.005), and CSF seeding (p<0.001) were negative prognostic factors. 2-year Overall survival for classic medulloblastoma and epenymoma grade II was 71.8% and 100%, respectively.

Conclusion:: Exposure of the fourth ventricle using telovelar approach was satisfactory in all patients, and the floor of the fourth ventricle could be visualized early and be protected. Removal of posterior arch of atlas gives greater working angle, especially to rostral part. Large cell/anaplastic medulloblastoma and anaplastic ependymoma had the worst prognosis.

Keywords: Fourth ventricle tumors, Posterior fossa surgery, Telovelar approach, Pediatric, Cerebellar mutism, Medulloblastoma

OP-NO.12-08

Surgical Treatment of Lateral Ventricle Tumors

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Background: Lateral ventricle's masses are challenging due to their deep locations and relationship to critical zones. Choosing the appropriate approach for each patient depends on many factors, such as location of the tumor, diagnosis, size of the tumor, vascularity, relationship to surrounding structures. The transcallosal approach offers direct access to the ventricular system bilaterally, risk of seizures is much lower compared with other approaches.

Method: We retrospectively reviewed 20 patients who underwent surgery with tumors of the lateral ventricle from 2015 to 2016. Demographic, clinical, radiological, surgical, histopathology, and follow up data were reviewed and analyzed.

Results: A total number of patients 20, 8 males and 12 females. The mean age was 25 years, (ranging 9-56 years), who are mostly young people of working age. The mean duration of follow-up was 10 months. In addition, the degree of resection has been analyzed. Transcortical transventricular-15 (75.0%), transcallosal-3 (15%) approaches were mainly used and a shunting operation - 2 (10.0%) was performed and 1 (5%) patient was reoperated.13 (65,0%) neoplasms of the lateral ventricles were anaplastic, 7 (35.0%) were benign. The most frequent tumors were oligodendrogliomas, ependymomas, astrocytomas, papillomas of choroidal plexuses, and meningiomas. 10 (50.0%) patients were discharged with improvement, 8 (40.0%) had a neurological deficit and 2 (10%) died.

Conclusion: Radical methods of resection of brain tumors using transcortical and transcallosal approaches are effective, mostly feasible to remove lateral ventricle mass lesions totally.

Keywords: Ventricular tumors, Transcallosal approach, Brain tumors, Seizures

OP-NO.12-09

Intraparietal Approach for Tumors of the Ventricular Atrium

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Aim: To determine the benefits and disadvantages of this approach in ventricular atrial tumors.

Method: 11 patients where found with ventricular atrial tumors, 6 males, 5 females, ages 16 to 65; weight oscillates between 55 and 110 kg. The parietal craniotomy was used. With 7 cases on the right side and 4 on the left side—intraoperative bleeding fluctuated between 150 and 750 cm^3, tumor vasculature being the determining factor,

the patients were ALL operated by the same surgeon obtaining as subjective data that the comfort of the surgical team was optimal. For the anesthesia service, this positioning and approach was useful, safe and of great importance in patients with overweight.
Results: Histology**:** a choroid plexus papilloma, a low-grade cystic neuroepithelial tumor, and another solid, four high grade Gliomas, two Meningiomas, one Ependymoma and one Subependymoma. Hospitalization was 4 to 10 days. Immediate complications included aseptic meningitis, hemoventriculum, internal CSF fistula. There was NO mortality. There was no increase in visual impairment. Atrial tumors are uncommon and their approach is a challenge, there are different approaches to the ventricular atrium. The authors have used the intraparietal route. The intra-parietal sulcus is an anatomic accident, stable, deep, which reaches almost 5-7 mm from the ventricular ceiling under normal conditions; this distance is shortened in tumors by tumor mass or by secondary hydrocephalus. The midpoint of this sulcus is the atrium's superficial projection. The semi-sitting position is safe. It is optimal for the surgeon's work, the cardio-respiratory mechanics of the patient, and the anesthetic monitoring. The craniotomy is generally fast and safe, with little bleeding. The key lies in the microsurgical dissection of the sulcus with protection on its lips in surface and depth, reaching the depth of the sulcus. In all the cases, the lesion was in sight or proximity of 3-4 mm of dissection of fibers. Surgical bleeding is histologically dependent and it determines the consistency of the lesion.
Conclusion: Tumors of the ventricular atrium are rare, deep, and the surgical field is surrounded by noble structures (thalamus, trine, long sensory-motorways, optical radiation), making difficult to work and to access them. Their low frequency makes it difficult to acquire important surgical experience, even in large centers. The intraparietal approach is a safe approach for ventricular atrial tumors. The use of the semi-sitting position does not limit its applicability in overweight patients. It provides better anesthetic monitoring and working comfort to the surgical team. The approach itself does not expose the pacient to major bleeding; the main variable in bleeding is the vascularization of the lesion.
Keywords: Atrial tumor, Intraparental, Approach

OP-NO.13-01

The Functional Connectivity in the Setting of the Intraoperative MRI: Feasibility and Challenges

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Background: The functional connectivity (FC) of the human brain can reflect the functional integrity of different brain regions. Analysis of the intraoperative FC can help in the operative planning and monitoring of the neural functions.
Method: Twenty patients with brain tumors were operated under intraoperative MRI control (Magnetom Espree Siemens AG Medical Solution). Besides the usual MRI sequences, resting state functional MRI (rs-fMRI) was performed under anesthesia before tumor resection and during each control. The fMRI date was realigned, time corrected, normalized and smoothed then coregistered to high resolution T1 images. A group analysis was performed to the 20 patients. A single subject analysis was also performed to test the reproducibility of the FC in each patient.
Results: In the group analysis, the motor, visual, language and salience networks were detectable. The default mode network showed a disconnection between the frontal component and the cingulate/parietal components. The attention network could not be detected. There was inter- and intra-individual variation in the reproducibility of different networks. The motor and the visual networks were reproducible in 18 patients. The language network was detectable in 14 patients. The disconnected default mode was found in 13 patients.
Conclusion: the functional connectivity is detectable in patients under anesthesia who were operated for brain tumor under intraoperative MRI control. Monitoring and analysis of resting network could a method for monitoring the neural functions during cranial surgery. It could be helpful for better functional preservation.
Keywords: Resting state fMRI, Functional connectivity, Intraoperative MRI

OP-NO.13-02

Olfactory Groove Meningiomas. Considerations of the Transcribriform Endonasal Endoscopic Approach

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Olfactory groove meningiomas represent 10% of intracranial meningiomas, originate from cribriform plate of ethmoid, frontal and sphenoid suture and the sphenoid plane. They are mostly benign and potentially curable tumors, the recurrence occurs in varying degree and the extent of surgical resection is the most important predictor of this recurrence. This article presents the results achieved with the transcribiform extended endoscopic endonasal approach in patients with meningiomas of olfactory groove in neurosurgery department of the "Hermanos Ameijeiras" hospital. The series was of 12 patients where headache, anosmia, and neuropsychological disorders were the predominant symptoms. The tumors had a size ≥ 6 cm on 50% of the cases and with transcribiform extended endoscopic endonasal approach was reached total removal in 92% (Simpson I) of the patients. The limits of endoscopic endonasal approach for anterior fossa are in constant expansion, being the transcribiform extended endoscopic endonasal approach the ideal and promising option for patients with olfactory groove meningiomas.
Keywords: Meningioma, Olfactory groove, Endoscopic approach

OP-NO.13-03

Atypical Meningiomas. Retrospective Multicentric Study of 69 Patients

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Background: Atypical meningiomas are rare and represents 1.75 to 2.5% of meningiomas. There is a controversy for management regarding aggressiveness and recurence rate. We report,

epidemiological, clinical, radiological, histopathological features and management of these tumors and evaluate management strategies in order to establish a prognosis and management algorithm.
Method: We report a multicentric retrospective study of 69 high grade meningiomas managed over a 10 years period.
Results: We found, 43 grade II and 26 grade III meningiomas. There was male predominance. Mean age was 55 years. Neurological deficit and headache were the most frequent presenting symptoms. Brain MRI studied tumor signal, relationship and insertion. Convexity wast the most frequent site (65 % of cases). GTR was done in 74 % of cases; 14,5 % had post operative adjuvant radiotherapy after first surgical procedure. Histopathological studies confirmed high grade meningioma according to WHO classification, predominantly atypical and anaplastic subtypes. Mean follow up period was of 57 months. All patients had post opeative MRI and 38 % were reoperated for tumor recurrence. 11,5 % had adjuvant radiotherapy. Mortality rate was 28%. Young age and good clinical condition in the pre operative period are good prognosis factor. Skull base, parasagittal localisation, peritumoral œdema, heterogeneous contrast enhancement, subtotal resection, and high grade lesion are poor prognosis factor.
Conclusion: High grade meningioma have poor prognosis. Management protocols are controversial. Adjuvant radiotherapy is mandatory for patients with Grade III meningiomas. For other subtypes, management decision should be taken by multi disclinary management team.
Keywords: Meningioma, Grading, Radiotherapy, Recurence, Prognosis

OP-NO.13-04

Surgical Strategy for Elderly Meningioma by Frailty Concept

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Background: By OECD health data, Japan has best life expectancy and highest elderly rate in the world. In recent years, the concept of the frailty in the elderly has been proposed, a mortality was identified as a perioperative outcome associated with frailty in many fields. However, no reports have discussed frailty among elderly surgical patients in the neurosurgical field. Now, we discuss the surgical strategy for elderly meningioma by frailty concept.
Method: From 2000 to 2016, we experienced totally 266 surgeries of meningiomas in elderly patients over 65 year-old. We evaluated the age, sex, Karnofski Performance Status(KPS), American Society of Anesthesiologists(ASA)score, tumor location, size, pathology, body mass index(BMI) and serum albumin as the frailty associated item.
Results: The mean age was 72.1 years old with 178 cases of females. The mean size of meningioma was 37.6 mm in maximum diameter. The mean follow up periods were 35.1 months. Pathologically investigation revealed high incident rate (35.4%) of Grade II and III. The rate of KPS deterioration was 21.1%. Multivariate analysis revealed that age, preoperative KPS and postoperative brain complication were risk factors of ADL deterioration 3 months after surgery over 75 years old, and that the serum albumin was one of the risk factors for KPS deterioration after surgery.
Conclusion: Preoperative serum albumin is useful factor as the frailty associated item. The frailty concept should be considered preoperatively in neurosurgical field. It is important to decide the best surgical timing and method after close follow-up.
Keywords: Elderly, Meningioma, Surgery, Frailty

OP-NO.13-05

Efficacy of Gamma Knife Radiosurgery in Operated Meningioma: A Long Term Analysis

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Background: Meningioma sometimes requires Gamma Knife Radiosurgery (GKRS) for it's post-operative residue or recurrence. An analysis of long-term results is carried out to establish the efficacy of GKRS.
Method: 119 consecutive cases of intracranial meningioma were treated by GKRS for their post-op residue or recurrence between 1998 and 2013 by the senior author. There were 77 females and 42 males. The mean age of the patients was 46 years. The mean tumour volume was 6.33cm3.The mean tumour margin dose to the 50% isodose line was 13.2Gy. Follow-up ranged from 1 to 16 years (mean follow–up 4.23 years) with a clinical follow-up of 103 (86.6%) cases and a radiological follow-up of 90 (75.6%) cases.
Results: On follow up imaging tumour volume was stable in 66 (73.3%) patients, decreased in 7 (7.8%) patients and increased in 17 (18.9%) patients. 15 (16.7 %) patients with symptomatic growth required repeat microsurgery,1 patient required a VP shunt and 1 patient underwent repeat GKRS. Of the 17 patients requiring some form of re treatment 4 cases were WHO Grade I, 7 were WHO Grade II and 4 were WHO Grade III and 2 were with unknown grades. The 13 patients without a radiological follow-up were clinically asymptomatic.
Conclusion: GKRS has a good long-term tumour control rate for meningioma except in higher WHO Grade (II & III), which have a more aggressive course.
Keywords: Gamma knife radiosurgery, Meningioma, Post-operative residue / Recurrence, Tumour control rate

OP-NO.13-06

Intracranial Meningioma in the Era of HIV-1 Infection and Antiretroviral Therapy; in KwaZulu-Natal, South Africa

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Background: As people infected with HIV-1 continue to live longer, it is estimated that between 30-40% of them will develop malignancy

in their lifetime. Failure of immune-surveillance may not be solely responsible for development of this malignancies. Our aim was to establish the age and histological grades differences between HIV-1 infected and HIV negative patients with intracranial meningioma.
Method: A retrospective review of clinical notes of all consecutive patients diagnosed with intracranial meningioma treated at the department of neurosurgery in KwaZulu-Natal, South Africa, between May-2003 until May-2015. Variables analyzed were demographics, histopathological results; HIV status results and CD4 counts levels, commencement and duration of antiretroviral therapy. Median age at presentation and histological grades of meningioma in HIV-1 seropositive patients were compared to those of HIV-1 negative patients
Results: A total of 399 patients were treated during this period. The median age between HIV-1 positive patients compared to HIV-1 negative were; 38 years (IQR =32-45) vs. 47yrs (IQR= 45-59), p<.0001. HIV-1 seropositive patients had 5-fold increased risk of developing high grade meningioma (WHO grade II/III), p<.001, (OR=5.05; 95%CI 2.53-10.07), after adjusting for age, gender and CD4+count. HIV-1 seropositive patients had 4-fold increased risk of harboring atypical meningioma, (OR=4.02, 95%CI 1.95-8.32) p<.001. HIV-1 seropositive patients also had 30-fold increased risk of developing anaplastic meningioma compared to their HIV negative counterparts, p<.001, (OR=30.81; 95%CI 3.41-278.76).
Conclusion: HIV-1 infection may play a direct oncogenic role in the development of meningioma in a relatively younger age and confer higher histological grades.
Keywords: Antiretroviral therapy, HIV, Meningioma, Non-AIDS-defining cancers, Oncogenic viruses

OP-NO.13-07

Microanatomical Surgery of the Middle Fossa Floor and Relation of the ¨Extended¨ Anterior Transpetrosal Approach

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Ten cadaver heads (20 specimens) fixed in formalin were dissected for this study. The heads were placed in Sugita head holder, turned 45° from the side of dissection and extended slightly to simulate the surgical position. A frontotemporal craniotomy was performed and the zygomatic arch together with part of the greater wing of the sphenoid bone removed. With the aid of the operating microscope, an extradural dissection was carried out identifying the main anatomical landmarks for this approach**:** mandibular branch of the trigeminal nerve, Gasserian ganglion, greater petrosal nerve, arcuate eminence and the horizontal segment of the petrous carotid artery. The petrous apex removal was performed in three ways**:** 1) Paratrigeminal, posterior to V3 and the ganglion; 2) Subtrigeminal, with removal of the trigeminal impression; and 3) Transcavernous, through the posterior area of Parkinson´s triangle. The superior petrosal sinus and the tentorium were cut before approaching the cavernous sinus. The average measurements of the area of bone drilled were**:** length (parallel to the longitudinal axis of the petrous bone) 22.39 +- 2.5 mm, width (perpendicular to the longitudinal axis petrous apex) 11.25+-3.5 mm, depth or height 8.96 +- 1.8 mm. The surgical view obtained by this ¨extended¨ drilling of the petrous apex simplifies the removal of difficult lesions located in the posterior cavernous- petroclival area.
Keywords: Microanatomical surgery, Middle fossa, Transpetrosal approach

OP-NO.13-08

Radiation Induced Meningioma, Single Center Experience

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Background: Meningioma is the most common radiation induced intracranial tumors, more common with high dose radiation (>20 gys).The genetics of radiation induced meningioma is different than spontaneous one, therefore the biological behavior differs and tend to be more aggressive although most of them are grade I and recurs more frequently and more rapidly. They associate with Changes to the scalp, including alopecia, atrophy, and poor vascularization.
Method: From 2003 till 2014 26 patient was diagnosed and operated as radiation induced meningioma.18 females & 9 males. age ranged 27-68years.latency period 17-35 years. 22 were grade 1, 4 grade 2.
Results: Total excision was achieved in 21 patients. 3 patients presented with recurrence. 2 patients had new postoperative neurological deficits.
Conclusion: Exposure to ionizing radiation has been shown to significantly increase the risk of meningioma. The risk of meningioma formation increases, and the latency period between exposure and tumor development decreases, with higher doses of radiation. Paradoxically, stereotactic radiotherapy may be used to treat patients with unresectable or residual/recurrent tumors.
Keywords: Meningioma, Radiation, Brain tumor

OP-NO.13-09

Prognostic Factors of Local Recurrence in Atypical Meningiomas

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Meningiomas are the most common brain tumors, accounts for 13% to 26% intracranial tumors. Approximatelly 5–7% of the meningiomas are atypical meningiomas (World Health Organization [WHO] grade II). The prognosis for patients with benign meningioma (grade I) is generally very favorable, outcomes for patients with atypical meningioma is rapid progression and more invasion. Ki-67 proliferatrion index 2.1%, recurrence rate is 29% in atypical meningiomas.
35 patients with atypical meningiomas underwent microsurgical resection were analyzed retrospectively. Cases aged 29 to 54 (54.6±12.1) years, female/male**:** 18/17. We evaluated the patient's age at diagnosis, gender, tumor location, Simpson grade, local tumor recurrence, receipt of radiation therapy. Recurrence rate was 6/35 (17.1%). Recurrence was found two times more in males. Parasagittal location was shown in 66.6% of the cases. Half of the

patients did not receive adjuvant radiotherapy. We found Simpson grade I was less recurred than grade III ($p<0.05$).
Atypical meningioma recurs more frequently than benign grade I lesions. Researches were shown the extent of resection, adjuvant radiotherapy in subtotally resected cases are prognostic factor of local recurrence. Higher MIB-1 index causes worse clinical outcomes. In the literature total excision is recommended with no severe complications are expected and adjuvant radiotherapy following surgical resection is advisable, especially for incompletely excised tumors or tumors located in the parasagittal area or posterior fossa. Although the data's give detailed information about surgical treatment and adjuvant radiotherapy, we should take into consideration the molecular characteristics of the tumors.
Keywords: Atypic meningioma, WHO grade II, Radiotherapy

OP-NO.14-01

A Novel Surgical Microscope Attachment Device for Fluorescence Visualization with 5-Aminolevulinic Acid

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Background: 5-ALA fluorescence-guidance during resection of malignant brain gliomas increases the extent of tumor resection. Unfortunately the tumor fluorescence can best be seen in the dark, which often makes resection difficult. We developed a surgical microscope attachment module for tumor fluorescence visualization in bright light.
Method: The device consists of the light-emitting diode fluorescence excitation unit, image receiving unit (set of HD cameras with filters), and microcomputer with original data processing software. The fluorescence excitation source and image receiving unit are attached to surgical microscope. Excitation unit is used to expose the target with white light and fluorescence excitation light according to special algorithm. Images acquired with receiving unit are processed and displayed on the monitor, where the fluorescent area is marked by contrast green. 5-ALA was given orally to ten patients with glioblastomas 3 hours before inductions of anesthesia in dose of 25 mg/kg body weight. Tumor samples and nearby tissue were obtained during surgery. The microscope attachment was used to observe fluoresce of the Carl Zeiss® blue400 conventional target and tumor samples in bright light.
Results: The device showed real-time HD color video of the test objects overlapped by digitally processed fluorescence image. There was clear difference between malignant tumor and adjacent tissue during all the ex vivo experiments with glioblastoma samples.
Conclusion: The new device might be useful for detection of malignant brain tumors fluorescence in bright light during surgery. Further research is required to assess efficiency and safety of this device for gross total tumor removal.
Keywords: Glioblastoma, 5-ALA, Resection

OP-NO.14-02

Value of the Intraoperative Ultrasound in Resection of Intrinsic Posterior Fossa Tumors (A Developing World Country Experience)

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Background: Recently, better patient survival outcomes have been suggested with maximizing extent of resection in patients with brain tumors. The intraoperative ultrasound (IOUS) would be considered a potential competitor tool in the developing world (with limited financial resources) for achieving such target. It would be our pleasure to share our experience with the use of the IOUS in such a compact area of the brain like the posterior fossa.
Method: This was a prospective observational study. Primary outcome was to assess the value of IOUS in detection of residual tumor volume of intrinsic posterior fossa tumors. Extent of resection was calculated and compared between the IOUS and control groups of patients.
Results: Forty-five patients with posterior fossa tumors were enrolled 23 and 22 patients in the IOUS and control arm respectively. IOUS well localized the lesions in 96% of cases and it differentiated solid and cystic parts in all our cases. IOUS well defined lesion borders in 20/23 (87%) of cases. An extent of resection > 85% was achieved in 19/23 (83%) of the cases in the IOUS group and in 11/22 (50%) of the cases in the control group. p value of 0.03. Residual volume calculated by the IOUS was not statistically significant different than that calculated by the immediate postoperative MRI.
Conclusion: Intraoperative ultrasound was found to valuable in**:** providing real time images to localize the tumor, differentiate solid and cystic part of the tumor and detect residual volume in patients with posterior fossa intrinsic tumors.
Keywords: Posterior fossa tumors, Medulloblastoma, Ependymoma, Hemagioblastoma, Intraoperative ultrasound

OP-NO.14-03

Impact of Diffusion Tensor Image-Merged Neuronavigation on Safety and Completeness of High Grade Glioma Resection in Eloquent Brain

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Background: The assessment of DTI influence on strategy, safety and completeness of HGG resection.
Method: Between September 2013 and September 2014, 65 patients underwent HGG resection. In 12 tumors were located in eloquent areas. Anatomical magnetic resonance images were obtained, fused with DTI and used for intraoperative navigation. All patients underwent intraoperative neuromonitoring. In three

patients awake surgery was performed. Control group included 25 patients with HGG in eloquent brain operated on with standard neuronavigation We comparatively analyzed length of surgery, completeness of resection, complications/outcome, and in DTI group we additionally assessed integrity of white matter tracts based on pre- and postoperative CT/MRI images.
Results: In all 12 pyramidal tract, and in 5, additionally, arcuate fasciculus was visualized. Among the 12, a gross total resection was achieved in 10 and subtotal in the remaining 2. Postoperatively 11 displayed improved or unchanged neurological status, and 1 demonstrated permanent neurologic deficit. Integrity of white matter tracts was preserved in 11. In the control group a gross total resection was achieved in 18 and subtotal in the remaining 7. Postoperatively 16 displayed improved or unchanged neurological status, 6 presented with transient worsening, and 3 permanent neurologic deficit. The differences in completeness of resection, presence of transient neurological deficit and surgery duration were statistically significant.
Conclusion: DTI-merged functional neuronavigation is a useful and safe tool in brain tumor surgery. Clear preoperative delineation of crucial white matter tracts eases preoperative planning of surgical strategy. White matter tract shift, can be overcome using intraoperative electrophysiology.
Keywords: DTI, Neuronavigation, Awake croniotomy, Resection

OP-NO.14-04

Radiological Low-Grade Glioma; Proposed Plan of Management

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Background: Advances in the understanding of low-grade glioma (LGG) biology have driven new paradigms in management. However, debate continues pushing the envelope toward improved quality of life and survival with safe gross total resection. In this article, we are trying to focus on the impact of the preoperative radiological data on the plan of management and intraoperative resection scenario.
Method: We applied a management protocol in our institute, in which we used functional magnetic resonance image (fMRI) and magnetic resonance tractography (MRt) data, in a prospective cohort of 56 patients with radiological diagnosis of LGG in the period from 2009 to 2016. Patients were divided depending on the management strategy into 3 groups**:** (1) gross total resection (GTR), (2) biopsy, (3) Don't touch. Our primary outcome was quality of life using Karnofsky scale (KPS). Secondary outcomes included**:** Focal neurological function and extent of resection.
Results: Distribution of the cases between the groups was 34, 18 and 4 cases in the GTR, Biopsy and don't touch groups respectively. We adopted radiological and clinical follow up every 6 months for a mean follow up period of 41.5 months. KPS < 70 (dependable) was found in 17/56 patients at presentation however at 18 months follow up 9/56 cases had KPS < 70 (dependable). Permanent morbidity (more than 6 months) was reported in 6/56 cases.
Conclusion: Functional radiological preoperative data would be implemented in surgical decision making for patients with radiological LGG.
Keywords: Low grade glioma, LGG, DTI, Tractography, Functional MRI

OP-NO.14-05

Navigated Transcranial Magnetic Stimulation (nTMS) Applied in Brain Function Research and Glioma Resection in Brain Eloquent Areas

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Difficulties for diffuse glioma resection in eloquent areas are definitely increased, compared to benign tumors. Not only the imaging boundaries but also the invisible function limitations should be considered, when we cope with surgeries for diffusely growing gliomas in these areas. BOLD MRI and DTI have been increasingly applied for such patients to map functional areas and track white matter fibers around lesions pre-surgically, and direct cortical and subcortical electrical stimulation (CSES) further ensures maximal safe resection intra-operatively. Navigated transcranial magnetic stimulation (nTMS) is a noninvasive method for analyzing cortical function. Currently, we utilized nTMS for operation planning and intraoperative visualization of brain function in patients with gliomas in eloquent areas, combined with BOLD MRI and DTI as well as CSES. Also, we applied nTMS in the research of perisylvian essential language cortices, cortices, motor area and Chinese character writing related cortical area as well as their subcortical connection. In this presentation, we would like to briefly introduce our above studies.
Keywords: Diffuse glioma, Eloquent area, nTMS, Intra-operative functinal visualization

OP-NO.14-06

Prolonged Survival and Quality of Life of 163 Patients with GBM Treated with a Proactive Surgical Resection Plan

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Clinical data from 163 GBM patients surgically treated by the senior author (AFK), retrospectively analyzed using Kaplan-Meier survival curve. There were 73 females, 60 males with median age of 59. Average follow-up was 11.82 +/- 19.37 months. All patient were initially treated by surgical resection followed by radiation and chemotherapy with closed follow up and additional surgical resection if there were early radiological signs of recurrence. All Total number of surgeries for tumor resection was 249. 64 of the 163 patients had repeated surgical treatment. 99 patients had one surgery, 46 patients had two surgeries, 15 had 3 surgeries and 2 patients had four surgeries and one patient with 5 surgeries. Mortality was 32%. Median survival rate in our study was 20 months (50% of patients survived 20 months).

Three year survival rate was 34% and five year survival rate was 20%. A strategy of repeated surgical resection for early radiological sings of recurrence results in a significant improvement of survival rate of patients with GBM.
Keywords: Glioblastoma multiforme, Occurrence, Surgeries

OP-NO.14-07

Age-Dependent Improvements in Neurologic Injury due to Suppression of Microglia Activation

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Background: Microglia in the neonatal brain respond to hypoxia-ischemia (HI) with increased activation, proliferation, and release of pro-inflammatory mediators compared to juveniles. Neuroinflammation has a critical role in modulating the microglia-mediated inflammatory response to ischemia and ischemic brain injury. However, microglia exhibit a complex response to injury, releasing cytotoxic mediators which may worsen injury, and also expressing immunomodulatory and neurotrophic factors which contribute to healing and recovery from injury. Furthermore, microglial proliferation and pro-inflammatory cytokine release increase in infant mice, compared to juvenile mice after hypoxia–ischemia. The aim of the current study was to assess for differences in the effect of microglial suppression on HI-induced brain injury in infant and juvenile mice.
Method: By using Vannucci model of neonatal hypoxia, HI was induced in neonatal (P9) and juvenile (P30) mice and minocycline or vehicle was administered at 2 h and 24 h post-HI. To evaluate the microglial morphology, sections at the level of hippocampus from each brain were double stained as above using rabbit anti-Iba1 (1:250) and mouse anti-MAP2 (1:500) as primary antibodies and goat anti-rabbit Alexa Fluor 488-conjugated IgG and goat anti-mouse Alexa Fluor 546-conjugated IgG as secondary antibodies. Sections were then mounted on slides with vectashield with DAPI mounting medium. To confirm and measure the neurological injury MRI was performed using a Varian 4.7T Small Animal MRI scanner.
Conclusion: P9 minocycline-treated mice demonstrated early but transient improvements in neurologic injury, while P30 minocycline-treated mice demonstrated sustained improvements in cerebral atrophy and Morris Water Maze performance at 60 days post-HI.
Keywords: Microglia, Neonatal hypoxia–ischemia, Neuroinflammation, Cerebral atrophy

OP-NO.14-08

Operating on the Inoperable: Pushing the Limits of Tumour Resection with Awake, Cortical and Subcortical Mapping

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Background: Inability to resect tumours located in motor, language or visual pathways without severe, permanent neurological deficits may deter surgeons from attempting resection, rendering these tumours inoperable.
Method: During a 24-month period (August 2014-August 2016) 62 patients with brain tumours considered either inoperable by other institutions or of high surgical risk at the local tumour board had surgery by a single surgery team. Awake craniotomy with cortical/subcortical mapping was employed. All data was collected prospectively including demographics; location and tumour histology; MRI-based Extent Of Resection (EOR) and surgical morbidity including WHO-performance status at 4 weeks, 3 and at 6 months.
Results: They were 30 males and 32 females; mean age 51.8 years (range 26-79). Anatomical distribution included frontal (29); parietal (13); temporal (5); occipital (6); insular (4); and cerebellar (5). 28 (45%) of patients had high-grade gliomas, 14 (22%) had low grade gliomas and 20 (32%) had metastases. 12 patients had recurrent tumours. Gross Total Resection (GTR, >95%) was achieved in 93% of patients with subtotal resection (<95%) in 7%. 6 patients (9.6%) had a mild deficit after surgery with 0 severe deficits and all patients had fully recovered by 3 months.
Conclusion: The location of tumours in presumed functional areas should not deter surgeons from intending maximum safe resection. Awake cortical/subcortical mapping and experienced surgical teams are essential to achieve this.
Keywords: Neurooncology, Inoperable, Awake, Craniotomy, Cortical, Stimulation

OP-NO.14-09

Impact of Intraoperative Magnetic Resonance Imaging on Extent of Brain Tumor Resection

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Background: Assessment of impact of intraoperative magnetic resonance imaging (iMRI) on extent of brain tumor resection.
Method: Between 8/1/2013 and 4/30/2015, 340 patients underwent brain tumor resection at our institution. Medtronic PoleStar N30 iMRI was used in 17 patients (mean age, 53.7 years, range, 21-69). First image acquisition was performed after positioning and used as reference exam for neuronavigation. Control iMRI was performed after presumed complete tumor resection. If there was remnant tumor mass amenable to surgery, resection was continued until control iMRI confirmed safety limit had been reached.

Results: In 10 patients tumor involved left, and 7 patients right hemisphere. In 12 cases first control iMRI confirmed complete (>95%) tumor resection. In 3 cases tumor remnant was further excised to achieve completeness, and in two cases resection of >85% was considered to reach safety limit. Postoperatively patients displayed improved or unchanged neurological status. None of the patients required early reoperation to improve extent of tumor resection. Neuropathologic examination revealed high grade glioma in 8 cases (glioblastoma multiforme,6, anaplastic astrocytoma, 1, anaplastic oligodendroglioma, 1), low grade glioma in 6 cases (diffuse astrocytoma, 2, oligoastrocytoma, 2, pilocytic astrocytoma, 1, ganglioglioma, 1) and metastatic tumors in the remaining 3 cases.
Conclusion: Use of intraoperative magnetic resonance in resection surgery for brain tumors provides satisfactory extent of resection and eliminates the necessity for early reoperation.
Keywords: Brain tumor surgery, Intraoperative magnetic resonance imaging, Tumor resection

OP-NO.15-01

Sodium Fluorescein Guided Excision of High Grade Gliomas: A Tool for Total Excision

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Background: The best management of high grade gliomas starts with adequate cytoreductive surgery followed by adjuvant therapies. The extent of tumor resection is an important prognostic factor, and it directly affects the tumor progression and the median survival period. Sodium Fluorescein is a fluorescent tracer that crosses the disrupted blood brain barrier, making it suitable for intraoperative visualization of malignant gliomas.
Method: This study was conducted on 30 patients who were indicated for surgical excision of radiologically diagnosed high grade gliomas. In all our cases at the time of opening the dura, after doing sensitivity testing, 15-20 mg/Kg Na Fluorescein was administrated intravenously. The visible yellow stained tumor was then excised using the standard microscopic procedure.
Results: All cases had primary brain gliomas (21 were WHO grade IV and 9 cases were grade III). Post-operative MRI showed gross total excision in 23 cases, near total excision in 6 cases, and subtotal excision in 1 case. None of our cases showed any complications related to reaction from Fluorescein, while 2 cases had transient post-operative motor weakness, and 1 case had postoperative dysphasia.
Conclusion: The use of Na Fluorescein has proven to be an effective tool for demarcation of tumoral tissue from brain tissue; this was clear using the naked eye. It is a simple, safe technique, and can be used in economically limited centers. It increases the chances of safe gross total excision of high grade gliomas.
Keywords: Sodium fluorescein, High grade glioma, Total excision, Median survival

OP-NO.15-02

High Grade Gliomas Surgery: Fluorescence, IOUS and CEUS Experience

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Background: Fluorescence guided surgery permits to resect infiltrated brain tissue distinguishing health brain from ill one. Sodium fluorescein seems to be more manageable than 5-ALA. IOUS and CEUS show health and infiltrated brain morphology and vascularization. Our purpose is to correlate the use of both technique focusing on resection rate and 6 months progression free survival.
Method: We enrolled 47 patients with suspicious of high grade glioma on contrast-enhanced MRI at admission. To all patients we administered intravenous 5mg/kg of sodium fluorescein (By Monico spa) at induction. During the surgical procedures, before dura madre opening, IOUS and CEUS was performed. We repeated this procedure every time we need to check glioma resection and, at the end, to prevent precocious complications.
Results: Over 95% of resection was achieved in 87% of cases. 6-months progression free survival was achieved in 95%. We did not observed any correlated complication from fluorescein/SonoVue administration.
Conclusion: Even if it's mandatory perform multicentre studies, our paper seems to encourage Echography and Fluorescence combined use to reach the maximum resection. In our series we documented a 6-month progression free survival in 95% of cases.
Keywords: CEUS, Fluorescein, High grade glioma, Sonovue, Yellow 560, IOUS

OP-NO.15-03

Epilepsy in Low Grade Glioma

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Background: We reviewed the role of prophylactic AEDs and surgical technique (awake craniotomy versus general anaesthetic) on seizure outcomes in patients with low grade glioma (LGG).
Method: In our retrospective study we included patients with a confirmed diagnosis of WHO grade II glioma within a 3-year period. Seizure incidence was recorded in the early post-operative period (EPP=0-10 days post-operatively) and longer term (3-12 months).
Results: 135 patients met the inclusion criteria. In the EPP, 24 patients suffered seizures, 1 patient who had total tumour resection (4.1%), 5 patients (20.8%) of those who had near-total resection, 11 patients (45.8%) of who underwent subtotal/partial and 7(29.1%) of those who had biopsy (p=0.03). During long-term follow up, 40(29.6%) patients had seizures, 3 (7.5%) of those who had total resection, 8 (20%) of near-total resection, 18 (45%) of subtotal/partial and 11 (27.5%) of biopsies (p=0.005). 34 (25.2%) underwent

awake craniotomy, and 101 (74.8%) underwent resection under GA. Awake craniotomy was associated with greater extent of resection(total and near total resection) compared to the GA (67.6% v/s 45.4%; OR = 2.5, p=0.028) 78 patients (57.8%) were pre-established on AEDs, 21 (15.6%) received prophylactic AED, and 36 patients (26.7%) no AEDs during follow up. Prophylactic AED treatment did not reduce seizures in the early post-operative period (OR 1.10, p=0.87).
Conclusion: Gross resection was associated with lower seizure incidence in the immediate post-operative period, and during long term follow-up. There was no significant difference in seizure incidence between patients treated with prophylactic AEDs and those who were not.
Keywords: Epilepsy, Low grade glioma, Surgery, Prophylactic antiepileptics

OP-NO.15-04

Awake Surgery for Cerebral Gliomas, a Challenge in a Developing Country

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Awake craniotomy is an innovative surgical approach that help identify and preserve functional areas during tumor resections. Neurosurgical department of Mohammed VI University hospital of Marrakesh in Morocco has recently adopted this technique for low grade gliomas in eloquent areas. The aim of this retrospective study is to present our experience of the first 20 procedures and the difficulties encountered. It includes all awake surgeries for gliomas done from Jun 2012 to October 2015. Of the 20 patients, 14 (70%) were males and 6 (30%) were females. The overall median age was 40 years [25-54 years]. The most common presenting complaint was seizures (70%) followed by headaches (30%). The left frontal lobe was the most common localization (11 cases) and the histological type was dominated by astrocytomas grade II. Intra-operative complications, represented by seizures, occurred in 7 cases. The median operative time was 300 minutes and the median length of stay was 5 days including one day in reanimation. The neurological functions was maintained post-operatively in 18 cases (90%) and two patients presented hemiplegia. Recurrence occurs in two other patients, whom had high grade gliomas. In addition to the learning curve, some difficulties, related principally to human resources and material means, has been encountered. Despite that, this technique provides excellent functional results even with fewer resources.
Keywords: Awake surgery, Gliomas, Developing country

OP-NO.15-05

Maximizing Resection of Diffuse Low-Grade Glioma; Functional Outcome

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Background: Most of adults with Diffuse Low Grade Gliomas (DLGGs) are diagnosed with an average age of 39 years and the diagnosis is often made around fully functioning individuals. Currently extent of resection (EOR) is a generally known variable that impacts overall survival (OS), progression free survival, and malignant transformation in these gliomas. Aim of the study was to evaluate the risks and benefits of maximizing the extent of resection of DLGGS while preserving neurological function.
Method: A prospective observational study of group of consecutive 20 patients with initial imaging diagnosis of supratentorial DLGGs. Preoperatively planned for maximal resection even if presuming the proximity of these lesions to eloquent cortex and their relative diffuse nature on imaging.
Results: 40 % near eloquent area and 30 % at eloquent areas. GTR achieved in 10% and STR in 65%. Pre-operative KPS was 100 in 10%, 90 in 65%, 72 hours post-operative 70 in 60%. During first 6 months of follow-up 60% were 100 and 5% died. After 6 months KPS was 100 representing 95% of the whole study. LOS was the longest (4-16 days) in near eloquent and shortest in eloquent (5-8 days). 30% had pre-operative uncontrolled seizures, which cured post-operative, 50% stopped AED within a year. Average back to work period was 2.5 for eloquent, near eloquent 2.8 and non-eloquent 2.6 months.
Conclusion: Careful pre-surgical planning based on proper history reviewing, recent imaging techniques and utilizing up-to-date intra-operative technology is helping to maximize safe surgical resection while saving patient function and quality of life.
Keywords: DLGGS, EOR, KPS

OP-NO.15-06

Ultrasound-Guided Versus Traditional Surgical Resection of Supratentorial Gliomas in a Limited-Resources Neurosurgical Setting: A Comparative Study

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Background: Image guidance became an important tool when tackling intrinsic brain tumors. Intraoperative (MRI) offers superior image quality but needs long acquisition time, special operating room setting and high initial and operational cost. Intraoperative ultrasonography (IOUS) represents a reasonable cheap alternative to help make intrinsic tumor surgery safer and achieve higher degrees of resection.
Method: This is a prospective cohort study comparing two group of patients with supratentorial gliomas. One group was operated using ultrasound guidance while the other group was operated using the traditional approach. The main outcomes were the extent of tumor resection (EOR) based on postoperative MRI, Karnofsky performance score (KPS). The EOR was calculated through a categorical method (gross-total [GTR], near-total [NTR] and subtotal-total [STR]) and also 3D volumetric analysis.
Results: There were 17 patients in the ultrasound group and 13 in the control group. EOR was significantly better in the IOUS group both by the categorical and the volumetric methods. GTR, NTR & STR were achieved in 29%, 24% & 47% respectively in the IOUS group, while 0%, 8% & 92% respectively in the control group (p for GTR/NTR vs. STR =0.01). The mean volumetric EOR was 83% & 66% in the IOUS and the control groups respectively (p=0.03).

Postoperative KPS was significantly better in the IOUS group (p=0.01).
Conclusion: IOUS guidance is superior to non-guided surgery in terms of EOR. This is particularly useful in limited resource setting where MRI and neuronavigation are not available.
Keywords: Intrinsic brain tumors, Supratentorial gliomas, Ultrasound guided tumor resection

OP-NO.15-07

Analysis of the Value of Sodium Fluorescein Guided Resection of Gliomas Under Yellow 560nm Surgical Microscope Filter

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Aim: To analyse the value and usefulness of sodium fluorescein dye under yellow 560nm surgical microscope filter in the identification and resection of gliomas.
Method: 15 glioma patients were included. 14 had supratentorial glioma and one had cerebellar glioma. 2 ml of sodium fluorescein dye (200 mg – 3-4 mg/kg) was injected intravenously just before durotomy. The tumor resection was then guided under 560 nm yellow filter of the operating microscope and white light was also used intermittently to compare the nature of the lesion.
Results: The tumor was identified as bright yellow lesion distinctly from normal parenchyma under filter in 12 patients and their histopathology was glioblastoma. In 4 patients, the lesion was not distinctly brightly yellow, rather it was less yellow than normal parenchyma but the margins were still distinguishable from normal parenchyma and the biopsy turned out to be a grade II glioma.
Discussion: We observed that in high grade lesions, the uptake of dye by tumor was distinctly bright whereas in low grade lesion, the uptake is contrastingly low in comparison to normal parenchyma called as "inverse contrast phenomenon".
Conclusion: Sodium fluorescence dye definitely helps in surgical decision making and resection in high grade gliomas. "Inverse contrast sign" is unique for low grade gliomas. It is cost effective particularly in developing countries.
Keywords: Gliomas, Fluorescein guided resection, Inverse contrast sign

OP-NO.15-08

The Functional Preservation on Recurrent Glioma with Awake Craniotomy

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Background: Awake craniotomy (AC) was performed for glioma occurred near eloquent cortex to reduce post-operative neurological deficit. Some studies prove that re-resection for recurrent glioma benefits the survival of patient. Whether re-resection by using awake craniotomy in recurrent glioma improves patient`s functional outcome is obscure. This study aims to compare the general performance and neurological outcome for glioma patients after AC in both newly onset and recurrent groups.
Method: From May 2013 to January 2016, medical records of 71 glioma patients` who received awake craniotomy were reviewed. New onset neurological deficits include motor weakness, sensory deficit, aphasia, and hemianopia were evaluated on postoperative 7 days (early) and 3 months (late). General performance was assessed by Karnofsky performance status scale (KPS) preoperatively and on postoperative 3 months.
Results: There are 45 patients in newly onset group and 26 patients in recurrent group There is no difference in characteristics of patients between two groups. The proportions of extension of resection (EOR) in two groups are similar. (p=0.56). The early neurological deficit (END) in two groups were 13.3%, 3.85% (p=0.196) and late neurological deficit(LND) were 2.2%, 3.8% (p=0.69) respectively. There were 42.2% patients in newly onset and 46.2% patient in recurrent group who observed the improvement of KPS after AC. (p=0.14).
Conclusion: Awake craniotomy in treating recurrent glioma is as effective as that in newly onset glioma. There is no difference in the EOR, neurological outcome and general performance after AC between the recurrent group and the newly onset group.
Keywords: Awake craniotomy, Glioma, Recurrent, KPS, Neurological deficit

OP-NO.15-09

Blue Versus White Light Image Guided Resection of Malignant Gliomas Using 5 Aminolevulinic Acid (5 ALA). 5-Year Experience at a Single Institution

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Background: Retrospectively analysis our experience with neuronavigation assisted use of 5-aminolevulinic acid for resection of malignant glioma which operated at our centre over a period of 5 years, from 2011 to 2016.
Method: All patients with malignant glioma were divided into 2 groups; with and without 5-ALA fluorescence assisted surgeries. The maximum thickness of post-operative residual tumour was measured radiologically. Out of 23 cases, 10 cases (5 grade III and 5 grade IV) were operated with 5-ALA fluorescence assisted surgery and remaining 13 cases (1 grade III and 12 grade IV) were operated without the fluorescence.
Results: The mean maximum thickness of residual tumour in the 5-ALA fluorescence group was 26.1mm and the non-5-ALA fluorescence group was 31.2mm,statistically the difference was not significant (p=0.431). 5-ALA fluorescence group, four patients (40 percent) with post-operative maximum thickness residual tumour ≤2cm, while remaining six patients (60 percent) with residual tumour >2cm. Non-5-ALA fluorescence group, two patients (15.4 percent) with post-operative maximum thickness of residual tumour ≤ 2cm and the remaining eleven patients (84.6 percent) with residual tumour >2cm (p=0.341).
Conclusion: The use of 5-ALA fluorescence in the management of malignant glioma surgery does not significantly extend the degree of cytoreduction compared to conventional method without the use of 5-ALA fluorescence.
Keywords: 5-aminolevulinic acid, Malignant glioma, Cytoreduction, Fluorescence microscopy, Glioblastoma, Neuronavigation

OP-NO.16-01

Microsurgical Treatment of Diffuse Intrinsic Brainstem Gliomas

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Background: Diffuse Intrinsic Pontine Glioma (DIPG) remains a leading cause of death for children with brain tumors. DIPG is traditionally considered unresectable because of its location and infiltrative nature. Chemotherapy either alone or in combination with radiation therapy has also not improved survival. With the improvement in neuroimaging and microsurgical techniques, DIPG should no longer be considered inoperable.
Method: The charts of 26 patients undergoing surgical treatment of DIPG between 2011 and 2016 in our institute were reviewed retrospectively. Patient demographics, lesion characteristics, surgical approaches, and patient outcomes were examined and analyzed. All cases had been operated under the integration of tractography into neuronavigation. Neurophysiologic monitoring including somatosensory evoked potentials and motor evoked potentials was routinely unitized.
Results: The study consisted of 7 adult patients and 19 children with a female-to-male ratio of 11**:**15. The main symptoms were abducens nerve palsy and weakness of the limbs. 17 cases have obstructive hydrocephalus. No surgery related mortality or permanent deficit was observed. Survival rate were 100% at 3-month follow-up. Preoperative symptoms were relieved at 70% of the patients. 5 cases had recurrences at the 6-month follow-up and went through second surgeries. The 1-year survival rate was 80%. Adult patients seem to have better outcome than their pediatric counterparts.
Conclusion: Our data suggest that DIPG patients can benefit from microsurgery. Undergoing microsurgery did not adversely increase the neurologic deficits.
Keywords: Diffuse intrinsic pontine glioma, Neuro-oncology, Microsurgery

OP-NO.16-02

Molecular and Clinicohistopathological Characteristics of Brainstem Gliomas in Paediatrics and Adults: A Retrospective Comparative Study

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In contrast to pediatric brainstem gliomas, adult brainstem gliomas are rare and tend to be less invasive. There are some notable differences between adult and pediatric brainstem gliomas which significantly affect their management and prognosis. The goal of this study was to analyze clinicohistopathological, neuroradiological and molecular markers differences between these two age groups in a small series of 38 histologically proven brainstem gliomas. Between 2010 and 2016, 38 patients with histologically proven brainstem gliomas were retrospectively analyzed. Data about clinical course of a disease, neuroradiological, molecular biomarkers and histopathological findings were analyzed.
The age ranged from 2.7 to 61 years (median 32 years). The female to male ratio was 1.1**:**1 in children and 2.5**:**1 in adults. Ocular symptoms were commoner in adults than pediatrics ($p<0.067$). On the post-contrast T1 weighted MRI, a higher proportion of children had diffuse and hyperintense masses involving the pons (52.9% versus 17.4%). Histologically, 73.7% of the tumors were astrocytomas with astrocytoma grade III being the most common. BSGs MGMT promoter expression in adults was significantly higher than in pediatric ($p<0.003$). The existence of clinical, radiological and molecular differences between adult and pediatric brainstem gliomas may be attributed by the differences in the tumor biology. The histopathological examination showed no significant difference between the two groups. Diffuse tumors remained to be highly common infiltrative lesion in children. BSGs MGMT promoter expression in adults was significantly higher than in pediatric ($p<0.003$). For resectable tumors, we advise gross total resection as they are associated with favorable outcome.
Keywords: Adults, Brainstem, Glioma, Histopathology, Molecular, Pediatrics

OP-NO.16-03

Surgical Approaches for Thalamic Gliomas

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Background: Surgical treatments of thalamic gliomas are challenging because of their deep anatomical location and proximity to surrounding vital structures high morbidity and mortality. Despite numerous studies on surgical results of thalamic masses, a consensus is still lacking regarding the optimal surgical strategy to approach this region. Our goal is to investigate the cases that were operated in Department of Neurological Surgery - University of Wisconsin (UW) \Madison, to compare different surgical strategies and developed an algorithm for these surgical strategies.
Method: The surgical approaches for the resection of thalamic gliomas were studied in formalin-fixed cadaveric specimens in UW-Madison Neuroanatomy laboratory. All patients' data were collected to establish the appropriate surgical procedures for these thalamic glioma patients. Furthermore, surgical records of the patients operated in UW-Madison Neurosurgery Department were investigated, and pre-operative and post-operative clinical findings were recorded.
Results: Data of 30 patients with thalamic glioma, were studied. The approaches used are as follows**:** Anterior interhemispheric transcallosal (n=9), middle temporal gyrus (n=7), parietooccipital transventricular (n=3), suboccipital supracerebellar infratentorial (n=5), orbitozygomatic (n=4), parietooccipital transcortical (n=2) approaches.
Conclusion: Appropriate approach provides a safe corridor for the resection of thalamic gliomas and gross total or subtotal resection is possible in most of these cases.
Keywords: Thalamic glioma, Approache, Cadaveric

OP-NO.16-04

Reclassification of Grade II and III Infiltrative Gliomas According to the 2016 WHO Classification of Tumors of the Central Nervous System

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Background: Diagnosis of diffuse infiltrating gliomas were based on cellular morphology and the presence or absence of anaplastic features in World Health Organization (WHO) Classification of Tumors of the Central Nervous System before 2016. However, several studies displayed various limitations of this classification system. Some patients with tumors of similar morphology and grade showed different biological behavior. Histologically ambiguous tumors without typical features of astrocytic or oligodendroglial morphology caused diagnostic problems as well. The most recent WHO classification embraces tumoral genetic information as well as histologic features in an effort to make more precise estimations of survival and to provide more accurate treatment for each patient.
Method: One hundred and twenty diffuse infiltrating gliomas of grades II and III diagnosed according to WHO classification systems before 2016 were re-evaluated. Immunohistochemical work up including IDH-1, p53, Ki-67 and ATRX was performed for each tumor and 1p 19q codeletion was investigated by FISH method. Each tumor was assigned to a new diagnostic category according to the new classification system. Prognostic information including age at first diagnosis, presence or absence of recurrence, transformation to a higher grade, choice of treatment and survival data were also evaluated.
Conclusion: In the present study, we re-classified grade II and III diffuse gliomas according to the 2016 WHO system emphasizing changes in diagnoses and compared the relevance of prognostic parameters in 2016 and previous classifications. Results will be presented in detail.
Keywords: WHO classification, 2016, Glial tumors

OP-NO.16-05

Primary Gliosarcoma: A Clinicopathological Study of 11 Cases Treated in a Single Institute

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Primary gliosarcoma (PGS), characterized by a biphasic glial and mesenchymal differentiated tissue pattern, is a rare variant of glioblastoma multiforme (GBM). We conducted a retrospective study of 11 patients with PGS to elucidate clinicopathologic characteristics through comprehensive immunohistochemistry study. The patient group comprised two men and nine women with a median age of 55 years (range, 32–80 years). The mean tumor size was 3.9 cm (range, 1.8–6.0 cm). Ten patients had supratentorial tumors, while one had a cerebellar tumor. Radiologically well-demarcated tumors were seen in all eleven patients, and three tumors (27.3%) exhibited ring-like enhancement. In 2 patients (18.2%), the tumors were enhanced homogenously on contrast, but in 9 patients (81.8%), the tumor exhibited heterogeneous patchy enhancement. All patients underwent tumor resection followed by radiotherapy and chemotherapy. Histologically, all tumors contained glial and sarcomatous components confirming by GFAP, S-100, vimentin and silver stain. We further evaluate the mutational status in both parts by immunohistochemistry for TP53, MDM2, EGFR, MGMT, IDH1 and ATRX. The analysis of immunohistochemistry showed the gliosarcoma may consist of strain from wild type IDH1 and wild type ATRX, followed by the TP53 mutation or alternation of MDM2. The average MIB1 index was 35%. Although the median survival was 12 months, 1 patient remains alive more than 6 years after the initial symptoms.
Keywords: Primary gliosarcoma, Immunohistochemistry, IDH1, TP53, ATRX

OP-NO.16-06

Optic Glioma: Treatment Strategy

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Background: Optic nerves are the extension of brain; therefore contain both the neurons and supporting glial cells. Tumor arising from Glial cells in optic pathways are termed as optic glioma. These tumors mostly are slow growing only occasionally became aggressive. Loss of vision result into significant disability therefore the management ranges from just observation to aggressive resection and palliative radiotherapy.
Method: Fourteen cases encountered at the department of Neurosurgery, Khoula Hospital, Muscat, Oman over 19 year period from 1998 to 2016 have been reviewed for the presentation.
Results: Age ranged from 10 months to 65 years. Eight patients were male and 6 female. Apart from common presentation of diminishing vision there were cases with focal motor deficit and physical retardation. Eleven cases underwent surgery at Khoula Hospital, Muscat, Oman and one was operated abroad. Youngest patient 10 month old was sent for chemotherapy without biopsy based on clinical and radiological findings and remaining one refused any form of treatment and got lost in follow up. Follow up of the patient ranged form 19 years 6 months. The biological behavior of the tumors has been from indolent to aggressive. When tumor attains large size the clinical course provided the clue about anatomical diagnosis of the tumor if it was optic pathway tumor or hypothalamic tumor.
Conclusion: Strategy in management followed had been observation, decompression biopsy and radiotherapy, total excision in case of involvement of one optic nerve to prevent further spread. Overall long-term outcome has been satisfactory in majority of cases.
Keywords: Optic nerve, Optic glioma, Radiotherapy

OP-NO.16-07

Supratentorial Parenchymal Brain Surgery: Same Concepts, Same Skills, Different Pathology

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Background: Evaluate the assumption that parenchymal brain surgery as opposed to cisternal (corridor) brain surgery or skull base surgery requires a set of principles and skills to attain the best possible surgical results.
Method: We retrospectively analyzed 250 cases of surgically treated intra-axial supratentorial lesions and discussed the basic knowledge, skills, technological intraoperative tools necessary to attain the best possible safe complete surgical excision.
Results: Anatomical knowledge and orientation remains the cornerstone of intra-axial supratentorial surgery. Proper understanding of the eloquent areas, functional networking and the white matter fiber network are essential. Intraaxial subpial bimanual technique using suction and bipolar is safest and efficient for all pathologies. The use of CUSA is beneficial in a minority of cases. Intraoperative evaluation of the extent of resection is very useful, our experience with intraoperative ultrasound confirms residual pathological tissue beyond the primary excision margin and the necessity to extend the resection margin in many cases. Intraoperative cortical stimulation and E-Co-g was not found beneficial and didn't affect the intraoperative surgical course, but must note that our experience using it is still very small. The use of operating microscope for magnification and illumination didn't add any benefit over the loupe with head light. In fact it was more time consuming and over-magnifying. Our microscope doesn't have filters for 5ALA.
Conclusion: Intraaxial supratentorial surgery is a subspecialty that needs unified set of principles, knowledge and surgical skills regardless the histopathological nature of the lesion excised.
Keywords: Surgical skills, Cerebral anatomy, Intraoperative tools

OP-NO.16-08

Staged Surgery of Deep Midline Tumors, Comparative Analysis and Literature Review

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In our research we have carried out clinical observation of 255 patients with deep midline tumors accompanied by secondary obstructive hydrocephalus. Of them 75 (29.41%) patients underwent endoscopic third ventriculostomy (ETV) as a first step, followed a week later by tumor resection as a second step of treatment. In 85 (33.33%) patients ETV and tumor resection was performed simultaneously, and 95 (37.25%) patients tumor resection with ventriculocisternostomy by Torkildsen's method was done. In ETV group condition of the patients is significantly improved after adequate correction of CSF circulation. All patients complained of headaches, symptoms of raised intracranial pressure or visual disturbances and vomiting or cerebellar ataxia. Complete tumor removal was achieved in 190 cases and partial removal or biopsy in the remaining 65. ETV was successful in 177 (87.50%) cases but failed in one. Two patients experienced intraoperative transitory bradycardia. Two postoperative complications occurred (one meningitis and one CSF leak). No death related to procedures occurred. Hospital stay ranged from 9 to 21 days (mean, 12.71 days). Follow up range was 4 months to 10 months.
Keywords: Posterior fossa tumors, Third ventricular tumors, ETV, Staged surgery

OP-NO.16-09

Correlation Between Tumor Tissue Volume and Serum Prostaglandin E2 (PGE2) Levels Preoperatively and Postopertaively with Using Cranial Magnetic Resonance Imaging in Astrocytic Tumor Patients

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Background: We planned to aim, patients with astrocytic tumors, if there is any relation or correlation between tumor volumes and serum PGE2 levels and if any changes happened in serum PGE2 levels after surgery. In consideration of these results, our hypothesis to speculate if serum PGE2 levels in patients with astrocytic tumors can be used as a prognostic factor.
Method: Between August 2015 and December 2016; with radiological prediagnosis thought as astrocytic tumor patients were included in the study. In total 20 patients, preoperative and postoperative (first 24 hours) contrast enhanced cranial MRI scans evaluated than preoperative and residual tumor volumes were calculated. All the patients that study included, three blood samples drawed; first one is preoperatively before corticosteroid therapy applied, second one is postoperatively in the first day after surgery and third blood sample drawed postoperatively in the first week afer surgery.
Results: After surgery, tumor volume difference median value was 86.4% (25.1 % - 100 %). The difference between patients consecutive PGE2 median values were statistically significant ($p< 0.001$). In all patients median values also delta values there was no statistically significant correlation between gender, complaint time, age, tumor volumes and serum PGE2 levels ($p > 0.05$).
Conclusion: We suggest of that results to the minority of patient population included in the study. At this point, serum PGE2 levels can not be use as a prognostic factor in Astrocytic tumor patients.
Keywords: Astrocytic tumor, Tumor volume, Serum Prostaglandin E2 (PGE2)

OP-NO.16-10

Management of Hydrocephalus in Posterior Fossa Tumors: Ventricular Drain vs Endoscopic Third Ventriculostomy

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Aim: To define the epidemiological, imaging, perioperative characteristics of patients with hydrocephalus secondary to posterior fossa tumors.
Method: We analyzed 16 patients between 03/01/2017 and 04/12/2017 with obstructive hydrocephalus secondary to posterior fossa tumor lesion. Upon admission, the following behaviors were adopted: preoperative third ventriculostomy+resection; External ventricular drain+resection; ventriculo-peritoneal shunt (VPS)+resection; or resection+transoperative ventriculostomy. The characteristics of the tumor lesion and of the definitive resection with the postoperative morbi-mortality were related and analyzed according to the treatment of hydrocephalus.
Results: Seventeen patients were analyzed, 76% of whom were women. The most frequent histopathological diagnosis was Schwannoma and the anatomical location was the cerebellopontine angle in 47%. The mean Evans index was 0.37 and the tumor volume was 24.24 cc. In preoperative management of hydrocephalus, the most frequent procedure was the third endoscopic ventriculostomy (n = 7), which was successful in 50% of the cases; while the placement of VPS (n = 4) was successful in 75% of the patients. Two patients died.
Conclusion: There is no single treatment for hydrocephalus in posterior fossa lesions, because several variables affect the success rate of the first procedure, such as the percentage of resection and tumor characteristics. Treatment should be individualized so as to ensure the best results in the least amount of surgeries, which has an impact on the cost of medical care
Keywords: Posterior fossa tumor, Ventriculo-peritoneal shunt, Third ventriculostomy

OP-NT.01-01

Study of Metabolic Changes in Outcomes of TBI with Magnetic Resonance Spectroscopy

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Aim: To investigate informative MR spectroscopy of metabolic changes in the brain in different outcomes of TBI in vivo. It has been studied the results of MR spectroscopy in 34 patients with various outcomes of TBI treated at the our clinic during 2013-2016. Prevailed males - 29 patients. Age of patients ranged from 6 to 48 years.
Method: We identified focal and diffuse posttraumatic changes in the outcomes of TBI, according to a classification of A.N. Konovalov et al. (2012), divided into 3 degrees**:** post-traumatic focal CT and MRI changes of mild degree in 7 patients, the average degree in 15 patients, and severe in 12 patients.
Results: In 19 patients on the spectrum and images of color mapping, on a plot of cystic-scarry-atrophic degeneration, compared to the spectrum of unmodified brain matter in the contralateral side (univoxel (UV) and multivoxel (MV) MR spectroscopy) were marked increase in choline content and choline-creatine ratio, a slight increase of lactate and expressed decrease in creatine, N-acetylaspartate.
Conclusion: Thus, our modest experience shows, that MR spectroscopy allows to determine in vivo and mark in dynamics the main brain metabolites as creatine, N- acetylaspartate, choline, lactate and alanine, which can give information about the state metabolic processes of structures of the central nervous system. In the future, we plan deeper study of the metabolic processes of the central nervous system in other outcomes of craniocerebral traumas using MR spectroscopy.
Keywords: Outcomes of TBI, MR-spectroscopy, Creatinine

OP-NT.01-02

Would the Circadian Intracranial Pressure be a Prognostic Factor in Traumatic Brain Injury?

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Background: Traumatic brain injury (TBI) generally influences circadian rhythms and has been implicated in changes in circadian rhythm. Whether TBI-induced changes of circadian rhythm may affect the prognosis or recovery from TBI remains to be investigated.
Method: Twenty-one patients with TBI were continuously monitored for intracranial pressure (ICP) during the first 24-hours after the implantation of intracranial pressure monitor. The data from each patient was analyzed using the least-squares fit of a 24-hour cosine function by single cosinor method. Parameters of circadian A (Amplitude)/M (MESOR) were used to evaluate the circadian rhythm of the patient. A linear regression analysis was then applied to calculate the correlation between circadian A/M of ICP and Glasgow Coma Scale (GCS) before discharge, the Extended Glasgow Outcome Scale (GOS-E), the dosage of mannitol, and time spent in the intensive care unit (ICU) respectively.
Results: The results demonstrated that circadian A/M of patients' ICP exhibited a positive correlation with GCS scores taken before discharge, GOS-E scores, and were negatively correlated with the amount of mannitol, and time spent in the ICU.
Conclusion: We conclude that changes of the ICP circadian rhythm in TBI patients could reflect an internal signal of brain damage and therefore, may be useful to predict a patient's prognosis and recovery from TBI.
Keywords: Circadian rhythm, Intracranial pressure, Traumatic brain injury, Prognosis

OP-NT.01-03

Evaluation of Double Layer Polypropylene Patch Dural Substitute During Decompressive Craniectomy

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Background: Decompressive craniectomy has been widely performed procedure in with patients of raised icp due to trauma, spontaneous hematoma or infarct. Various materials as dural substitutes have been described in literature. All of them to some

extent or the other have lead to more or less degree of fibrosis thus causing difficult dissection of flap during subsequent cranioplasty as well as problems related to cosmesis post cranioplasty.
Method: We performed emergency frontotemporoparietal (FTP) decompressive craniectomy using double layer of poly propylene (PTFE) patch as dural substitute. One layer was kept under the cut edge of dura and second layer above it separating it from temporalis muscle. Subsequent cranioplasty was done in these 35 patients using autologous bone flap. The development of adhesion formation between the tissue layers, amount of blood loss and flap dissection time was recorded.
Results: During the cranioplasty, clear and smooth plane was found between the two layers of PTFE patch in all the cases. Average flap elevation time was 18 minutes. Average blood loss was also significantly less compared to our past experience with single layer substitutes. None of our patients required patch removal due to infection.
Conclusion: Dural substitution using double layer poly propylene patch during decompressive craniectomy facilitates subsequent cranioplasty by preventing adhesions between intracranial components and overlying temporalis muscle and galea. Its usage makes cranioplasty dissection faster and potentially safer leading to better cosmetic result as well as reduced blood loss.
Keywords: Double layer dural substitute, Polypropylene mesh, Decompressive craniectomy, Cranioplasty

OP-NT.01-04

Post-Traumatic Hydrocephalus: Comparison of Endoscopic Third Ventriculostomy and Ventriculo-Peritoneal Shunt

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Background: Traumatic brain injury (TBI) can lead to posttraumatic hydrocephalous (PTH). Ventriculoperitoneal Shunt (VPS), Endoscopic third ventriculostomy (ETV), and Thecoperitoneal shunt (TPS) are known treatment modalities for PTH. We have compared ETV and VPS in operated cases of PTH.
Method: 141 consecutively treated patients of PTH were included in the study. VPS and ETV were compared as separate groups. To determine the failure free survival of each procedure we used Gap-Time model to account for the repeated nature of the outcome. All the variables showing some association with the procedure failure with a $p<0.1$ were considered for multivariable analysis.
Results: 175 procedures (30 ETV and 145 VPS) were performed. Mean age in ETV**:** VPS groups were 37**:** 32 yrs respectively. Clinical improvement was recorded as 37% (ETV) vs 76(VPS). Re-do surgical procedure was needed in 60% (18) cases of ETV v 18% (26) cases of VPS ($p=0.001$). Significant reduction in ventricular size was observed in VPS group (0.001). Poor clinical outcome was statistically co-related with poor GCS, previous CSF infection and post-operative meningitis, as the hazards ratio for these conditions was 2, 2.1 and 7 respectively. Univariate analysis for ETV vs VPS showed hazards ratio of 0.31.
Conclusion: VPS has shown to decrease the ventricular size. ETV has higher failure rate. Chances of failure are higher in cases of lower GCS, pre-operative (prior) CSF diversionary procedure, treated meningitis and post-operative meningitis. ETV can be considered as an option, when multiple shunt failures, preclude further chances of shunt success.
Keywords: Post traumatic hydrocephalus, Endoscopic third ventriculostomy, Ventriculosperitoneal shunt, Management

OP-NT.01-05

Decompressive Craniectomy; Water Tight Duraplasty vs without Water Tight Duraplasty

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Background: Decompressive craniectomy (DC) is a widely used procedure in neurosurgery. Our objective was to conduct a prospective randomized controlled trial comparing two techniques for performing DC**:** with watertight duraplasty vs. without watertight duraplasty.
Method: The study population was composed of patients aged 18 to 60 years who were admitted to the Neurotrauma Service of the Hospital da Restauração with clinical indication for unilateral decompressive craniectomy. Patients were randomized by numbered envelopes into two groups**:** with watertight duraplasty (control group) and without watertight duraplasty (test group).
Results: Fifty-eight patients were enrolled, 29 in each group. Three patients were excluded, leaving 27 in the test group and 28 in the control group. There was no significant difference between groups regarding age, Glasgow Coma Scale score at the time of surgery, GOS and number of postoperative follow-up days. There were nine surgical complications (five in the control group and four in the test group), with no significant difference. The mean surgical time in the control group was 132 min, while in the test group the average surgical time was 101 min, a difference of 31 min ($p=0.001$). There was a mean total cost reduction of $420.00 (USD) – 23,4% – per procedure in the test group.
Conclusion: Decompressive craniectomy without watertight duraplasty is a safe procedure, It is not associated with a higher complication rates. Surgery time is less with reduced cost
Keywords: Decompressive craniectomy, Traumatic brain injury, Duraplasty

OP-NT.01-06

The Importance of Application of Moscow Coma Scale and the Scale Score Evaluation of Condition for the Dynamic Evaluation of Treatment Efficacy of Traumatic Brain Injury

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We have created a database on TBI with using Moscow come scale (MCS) and scoring evaluation state (SET). Material of the study are survey data 411 patients. We offer 4 the outcome of TBI**:** a fatal

outcome (FO), gross neurological disorders (GND), moderate neurological disorders (MND) and the compensated state (CS). All the patients in the dynamics have been performed an intensive drug therapy and 175 patients have been performed surgical intervention and intensive care therapy.
Among the patients admitted in a state of moderate coma dies 1/3, this means the likelihood of a favorable outcome in patients admitted in a state of mild coma is quite high – 64,2%. It was noted a sharp increase in the likelihood of a favorable outcome in patients admitted to the stunned and soporous minds, compared with varying degrees of comatose condition. Among the patients admitted in stunned and soporous state, it has been determined a high probability of a favorable outcome – 87%.
Thus, important for the clinician is the fact that the criterion for the effectiveness of diagnostic and therapeutic measures can serve as a gradual transition of patients on a scale of SET and MCS in the upper intervals and easier phase of impaired consciousness, where the probability of a favorable outcome is high. Conversely, transition to the lower values due to SET and comatose condition due to MCS are the criteria for inefficiency of the performed diagnostic and therapeutic measures, or disruption of the compensatory processes of the organism.
Keywords: TBI, Moscow come scale, Scoring evaluation state

OP-NT.01-07

Early Decompressive Craniectomy for Raised ICP Following Severe Traumatic Brain Injury; A Case Series at Kenyatta National Hospital, Kenya

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Background: Severe traumatic brain injury remains of major public health concern especially in developing countries where preventative measures are inadequate. Raised intracranial pressure (ICP) when inadequately controlled contributes to poor outcome in this subset of patients. The aim of this study was to evaluate the usefulness of early decompressive craniectomy in controlling ICP adequately and therefore possibly improving outcomes.
Method: A prospective series of 15 patients managed through a hospital based protocol were analysed. Patients included had injury within 72 hours and ICP >20 mmHg after initial basic medical treatment that included osmotherapy with mannitol. Glasgow outcome score was evaluated 3 months after surgery.
Results: 15 patient (13 men and 2 women) with mean age of 27 years (range 6-45) were analysed. Road traffic accidents accounted for 80% of these injuries. Mean GCS at admission was 5(range 4-8) and average ICP values at decision to operate was 35mmHg (range 24 -67 mmHg). ICP values following craniectomy averaged 14 mmHg (range 9-11). 5 patients died (GOS 1), 7 remained in persistent vegetative state (GOS 2), 1 at GOS 3 and 2 recovered well to GOS of 5. The outcome seemed to correlate with age where the 2 patients with GOS of 5 were age 10 years and 6 years while all those above 40 years died.
Conclusion: Early decompressive craniectomy controls ICP adequately. It is potentially useful in improving outcome in children. Outcome in adults may not justify its' routine use, especially in consideration of resource use and eventual social impact of patients left in persistent vegetative state.
Keywords: ICP, Decompressive craniectomy, Outcome

OP-NT.01-08

Neurosurgery in War, Syria Example

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Practicing neurosurgery at war is like going back to history to treat patients as the pioneers did in the last century like Cushing and others did. You should work with a very simple surgical tools, and sometimes without any diagnostic assistance and you should have your surgical decisions with only simple X-rays and rarely with CT scans. Working in field hospitals with less degree of sterilization in underground areas with very limited options make your work sometimes very limited. New destroying weapons that used against civilians in the cities and villages make the status of the injured people more complicated and worse than that we had seen in the literature and the chance for survival are less also. Also the bad circumstances in long siege areas of lake of new medicine and good nutrition make the injured people more sufficient for infection and have less chance for survival.
Keywords: War neurosurgery, Field hospitals, Siege areas

OP-NT.01-09

Decompressive Craniectomies for Severe TBI After the Rescue ICP

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Aim: To retrospectively analyze clinical characteristics, complications and factors associated with the prognosis of patients undergoing decompressive craniectomy (DC), and to compare the clinical outcome when DC was performed within 6 hours and 12 hours of hospital admission.
Method: Retrospective cohort study in the Hospital database, assessing medical records.
Results: Analyzed 249 patients with increased intracranial pressure (ICP) undergoing DC from 2013 to 2014. Highest range of patients came from countryside and the mean age was of 41 years. The majority had DC performed primarily, with duroplasty and discard of the bone flap. It was verified that ICP monitoring was practically unused and the hospitalization time was less than 15 days. The higher percentage of cases had surgery performed within 12h of admission, this group had trauma brain injury (TBI) as primary

cause of raise of ICP and had a statistically significant lower mean age and lower score on glasgow coma scale (GCS) at admission, in contrast to those operated after 6h and 12h.
Conclusion: Our serie represents patients from the countryside, middle-aged, TBI victims and noted to be the largest series in severe TBI in this region. We noted that critical patients, with lower GCS score were operated earlier, but they had the same clinical outcome of those with higher GCS score. The results may represent that patients operated earlier, although more severe on admission, presented similar clinical outcomes, emphasizing the importance of early DC in the management of severe TBI. Further studies, however, are needed to elucidate this issue.
Keywords: Decompressive craniectomy, Intracranial pressure, Trauma brain injury

OP-NT.02-01

Traumatic Brain Injury Care Quality Assurance in Ukraine

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Background: Around 200,000 people sustain TBI annually (11,000 die) in Ukraine. Only every fourth patient with TBI is examined and treated in neurotrauma departments. Up to 50% of patients with GCS 13-15 exhibit structural changes in the brain, including those that need surgery. Up to 11% of patients with GCS 13-15 have disability in the remote period. TBI Admitted 45291 (2015)**:** surgery – 34.4%, TBI related mortality – 3.3%, Mortality postop –7.0%.
Method: 12 protocols developed by Romodanov Neurosurgery Institute in cooperation with Ukrainian Association of Neurosurgeons (based on Brain Trauma Foundation Guidelines), and approved by the Ministry of Health. Two interacted parts**:** 1. Management (how to organize medical care for patients with TBI according to EBM data). 2. Clinical (how to provide medical care to patients with TBI according to EBM data).
Results: Protocols introduce the concept of the "guaranteed" quality of care for TBI patients**:** Availability of specialized department, appropriate equipment and trained staff; Clear instructions for management of TBI patients; Sufficient drugs supply.
Conclusion: Enhancing the effectiveness of medical care to acute TBI patients is possible, when**:** Adequate resources are available; Health care providers are professionally competent and trained; State-of-the-art technologies are employed; Strict compliance with medical care protocols in line with evidence-based guidelines are ensured; Quality indicators of medical care developed and used. Quality Indicators give the possibility to asses all components of medical care and identify existing problems and should be considered for the developing the next generation of standards for management patients with TBI.
Keywords: TBI, Quality assurance, TBI protocols

OP-NT.02-02

A Prospective Clinical Study of Routine Repeat Computed Tomography (CT) After Traumatic Brain Injury (TBI)

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Aim: To discuss the repeated CT scanning in patients with traumatic brain injury (TBI) and to identify the conditions under which this approach is necessary.
Method: One hundred and seventy-one patients who suffered TBI but were not surgically treated were divided into two groups**:** the routine-repeat CT group (n1⁄489) and the non-routine-repeat CT group (n1⁄482). The patients' clinical characteristics were compared. T-tests and stepwise logistic regression were used for analysis. Patients in the routine-repeat CT group were divided into three groups according to GCS scores to determine the need for routinely repeated CT scans.
Results: The results revealed statistically significant differences between the two groups in terms of neuro-ICU-LOS and LOS ($p<0.01$). No significant differences emerged with respect to hospital charges and GCS scores at discharge ($p>0.05$). AGE, international normalized ratio (INR), D-dimer concentration (DD), GCS scores and number of hours between the first CT scan and the injury (HCT1) were influential factors of developing progressive haemorrhage.
Conclusion: The routine-repeat CT group fared better than did the non-routine-repeat CT group. Routinely repeated CTs were minimally effective among those with mild TBI, whereas this procedure demonstrated a significant effect on patients with moderate and severe TBI.
Keywords: Traumatic brain injury, Routine computed tomography, Progressive haemorrhage

OP-NT.02-03

Feedbak to Pre-Neurotrauma Teams to Reduce Secondary Insults in Adult Severe Brain Injury Who Underwent Hematoma Evacuation

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We collect & feedback process information about care before neurosurgery in adults severe-brain-injury. Airway management regarding proper decision & immediate results concerning secondary insults**:** aspiration precautions, hypotension, hypoxia and capnometry deviations might benefit outcome.
697 adults with hematoma evacuation (228 decompressive craniectomy). Mode of evacuation**:** direct (238 ambulances, 108 helicopter) and through another hospital. Difference between actual 6-month mortality and IMPACT-risk were assessed for significance. Airway problems**:** delayed decision and first blood-gas analysis (hypoxia, out of 30-45 mmHg pCO2) & shock (admission blood-pressure of <=90 mmHg). Feedback to EMS about the prehospital management was given in 58.4% of direct evacuations, 50.7% of

transferrs (p=0.05). Delays in decision and referral (16% with direct evacuation, 9% of transferrs), mean time to surgery was 3.3 vs. 4.7 hours. 6-month mortality was not differ in patient that their record showed an airway problem (36.3% vs. 31.9%) but results were significantly better than IMPACT-risk in patients without airway problems (p=0.008). 8.7% suffered hypotension**:** 62% mortality in adults 16-65 vs. 21% without (p<0.0001). Overall 29% of patients entered surgery >5 hours of injury.
Hematoma evacuation homogenous group stress known risk-factors for mortality. Pre-neurotrauma care needs continuous feedback. Faster neurotrauma arrival, even with documented process problems might improve outcome. Debriefing incidents of suboptimal process might reduce mortality. Rare event of hypotension contributed to adverse outcome. Absence of problems with smooth airway management, range of normal capnometry and within 4 hours to hematoma evacuation have significantly better outcome than their IMPACT risk. In older age these factors will not translate to meaningful help.
Keywords: Severe brain injury, Pre-neurotrauma care, Secondary insults, Hypoxia, Hypotension, Hypocapnia, Hypercapnia, Time to hematoma evacuation

OP-NT.02-04

Prevention of Traumatic Brain Injury in Brazil - The "Think Well" Program of Brazilian Neurosurgery Society

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Background: Trauma is a worldwide public health concern and constitutes the main cause of death among young people and children in Brazil. Traumatic brain injury (TBi) is the event most responsible for severity of all traumas, mainly among traffic accidents. Since 1995, adapted from American model "Think First" for Brazilian environment, the Brazilian Society of Neurosurgery (BSN) started an educational program for prevention of TBI, called Think Well Program (TWP). The aim of this study is to present the new trends of TWP directed to young people and children in school age, in partnership with the Brazilian Federal Government (BFG), at the last ten years.
Method: The interest of BFG in programs for reducing severity of traumas was the link to public-private partnership with BSN by TWP. BFG provided funds for educational materials (videos, CDs, adhesives, banners and educational leaflets) and for logistic organization. A national program was established at 49 urban agglomerations in Brazil with educational actions targeting to prevent traffic accidents among young people and children between 10 and 14 years old in National Fundamental Instruction, with massive participation of neurosurgeons.
Results: By the first time, the BSN established a partnership with public administration for TBI prevention. Epidemiologic studies showed reduction of severity of TBI and deaths.
Conclusion: TWP reiterates the role of Brazilian neurosurgeon to deal with an important problem of public health in modern times**:** the neurotrauma. In a prospective fashion, this partnership may create a political alliance that will enable BSN to expand TWP in all national territory.
Keywords: Traumatic brain injury, Prevention, Traffic accidents, Children

OP-NT.02-05

The Effect of the Surgery on Survival Time of the War Related Cranial Injuries (510 Cases Experience)

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Background: War related traumatic brain injuries are highly mortal. Especially craniocerebral gunshot injuries are the most lethal injuries. The survival rates are only between 7% and 15%. In war, you have to deal with several injury types. We evaluated the patients who were injured in the Syrian war and treated in our clinic, between March 2012 and January 2017. The injury patterns and types were investigated. Age, gender, Glasgow Coma Score (GCS), survival time, and mortality-morbidity rates were evaluated.
Method: 510 patients were evaluated, 77% were adults and 85% were man and the age of victims ranged from 1 months to 81 years.
Results: In terms of injury patterns, 297 patients (58.2%) had non penetrating injuries (Group-1) while 213 patients (41.8%) had penetrating injuries (Group-2). The subtypes of the Group-1 injuries were blunt and tangential type and the subtypes of the Group -2 injuries were penetrating, crossing and perforating type. The mortality rates were 20.78% for group–1 and 20.20% for Group-2. The overall mortality rate was 40.98%. In mortal group, the average of the survival time are 15 days for group-1 and 11 days for group-2. In group-1 the average survival times are 16 days for un-operated and 13 days for operated group and in group-2 10 days for un-operated and 16 days for operated group.
Conclusion: Our experience; the surgery can extend the survival time, especially in penetrating injuries had between GCS 4-7.
Keywords: Craniocerebral injury, Survival time, Traumatic brain injury, War, Gunshot wounds

OP-NT.02-06

Traumatic Brain Injury Changes; A Clinical and Patho-Biochemical Profile of Trends During Neurosurgical Management

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Background: TBI is management is characterised by changes in monitoring parameters and biomarker trends. The underlying events in TBI are responsible for the poor clinical outcomes seen. An understanding of the changes and their interaction with clinical parameters may help in effective management. The aim of this study is to describe the clinical and pathophysiological trends during TBI management of patients at a University Teaching Hospital in South Africa. The study describes trends in, multimodal parameters and biomarkers evident during neurosurgical management of patients with moderate to severe TBI.

Method: Patients with moderate to severe TBI were managed at the Nelson Mandela Academic Hospital during the period between march 2014 - march 2016. Following neurological evaluation, surgical intervention measures instituted included craniotomy, craniectomy, external ventricular drain and ICP/ PBO2 monitor insertion. Postoperatively in ICU, blood and CSF were sampled daily for evaluation of oxidative and inflammatory inflammatory biomarkers for 7 days.
Results: 64 patients of ages 10-62 years were seen and admitted during the period of study. The ICP and the brain tissue temperatures trends showed an initial upward trend followed by normalization. The PBO2 improved during the period of management.
Conclusion: These changes correlated with the trends in the interleukin-1 which showed a positive relationship with the ICP trend and a negative linear relationship with the brain tissue oxygen tension. The antioxidant levels had a negative and linear relationship with the ICP.
Keywords: Traumatic brain injury, Oxidative stress, Inflammatory, Biomarkers, Intracranial pressure

OP-NT.02-07

Neurotrauma and Disaster Response: Meeting the Global Surgery 2030 Goals

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Disasters have cost over 1.3M lives and US $2T damage since 1995. In the 2010 Haiti earthquake, 20,000 people died each day from lack of surgical facilities. Man-made disasters - from building collapse to terrorist incidents - are also frequent mass casualties. Disaster response (DR) - e.g. UN, Red Cross - remains separate from ongoing healthcare systems. To improve outcome, DR must occur within hours - not the current week or more. Trauma/stroke centers (TSCs) evolved with the reduced morbidity/mortality that immediate "24/7" treatment provides. TSCs are an integral part of ongoing healthcare. We propose that Disaster Response Centers (DRCs), staffed by local physicians side-by-side with developed country physicians, be part of ongoing healthcare in low and middle-income countries (LMICs). A helicopter-mobile DRC (operating room with battery-powered CT) can reach a disaster anywhere in 24 hours. Internet-based telemedicine plus disaster-specialized robots and drones enhance DR. International societies (e.g. WFNS) develop universal training standards and research protocols. Fortunately the universal humanitarian DR suspends the political and cultural barriers that hinder response to other global crises. By 2030, LMICs will lose US $1.2T GDP annually to trauma and cancer. DRCs provide the broad surgical resources (e.g. radiology, blood bank, pathology) necessary to achieve the 2015 Lancet Commission**:** Global Surgery 2030 goals. This global "mega TSC system", with multinational staff, will improve DR and establish global training/certification/research standards, advancing healthcare worldwide. There are political and socioeconomic benefits - in addition to neurotrauma/healthcare benefits - of integrating DR into the ongoing global healthcare system.
Keywords: Disaster response, Global surgery, International neurosurgery, Neurotrauma, Training standards

OP-NT.02-08

Outcomes and Complications of Cranial Wounds in Syrian Civil War

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Aim: To investigate the surgical outcomes and complications of Syrian Civil War cranial injuries in our hospital.
Method: This study included explosive missile, gunshot and combat-terrorism related injuries. One-hundred and eight patients were analyzed retrospectively between May 2015 and June 2016. All patients were treated in Kilis State Hospital, Kilis, Turkey,which is near to Syrian border.
Results: During this time period 128 patients were treated. Of these, 100 patients were adult (male/female**:** 91/9), 28 were child (male / female**:** 21/7). Mean age was 25.71±13.95 years. Mean Glascow coma score (GCS) of patients at the time of admission was 8 ±3 (range 3-14). 98 patients (76.6%) treated surgically and 30 patients (23.4%) conservatively. Middle cerebral artery, cardiac arrest, venous sinus bleeding were preoperative complications, cerebrospinal fluid leak, rhinnorea and wound infection were postoperative complications. Mean Postoperative GCS was 10 ± 3 (range 3-15).Sixty-six patients postoperative GCS were increased, 20 patients were unchanged and 12 patients were decreased. Fifty-six patients (43.8%) were died at the hospital. Seventy-two patients (56.3%) were discharged from the hospital. Average Karnofsky score was 70.
Conclusion: Gunshot, shrapnel, blast, assault and combat independent injuries are different injury types during war. Cranial gunshot has high mortality and morbitidy. Multiple factors affects the surgical results of war injuries. Injury pattern, velocity of the weapons, initial GCS of patients are important factors affecting the results.
Keywords: Cranial wound, Injury pattern, Syrian civil war, Weapon

OP-NT.02-09

Weight, Volume and Computer-Tomography Estimated Specific Gravity in Mild to Moderate Traumatic Brain Injury

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Background: Brain oedema after traumatic brain injury is an important component in the management and outcome of these patients. Brain's weight and volume could be measured from CT images and from these properties the estimated specific gravity. This variable could be used as an indirect measure of oedema. The main objective of this research is to evaluate variation in weight, volume and eSG in patients with mild to moderate TBI. As a secondary goal, we evaluated the relationship among these variables in a subset of patients with neurological deterioration.

Method: CTs from patients with mild to moderate TBI admitted (TBIgr group) were analysed to measure weight, volume and eSG. Control values were obtained from randomly selected patients whose CT scan had no pathological findings (Cgr group). TBIgr was subdivided into two subgroups according to whether patients suffered neurological deterioration (TBIgr1) within the 14 days post trauma, or not (TBIgr0).
Results: Twenty five patients with MM-TBI were included in this study. Values for weight, volume and eSG differences among TBIgr and Cgr groups were statistically significant ($p<0.05$). There was no statistically significant difference between subgroups in weight volume and eSG.
Conclusion: An increase of weight, volume and eSG exists for patients who suffer from TBI, even when it is mild or moderate. Due to the limitation of the present study, in particular relatively small amount of the cases under study, further prospective studies are recommended in order to assess the clinical relevance of this technique.
Keywords: Traumatic brain injury, Computer tomography, Estimated specific gravity, Neurological deterioration

OP-NT.03-01

Endoscopic Management of Traumatic CSF Rhinorrhoea, Our Experience in a Tier 2 City

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Background: Endoscopy is the treatment of choice for the management of CSF rhinorrhoea. We made a retrospective analysis of patients managed endoscopically for traumatic CSF-rhinorrhoea in our institute, highlighting location, size of defect and outcome.
Method: All the patients who underwent Transnasal endoscopic skull base packing with fascia lata over a period of 10 years were retrospectively analyzed. HRCT brain with 3D reconstruction was done for all patients, size and location of defect was noted. All patients were managed conservatively with acetazolamide and Lumbar puncture. Patients who failed to respond conservative measures underwent endoscopic skull base packing usually after 7 days.
Results: 127 cases of traumatic CSF rhinorrhoea were endoscopically managed. All were males and mean age of presentation was 36.13 years. Watery nasal discharge is most common presentation (100%) and 12% had associated symptoms and signs of meningitis. Most common location was frontal bone constituting 51.72% followed by multiple defects involving more than one bone (22%). The maximum size of defect was 2.5 x 2.7 cm in the frontal bone. Out of 127 patients, 18 patients (14.17%) had recurrence, out of which 14 patients responded to conservative management and 4 patients (3.14%) underwent repacking endoscopically. 2 patients (1.57%) had recurrence after second packing. Successful resolution of rhinorrhoea is seen in 85.82% of patients after first time surgery and 98.43% after second surgery.
Conclusion: Endoscopic management is the standard of care for traumatic CSF rhinorrhoea. It has advantages of minimal morbidity, hospital stay and low recurrence.
Keywords: Traumatic CSF rhinorrhoea, Endoscopic skull base packing, Lumbar puncture

OP-NT.03-02

Endoscopic Endonasal Repair of CSF Rhinorrhea: Experience from Tertiary Care Centre of Pakistan

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In recent years, endoscopic repair has become the standard of care for managing CSF rhinorrhea and is gradually replacing the traditional open transcranial approach. This is a retrospective study analyzing 40 patients suffering from either traumatic and spontaneous CSF rhinorrhea. A special diagnostic protocol is developed and followed in our hospital to detect site of leak comprising of CT FESS and intraoperative fluorescein. The choice of repair was guided by size of defect ranging from fat graft, fascia lata, middle turbinate and hadad flap alone or in varying combinations. Mild postop complications like fever and headache were found in 7 patients which settled over 3 to 5 days. No major procedure related complication encountered. Four patients had post traumatic anosmia. No patient had postop anosmia. The cribriform plate was the most common site of defect (14 patients), followed by sphenoid sinus (5 patients), both cribriform and lateral lamella (4 patients), lateral lamella (3 patients) and fovea ethmoidalis in one patient. All patients were followed for 3 months. In addition, the authors present 2 surgical videos demonstrating endoscopic repair of CSF rhinorrhea in 2 distinct clinical scenarios.
Keywords: Cerebrospinal fluid, Endoscopic endonasal approach, Rhinorrhea

OP-NT.03-03

Storage Method for Bone Flaps After Decompressive Craniectomy, A Comparison Between Subcutaneous Pocket and Cryopreservation: A Retrospective Study of 165 Cases

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Background: Decompressive craniectomy is performed for brain swelling to treat TBI, malignant MCA infarction and sometimes in tumor surgeries when brain edema prevent bone to be replaced. Such bone flaps are stored in sterile technique until cranioplasty. There are mainly two ways of bone flap preservation in practice those are subcutaneous pocket (SP) and cryopreservation (CP). There are few studies conducted comparing the methods and few are for surgical site infection. Hereby we would like to share our experience of bone flap preservation in SP and CP comparing bone flap resorption and surgical site infection.
Method: During 2 years period, 165 patients underwent DC for TBI, malignant MCA infarction and brain tumor surgeries, after which subsequently went for cranioplasty. The bone flaps taken from 115 patients were stored in SP and rests of 50 were stored using Cryopreservation. Demographic data and incidence of bone flap resorption and surgical site infection was compared in both group.
Results: There were no significant demographic differences between the groups. Surgical site infection was occurred in 6 patients (5.21%) in the subcutaneous group and 3 patients (6%) in the cryopreservation group. The bone flap resorption was seen high in CP 8 (16%) than that of SP 10 (8.7%).

Conclusion: Both SP and CP are equally effective for preservation of bone flaps after DC for TBIs or non traumatic craniectomy. On the basis of bone flap resorption, SP is the choice for preservation and CP is slightly better than that of SPt on the ground of surgical site infection.
Keywords: Cranioplasty, Craniectomy, Surgical site infection, Cryopreservation, Resorption

OP-NT.03-04

Factors Influencing Achievement of Total Enteral Nutritional Support in Severe Traumatic Brain Injury at the Kenyatta National Hospital

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Background: This study was designed to describe the socio demographic characteristics of patients with severe head injury (SHI) at the Kenyatta National Hospital, time taken to achieve total enteral nutritional (TEN) support and factors that influence the achievement of TEN support in these patients.
Method: 43 patients managed at the KNH with SHI qualified to be included in the study. 83.7% were males and 16.3% were females.
Results: All the patients were fed via enteral route, with the initiation of enteral feeding initiated within 48 hours of trauma in 83.7% of the patients. TEN support was achieved within 4 days in 97.6% with 67.4% between 48 and 96 hours. None of the patients with gastric intolerance achieved TEN support within 48hours whilst amongst those without gastric intolerance 32.5% achieved TEN support within 48 hours. 83 % of the patients with abnormal blood sugar levels on day 1 achieved TEN support after 48 hours a whilst 63% with normal blood sugar levels on day 1 achieved TEN support within 48 hours. 25% of patients with low GCS score (4-6) achieved TEN support within 48 hours compared to 34.7% of the patients with high GCS score (7-8) who achieved TEN support within 48 hours. Patients with Marshall type III and IV lesions took more than 48 hours to achieve TEN support (73.7% and 63.2% respectively).
Conclusion: Patients with gastric intolerance, deranged glucose levels, abnormal CT scan findings and low GCS scores took longer to achieve TEN support although this was not found to be statistically significant.
Keywords: Severe head injury, Total enteral nutrition, GCS

OP-NT.03-05

Efficacy and Safety of Using N-Butyl Cyanoacrylate in Fixation of Cranial Following Trauma and Other Pathologies

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Background: Skull Bone fixation following different cranial surgeries is essential and should be rigid, simple and cheap. We describe our technique of cranial fixation using the adhesive cyanoacrylates.
Method: At the end of cranial and intracranial surgeries the craniotomy flap and bone pieces are returned, realigned and fixed using Histoacryl® (N-Butyl Cyanoacrylate) glue. The glue is applied all around the flap in 360 degrees fashion.
Result: The adhesive material was used in 24 cases after different surgeries involving the calvaria of the skull. Patient's age ranged from 1 month to 55 years. Seven cases presented with depressed fractures, 5 traumatic hematomas, and 2 cases after decompressive craniotomies for malignant MCA infarctions, and 10 cases operated for brain tumors. No skin or bone flap infections were encountered during the follow up period, fusion of the edges of bone flap was observed on follow up imaging in most of the cases.
Conclusion: Skull bone realignment and fixation using glue is a simple, safe, and non-expensive method. Operative procedure are not prolonged. The cosmetic appearance, realignment and fusion of bone flap was achieved. Further neuroimaging methods are not prohibited. Glue is suitable for the growing skull of children. Glue is suitable in compound depressed fractures of the skull with possibility of infection.
Keywords: Cyanoacrylate, Efficacy, Cranial, Fixation, Fracture

OP-NT.03-06

Neuroendoscopic Approach to the Intraventricular Lesions and Report of Clinical Experience of Neuronavigation Guided Endoscopic Transventriculoport Intervention of 43 Consecutive Cases

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The surgery of ventricular tumors and deep-seated lesions contains some difficulties. Usually brain retraction is necessary in neurosurgical procedures for deep intracranial lesion management. These lesions are managed by approaches and microsurgical techniques that need retraction and dissection of eloquent brain structures because of the central location of the ventricles. Most of these patients will be pending tumor removal and decompression rather than just a biopsy and fenestration. Consequently, neuroendoscopy has been shown to be an effective minimally invasive method in the gross total resection of intraventricular tumors with the help of adjunct apparatuses. Our technique fuses parallel endoscopy, neuronavigation guidance, and microsurgical technique through an endoscopic transcortical port that allows us to use bipolar forceps, suction tube, dissectors, fine alligator cup forceps and scissors which can accompany the endoscope through the port. In this study, we would like to report our experience on the transventriculoport endoscopic interventions to the intraventricular lesions of 43 consecutive cases. During the period from 2007-2016, 43 patients underwent neuronavigation guided endoscopic transventriculoport surgeries for intraventricular tumor and hemorrhages. When this approach is employed in the management of deeply seated lesions, one should still consider the white fiber tracts and healthy cortical tissue to minimize the tissue morbidity for select lesions and select clinical conditions. The use of renal dilator system we introduced provides the surgeon an adequate visualization with minimal tissue damage and enables navigation to the outer limits of the lesion, because it is very thin-walled, slippery in the outside, and the height of the profile is adjustable as needed.
Keywords: Neuroendoscopic approach, Intraventricular lesions, Neuronavigation, Transventriculoport

OP-NT.03-07

Diagnostic Challenges of Posttraumatic Hydrocephalus and Long-Term Outcomes of Treatment in Patients in Vegetative and Minimal Consciousness State

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Background: Diagnosis of posttraumatic hydrocephalus (PTH) still remains a challenge, especially in vegetative (VS) and minimally conscious (MCS) states. A unified diagnostic protocol for all patients with suspected PTH was developed to specify indications for surgery. Long-term treatment outcomes in VS and MCS patients were analyzed.
Method: We report 215 cases of PTH assessed in Burdenko Center for Neurosurgery**:** 200 patients who underwent shunting procedures earlier were analyzed retrospectively and 15 patients with a suspected PTH were recruited in the prospective study. In the first group 31 patients were in VS and 46 in MCS (mean time of surgery after trauma 5.6±4.01 months).
Results: Surgery-related mental recovery was achieved in 20 (64.5%) patients in VS group and 30(65.8%) patients in MCS group. Unfavorable outcomes were observed in 11 VS patients and 16 MCS patients with a mortality rate of 9.6% and 4,3%, respectively. Shunt infection was encountered in 8 cases**:** three cases (9.6%) in VS group and 5 (10.8%) cases in MCS group. In the prospective group a unified diagnostic protocol was used, including a complex MRI analysis and a clinical evaluation; 13 patients were selected for surgery and showed a significant improvement, while two patients in the prospective group were not treated due to ventriculomegaly as a result of atrophy.
Conclusion: CSF dynamics disturbances affect mental recovery in patients after TBI. However, post-traumatic ventriculomegaly remains a clinical problem resulting in dissatisfactory outcomes in a considerable number of cases. New neurovisualization modalities can be an additional tool in decision-making.
Keywords: TBI, Posttraumatic hydrocephalus, Vegetative state, Minimal consciousness

OP-NT.03-08

Traumatic Otorrhea

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Post traumatic otorrhea frequently complicates skull base fractures, while most of leaks will cease without treatment and can increase risk for intracranial infection. Study was carried over 71 patients in 10 years period with otorrhea which consists 14% of craniobasal trauma. Otorrhea persist for 1-8 days in 79%, less than 12 days 8%, and for 19 days in 13%. 85% had associated skull fractures. Recurrent otorrhea was seen in 8.5% in patients with post traumatic otitis. For diagnosis of otorrhea was used glucotest, beta-2 transfferin and high resolution CT scan.
We review retrospectively the files of 35 patients (1st group) admited to the hospital with traumatic otorrhea, and prospectively 36 patients (2nd group). All patients was treated conservatively, no one case required surgery. Prophylactic antibiotics were used in all cases. Decametoxine as antiseptic was used as ear drops in all patients second group. 11.5% first group developed meningitis, one patient was operated for temporal abcess. The main pathogene was pneumococcus. Use of decametoxine as local ear drops can prevent and reduce the development of CNS infection in traumatic otorrhea.
Keywords: Traumatic otorrhea, Skull base trauma, Meningitis

OP-NT.03-09

Chronic Traumatic Encephalopathy (CTE): Causes, Diagnosis, Role of the Neuroscientist and Medico-legal Implications

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Background: Chronic Traumatic Encephalopathy (CTE) is a serious medical problem that has recently been forced into the spotlight. CTE is defined by the Boston University CTE Center as a progressive degenerative disease of the brain found in athletes (and others) with a history of repetitive brain trauma, including symptomatic concussions as well as asymptomatic subconcussive hits to the head. The signs/symptoms of CTE include memory loss, confusion, impaired judgment, impulse control problems, aggression, depression, and, eventually, progressive dementia. The diagnosis can only be made post-mortem with findings of abnormal build-up of tau protein in brain tissue..This condition was originally referred to as Dementia Pugilistica because it was thought to only occur in boxers. However, recent research has shown other sports, as well as non-sporting activities, to be associated with these neurologic changes.
Method: This presentation will concentrate on the clinical evaluation of 50+ former National Football League patients with suspected CTE. We will outline our, examination techniques, reporting vehicles and possible implications of our evaluations. All players had medical, concussion and sub-concussive event, and sports medicine histories. All patients had neurological examinations including mini-mental status exams and clinical dementia rating scores. In addition, each patient underwent an extensivesessions of neuropsychological testing.
Results: Graphic analysis of pertinent historical events, deficits found on neurological examination, clinical mental status testing and detailed neuropsychological scores will be presented.
Conclusion: The authors' will conclude with recommendations for future considerations for the broad spectrum of athletes including soccer players who may be exposed to the same disease processes.
Keywords: CTE, Sports medicine, Concussion,TBI

OP-NT.04-01

Report of Clinical Experience of Neuronavigation Guided Endoscopic Transventriculoport Intervention of 23 Consecutive Intraventricular Hemorrhage Cases

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Aim: To share clinical experience in the management of intraventricular hemorrhage (IVH) patients who were surgically treated by evacuating the hematoma using an endoscope.
Method: During the period from 2010-2016, 45 patients underwent neuronavigation guided endoscopic endoport surgeries for intracerebral hematoma evacuation. 28 of these patients had either primary or secondary IVH as an extension of intraparenchymal hematoma or subarachnoid hemorrhage. 23 patients underwent endoscopic transventriculoport evacuation surgery.
Results: In the postoperative follow-up period, mean hospital stay was 15 days. One patient developed brain edema and we had to perform a decompressive craniotomy. He was treated in the neurointensive care unit for three weeks, and then he was discharged with hemiparesis. During hematoma evacuation, we placed external ventricular drainage catheter in 5 patients. 4 among 23 patients developed hydrocephalus and we performed third ventriculostomy on these patients. 21 patients had significant neurological progress and were discharged, uneventfully. IVH is a significant and independent contributor to morbidity and mortality. Reducing intraventricular clot volume by extraventricular drainage is a way of managing the concomitant complications of IVH. However, the debris of the hematoma in the ventricular system gradually cover the ventricular surface and produce a membrane that prevents absorption of the cerebrospinal fluid, thus causing hydrocephalus.
Conclusion: Since patients showed earlier neurological improvement and the need for both external ventricular drainage catheter placement and shunting has significantly decreased, the presented endoscopic transventriculoport hematoma evacuation surgery seems to be a promising minimally invasive intervention.
Keywords: Intraventricular hemorrhage, Hematoma, Endoscopic, Hematoma evacuation

OP-NT.04-02

Predictive Factors of Mortality for Primary Pontine Haemorrhage in an Asian Population

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Background: Primary pontine haemorrhage is the most devastating form of haemorrhagic stroke accounting for about 10% of intracerebral haemorrhages with an overall mortality rate of 40-50% as reported in the literature. Factors such as Glasgow Coma Scale (GCS) score, clot location, clot volume, age and history of hypertension have reported to have an association. We analysed the clinical and radiological parameters to determine the predictive factors and prognosis in primary pontine haemorrhage.
Method: We retrospectively reviewed the clinical data of 47 patients admitted to Khoo Teck Puat Hospital, Singapore with a confirmed diagnosis of primary pontine haemorrhage from 2009 to 2015. Subsequently, predictive factors of mortality were identified by statistical analyses.
Results: Overall 30-day mortality rate was 25.5%. Positive predictive factor of 48-hour mortality was mean systolic blood pressure of 160 mmHg or above in the first 48 hours of admission. Positive predictive factor of 30-day mortality was GCS score of 8 or less on arrival. Lowering of mean systolic blood pressure by 20% or more in the first 48 hours correlate with reduction in 48-hour and 30-day mortalities.
Conclusion: The overall 30-day mortality rate of 25.5% for patients with primary pontine haemorrhage in our study population is better than that reported in the literature. We attribute this to acute reduction of mean systolic blood pressure by 20% or more in the first 48 hours of admission. Persistently raised mean systolic blood pressure in the first 48 hours and GCS score of 8 or less on arrival are positive predictors of mortality.
Keywords: Primary pontine haemorrhage, Lowering mean arterial pressure, Glasgow coma scale

OP-NT.04-03

A Volumetric, Segmentation-Based Method to Assess Cerebral Vasospasm of the Middle Cerebral Artery by CT-Angiography

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Background: Posthemorrhagic cerebral vasospasm contributes to delayed neurological deterioration after subarachnoid hemorrhage (SAH). Non-invasive diagnostics for vasospasm include neurological monitoring, transcranial Doppler sonography (TCD), CT perfusion measurements (CTP), and assessment of vasospasm by CT angiography (CTA). Indicating interventional treatment is difficult. Therefore, a simple measure giving information on the severity of vasospasm could be helpful. Here we tested the feasibility of an automated, volumetric analysis of the M1 segment of the MCA from CTA data.
Method: SAH patients with TCD vasospasm monitoring, CTA, and CTP-exams with or without subsequent interventional vasospasm treatment were identified retrospectively. Vessel volumes of the M1 segments of the middle cerebral arteries were determined from CTA data using Amira software by following a standardized protocol. Predictive values concerning indication for interventional vasospasm treatment were calculated.
Results: In 24 SAH patients, 84 CTA exams were identified. 9 of these exams had been followed by interventional vasospasm treatment. We found high negative predictive values concerning presence of indication for interventional therapy for CTA-derived vessel volumes < 5 µl/mm (91.1%) and < 7.5 µl/mm (97.6%), while positive predictive values were lower (35.7% and 14.5%).
Conclusion: Our data indicate that volumetric analysis of the M1 segment of the MCA could be a helpful additional tool in the

evaluation of CTA data in patients with posthemorrhagic vasospasm after SAH. Further studies are needed to confirm these results for other vascular segments.
Keywords: DCI, Vasospasm, Subarachnoid hemorrhage, SAH

OP-NT.04-04

Clinical Significance of the Reversed Pressure Volume Index in Neurosurgical Patients

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Background: Intracranial pressure (ICP) and initial Glasgow Coma Scale (iGCS) are reliable with the patient prognosis. But in some patients outcomes are different even the same initial ICP and iGCS. Pressure volume index (PVI) was defined by the amount of fluid need for increase the initial ICP by 10 times. But in clinical situation, adding fluid is impossible for the patient with increased ICP. Authors measured modified pressure volume index (mPVI), and analyze the correlation with the patient outcomes.
Method: In 244 patients, ICP changes were measured according to the CSF withdrawal by 1 ml after EVD and plotted 1st degree equations by the Excel program. 150 patients' data, the initial ICP between 10 cm$H_2$0 and 40 cm H_2O and R-square of the 1st degree equations more than 95% were included in this analysis. With this 1st degree equation, calculate the expected CSF volume that requires for decrease the ventricular pressure one tenth of the initial ICP. And analyze the correlation between mPVI and end Glasgow Coma Scale (evaluated 90 days**:** eGCS).
Results: Large mPVI, low initial ICP and good initial GCS showed better neurologic outcomes ($p < 0.05$). And multi-variant analysis shows eGCS = 0.9 + 0.08 x mPVI + 0.95 x iGCS ($p<0.05$, $R^2=0.54$).
Discussion: In this study, mPVI was defined amount of CSF for decrease ICP one tenth of initial ICP and correlated well with the patient neurologic outcomes. Authors would like to propose mPVI can be an alternative prognostic factor for the neurosurgical patients.
Keywords: Pressure-volume index, Brain compliance, Decompressive craniectomy, Major stroke

OP-NT.04-05

Single Burr Hole Draining Technique in Subacute Subdural Hematoma

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Background: Sub-acute subdural hematomas are a common neurosurgical entity, most of them presenting in elderly patients. A short anesthetic and surgical procedure is ideal in order to avoid some complications and obtain better results.
Method: We review 54 cases of surgical draining of sub-acute subdural hematomas through single burr hole performed in 51 patients between January 2005 and December 2015 in Acapulco General Hospital. 42 males and 9 females, ages between 62 and 81 yo, all of them presenting with focal neurological deficits. We performed a single burr hole technique through an incision made over the thickest point of the hematoma, without opening the hematoma membrane nor connecting it to the subarachnoid space. Left a 14 FR catheter in the hematoma space, connected to an empty air receptacle during a period between 48 and 96 hours.
Results: All patients recovered from neurological deficits between 3 hours and 7 days after surgery. They were released from hospital between 4 and 7 days after surgery. No systemic complications were observed. Only one patient suffered from an ischemic stroke on the opposite side of the hematoma 3 days after surgery.
Conclusion: Single burr hole technique is a short, safe and effective method for draining sub-acute subdural hematomas. Its effectiveness without opening arachnoid is probably due to its not yet well organized membrane.
Keywords: Sub-acute, Subdural, Hematoma

OP-NT.04-06

Prophylactic Use of Phenytoin in Preventing Early Postoperative Seizure in Chronic Subdural Hematoma: A Randomized Controlled Trial

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Background: Chronic Subdural hematoma (CSDH) is common neurosurgical entity with an incidence ranging from 8 - 58 per 100,000 in people > 65 years. The rate of postoperative seizures in these patients have been reported between 1 to 32% in various series. The efficacy and requirement of seizure prophylaxis in this group of patients has not been adequately addressed. There has been no randomized Trial on this aspect till date. We performed a randomized trial to look for the efficacy of phenytoin in patients undergoing surgery for CSDH. The primary objective was to assess the efficacy of phenytoin in preventing postoperative seizure.
Method: The study period was 1 year. We had 27 patients randomized to the phenytoin group and 27 patients randomized to No Phenytoin group. All patients underwent Single burr hole drainage of CSDH.
Results: In the phenytoin group there was no seizures and in No phenytoin group there was seizures in 3 patients. One of those patients had cerebral contusion and the other had empyema. CT finding was normal in one patient. There was no extra morbidity owing to the seizure. Statistically there was no significant difference in seizure with or without phenytoin.
Conclusion: Routine use of Phenytoin (Antiepileptic drug) in Chronic subdural hematoma is unjustified.
Keywords: Chronic subdural hematoma, Phenytoin, Seizure

OP-NT.04-07

An Innovative External Ventricular Drainage (AW-EVD) Board System

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External ventricular drainage (EVD) is the most simple and common neurosurgical procedure. We perform more than 1000 EVDs per year in our centre Sarawak General Hospital. Cost of the branded EVD system is a burden to our department, especially in developing country. Hence, we utilised the readily available common and cheap medical consumables to assemble EVD drainage system. We recycled medical equipment box and old faded expired radiograph film to build the EVD board system. A simple intravenous drip set and microdrip chamber solution administration set were utilised to create the EVD drainage system in a sterile manner intraoperatively, Nylon rope is tied to the EVD Board for height adjustment. We conducted a study and aimed to assess the integrity of the EVD drainage system. Nursing team participated in the evaluation of user friendliness of the system. Results showed no leakage of the system and there were no evidence of infection from sampled cerebrospinal fluid (CSF). We concluded the innovation was easy to use and cost effective.

Keywords: AW-EVD innovation, Cost effectiveness, EVD board system, External ventricular drainage

OP-NT.04-08

Recurrent Chronic Subdural Hematomas: Predictive Factors and Management

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Background: Chronic subdural hematoma is a common neurosurgical disease. However there are still controversies concerning treatment, recurrence and management of this later. Predictive factors of recurrence are also debated. We report results of a prospective study focusing on recurrence.

Method: It's a prospective study of 189 cases collected during a period of 3 years. All patients undergone one burr hole trepanation with spontaneous evacuation and open drainage. Data analyses include rate of recurrence, factors that can be potentially associated with recurrence and management.

Results: 189 patients were operated. 27 patients recurred (14.28%). 19 patients were reoperated by the same technique while 3 were treated by corticosteroids; cure was obtained in 81.4%. A second recurrence was observed in 5 patients; one of them was treated by a subdural peritoneal shunt. Pre operative density on CT scan was the most significant factor of recurrence. Our rate of recurrence is in concordance with those of literature. Corticosteroids were efficient in most cases.

Conclusion: We recommend the use of the initial technique for the first recurrence. The subdural peritoneal shunt is a good option for the second recurrence. In patients with mild symptoms corticosteroids can be considered. Patients with hyperedenses hematoma must be closely monitored.

Keywords: Chronic subdural hematoma, Burr hole, Open drainage, Preoperative density

OP-NT.04-09

Preoperative Trepanation and Drainage for Acute Subdural Hematoma

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Aim: To present two cases of elderly patients with acute subdural hematomas treated by preoperative trepanation and drainage.

Method: Two cases of elderly patients with acute subdural hematomas treated by preoperative trepanation and drainage were selected from the Department of Neurosurgery between January 2015 and November 2015,and a retrospective analysis was performed.

Results: Two patients were performed operation successfully.

Conclusion: Preoperative trepanation and drainage, in which a burr hole is created in the skull to reduce pressure, may improve surgical outcomes or, in some cases, may reduce the need for follow-up surgical care.

Keywords: Acute subdural hematoma, Trepanation, Drainage

OP-NT.05-01

Predictors of Progression in Brain Contusions: Retrospective Study on 352 Patients Treated in 11 Hospitals Connected with Telemedicine

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Background: Controversy exists concerning the association between radiological and clinical evolution of brain contusions. The aim of this study was to identify predictors of brain contusions progression, related to indications for surgery.

Method: In this retrospective, multicenter study, patients with brain contusions were identified from 11 hospitals, connected with a telemedicine from 2008 to 2011. Data on clinical course were collected. Brain contusions CT scan findings at the time of admission and at subsequent follow-up times were analyzed. Outcomes were evaluated 6 months after trauma by using the Glasgow Outcome Scale-Extended.

Results: A total of 352 patients met the inclusion criteria for the study. The GCS scores at the time of admission were distributed as follows**:** 41.5% mild TBI, 29.8% moderate TBI, and 28.7% severe TBI. 80% were treated in a neurosurgical hospitals, whereas 71 patients were managed in peripheral hospitals under neurosurgical telemedicine. At multivariate analysis onset of or increase in midline shift ($p < 0.001$) and increased effacement of basal cisterns ($p < 0.001$) were identified as statistically significant predictors of clinical deterioration on follow-up CT images. A favorable outcome of 65.6% was observed in whole population, with an increase up to 81.6% in patient from 18 to 60 years.

Conclusion: In TBI patients the increase of the hematoma or edema volume are not significant for progression. A combination of clinical deterioration and increased midline shift and worsened of basal cistern compression is the most reasonable indicator for surgery. No difference were observed in the outcome between peripheral and neurosurgical hospitals.
Keywords: Cerebral contusion, Radiological progression, Telemedicine, Clinical deterioration, Traumatic brain injury

OP-NT.05-02

The Ethiopian Neurosurgery Outcome Monitoring Database: Development and Progress with Emphasis on Neurotrauma

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Background: Neurosurgical practice in sub-Saharan countries is hampered by a deficiency of human resources and adequate hospital facilities. Ethiopian neurosurgery has seen great progress since the start of the residency training program in 2006, and sustainable academic neurosurgical practice is under development. However, there are some unmet challenges when it comes to patient monitoring and outcome assessment. To this end, we developed an outcome monitoring database to provide better overview of the quality and quantity of the neurosurgical service.
Method: Pretested questionnaires were developed for neurotrauma and elective cases. We collected data prospectively from October 2012 to May 2015 at three main teaching hospitals**:** Black Lion, Zewditu and MCM Korean Hospitals. Data analysis was performed using SPSS 21 software.
Results: The total number of patients registered in the database was 2078, of which 1163 (56%) were neurotrauma cases. A documented preoperative diagnosis was registered for 1151 neurotrauma patients; 995 (86.4%) had traumatic brain injury and 156 (13.6%) had spine injury. There were 14.2% severe head injuries and 31.6% moderate head injuries. Postoperative complications were seen in 6.2% of all operated emergency patients, and the most common complication was postoperative infection (42%). The mortality rate among all operated emergency patients was 6.8%.
Conclusion: The neurosurgical outcome monitoring database has become an integral and important part of the neurosurgical practice in Ethiopia. Building on this database, and with a particular emphasis on the prevalent neurotrauma cases, we hope to gain a better overview and understanding of the services provided in our resource-limited setup.
Keywords: Neurotrauma, Database, Outcome, Monitoring, Training, Low-income

OP-NT.05-03

The Application of Heart Rate Variability in Patients with Mild Traumatic Brain Injury

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Background: Anxiety is one of the most frequently diagnosed emotional disorders after a mild traumatic brain injury (mTBI); however, predictors of anxiety after an mTBI remain uncertain. Recent research has indicated that anxiety is associated with abnormalities in the autonomic nervous system (ANS) which can be evaluated by power spectrum analysis of heart rate variability (HRV). In this study, we investigated whether a frequency-domain analysis of HRV could correlate with the occurrence of anxiety in mTBI patients.
Method: We recruited 288 Taiwanese patients diagnosed as mTBI and 152 volunteer healthy controls from three affiliated hospitals of Taipei Medical University during 2010-2016. Beck Anxiety Inventory (BAI) was assessed at the 1st, 6th and 12th week. Correlation and logistic regression analyses of HRV parameters with BAI scores were analyzed in individual mTBI patients.
Results: We found that mTBI patients were more vulnerable to anxiety compared to healthy controls. Global HRV and sympathetic tone were significantly lower in mTBI patients than healthy controls. Temporal analyses of HRV parameters indicated sympathetic over-activity, as reflected by increased percentage of low frequency power (LF%), was significantly noted at the 6th week in mTBI patients with anxiety. Correlation analysis indicated anxiety negatively correlated most significantly with LF power at the 6th week. Logistic regression analysis revealed the mathematical equation between anxiety and HRV parameters. Reduced LF power in mTBI patients predicted higher risk for anxiety.
Conclusion: This study suggests the clinical usefulness of HRV as a potential biomarker of later anxiety in mTBI patients.
Keywords: Anxiety, Mild traumatic brain injury, Heart rate variability, Low-frequency (LF) power

OP-NT.05-04

Penetrating Traumatic Adult Brain Injury in the North of Palestine

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Background: Traumatic brain injury has relatively high incidence in Palestine, particularly due to bullet-induced head injury. Literature about bullet-induced head injury is scanty. I managed a lot of cases during the Palestinian uprising (Intifada). Etiology, types, diagnostic tools, methods of treatment, and prognosis were

fully discussed, with special emphasis on CT-scan dynamic changes.
Method: 380 adults sustained bullet-induced traumatic brain injury over four years period. Patients were classified according to age, sex, type of lesion, injurious agent, level of consciousness, type of operations, radiology, and neurological deficit. Glasgow coma scale (GCS) and outcome scale were adopted for assessment of the level of consciousness and final outcome, respectively.
Results: Presenting symptoms were defined.100 patients required surgery**:** 56 of them were doomed to death, 26 had favorable outcomes, 2 went into vegetative state, and 16 developed severe disability. All those who were conservatively treated had uneventual survival, only 2 of them developed severe disability.
Conclusion: Craniectomy and craniotomy with bone flap removal were the frequently adopted surgical procedures. Brain CT-scan was indispensable in defining type, site, size and further evolution of cerebral lesions. The level of consciousness, severity of the lesion, and method of treatment were the cardinal prognostic factors which had a direct impact on the final outcome of traumatic brain injury.
Keywords: TBI, CT-scan, GCS

OP-NT.05-05

Axe Injury Brain and Its Consequences

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Aim: To determine the affect of Axe injury on brain.
Method: This is a prospective observational study performed at the Department of Neurosurgery Lumhs Hospital Hyderabad & Jamshoro during January 2015 to June 2015. 40 patients of either sex presented with Axe injury brain were enrolled. All pts after admission underwent complete clinical assessment including detailed history & examination particularly neurological examination. Treatment planned according to type of injury.
Results: Among total of 40 patients, majority were males (24 patients i.e 60%), most common site of injury was fronto partieal on left side. Commonly associated injuries were scalp injuries and property dispute was common factor for injury.
Conclusion: Axe is cheap & easily available dangerous weapon. Its availability either should be banned or license should be issued.
Keywords: Axe, Brain injury, Fractures

OP-NT.05-06

Surgical Removal of Intracranial Bullets Using Intraoperative Fluroscopy

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Background: Removal of intracranial bullets is a challenge to neurosurgeons. Intraoperative localization of the bullet is sometimes difficult due to its migration inside the brain. In this study we will evaluate the role of intraoperative fluoroscopy in accurate localization and removal of the bullet.
Method: The following study comprises 25 cases admitted to Cairo University Hospitals between January 2013 to January 2016. Patients were assessed in the ER prior to admission until they were transferred to their definitive treatment destinations. Where operative intervention was required fluoroscopy was performed for all cases and was found to be the most useful adjunct tool to extract radiopaque bullets. The use of a radiopaque Mayfield (as present in our operative setting), was abandoned since our first case as it hinders the view of the foreign body; a headrest was used instead.
Results: 20 cases were successfully removed after localization by fluoroscopy. In 4 cases the bullet migrated and was identified and removed. In one case the bullet couldn't be removed as it was adherent to internal carotid artery.
Conclusion: The use of intraoperative fluoroscopy facilitated safe removal of intracranial bullets, decreased duration of surgery.
Keywords: Bullet, Intracranial, Fluoroscopy

OP-NT.05-07

Factors Influencing Outcome in Head Injury Patients with GCS < 8

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A prospective study analysed multiple factors influencing the outcome of 350 severe head injury patients with GCS < 8 and studied each factor in detail in relation to Glasgow Outcome scale (GOS) and predict Best and Worst outcome with each factor and determined the modifiable risk factors that can improve the outcome of those severe head injury patients. The analysed factors were Mode of injury,Time interval,Age, Sex, GCS on admission, Motor response, Pupillary Light reaction, DEM, Associated injuries, CT findings, Glycemic status, Hb level, Coagulation profile, Management. Each factors were analysed statistically and identified the modifiable risk factors that can improve the outcome of severe head injury patients.
Keywords: Glascow coma scale, Glascow outcome scale, Dolls eye movement, Pupillary light reaction

OP-NT.05-08

Glasgow Coma Score vs. Simplified Motor Score: External Validation for Important Neurosurgical Steps and Clinical Outcome

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Background: Wrongly estimated Traumatic brain injury (TBI) severity based on wrong Glasgow coma score (GCS) can be occasionally observed in traumatological units. Initial false estimation could lead to unnecessary/delayed-urgent treatment steps. Simplified motor score (SMS), three-point measure (Obeys commands=2, Localizes pain=1 and withdraws to pain or worse=0) has been developed to simplify neurological assessment in non-neurological units/extrahospital setting. Our goal was to validate the SMS predictability, so it could be applied both in previously mentioned settings that have rare TBI occurrence.

Method: This retrospective study analyzed patients during one-year period in the Clinical center of Vojvodina, Novi Sad, Serbia. Analyzed factors were**:** Emergency intubation, neurosurgical intervention, early outcome based on Glasgow outcome scale (GOS) and mortality. Area under the receiver-operating characteristic curves (AUC) and paired T-test were used to compare two groups (GCS vs. SMS).
Results: SMS and GCS revealed a similarity between sensitivity, specificity and AUC for all outcomes. There was less than 5% difference in specificity for all outcomes. Discriminatory power was similar with the difference in AUC no greater than 10% for any outcome (no statistically significant differences, despite GCS having a slightly higher score overall).
Conclusion: SMS showed similar test performance compared to the more complex GCS score in predicting clinically important traumatic brain injury outcomes and clinical steps. This score validation had similar results between SMS and GCS. Despite having a insignificantly lower discriminatory power, SMS could simplify the process of initial TBI assessment and eventually lead to better care for the patients with TBI.
Keywords: TBI, GCS, SMS, Early outcome, Intubation, Neurosurgical intervention

OP-NT.05-09

Beneficial Effect of Cerebroprotein Hydrolysate on Severe Traumatic Brain Injury Patients: A Case Series

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In a retrospective chart review of severe traumatic brain injured patients from December, 2010 to June 2012, the author was able to gather twenty six patients with Glasgow coma score on admission ranging from GCS 5 to GCS 7 who were given two weeks of cerebroprotein hydrolysate (Cerebrolysin) at the dose of 30 ml/day and subsequent dose of 10 ml/day for another two weeks. This was done in addition to the usual management and protocol for TBI (traumatic brain injury) patients. These patients were motorcycle crash incidents and brain injuries sustained ranged from cerebral contusions with subdural hematomas and epidural hematomas. Patients were all managed medically and no operative lesion was included in the series. The completed follow up of 21 days showed that patients who were intially GCS 5 (12 patients), GCS 6 (9 patients) and GCS 7 (5 patients) improved and assessment on day 21 yielded, GCS 5 patient (0patient), GCS 6 (1 patient), GCS 7 (2 patients), and GCS 8- 14 (23 patients).
Keywords: Cerebroprotein hydrolysate, Severe traumatic brain injury, Beneficial effects

OP-NT.06-01

Predicting Posttraumatic Hydrocephalus: Derivation and Validation of a Risk Scoring System Based on Clinical Characteristics

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Posttraumatic hydrocephalus (PTH) is a common complication of traumatic brain injury (TBI) and often has a high risk of worse outcomes. The incidence and risk factors for the PTH after decompressive craniectomy (DC) has been assessed in previous studies, but rare studies identify patients with higher risk for PTH among all TBI patients. This study aimed to develop and validate a risk scoring system to predict PTH. Demographics, injury severity, duration of coma, radiologic findings, and DC were evaluated to determine the independent predictors of PTH through logistic regression analysis. A risk stratification system was created by assigning a number of points for each predictor and validated. Of 526 patients in the derivation cohort, 57 (10.84%) developed PTH during 6 months follow up. Age > 50 (4 points), duration of coma ≥ 1 w (9 points), Fisher grade III (5 points) or IV (7 points), bilateral DC (9 points), and extra herniation after DC (5 points) were independently associated with PTH. Rates of PTH for the low- (0-12 points), intermediate- (13-22 points) and high-risk (23-34 points) groups were 1.16%, 35.19% and 78.57%. The corresponding rates in the validation cohort, where 17/175 (9.71%) developed PTH, were 1.35%, 37.50% and 81.82%. The risk score model exhibited good-excellent discrimination in validation cohort, with area under receiver operating characteristic curve of 0.894 and good calibration (Hosmer-Lemshow p = 0.68). This model will be useful to identify patients at high risk for PTH who may be candidates for preventive interventions, and to improve their outcomes.
Keywords: Posttraumatic hydrocephalus, Traumatic brain injury, Prognostic model, Risk score, Validation

OP-NT.06-02

Correlation Between Craniospinal Volumetric Reserve Parameters Obtained During Continuous ICP Monitoring and Lumbar Infusion Tests

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Aim: To identify parameters of continuous ICP recordings that could be used as surrogate variables of the caniospinal volumetric reserve compartment.
Method: Since 2006, ICP Digital Tools, a digital recording software has been systematically used to approach and evaluate the therapeutic indication of 109 patients with idiopathic normal pressure hydrocephalus (iNPH). A retrospective review was conducted, were, according to continuous ICP monitoring and infusion test results a diagnosis of ex-vacuo ventricular dilation was made and each case was pared by age and sex with four controls diagnosed of iNPH. Employing the statistical software SPSS v.21, Pearson correlation coefficients were calculated between craniospinal pulsatility variables derived from continuous ICP monitoring (systolic ascending coefficient, RAP index, elastance index, pulse pressure, etc.) and parameters obtained during lumbar infusion tests (pressure-volume index, compliance, elastance constant). Statistical significance was defined as P <0.05.
Results: Of all the studied parameters, the ones that presented

the highest number of at least moderate correlation (r >0,4), are**:** the mean cerebral pulse pressure that showed correlation with the pressure-volume index and the compliance constant; the percentage of pulses with an amplitude superior to 5 mmHg that correlated with the elastance constant; the area under the curve of the Fourier transform equation between the frequencies 0,0083 and 0,05 Hz that correlated with the pressure – volume index and the elastance constant.
Conclusion: The digital analysis of continuous ICP monitoring might allow the extraction of surrogate variables from the craniospinal volumetric reserve compartment in patients with iNPH.
Keywords: Intracranial pressure, Lumbar infusion test, Craniospinal volumetric reserve compartment, Idiopathic normal pressure hydrocephalus

OP-NT.06-03

Outcome of Decompressive Craniotomy for Severe Traumatic Brain Injury Patients with Persistently Elevated Intracranial Pressure on Medical Treatment: A Prospective Study Controlled by Intra-parenchymal Pressure Monitoring

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Aim: To evaluate outcome of decompressive craniotomy (DC) for management of severe traumatic brain injury (STBI) with persistently elevated intracranial pressure (ICP) on medical treatment and to determine feasibility, safety and accuracy of intraparenchymal ICP monitoring (IPM).
Method: Forty-one patients admitted to ICU with STBI underwent clinical and radiological evaluation. IPM was inserted and initial ICP was recorded. Patients failed to respond to medical treatment underwent DC. Study outcome included frequency of postoperative complications and functional outcome judged 3, 6 and 12-m after hospital discharge.
Results: Twenty-seven patients underwent early DC, while 14 patients had late DC. Unilateral craniectomy was performed in 38 patients and bifrontal craniectomy in 3 patients with diffuse cerebral edema and no MLS. During 48-hr PO, arterial pressure measures gradually increased, while ICP gradually decreased and CPP was progressively increased. Mean duration of ICP monitoring was 4±2.4 days, mean duration of ICU stay was 6.8±3.4 days and mean total hospital stay was 11.4±5 days. Five patients developed surgery-related PO complications and 12 patients died, but there was no surgery related mortality. At end of 12-m follow-up; 9 patients had good recovery, 9 patients had moderate disability and 3 had severe disability, while 3 patients were in vegetative state.
Conclusion: Short-term trial of medical treatment judged by ICP monitoring of STBI patients allows early surgical decision making. Decompressive craniectomy for patients with persistently elevated ICP provided rapid control of ICP with subsequent improvement of CPP and little PO surgery-related morbidity and no mortality.
Keywords: Severe traumatic brain injury, Intraparenchymal ICP monitoring, Decompressive craniectomy

OP-NT.06-04

Technical Consideration of Cerebral Venous Sinus Repair in Hatchet Combat Injury to Cerebral Venous Sinuses

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Background: Injury to dural venous sinuses may be encountered in penetrating and non-penetrating head trauma or can result from accidental disruption during a craniotomy. Hatchet combat injury can be impalemental. The decision to repair versus sacrifice the sinus is dependent on the location of injury. When repair technique ranges from tamponade effect, direct repair, to grafting techniques. Our aim is to assess and manage Hatchet combat injuries to cerebral venous sinuses with variety of surgical methods.
Method: Study conducted from Aug 2014 to July 2016. All the patients were assessed clinically and radiologically and prepared for OT with adequate amount of blood.
Results: 15 patients of Hatchet Dural venous sinus injury, managed surgically which includes 3 (20%) females and 12 (80%) males with mean age of 35 years and mean GCS of 9 -12. There were 08 (53.33%) cases involving superior sagittal sinus, 02 (13.33%) transverse sinus, 02 (13.33%), sigmoid sinus 02 (13.33%), combine sigmoid and transverse sinus injury 01 (6.66%). Out of 15 patients, bleeding was controlled by sinus compression in 08 (53.33%) patient, ligation in 03 (20%), dural grafting in 03 (20%) and repair with saphenous venous graft in 01 (6.66%) patient. 01 (6.66%) death, 02 (13.33%) patients had CSF leak, hemiplegia in 02 (13.33%) patients and 01 (6.66%) patient had aphasia.
Conclusion: Hatchet combat injuries to venous sinus should be managed carefully with adequate exposure of the sinuses and securing hemostasis with simple compression, ligation, dural grafting or saphenous vein interposition graft
Keywords: Technical considerations, Cerebral venous sinus repair, Hatchet combat, Cerebral venous sinus

OP-NT.06-05

Ex Vivo Bone Flap Preservation: A Novel Technique for Resource Poor Scenarios

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Background: Conventional abdominal wall preservation of bone flap following decompressive craniectomy are widely associated with complications like wound infections, bone absorption and empyema. We present our experience with a novel method of ex-vivo bone flap preservation (BFP) and restoration.
Method: A retrospective study was conducted including patients who underwent autologous cranioplasty (AC) for traumatic brain injuries between January 2013 and December 2016. Bone flap was cleaned off soft tissues and preserved ex-vivo in spirit solution, sealed in air tight bottle and later before implantation was sterilised using ethylene oxide gas and restored using titanium plates. Outcome was analysed in term of ease of procedure and post-operative challenges, cosmesis, and graft take up.

Results: A total of 81 patients underwent AC with minimum of 1 year follow up. None of the bone flap was discarded due to poor bone quality. 2 patients developed post operative wound infection with one developing epidural empyema which was removed and acrylic cranioplasty was performed after 6 months. Graft was taken up well and fusion seen on post op scan. In 5 patients there was slight cosmetic deformity seen due to mini-plate projecting through temporal or frontal surface, without any consequences. There was no mortality in the series.
Conclusion: BFP is safe and efficacious technique as there are no graft preservation sites problems seen in conventional technique. Besides the graft remains in good health and fusion seems to be appropriate with good cosmetic outcome in our series.
Keywords: Autologous cranioplasty, Bone preservation, Storage

OP-NT.06-06

Hybrid Computer-Assisted Design Technique for Preoperative Modeling of Large Cranial Defect Titanium Implants – High-Standard Medical Care in Low Income Countries

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Background: A principal problem in large cranial defect alloplastic closure is repeating the exact topology of the skull. Computer-assisted design (CAD) of individual implants is the natural solution, but an expensive one. We present an alternative available for low income countries. A new hybrid technique, consisting of CAD and manual preoperative modeling of an individual titanium implant for large cranial defect alloplasty is proposed.
Method: The technique was used in 4 cases till the moment, first of them 2 years ago. The core of the method consists of 3D-printing of a PLA (PolyLactic Acid) CAD-model and manual shaping of titanium mesh to repeat the topology of the model. All patients were closely followed-up and interviewed about the cosmetics of the cranioplasty, presence of pain/discomfort and probability to choose again the same method.
Results: No postoperative complications were registered. In two patients, showing signs of the "syndrome of the trephined", rapid postoperative recovery was noted. In generally, the surgery time and the postoperative stay were shortened in comparison to the conventional alloplasty methods. The interview results were in favor of the new technique.
Conclusion: The preliminary results show high applicability of this new hybrid method for large cranial defect cranioplasty. The exclusion of the very expensive step of metal (Titanium) sintering or PEEK printing considerably reduces the cost while attaining the high-standard accuracy of the individualized computer design. Adding new cases to the series will help to improve the method and thoroughly assess its safety and efficacy.
Keywords: Cranioplasty, Alloplasty, Individualized titanium implant, Computer assisted design (CAD), 3D printing, Polylactic acid (PLA)

OP-NT.06-07

A Comparative Study Between Marshall and Rotterdam CT Scores in Predicting Early Deaths in Patients with Traumatic Brain Injury in a Major Tertiary Care Hospital in Nepal

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Background: CT plays a crucial role in the early assessment of patients with traumatic brain injury (TBI). Marshall and Rotterdam are the mostly used scoring systems, in which CT findings are grouped differently. We sought to determine the values of the scoring system and initial CT findings in predicting the death at hospital discharge (early death) in patients with TBI.
Method: There were consecutive 634 traumatic neurosurgical patients with mild-to-severe TBI admitted to the emergency department of College of Medical Sciences. Their initial CT and status at hospital discharge (dead or alive) were reviewed, and both CT scores were calculated. We examined whether each score is related to early death; compared the two scoring systems' performance in predicting early death, and identified the CT findings that are independent predictors for early death.
Results: Both imaging score (Marshall) and clinical score (Rotterdam) can be used to reliably predict mortality in patients with acute traumatic brain injury with high prognostic accuracy. Other specific CT characteristics that can be used to predict early mortality are traumatic subarachnoid hemorrhage, midline shift and status of the peri-mesencephalic cisterns.
Conclusion: Marshall CT classification has strong predictive power, but greater discrimination can be obtained if the individual CT parameters underlying the CT classification are included in a prognostic model as in Rotterdam score. Consequently, for prognostic purposes, we recommend the use of individual characteristics rather than the CT classification.
Keywords: Marshall score, Rotterdam score, Outcome, Head injury

OP-NT.06-08

Role of Bromocriptine in Multispectral Manifestations of Traumatic Brain Injury

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Background: Despite the prevalence and cost of TBI-related disabilities there is a paucity of literature reviewing modern approaches to pharmacotherapy. There is, however, growing evidence that medications may speed recovery by enhancing some neurological functions without impacting others. Herein we discuss the role of bromocriptine as an imperative means to provide neuro-rehabilitation in patients with traumatic brain injury.
Method: 36 selective nonsurgical cases of traumatic brain injury in state of minimally conscious state were enrolled in the study. Positive result was determined by improvement in the GCS score of 2 and British Medical Council motor power by at least 1 point. Improvements of deficits were evaluated in terms of fluency of speech for aphasia, task switching, digit span double tasking and trail-making test for cognition and attention and lastly Functional independence Motor score for motor functioning and self independence.

Results: Accelerated in arousal was seen in 8/17 (47.0%) cases over 4- 40 days. In 7/17 (41.2%) cases, GOS improved to 4/5 in 90 days. Improvement in hemi paresis by BMC grade of at least 1 was seen in 5/9(55.6%) of cases in a period of 40 days. Aphasia improved in 4/5 (80%) cases over 7- 30 days. Moderate improvement in cognitive impairment was seen in 2/3 (66.7%) cases in 14-20 days.
Conclusion: Bromocriptine improves neurological sequelae of TBI as well as the overall outcome in the patients. It can be the missing link in the puzzle to resolve the neuro-rehabilitational aspects of certain selected neurosurgical patients.
Keywords: Bromocriptine, Neuro-rehabilitation, Outcome

OP-NT.06-09

Progression of Cerebral Contusion/Hematoma on 2nd CT Scan and Their Outcome, in Patients of Traumatic Head Injury

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Background: Traumatic expansion of cerebral contusion/hematoma often occurs in early hours of traumatic impact which can lead to irreversible neurological functions. Aim of our study is to find risk factors associated with expansion of cerebral contusion/hematoma on repeat 2nd CT Scan and their outcome.
Method: This study was conducted from Jan 2014 to July 2014 in Neurosurgery ward Liaquat University hospital Hyderabad. 40 patients were included in this study with traumatic cerebral contusion/hematoma on intial CT SCAN. An intial neurological examination including GCS was performed on admission. Repeat CT scan was done within 24 hours of traumatic brain injury. Expansion of contusion hematoma was measured with ABC/2 method. Risk factors causing expension of hematoma were assessed and their outcome was recorded.
Results: Age range was between 16 to 65 years. Out of 40 patients 35 were male and 5 were female. Hematoma expasnsion occurred in 16 patients (40%) while in remaining 24 patients (60%) it slowly resolved. Majority of expanding hematomas 12 (75%) out of 16 were associated with RTA and remaining were associated with H/O fall and assault. 11 patients (68.75%) out of 16 had GCS of 8 or below while remaing 5 patients (31.25%) had GCS of 9-12.None of patient with GCS 14-15 had expending hematoma.2 patients (12.15%) with expanding hematoma and GCS below 8 died.
Conclusion: Cerebral hematomas expand in early periods of traumatic insults. Chances of expansion increase with severity of trauma and poor GCS.
Keywords: Contusion, GCS, Expansion, Subdural hematoma

OP-NT.07-01

Skull and Brain Gunshot Wound during the Armed Conflict in Eastern Ukraine. Optimization of Medical Care

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Background: A prospective study of the results of treatment of 132 patients with gunshot traumatic brain injury (GTBI), who were admitted during the period from May 2014 to December 2015, has been conducted.
Methods: Surgical tactics issues, complications frequency and nature, reasons for reoperation, mortality among the injured, ways to improve the medical care delivery have been studied.
Results: 93 (70.5%) patients had penetrating traumatic brain injuries (TBI) with the dura injury, and 39 (29.5 %) – nonpenetrating TBI. Injuries with mine and explosive devices debris were diagnosed in 115 (87.1%) patients, and injuries with small arms bullets – only in 17 (12.9%). On the basis of own experience and analysis of the literature data about GTBI treatment, 12 main operation stages have been distinguished. During penetrating injuries surgical debridement all devitalized tissues - detritus, blood clots, aggressive lesions, foreign matters – shall be radically removed; primary reconstruction of the skin, dura, skull base and skull cap shall be used widely. In the conducted study, Among 132 patients 16 (12.1%) persons died. All 39 patients with nonpenetrating TBI survived. Among patients with penetrating TBI mortality rate made 17.2%.
Conclusion: The main task of the surgery for penetrating traumatic brain injuries is its execution by the neurosurgeon to the full extent during a single surgery. A perspective direction to improve the results of treatment of patients with head wounds is the realization of conception of the early specialized neurosurgical service with the usage of the early reconstructive neurosurgery tactics.
Keywords: Skull and brain gunshot wound, Armed conflict, Optimization of medical care, Penetrating injuries, Gunshot traumatic brain injury

OP-NT.07-02

Analysis of Epidemiologic Data of Head and Spine Injury in Ten Years of Telemedicne Experience in the North-West area of Emilia Romagna Region of Italy

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Background: In the last years a decrease of trafic accident and an increase of fall and suicide has been observed by the Italian National Istitute of Statistic.The aim of this study is to report the modified epidemiology of patients admitted for head and spine injury in the last ten years of telemedicine experience of the North-West area of Emilia Romagna region has been analyzed. This geographical area is extended for 100 Km2, with 1.400.000 inhabitans. The territorial organization of health care provides a Level I Trauma Center (HUB), a Level III Trauma Center with Neurosurgeon 12h on duty/12h on call (NSPOKE) and 9 peripheral hospitals with CT scan 24h (SPOKE).
Method: In this retrospective observational study two 2-years periods one from June 2007 to July 2009 versus one from July 2014 to June 2016 has been compared.

Results: The number of telecounselling increased of 112,6%, from 865 in the previous period to 1839 in the last period. Telecounselling for head trauma diminished less than 1%, meanwhile the spinal trauma telecounselling increased from 8,7% to 16,2%. Notwithstanding the transferral rate is diminished from 21.6% of the first two years to 17.7% in the last two years an increased number of the overall patient centralized to the HUB has been observed (73,8%)**:** in the last period 138 patients were centralized mor than previous period.
Conclusion: In a telemedicine territorial health care system a management of the spine trauma should be relevant as much as the protocols of transferral a traumatic brain injury
Keywords: Telemedicine, TBI, Spine trauma, Transferral protocol, Hub & Spoke system

OP-NT.07-03

Neurosurgeons Performing Tracheostomies - Maintaining Proficiency in the Modern Era

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Background: Tracheostomy is a basic surgical procedure that most surgeons, regardless of specialty, learn early in their training. With improvements in intensive care medicine, the number of neurosurgical patients requiring tracheostomy has declined. As neurosurgeons advance in their training, familiarity with airway management declines and falls under the domain of other specialties. Because neurosurgeons still manage critically ill patients, they often defer the airway management to other specialists. In many institutions, neurosurgeons no longer perform tracheostomies. The purpose of this study was to evaluate complications and outcomes following tracheostomies performed by neurosurgeons.
Methods: We reviewed a database of all neurosurgical procedures performed at a single institution from 9/2007 to 2/2017. We reviewed the operative and medical records of patients whose tracheostomies were performed by a neurosurgeon.
Results: Neurosurgeons performed 65 tracheostomies over the study period. All of the procedures were done in an operating room using traditional open technique. Four patients had previous tracheostomy. Five patients were on dual antiplatelet therapy. The procedure was successful in all patients. There were no immediate complications in any patient. One patient required revision one week later for impending tracheal erosion.
Conclusion: Tracheostomies can be performed safely by neurosurgeons in this era of subspecialization. There is a renewed interest in maintaining critical care proficiency in neurosurgery. Airway management is an important part of this skill-set. Neurosurgeons manage patients with brain injuries, cranial nerve deficits, and cervical spine injuries, Consequently, learning how to establish a surgical airway remains necessary in neurosurgical training.
Keywords: Tracheostomy, Airway, Neurocritical care

OP-NT.07-04

A Guide for Management of Firearm Brain Injuries, Local Experience of 126 Cases at Sohag University Hospital

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Background: Traumatic brain injury (TBI) caused by firearm head injury is a complex injury with a broad spectrum of symptoms and high rates of mortality and morbidity. This study presents an evaluation of TBI caused by foreign body penetration wounds and discusses possible predictive factors for the outcome of surgical intervention.
Method: We reviewed the medical records of 126 patients in the Department of Neurosurgery of Sohag University hospital diagnosed with traumatic firearm brain from January 2009 to December 2015. These patients were evaluated as regard to**:** age, sex, Glasgow Coma Scale (GCS) on admission, brain region affected, type of injury, and the type of treatment and outcome.
Results: Almost all patients (74.6%) were male, and the mean patient age was 22.3 years. Wounds were caused by bullet in 72.2 percent of patients. The Glasgow Coma Scale (GCS) score at admission was below 8 in 38 patients (30%) and above 8 in 12 patients (70%). In total, 36 patient (28.5%) died despite surgical management, with diffuse brain injury the most common cause of death.
Conclusion: Low GCS scores, ventricular injuries and bihemispheric injuries are correlated with poor prognosis. Early and less invasive surgery in conjunction with short transportation time to the hospital could decrease mortality rates.
Keywords: Traumatic brain injury, Gunshot wounds, Bullet, Surgery, Prognosis, Brain injury

OP-NT.07-05

The Circadian, Circaceptan and Cirannual Variation of Traumatic Brain Injury Occurrence

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Background: It has been reported that TBI incidence peaked during the third quarter of the year and there were three peaks of patient admissions during the day. However, there is no detailed information about circadian variations of TBI occurrence. The aim of our study was to analyze the circadian rhythm and diurnal, weekly seasonal variations in the occurrence of TBI.
Method: Consecutive TBI admissions to the West China Hospital were analyzed from 2009–2012. 815 cases were analyzed by single cosinor method according to different classification to identify the circadian rhythm. The circannual and circaceptan variation were tested by Chi-squared, respectively.
Results: The result showed that there were 622 men (76.3%) and 193 women (23.7%), 174 juveniles (21.3%), 552 adults (67.8%) and 89 seniors (10.9%), 338 low-literacy (41.5%) 391 mid-levels (47.9%) and 86 high-levels (10.6%), in subjects in our study. We found that the circadian rhythm of TBI occurrence time in all subjects as a whole was prove to be exist (p=0.000). Additionally, the existence

of circadian rhythm in male (p=0.000), female (p=0.001), juvenile (p=0.001), adults (p=0.000), seniors (p=0.006), low-literacy (p=0.012) and mid-literacy (p=0.000) all prove to be with statistical significance, while high-literacy subgroup showed no statistical significance (p=0.162).The monthly TBI distributions were with statistical difference among age-subgroups (p=0.032) and literacy-subgroups (p=0.020), but have no relationship between male and female (p=0.155). The circaceptan TBI occurrence distributions showed no significant difference among all subgroups.
Conclusion: The TBI incidence accord with circadian rhythm and the monthly incidence has some certain relationship with age and education Background.
Keywords: Circadian, Circaceptan Circannual, Rhythm, Occurrence time, Traumatic brain injury

OP-NT.07-06

Minor Injury on the Head Accompanies Major Impact on the Brain and Mind-the Post-traumatic Emotional Disorder After Mild Traumatic Brain Injury and the Prediction Model in a Two-Year Follow-up Study

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Background: Mild traumatic brain injury (mTBI) is defined as minor injury to the brain without significant damage after accident. However, emotional disorders, such as anxiety, depression, dizziness and insomnia may be accompanied after mTBI. Rare long-term study discussed the occurrence of post-traumatic emotional disorders (PTED) and the prediction model of these after mTBI.
Method: We conducted a prospective observation and comparison cohort study between 2010 and 2016. The study group was included as adult with acute mTBI within one week. The control group was included as adult healthy volunteers without new mTBI. They were assessed with emotional questionnaires and serum biomarker while brain MRI was additional in study group. Both groups were followed in 1, 6, 12 weeks and 6, 12, 24 months.
Results: We recruited 511 cases in study group and 276 cases in control group. The mTBI cases were more vulnerable to present post-traumatic anxiety compared to healthy controls (49% vs 0%, p <0.001). The mTBI group had also higher post-traumatic depression rate than control group (41% vs 1%, p<0.001), especially in the female population (p<0.005). The prediction model demonstrated that once mTBI cases had more than 3 of 7 risk factors (female, age > 30 years, cigarette smoking, alcohol consumption, vehicle injury, higher BMX level in serum biomarker, and microbleeder in brain MRI), they were more vulnerable to have more than one of PTED.
Conclusion: We showed the long term outcome of post-traumatic emotional disorder and demonstrated an effective prediction model for these mTBI populations.
Keywords: Anxiety, Depression, Insomnia, Mild traumatic brain injury, Post-traumatic emotional disorder, Prediction model

OP-NT.07-07

Predictors of Survival and Fatality in Traumatic Brain Injury Patients at a University Teaching Hospital in South Africa

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Background: Predictors of survival and fatality in traumatic brain injury patients at a University teaching Hospital in South Africa. Interpersonal violence is a major cause of traumatic brain injury in South Africa. Indeed the consequences of traumatic brain injury are severe and the outcomes are often poor in moderate to severe injuries. Various models developed to predict outcomes in TBI have been based on clinical profiles, however they still have major limitations. Biochemical and physiological changes occur in traumatic brain injury especially in patients with moderate to severe head injury. Trauma induces basic inflammatory and oxidative stress changes, aggressive neurosurgical and neurocritical care management of traumatic brain injury patients, improves the anti-oxidant status and the inflammatory response and may result in better clinical outcomes in these patients. The aim of this study was to identify independent predictors of recovery of functional status and fatality in patients with moderate to severe TBI.
Method: Patients with moderate to severe traumatic brain injury were managed at the Nelson Mandela Academic Hospital during the period between march 2014 - march 2016. During the post-operative management in the intensive care unit, blood and cerebrospinal fluid were sampled daily for evaluation of oxidative stress and inflammatory biomarkers for 7 days. The admission GCS as well as the GOS at 2 weeks and 12 weeks were tabulated.
Conclusion: Biomarkers including serum and CSF superoxide dismutase, total anti-oxidant capacity and, interleukins correlated with the clinical profiles and outcomes.
Keywords: Traumatic brain injury, Fatality, Survival, Age, Biomarkers

OP-NT.07-08

Reconstruction of Orbital Fractures in Patients with Craniofacial Trauma

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Background: Trauma to the face frequently results in orbital fractures which may range from a small isolated "blowout" fracture to major destruction of the entire orbit. Many studies have emphasized the importance of accurate anatomic reconstruction of both bony orbital volume and shape to achieve normal eye position and function following injury.It is now thought that inadequate initial reconstruction of orbitalvolume (rather than fat atrophy) is one of the most important reasons for unsatisfactory eye position postoperatively.. Plates are thought provide better stability than traditional wire fixation. Micromeshes are also beneficial in building up the fragile bony orbit around the eye and its adnexae This study emphasises the use of these devices in management of

orbital fractures'. Background**:** fractures of the orbital walls can occur in isolation or association with other facial fractures. The article evaluates the use of titanium micromesh and plate in orbital reconstruction after traumatic injury.
Method: 13 patients with orbital fractures were included in the study; clinical and radiographic examination including C.T. scan were performed for all patients. Early repair was the policy to treat those patients. Rim fractures were stabilized by titanium microplating system while wall defects were reconstructed using titanium micromesh and wiring.
Results: Normal eye function without diplopia or restricted motility was noted in II patients. Normal globe position was seen in 12 patients while enophthalmos persisted in one patient.
Conclusion: Titanium micromesh and plate system wiring proved to be good alternative to in orbital reconstruction.
Keywords: Craniofacial, Reconstruction, Orbital fractures

OP-NT.07-09

Definition of Clinically Tight Posterior Cranial Fossa with Traumatic Brain Injury

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The posterior cranial fossa is formed by the occipital and two temporal bones, being an integral part of the base of the skull. The borders of the posterior cranial fossa are**:** in front - the base of the back of the Turkish saddle, along the edges on both sides - the upper edges of the pyramids, behind - the sulcus of the transverse sinus of the occipital bone, from above - the cerebellar nest.
At the present time, the developed formula was used to determine the volume of the DCF**:**
$V = 1/3\ S \times (b + c\ (a2 + ae + e2) / a2)$
where $S = \pi ad / 4$; A - length, b-height of the cerebellum, e - longitudinal size of the occipital orifice, c- height, d - width. The volume of FFW was calculated as the sum of the volumes of two truncated cones.
When analyzing the obtained craniometry data, we found that the dimensions of the RFI in the studies are from 110 cm^3 to 218 cm^3, an average of 158 cm^3. The statistical deviation was 19.14.
Thus, a hematoma of 25 cm^3 for an AST in a volume of 140 cm^3 is 18% and for a volume of 240 cm^3-10%.
The volume of the hematoma is not a direct indicator for surgical treatment, the indication for the operation is the ratio of the volumes of hematoma and DCW equal to more than 14%.

OP-NV.01-02

Neuro-Regeneration Therapy Using Human Muse Cells is Highly Effective in a Mouse Intracerebral Hemorrhage Model

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Background: A novel type of non-tumorigenic pluripotent stem cell, the Muse cell, resides in connective tissue and in cultured mesenchymal stem cells (MSCs) and is reported to differentiate into multiple cell types according to the microenvironment to repair tissue damage. We examined the efficiency of Muse cells in a mouse model of intracerebral hemorrhage (ICH).
Method: Seventy microliter mouse cardiac blood was stereotactically injected into the left putamen of immunodeficient mice. Five days later, 2 x 10^5 of human bone marrow MSC-derived Muse cells or cells other than Muse cells in MSCs (non-Muse) or the same volume of PBS were injected into the ICH cavity. Water maze and motor function tests were implemented for 68 days and immunohistochemistry for NeuN, MAP2 and GFAP was done.
Results: The Muse group showed impressive recovery**:** recovery was seen in the water maze after day 19, and motor functions recovered after 5 days compared with the other two groups, with a significant statistical difference ($p<0.05$). The survival rate of the engrafted cells in the Muse group was significantly higher than in the non-Muse group ($p<0.05$) at day 69, and those cells showed positivity for NeuN (~57%) and MAP-2 (~41.6%).
Conclusion: Muse cells could remain in the ICH brain, differentiate into neural-lineage cells and restore functions without inducing them into neuronal cells by gene introduction and/or cytokine treatment prior to transplantation. A simple strategy, namely the collection of Muse cells and their supply to the brain in the naïve state, facilitates regenerative therapy in ICH.
Keywords: ICH, Neuronal regeneration, Multi-lineage differentiating stress enduring cell, Mesenchymal stem cells, Water maze, Neural differentiation

OP-NV.01-03

The Effect of Mannitol on Cerebral Vasospasm Following Subarachnoid Hemorrhage in an Experimental Rabbit Model

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Aim: To examine the effects of mannitol, an osmotic diuretic agent in experimental models of subarachnoid hemorrhage(SAH) in rabbits. Mannitol is used frequently in the event of increased intracranial pressure.
Method: In this study a total of 28 New Zealand white rabbits were used. Rabbit Group 1 [control, n = 7] and Group 2 [SAH (+), n = 7] Group 3 [SAH (-) 20% Mannitol (+), n = 7] Group 4 [SAH (+) 20% Mannitol (+), n = 7] were divided into 4 groups. SAH has created one of the rabbits in groups 2 and 4 cisterns manga given the autologous arterial blood. Group 3 and 4 rabbits were 1g/kg/day intravenously for 3 days, 20% mannitol in 4 equally divided doses. All rabbits were sacrificed 72th h after the formation of SAH in the brain and brain stem were removed globally and fixed.
Results: The resulting thickness of basilar artery cross-sectional vessel, the vessel diameter, lumen diameter and lumen cross sectional area and total vessel area was measured. There was no significant difference between the 1,3,4. groups in terms of vessel wall thickness ($p=0.01$). Among all groups, maximum vessel wall thickness was measured in the group 2. Compared to Group 1 and 3,

there was no significant difference between the basilar artery lumen diameter (p=0.46).There was no significant difference between the basilar artery lumen cross-sectional area (p=0.08).
Conclusion: Mannitol therapy on developing experimental models of cerebral vasospasm after subarachnoid hemorrhage has been found to have any beneficial or adverse effects.
Keywords: Subarachnoid hemorrhage, Cerebral vasospasm, Mannitol, Basillar artery, Experimental subarachnoid hemorrhage model

OP-NV.01-04

A Chronic Cerebral Hypoperfusion Model with Cerebral Blood Flow Reduction, Angiogenesis and Cognitive Impairment in Rats

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Background: Bilateral stenosis/occlusion of common/internal carotid artery has been frequently used to mimic cognitive deficit of vascular dementia (VD). However, in these models, the cerebral blood flow (CBF) drops sharply after ligation of common carotid arteries (CCAs), which differs from 'chronic' cerebral hypoperfusion. Other modified techniques were applied by staged occlusion of both CCAs costing a longer procedure, and others used microcoils for CCA stenosis with hazardous effect on arterial endothelium. To overcome the problems described above, we developed a new model of chronic cerebral hypoperfusion (CCH) in rats.
Method: Male Sprague-Drawly rats were subjected to one side occlusion and contralateral side stenosis of CCA. Cortical regional CBF (rCBF) was measured using laser speckle flowmetry. The rats were assigned to CCH and sham operation groups. After 4 weeks, cognitive function was assessed and cervical/intracranial arteries as well as parenchymal injury were evaluated by MRI. Then rat brains were histologically evaluated.
Results: Gradual CBF reduction was observed in the CCH group. Cellular density decreased in the hippocampus as well as the cerebral cortex, whereas MRI revealed no cerebral infarctions. Immunohistochemistry demonstrated upregulated inflammatory cells and angiogenesis in the hippocampus and cerebral cortex. Spatial learning and memory impairment was significantly high in the CCH group.
Conclusion: We established a new model of CCH in rats. The model is easy and reproducible, and may be useful to investigate VD and CCH as well as pathology of angiogenesis.
Keywords: Cerebral hypoperfusion, Angiogenesis, Cognitive, Inflammation

OP-NV.01-05

Apolipoprotein E Epsilon 4: A Possible Risk Factor of Intracranial Pressure and White Matter Perfusion in Good-Grade Aneurysmal Subarachnoid Hemorrhage Patients at Early Stage

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This study evaluate the potential association in effects of the APOE allele on the early brain injury (EBI) in light of elevated ICP and cerebral perfusion disorders in a consecutive series of noncomatose Chinese patients with aSAH. A total of 122 patients with aSAH (54 males and 68 females) were enrolled. Demographic and clinical data were collected. We measured ICP before microsurgical clipping or endovascular coiling during the first 72 h after aneurysm rupture. CTP examination in patients was performed before treatment. In this study, 68 patients (55.7%) had a normal ICP, whereas 54 (44.3%) had an elevated ICP. Fourteen of 21 patients with APOE ε4 had an elevated ICP, which was significantly different from those without APOE ε4 (p =0.03). The patients with the ε4 allele had a higher incidence of elevated ICP (p =0.009, 95%, CI =1.481-15.432, OR =4.780) than those without this allele. For CTP measurements, a lower mean cerebral blood flow (CBF) (difference, -4.74; 95% CI, 0.53 to 8.94 s, p=0.03), longer mean transit time (MTT) (difference, 0.47; 95% CI, -0.87 to -0.78, p=0.02) and time-to-peak (TTP) (difference, 2.29; 95% CI, -3.64 to -0.93 s, p=0.02) were observed in patients with ε4 allele than in those without in the internal cupsule regions. In conclusion, the APOE ε4 allele predisposes patients to elevated ICP and perfusion disorders in white matter regions during the first 72 h after aSAH. The presence of an APOE ε4 allele plays an important role in the early brain injury response to aSAH.
Keywords: Subarachnoid hemorrhage, APOE, Intracranial pressure, Cerebral perfusion

OP-NV.01-06

Study of Thymosin Alpha 1 and Its Effect in Postoperative ICH Patients

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Background: Thymosin alpha1 (Tα1) is considered as a promising immunomodulatory drug. Here our study is to evaluate the potential safety and efficacy of Tα1 for patients with ICH and its outcome.
Method: Eighty two spontaneous ICH patients admitted in the West China Hospital Neurointensive care unit (NICU) during March 2014 to Feb 2015 were enrolled as prospective randomized study. They were randomly divided into treatment group (52 cases) and control group (30 cases). The control group were given regular conventional treatment. The treatment group received conventional treatment plus immunomodulation therapy including Tα1 (1.6 mg subcutaneous twice a week till three weeks).They were assessed and managed with Tα1 by measuring peripheral blood, CD4+, CD8+ lymphocyte subsets, total count and lymphocytes count at hospital admission (t0), 5 days (t1), and 10 days or later (t2). The

relationships of immunological and Thymosin alpha1 to clinical outcome were evaluated.
Results: Two groups were matched each other's. The treatment group showed significant improvements with increased CD4+ CD8+ lymphocyte subsets and total count after initiation of treatment. The outcome was evaluated with modified Rankin score and found that Thymosin group 35 (67.3%) had better outcome than control group 12 (40%).In addition, pro inflammatory mediators IL-2R also significantly changes with treatment group than control group.
Conclusion: Ta1 appeared to increase levels of IL-2R and T lymphocytes subset in a group of patients with ICH, and assisted to lower the possibility of postoperative nosocomial pneumonia. Ta1 has been sound tolerated by ICH patients and has no any significant side effects.
Keywords: Immunomodulatory therapy, Intracranial hemorrhage, Thymosin alpha1

OP-NV.01-07

Detection of Spreading Depolarizations in the Early Phase of Subarachnoid Hemorrhage via Laser Speckle Contrast Imaging in Mice

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Background: Spreading depolarizations (SD) have been shown to occur in more than half of the patients with subarachnoid hemorrhage (SAH) and found to correlate with delayed ischemic neurological deficits. In contrast to healthy brain, SD is accompanied by vasoconstriction (i.e. spreading ischemia) in compromised tissue (e.g SAH). Here, we aimed to investigate whether SDs occur in the hyperacute phase following SAH and how cerebral blood flow (CBF) respond to SDs.
Method: Fifteen Swiss albino mice (25-40 g) were used (10 SAH, 5 sham)Under isofluraneanesthesia, the cranium overlying both hemispheres was thinned. SAH was induced with endovascular filament perforation method. Continuous imaging of cortical CBF changes from both hemispheres was performed immediately after SAH induction for 90 minutes with laser speckle contrast imaging (LSCI). In sham group (and also in SAH group, if SD did not occur spontaneously), SD was induced by pinprick and CBF responses were recorded by LSCI.
Results: Induction of SAH produced an abrupt, significant hypoperfusion in both hemispheres, albeit more severe in ipsilateral. Sixty percent of animals had at least one SD in the ipsilateral hemisphere. In three animals (30%), SDs also emerged in the contralateral hemisphere spontaneously. Additional three animals (30%) had SDs in the contralateral hemisphere in response to pinprick-induced SD in the ipsilateral hemisphere. SD was accompanied by spreading ischemia in virtually all animals with SAH.
Conclusion: This study shows that the induction of SAH causes recurrent SDs, which aggravated early cerebral ischemia, in both hemispheres during the early phase of SAH.
Keywords: Subarachnoid hemorrhage, Cerebral microcirculation, Laser speckle contrast imaging, Cortical spreading depolarizations

OP-NV.01-08

Effect of Tadalafil on Vasospasm After Experimental Subarachnoid Hemorrhage

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Aim: To investigate the effectiveness of tadalafil, which is a potent, selective and reversible phosphodiesterase type 5 (PDE-5) enzyme inhibitor, on the vasospasm developed after experimental subarachnoid hemorrhage (SAH).
Method: Rats are divided into 5 different groups as saline, SAH, SAH + tadalafil 5mg/kg, SAH + tadalafil 10mg/kg and SAH + tadalafil 15 mg/kg. In saline group; salin was given into cistern magna and tadalafil solvent (10% DMSO) was administered intraperitoneally. Autologous arterial tail blood in SAH and SAH+drug groups were given into cistern magna. Tadalafil in SAH+ drug groups were applied via intraperitoneally. Basilar arteries were investigated at third and seventh days. In all groups, vessel wall thickness, lumen space and the quantity of apoptosis in the basilar artery wall were examined.
Results: Tadalafil at all doses reduced the formation of vasospasm in the vessel wall thickness and lumen spaces (3rd and 7th days). Tadalafil markedly reduced the occurrence of early apoptosis (3rd day), meanwhile it showed no effect in the late apoptosis (7th day) at low dose (5-10 mg/kg). Also high dose tadalafil (15 mg/kg) reduced the occurrence of late apoptosis.
Conclusion: Tadalafil has a beneficial effect in treatment of cerebral vasospasm following experimental SAH. If further investigations support our results, tadalafil may be useful agent in treatment of aneurysmal SAH.
Keywords: Tadalafil, Apoptosis, Experimental, Subarachnoid hemorrhage

OP-NV.01-09

The Comparison of Bemiparine Sodium and Dabigatran Etexilate Substances After Anastomosis Which Made in the Rat Carotid Arteries on the Development of Neointima and Thrombolytic Efficacy

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Background: The results of reperfusion after ischemia occurring in oxygen reaching ischemic tissue, increasing reactive oxygen species can cause secondary damage. Therefore, revascularization before infarct development will be decreased the degree of morbidity.

Dabigatran is a direct thrombin inhibitor. Bemiparin sodium is a second generation low molecular weight heparin. Because of these we researched and compared bemiparin sodium and dabigatran etexilate substances after anastomosis which made in treat carotid arteries on development of neointima and thrombolytic efficacy.
Method: In our work, randomly chosen, Sprague-Dawley type, male or female 24 rats used. The rats right side carotid artery was used for anastomosis an the left side carotid artery was used for controlling. Then the carotid artery was dissected and transected. Anastomosis was applied with 10/0 polypropylene suture. The rats were seperated into 3 groups. Group 1 were control group. Group 2 were dabigatran group which 10 mg/kg dose of dabigatran etexilate were given oral gavage. Group 3 were bemiparin group which 250 IU/kg dose of bemiparin sodium were given subcutaneously. After seven days treatment, the right carotid artery which were anastomosis and the left carotid artery which were not anastomosis were removed and sent to patology laboratory.
Results: Bemiparin sodium used after anastomosis caused less thickening of tunica media and reduced intimal hyperplasia, but didn't decrease lumen diamater and area. Dabigatran etexilate increased edema and inflammation, but didn't prevent intimal hyperplasia.
Conclusion: Bemiparin reduced intimal hyperplasia, prevented thrombosis angiogenesis but dabigatran didn't prevent intimal hiperplasia and its anticoagulation effect was more than antithrombotic effect.
Keywords: Anastomosis, Intimal hyperplasia, Restenosis, Bemiparin sodium, Dabigatran etexilate

OP-NV.02-01

Safety of Neuroendovascular Procedures in Patients with Renal Insufficiency

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Background: The incidence of contrast induced acute kidney injury (CI-AKI) is low for the general population (~2%). However, in patients with high risk factors such as pre-existing renal insufficiency (glomerular filtration rate < 60 mL/min) and diabetes mellitus (DM), this incidence can reach up to 50%. We present our experience with patients with high risk factors for CI-AKI who underwent neuroangiogaphic procedures.
Method: We conducted a review of clinical and laboratory data on 2128 consecutive neuroangiographic procedures performed at our institutions from January 2012 to January 2016. Patients with baseline renal insufficiency were identified.
Results: One hundred eighty-three procedures were included in the analysis with 44 neuroendovascular interventions and 139 cerebral angiograms. All 183 patients (mean age 65 years, 74 males, 109 females) had renal insufficiency with 55 (30%) having DM. Mean baseline estimated GFR was 45 mL/min and thirty patients had baseline estimated GFR < 30 mL/min. Mean contrast volume injected was 71 mL (range 15 – 225 mL). Mean estimated GFR 48-72 hours after the procedure was 51 mL/min. One patient (0.5%) had acute kidney injury (AKI) following a cerebral angiogram.
Conclusion: In our experience, neuroendovascular procedures are safe and not contraindicated in patients at high risk for CI-AKI. All our high risk patients received intravenous volume expansion prior to and after the procedure for at least 2 hours. Catheters were aspirated after each run to minimize volume of contrast. Rotational 3D angiography was avoided whenever possible.
Keywords: Contrast, Neuroendovascular, Renal insufficiency

OP-NV.02-02

Transarterial Coil Embolization of Direct High Flow Carotid Cavernous Fistula

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Background: Type A Carotid Cavernous Fistula (direct CCF) represent an abnormally high flow arteriovenous communication between internal carotid artery (ICA) and cavernous sinus (CS), usually resulting from tear in the carotid wall. This study reports and validates efficacy and safety of trans-arterial embolization of direct high flow CCF by coils instead of balloons as primary modality of treatment.
Method: Between December 2010 and December 2016, a total of 12 patients (10 male & 2 Female) Direct CCFs were treated by endovascular trans-arterial approach by coils. Patients were followed up for at least 6 months.
Results: Complete obliteration of fistula was achieved in 12 patients (100%). one patient had partial recanalization during the period of follow up and needed a second session. There were no treatment related morbidity or mortality.
Conclusion: Coil embolization is an effective and safe alternative to balloons for treatment of direct high flow CCF. Advantages of coils including easy access, control, adjustment, deployment, retrieval, reposition, availability of different thickness, sizes, lengths and shapes.
Keywords: Transarterial, Coil embolization, Direct high flow carotid cavernous fistula

OP-NV.02-03

Using of Modern Endovascular Methods and Techniques in Treatment of Complex Aneurysms

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Aim: To study the using of modern endovascular methods and techniques including ballon-assisted, stent-assisted, dual-catheterization coilling and flow-diverting devices for correct selection and treatment of patients with compex shape, difficult vessel strucrure aneurysms.

Method: The results of 80 patients (37 (46.25 %) men, 43 (53.75 %) women) with 85 aneurysms with compex shape and difficult vessel strucrure treated with modern endovascular methods and techniques including ballon-assisted, stent-assisted, dual-catheterization coilling and flow-diverting devices within 2011–2015 years in our clinic, The mean age of the patients was 46 years.
Results: Comparing intraoperative and retrospective findings (control cerebral angiography in 6–24 months) shows that Type I by modified scale of Raymond–Roy of aneurysms have achieved in 46 (58.9%) cases, type II in 26 (33.3 %), type III in 6 (7.8 %), In 7 cases flow-diverting devices were implanted. These cases don't include in modified scale of Raymond–Roy.
Conclusion: Intraoperative as well as control Digital Substraction Angiography in 6–24 month shows that balloon assisted and dual catheterization technique allows to achieve maximal occlusion of brain aneurysm with coil stabilization, in case of stent assisted technique, most in middle size aneurysms even in incomplete occlusion, Digital Substraction Angiography shows total occlusion with coil stabilization. Therefore modern endovascular methods and techniques including ballon-assisted, stent-assisted, dual-catheterization coilling, flow-diverting devices and correct selection of the patients with compex shape, difficult wessel strucrure brain aneurysms gives us possibilities to solve the problem with minimal risk, find the best way for treatment and improve the final outcome.
Keywords: Endovascular treatment, Brain aneurysm, Protect balloon, Protect stent, Flow- diverter, Dual-catheter

OP-NV.02-04

Endovascular Treatment of 102 Unruptured Middle Cerebral Artery Bifurcation Aneurysms

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Aim: To evaluate the results of endovascular treatment (EVT) of unruptured MCA bifurcation aneurysms which are relatively harder to treat endovascularly.
Method: From February 2013 to March 2017, we treated 90 consecutive patients with 102 unruptured MCA aneurysms (85 small, 17 large/giant) with EVT. Procedural and clinical data was evaluated retrospectively.
Results: Mean age was 52.9 years (range, 23–79 years 62 women). 84 aneurysms were treated by coiling (71 with assistance of another device), 18 with flow diverters. Permanent morbidity occurred in 3 patients (3.3%), there was no mortality. Follow-up was available in 82 patients (91.1%). One patient died from unrelated causes. There were 4 transient neurological events and 2 access related hemorrhagic events without sequela. At a mean follow-up of 15 months, 89 aneurysms were either stable or improved, 5 aneurysms had recanalized and were retreated without adverse events (4 with EVT, 1 surgically).
Conclusion: The use of new generation cerebrovascular stents and flow diverters improved the procedural results of EVT in unruptured MCA aneurysms. Follow-up results suggest that the treatment is durable at midterm. Long term results with these newer devices are awaited to determine if EVT can meet the high standards set by surgical treatment.
Keywords: Aneurysm, Middle cerebral artery, Endovascular

OP-NV.02-05

Endovascular Treatment of Symptomatic Vertebral Artery Dissecting Aneurysms

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Vertebral artery dissecting aneurysms (VADAs) are rare and many debates are present about treatment options. We review types and efficacy of our endovascular treatments and establish a safe endovascular therapeutic strategy in regard to the angio-architecture of VADAs. Between July 2008 and October 2015, we treated 22 patients with symptomatic VADAs. Fifteen patients presented with subarachnoid hemorrhage from the ruptured VADAs, digital subtraction angiography and magnetic resonance image confirmed the diagnosis and endovascular treatments were followed as their angio-architecture. Among the three different endovascular treatments, 12 patients (80%) were treated with VA coil trapping, 2 patients (13%) with stent-assisted coil embolization, and 1 (6%) patient with stent insertion alone. Clinical results were good in 13 patients (86.7%), and there were no technical problems during endovascular procedures. The other 2 patients with poor prognosis showed severe neurological deficits at the initial evaluation. There were no radiologic cure in one patient with stent insertion alone, but the patient had no significant clinical symptoms either. Endovascular treatments are safe and effective treatment option for managing VADAs and can be the first treatment of choice for most patients. Selecting proper endovascular treatment according to the angio-architecture of VADAs can reduce the risk of the treatment.
Keywords: Vertebral artery, Dissecting aneurysms, Embolization

OP-NV.02-06

Endovascular Treatment of Middle Cerebral Artery (MCA) Aneurysms as a First Option: A Single-Centre Experience

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Background: Controversy exists regarding the optimal management of middle cerebral artery aneurysms. Many units prefer surgical clipping for this location due to the easy surgical accessibility and the potential risks of aneurysm recurrence with coiling. Our institution adopts endovascular coiling as a first-line treatment modality and reserves surgical clipping for patients in whom coiling has failed. The objective of this study is to access the medium-term outcome of patients with middle cerebral artery aneurysms treated by endovascular means.
Method: This is a retrospective analysis of a prospectively maintained database. Consecutive patients admitted to the Department of

Neurosurgery at Inkosi Albert Luthuli Central Hospital from 2012 to 2015 who received treatment for a middle cerebral artery aneurysm were included. Data was analysed for patient characteristics, imaging findings, management, complications and outcome.
Results: A total of 32 patients were treated. 27 patients (84%) had saccular MCA aneurysms. The remaining 5 patients (16%) had other aneurysms (3 traumatic pseudoaneurysms following stab head injuries, 1 dissecting aneurysm in an HIV positive patient and 1 mycotic aneurysm in a patient with infective endocarditis). All 5 of these were treated by endovascular parent vessel occlusion (3 with coils and 2 with N-Butyl-CyanoAcrylate) with good outcome.
Conclusion: In our experience endovascular treatment of MCA aneurysms is safe, effective and durable. We recommend this as a first option, with surgical clipping reserved for the minority of patients who are not suitable for endovascular management.
Keywords: Middle cerebral artery aneurysms, Endovascular coiling, Surgical clipping

OP-NV.02-07

Neuroendovascular Treatment of Pial and Dural Arteriovenous Fistula: Our Experience

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Intracranial pial arteriovenous fistula (AVFs) are rare cerebrovascular lesions with a distinct entity; a disease of young patients. AVFs have a single or multiple arterial connections without an intervening nidus. Many of them have family history of associated Hereditary Haemorrhagic telengiectasia (HHT). Patients usually present with seizure or haemorrhage. Mortality is very high (about 63%) if treated conservatively. The reason for the comparatively low frequency of AVFs in adults would suggest either their early expression or their spontaneous asymptomatic thrombosis. Management of AVF is just to cut down the shunt either by surgery or by endovascular interventions. The indications, the time and the method of treatment chosen for the management of AVFs depend on a variety of factors such as the age at presentation, presenting symptoms, the status of the brain and the status of the other organs. Here we will present two cases of pial AVF treated by endovascular means. Both of them are young lady presented with bleed with poor neurology. We will also discuss two cases of traumatic carotid cavernous fistula (CCF) presenting with pulsatile proptosis and visual deterioration which were occluded by transvenous approach.
Keywords: Neuroendovascular, Pial, Dural, Arteriovenous, Fistula

OP-NV.02-08

WITHDRAWN

OP-NV.02-09

Results of Endovascular Treatment in Aneurysms Involving Anterior Choroidal Artery

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Anterior choroidal aneurysms constitute 2 to 5 percent of all intracranial aneurysms. They are difficult to treat. Morbidity and mortality ratios after treatment involving this localization are relatively higher compared to other sites were considered. The study involves 41 anterior choroidal artery aneurysms which were treated between 2012 and 2016. The study is focused on patency of anterior choroidal artery after treatment session and the clinical results. Apart from primary coiling, bioabsorbable stent, low profile or regular intracranial stents or flow diverters were also involved in the treatment sessions. Correlation between patency of anterior choroidal artery, clinical experience and postoperative complications were studied. In conclusion, early postoperative anticoagulation used prophylactically to keep anterior choroidal artery patent is an important strategy to handle complications.
Keywords: Anterior choroidal artery, Endovascular treatment, Endovascular surgery, ICA, Intracranial aneurysms

OP-NV.03-01

Management of Intracranial Serpentine Aneurysms: A Prospective Cohort Study

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Background: Serpentine aneurysm is a rare and challenging subtype of intracranial aneurysms. The treatment strategy remains controversial currently. We report our pilot experience and considerations about management of serpentine aneurysms in our institute.
Method: Data were collected of 13 consecutively enrolled cases with serpentine aneurysm since 2012. The management strategy was made individually by a team including two experts in endovascular intervention and three experienced neurosurgeons. The clinical presentation, outcome and follow-up data of all 13 cases were analyzed by one neurologist and two neurosurgeons blindly.
Results: Among 13 cases, Male**:** Female=6**:**7, age range 7-58 yo, 5 cases suffered bleeding, 3 complained ischemic symptoms, 2 presented with mass effect and 3 diagnosed incidentally. Aneurysms located at ICA/MCA in 4 patients, vertical/basilar artery in 2, ACA in 1 and PCA in 2 cases. With fully informed consent, 6 patients received surgical clipping with/without EC-IC bypass, 1 coiled after A3-A3 bypass, 1 received stent assisted coil and 3 cases choosing

close observation follow-up conservatively. No new neurological deficiency occurred in all cases received surgery or coil. Among three cases receiving observation, one case died suddenly 8 days after discharge, while the lesions of the other two cases remained stable after more than 18-month follow-up.
Conclusion: Clipping or trapping combined with bypass is safe, effective and promising for intracranial serpentine aneurysm. However, the pathogenesis and natural history of serpentine aneurysm remains to be elucidated. Further study is needed.
Keywords: Serpentine aneurysm, Microneurosurgical management, Bypass

OP-NV.03-02

Functional Approach for Brainstem Cavernomas: Surgical Results in the Era of Electrophysiology and Functional Imaging

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In this single-center retrospective study we compare the surgical results of a series of superficial and deep-seated CMB. 42 consecutive cases of CMB treated surgically within a 12-years period were reviewed. Neuronavigation and brainstem mapping were used to custom tailor the surgical approach and to determine a safe point of entry. IOM included MEPs and SEPs of the lower and upper extremities, facial EMG & MEPs, AEPs and EMG of the motor brainstem cranial nerves. The clinical outcome was assessed by the Glasgow Outcome Scale at the last follow-up. All patients suffered at least one hemorrhage before undergoing surgical treatment. Symptoms included headaches, hypaesthesia, gait disturbance, diplopia, facial palsy, hearing loss and difficulties in swallowing. Fourteen deep-seated lesions were 1 to 5 mm distant from the surface of the brainstem. Using 3D tractography, neuronavigation, brainstem mapping, and blunt microsurgical dissection under continuous intra-operative monitoring, total removal of the lesion was achieved in 24 patients (85,7%) in the superficial group and in all deep-seated lesions. New cranial nerve deficits were observed in four patients (14,28%) after surgery in the superficial group and 2 (14,28%) in the deep-seated. Out of four patients with incomplete removal of the cavernoma, all superficially seated, re-bleeding was observed in one patient during follow-up. Overall, the GOS improved from 4 to 5 after surgery. Our results show that a tailored approach guided by electrophysiology, navigation and sometimes tractography yields a high chance of total resection of CMBs even in deep-seated lesions, with low morbidity rates.
Keywords: Cavernous malformation, Brainstem, Surgical technique, Electrophysiology, Neuronavigation, Fiber tracking

OP-NV.03-03

Minimally Invasive Endoscopic Transnasal Ligation of Anterior Ethmoidal Artery: Technical Note

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Aim: To validate the feasibility of a novel minimally invasive endoscopic approach integrated with neuronavigation to perform ligation of anterior ethmoidal arteries (AEA).
Method: This descriptive study used ten preserved adult cadaveric heads (20 sides) injected with colored latex with high-resolution CT scans with appropriate protocol for neuronavigation. Subsequently, we perfomed a minimally invasive endoscopic transnasal approach assisted by frameless neuronavigation to investigate the feasibility of AEA ligation.
Results: All 20 AEA were successfully identified and the surgical endoscopic landmarks validated. The suitability of neuronavigation was satisfactory in all specimens and resulted in a less invasive and time-consuming procedure.
Conclusion: The anatomic knowledge of endoscopic transnasal approach is mandatory, however it might be improved with advent of integrated neuronavigation to achieve safely the AEA ligation and avoid unexpected complications.
Keywords: Endonasal endoscopic, Anterior ethmoidal artery, Skull base

OP-NV.03-04

Automatic Labeling of Brainstem Fiber Pathways Using Anatomically-Constrained Density-Based Clustering

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Diffusion MRI makes it possible to probe the white matter (WM) structure of a brain in-vivo by making use of the anisotropy of diffusion of water molecules. Diffusion Tensor Imaging (DTI) reconstructs a diffusion tensor at each voxel in the image domain that represents the anisotropy of water diffusion at that voxel. Using DTI images, digital representations of WM fiber trajectories can be constructed. Grouping of these white matter tracts into neuro-anatomically known fiber bundles is extremely useful for surgical planning as well as intra-patient longitudinal analysis and population studies on brain structural connectivity. We present a novel method that automates the process of construction of structural organization of the following major white matter fiber pathways traversing the brainstem**:** corticospinal tract (CST); medial lemniscus (ML); middle cerebellar peduncle (MCP); inferior cerebellar peduncle (ICP); superior cerebellar peduncle (SCP). The method combines a density-based data clustering

approach with neuroanatomical priors in order to acquire bundles consisting of fibers that are geometrically close to each other and are anatomically meaningful. The proposed method can relieve the experts from the tediousness of manual fiber extraction, shorten the duration of the brainstem fiber clustering process, and make it less prone to operator-dependent errors. Experimental results on diffusion MRI scans of healthy subjects and expert evaluations demonstrate its utility.

Keywords: Diffusion MRI, White matter, Brainstem fiber clustering, Density-based clustering, OPTICS

OP-NV.03-05

Surgery of Brainstem Cavernous Angiomas

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Background: Surgical excision is still the most effective option for treatment of cavernous angiomas of the brainstem (BSC). Indications for intervention, timing of surgery, approach choice and extention of cavernoma resection are still debating.

Method: In period 2008-2016 there were 30 patients (F/M- 11/19) in age 16-48 years. 25 were located in lower brainstem, 5- in upper brainstem. All the patients had neurological deficit with hemorrhage on CT/MRI. Overall 32 surgeries were performed in 30 patients. Pterional transsilvian, transcallosal, precallosal interhemispheric, extradural subtemporal with anterior petrosectomy, subtentorial supracerebellar, retrosygmoid, transcondillar and frontolateral surgical approaches were applied.

Results: In all cases but one BSC were removed completely. New postop neurological deficit in two patients resolved by the third month. Two patients were re-operated due to recurrence of non-radically removed BSC. In presented cohort all BSC were removed without new permanent neurological deterioration. There were no lethal cases.

Conclusion: Broad spectrum of surgical approaches, non-traumatic brainstem penetration and microsurgical cavernoma dissection were the key to providing of patients' neurological improvement and prevention of repeat hemorrhage due to BSC recurrence.

Keywords: Cavernous angioma, Brainstem, Medulla, IV ventricle

OP-NV.03-06

Treatment of Brainstem Cavernous Malformations: Reconsideration of the Surgical Strategy and Application of Advanced Supplementary Techniques

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Background: Microsurgery is considered to be the optimal treatment for brainstem cavernous malformations (BCMs). However, the high surgery-related morbidity requires further assessment of therapeutic protocols. Hence, we summarize our surgical experience and discuss the optimal surgical strategy of this disease.

Method: From September 2007 to September 2016, a total of 148 patients with BCMs underwent surgical treatment in our hospital. The clinical features and neurological outcome of these patients were retrospectively analyzed, and our institutional surgical strategy and the application of advanced supplementary techniques was discussed.

Results: Preoperative rehemorrhage rates for BCMs were 48.6%. The associated venous anomalies were observed in 53 patients (36.5%) and were protected or managed safely. Gross total resection was achieved in 143 patients (96.6%) and subtotal resection in 5 (3.3%). The postoperative new-onset or worsened symptoms occurred in 68 cases, 51.5% of which improved during the follow-up. After a mean follow-up of 41.2±24.4 months, the neurological status was improved in 81 patients (64.8%) and remained stable in 29 (23.2%). The mean modified Rankin score (mRS) score was 2.62±0.81 preoperatively, 2.79±0.72 postoperatively, and 1.62±0.87 at the recent follow-up. The surgery-related mortality was 1.7% (n=2), and 3 patients suffered from recurrence during the follow-up period.

Conclusion: BCMs suffered from higher rehemorrhage rate. Safe resection and favourable outcome can be achieved via standardized surgical strategy and application of advanced supplementary techniques in surgical treatment of BCMs. The occurrence of DVAs was not as high as reported and should be treated on case by case basis.

Keywords: Brainstem, Cavernous malformation, Microsurgery

OP-NV.03-07

Evolution of the Choroid Plexus as a Portal to Homeostasis

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Background: The desired functional parameter of evolutionary selective pressure is homeostasis; choroid plexus (CP) as central player produces/refines energetically-favored molecules.

Method: This paper investigates evolutionary paths of three proteins**:** transthyretin (TTR), IGF-II, lactate dehydrogenase (LDH), pivotal to homeostasis.

Results: As predominant secreted protein, TTR is synthesized de novo/constitutively expressed. Its evolutionary oldest fundamental function is transport of thyroid hormones (THs) T3 and T4 into CSF, creating pools for growth/differentiation/full proliferation of neural-stem-cells in adjacent subventricular-zone. In stem reptiles 350Mya is evidence of CP-TTR gene-transcripts accompanying nascent emerging neocortex. This ancient CP-TTR partnered THs, signal transduction mechanism-free. TTR homeostasis guarantees phenotypic survival, $p<0.001$; no human null-TTR-embryo could survive. Homeostatic IGF-II is transcribed/secreted into CSF. Paternally imprinted, CP-IGF-II is ideosyncratically bi-allelic; mitogenic autocrine/paracrine effects begin just after neural-tube closure, continuing first-half gestation, guiding/patterning general/specific brain growth, subvenrticular-zone niches**:** asymmetric neurons E0-E40/E0-E43; symmetric neurons E40-E100/E43-E120, macaques/humans, respectively. Eutherian lineage, 130Mya, evolutionary switch from extracellular T3 toT4 prominence gave greater flexibility; precise control intracellular T3 benefited specific brain regions**:** cortex-65%, cerebellum-51%, pons-35%.

LDH focuses on choroidal transport-mechanisms essential to ion-homeostasis; vertebrate transitioning to air breathing >400Mya, reestablished acid-base parameters**:** newly elevated PCO2 stimulus necessitated regulation extracellular pH through HCO3 and lactate transport. Highly-vascularized CP, septuple blood flow, quintupule capillary diameters maintained respiratory/metabolic energy requirements. RBCs poured lactate into abundant mitochondria whose portal to aerobic metabolism is LDH, and polypeptide LDH-B**:**LDH-A's aerobic status, evolutionary sensitive**:** rats 0.0, macaques 1.8, humans 3.8.
Conclusion: Earliest CP function proposed, "animal spirits that gave energy", embodies this far-reaching role.
Keywords: Evolution, Choriod-plexus, Homeostasis, Transthyretin, IGF-II, Lactate-dehydrogenase

OP-NV.03-08

Safe Occlusion Time of Recipient Artery in Direct Bypass for Moyamoya Disease: Analysis of Anastomosis-Related Ischemic Lesion

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Aim: To investigate the relationship between clamp time of the recipient artery and occurrence of postoperavie anastomosis-related ischemic lesion (PA-RIL) in superficial temporal artery to middle cerebral artery (STA-MCA) anastomosis for moyamoya disease (MMD).
Method: Consecutive fifty-five bypass surgeries in thirty-one patients with MMD (M**:**F=10**:**21, mean age 30.7+17.5 years old) were included in this study. All surgeries underwent performed with 11-0 monofilament nylon sutures by independent five operators. Ten of fifty-five surgeries were done by new-invented microforceps combined with microscissors around the tip. 3-tesla magnetic resonance imaging (3T-MRI) studies including diffusion-weighted imaging (DWI) underwent before and within one week after surgery tip. Fresh ischemic high intensity signal spots around anastomostic sites on frontal and temporal cortex are defined as PA-RILs. Relationship between the clamp time of the recipient artery and occurrence of PA-RIL, and effects of use of new forceps on the occurrence was statistically analyzed.
Results: Occurrence of PA-RILs was not significantly related to age and gender of the patients but to the length of the clump time of the recipient artery and the clamp time per one suture. ROC analysis showed the threshold is 35.3 minutes (sensitivity 100%, specificity 80%). Use of new forceps significantly shortened the clamp time and clamp time per one suture, which resulted in no occurrence of PA-RILs.
Conclusion: Concerning the occurrence of PA-RILs, the clamp time of the recipient artery in direct bypass for MMD should be less than 35 minutes.
Keywords: Clamp time, Bypass, Moyamoya

OP-NV.03-09

Non-Classic Indications for Brain Revascularisation in Various Groups of Patients with CNS Pathologies

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Background: At this moment main indications to carrying out of Brain Revascularisation (BR) is extra/intra cranial atherosclerosis, moya-moya illness, some others situations. We belive indications to BR can are expanded using simple and effective technique of BR.
Method: We used own technique of BR consisting in partial or full ligation of main 2-4 branches of external carotid arteries at expense of what redirection of blood flow to carotid pool, and in presence of at least one posterior communicating artery and to vertebral-basilar pool is created. Doesn't demand trepanation. It was heterogeneous group with various CNS pathologies. We analyzed 76 patients. Women 35, men 41. Aged from 4 months to 67 years. Chromosomal pathology excluded. Cerebral Blood Flow (CBF) investigated by TCD, in certain cases SPECT/ PET. Types of CNS pathologies**:** vegetative status, epilepsy as result hypoxic-ischemic brain injury (HI-BI), progressing optical nerve atrophy, paralytic squint as consequence of HI-BI, frequent nasal bleeding at children as a result of postponed HI-BI, eavy hyperactivity in children as result of postponed HI-BI, essential changes of hemodynamic in deformations, hypoplasia of the main extra/intra cranial arteries, heavy forms of obsessive-compulsive, panick disorders, major depression, autism. To indications to BR were not an efficiency of medications or deterioration of condition of patients.
Results: Decrease of CBF revealed in varying degree in all patients. In all groups will reach notable positive clinical result (special discussion of each group is required). Positive clinical results well correlated with restoration of CBF. TCD picture in post-surgery showed post-ischemic hyperperfusion in middle cerebri arteries.
Conclusion: It is necessary to expand indications to BR using offered eurosurgery, particular for hard cases.
Keywords: Brain revascularisation vegetative hipoxia ischemia autism appalic

OP-NV.04-01

Hyperperfusion Syndrome After STA-MCA Bypass in Patients with Moyamoya Disease

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Generally, the cerebral autoregulation has been compromised in patients with moyamoya disease. Hyperperfusion symdrome is a major complication for such cases after direct revascularization, which might induce disaster outcomes. Since Oct. 2013, our center have encountered 26 cases with hyperperfusion syndrome after STA-MCA anastomosis. The hyperperfusion syndrome occurred two or three days after surgery. In our serious, one of two patients, who suffered spontaneous ICH, died quickly around 30 minutes after hemorrhage. Various presentation, such as aphasia, paralysis, headache, emotional abnormality and subtle recognize function, was noticed among the other 24 case. In order to differentiate from

ischemic syndrome, we adopted multiple modalities, including CTP, MRI, PET-CT et al, to verify exist of the abnormally increased blood supply in the local surgical area. Proper blood pressure control was the most important strategy to deal with such a situation. Edaravone was also a potentially promising medication, which was infused 3 days before and 7-14 days after revascularization surgery in patients with Moyamoya disease. 23 of the other 24 cases with hyperperfusion syndrome had completely relieved 5-14 days later, while one cases suffered ischemic stroke leading transient paralysis and aphasia. In summary, hyperperfusion syndrome was not a rare complication in Moyamoya patients after revascularization surgery with potentially fatal or disaster risk. If could be diagnosed early considerately, hyperperfusion syndrome could have a preferred outcome with narrowly controlled proper blood pressure and Edaravone scavenging oxygen free radicals.

Keywords: Moyamoya disease, Direct revascularization, Hyperperfusion syndrome

OP-NV.04-02

Cerebral Revascularization: Single and Double Barrel Extracranial-Intracranial Bypass Experience

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Background: Nowadays we observe revival of interest towards extracranial-intraranial (ECIC) bypass surgery in patients with chronic internal carotid artery occlusion. There are several variants of surgical techniques, including single and double barrel bypass.
Methods: 188 patients underwent ECIC bypass from 2008 to 2017 in our clinic. In 105 cases single superficial temporal artery branch bypasses were applied. And in 83 cases double barrel bypasses were applied. All patients were selected for the operation according to computed tomography-based perfusion (CTP) revealed misery perfusion characteristics including decreased cerebral blood flow and increased blood volume. Following CTP indexes were applied for assessment**:** CBF, CBV and MTT. CTP was performed before surgery, 5-10 days following operation and approximately 6 months following operation.
Results: Typical post-operation CTP observation included increased CBF values associated with increased CBV values possibly representing cerebral hyperperfusion. Above mentioned values in double barrel bypass group showed tendency to be more dramatically changed in comparison to baseline values. Moreover there are several cases with more longstanding follow-up period (up to two years) with CTP performed indicating tendency of CBF variables for being close to those observed shortly after surgery with decreasing CBV values probably representing normalization of microcirculation autoregulation.
Conclusion: Revascularization (ECIC bypass) brain surgery is associated with improved cerebral blood flow confirmed by CTP results. Results of application of double barrel bypass are non-inferior to the single anastomoses however they are associated with tendency to higher values in early post operation period and probably with higher risk of hyperperfusion.

Keywords: Cerebral revascularization, Single and double barrel, ECIC bypass, Hyperperfusion syndrome

OP-NV.04-03

Changes in Serum Vascular Endothelial Growth Factor and Endostatin Concentrations Associated with Circulating Endothelial Progenitor Cells After Acute Ischemic Stroke

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Background: Angiogenesis is an important pathophysiological response to cerebral ischemia, and can be modulated by vascular endothelial growth factor (VEGF) and endostatin. Circulating endothelial progenitor cells (EPCs) also play an important role as an endogenous repair mechanism for ischemic injury. We sought to investigate early changes in the expression of VEGF and endostatin in serum and the circulating EPCs in patients with acute ischemic stroke (AIS) and analyzed the relations between them.
Method: The peripheral blood and serum samples were obtained from 30 patients at 1, 3, 5 and 7 d after AIS. Flow cytometry was used to quantify EPCs, and VEGF and endostatin were measured by enzyme linked immunosorbent assay.
Results: Compared with control subjects, circulating EPCs numbers increased from a very lower initial level ($p< 0.001$) until 7 d after AIS. Serum VEGF and endostatin levels increased and peaked at 3 d and 5 d post-stroke (both $p < 0.001$), respectively. A significant correlation ($p=0.001$) was found between peak serum VEGF concentration and peak endostatin concentration. VEGF/endostatin ratio at day 1 and day 3 after AIS significantly correlated with circulating EPCs numbers at day 5 ($p< 0.001$) and day 7 post-stroke ($P < 0.001$). Receiver operating characteristic curve analysis suggested that circulating EPCs number at day 7 had a significantly predictive power for good prognosis.
Conclusion: VEGF and endostatin may mediate EPCs proliferation in the early phase of ischemic stroke, and the circulating EPCs levels can be a predictor of clinical outcome in AIS.

Keywords: Acute ischemic stroke, Vascular endothelial growth factor, Endostatin, Endothelial progenitor cells, Prognosis

OP-NV.04-04

Safety and Efficacy of Urgent EC-IC Bypass for Acute Atherosclerotic Ischemic Stroke

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Aim: To evaluate the safety and efficacy of urgent extracranial-intracranial (EC-IC) bypass in the management of acute atherosclerotic ischemic stroke in carefully selected patients.
Method: The authors reviewed the medical records and neuroimaging studies in 22 consecutive patients who underwent urgent surgical cerebral revascularization to treat acute atherosclerotic ischemic stroke. They were previously treated by urgent medical or endovascular therapy but failed to recanalize. The patients' ages ranged from 45 to 69 years. The mean follow-up review was 2 years, and no patient was lost to follow-up.
Results: Preoperative angiographic evaluation identified critical

stenosis or occlusion of the middle cerebral artery (MCA). All patients had progressive, refractory symptoms associated with enlarging areas of infarction on diffusion weighted MR imaging, despite antiplatelet agents, blood pressure elevation, and fluid resuscitation. All patients underwent superficial temporal artery (STA) - MCA anastomosis on an urgent basis. No hemorrhagic complication occurred. Seventy-three percent of patients showed improvement of neurological function after surgery, and 77.3 % of patients had favorable outcome.
Conclusion: In this series of 22 carefully selected patients, STA-MCA bypass was successful in arresting progression of stroke, and in majority of cases resulted in neurological improvement. In the authors' experience, urgent EC-IC bypass in patients with acute atherosclerotic ischemic stroke was both safe and effective.
Keywords: Acute atherosclerotic ischemic stroke, EC-IC Bypass, Revascularization

OP-NV.04-05

Stroke Center in a Third World Country: It is Posible!

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Cerebrovascular disease is the second cause of death worldwide. In Mexico, it the fourth cause of mortality. Based in the stroke treatment guidelines published by World Stroke Organization (WSO), American Heart Assosiation, and other international organizations. In the Neurosurgery department, we created an algorithm to facilitate the reception and prompt treatment of stroke patients. There are in Mexico three principal public health care institutions that account for the treatment of nearly 80% of the Mexican population. Mexican Institute of Social Security (IMSS), Social Security for Federal Government Employees (ISSSTE) and Ministry of Health (SS). However, these Institutions face heavy financial constrains which are barriers to offer adequate treatment to the population; particularly to overcome all the burden created by the diseases that contribute with the highest mortality in the population as stroke. The new era of stroke treatment has become a revolution in all the world. To continue with this trend, we analyzed the cost and effectiveness of the implementation of a Stroke Centers using endovascular thrombectomy in Mexico, at a city, regional and national level. As a pilot study, we opened in February 2017 the first Stroke Center in Mexico in the ISSSTE hospital "1ero de Octubre". The outcomes obtained in this month period are 3 patients treated, with NIHSS average of 20pts, and mRS 3 or less in all of them. The door-puncture average time was 45 minutes. We hope to be able to exterder the treatment centers to strategic points in all the country in 2 years
Keywords: Stroke center, Mexico, Endovascular thrombectomy

OP-NV.04-07

The Value of Perfusion CT as a Prognostic Factor After Mechanical Thrombectomy in Anterior Circulation Large Vessel Occlusion Patients

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Background: In patients with ASPECT score of 7↑, the infarction volume on the diffusion MRI can occur throughout the MCA territory, resulting in hemorrhage after the thrombectomy and low cost effectiveness. We conducted a study to determine whether perfusion CT could be used as a predictor of prognosis.
Method: The CVA protocol was activated when LVO was suspected, and non-enhance CT, perfusion CT, and CT angiography were performed. In these patients, 10 areas such as ASPECT score were designated and scores were given to the lowered areas of CBF, MTT, and CBV compared with the contralateral side, and scoring was performed at 10 points. EMR and imaging study of patients with ASPECT score of 7↑ were confirmed.
Results: 94 patients met the inclusion criteria of this study. After recanalization, TICI G 2b ↑ were achieved 80 patients (85.10%). 71 patients (75.53%) had a CBV score of 4points or less and 23 patients (24.47%) had a score of 5points or more. In patients with CBV 4 points↓, good outcome (mRS 2↓) was 34 patients (47.88%). In patients with CBV 5 ↑, good outcome (mRS 2↓) was 6 patients (26.08%). The mortality rate was 7.04% (5 patients) in patient with CBV 4points ↓, but there were 30.43%(7patients) in patients with CBV 5points ↑.
Conclusion: Mechanical thrombectomy showed better prognosis in LVO patients with CBV score of 4 points↓. But there is showed higher mortality rate in patients with CBV score of 5 points ↑. Perfusion CT can be helpful in predicting the prognosis of the patient.
Keywords: LVO, Thrombectomy, Prognosis, Perfusion CT

OP-NV.04-08

Surgical Management of Moyamoya Disease-Retrospective Analysis of a Single Institution Series

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Aim: To show the experience with revascularization for a group of twenty two patients of Moyamoya disease operated in an Indian tertiary care center. An attempt is also made to study the clinical profile, surgical as well as radiological outcome of pediatric and adult patients operated for Moyamoya disease.
Method: All patients with Moyamoya disease treated surgically in the period 2003 to 2014 were included in the study. The demographic details, clinical features and investigations were obtained from retrospective chart review and analysed.
Results: 13 pediatric and 9 adult patients were included in the study who underwent cerebral revascularisation procedure over a eleven year period. Out of the 9 adult patients, 7 (77%) presented with

ischemic and 2 (22 %) with hemorrhage, while all pediatric patients had ischemia as the presenting symptom.13 patients underwent indirect revascularization in the form of EDMAS while 9 patients underwent a ST-MC bypass. Post-operative imaging showed that all revascularization procedures produced patent bypass channels in 6/6 (100%) adult and 5/5 (100%) of pediatric patients. At last follow up an excellent outcome (Modified rankin scale of = 2) was seen in 61% (8/13)pediatric patients and 75% (6/8) adult patients. Per-operative ischemic events were noted in two patients while one patient had a per-operative mortality due to anticoagulant induced bleed.

Conclusion: Moyamoya disease if untreated, will inevitably progress and can lead to devastating, permanent neurological impairment. Cerebral revascularization surgery, either direct and/or indirect, helps to prevent recurrent attacks and should be offered early in the course of illness.

Keywords: Moyamoya, Revascularization, EDAMS

OP-NV.04-09

Retrospective Analysis of Diagnostic Accuracy of Colour Doppler Ultrasonography, Computed Tomography Angiography and Magnetic Resonance Angiography Compared with Digital Subtraction Angiography in Patients with Carotid Artery Stenosis

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Background: Extracranial carotid artery atherosclerosis is an important cause of morbidity and mortality in older age group. The morbidity and mortality rates can be lowered with proper treatment after the diagnosis.

Method: We retrospectively evaluated 76 patients who underwent DSA for an extracranial carotid artery stenosis. Color doppler ultrasonography (DUS) of 59, computed tomography angiography (CTA) of 30 and magnetic resonance angiography (MRA) of 12 patients were available. DSA tests were accepted as the gold standard and the sensitivity, specificity, positive and negative predictive values of the other tests were calculated.

Results: Of the patients, 51 were male and 25 were female. The mean age of the patients was found as 69.04. Bivariate correlation of the other tests were examined according to DSA, it was found that all three tests were statistically significant. When compared by ROC analysis, sensitivity, specificity values of DUS, CTA and MRA tests were found to be high and statistically significant. When 32 carotid arteries were evaluated by linear regression analysis in which DAS, DUS and CTA were performed, DUS and CTA variables explain DSA at 61%. DUS's modeling contribution is bigger than CTA and statistically significant. Same way, CTA's modeling contribution is statistically significant.

Conclusion: DUS, CTA, MRA are adequate non-invasive tests for carotid artery stenosis screening in most patients. The accuracy is higher when these tests are combined. DSA can be performed as a second or third line test according to the patient's clinic in patients with contradictory results.

Keywords: Digital subtraction angiography, Colour doppler ultrasonography, Computed tomography angiography, Diagnostic accuracy

OP-NV.05-01

Impact of Endovascular Embolization on Seizure Control in Patients with Brain Arteriovenous Malformations (AVMs)

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Background: Seizures are the second most common manifestation of cerebral AVMs. The impact of treatment modality on seizure control remains unclear. Seizure control is however an important factor to consider in the endovascular treatment of AVMs

Method: 137 cases with symptomatic epilepsy of 365 AVM patients underwent endovascular embolization. 67 patients had total and subtotal AVM devascularization, 70 patients had partial AVM embolization. All patients were followed for 1-5 years (mean 3 years). The seizure control according to Engel scale in two groups were evaluated.

Results: Class I Engel grade scale in the first group was obtained in 44 patients (66.7%) in the second group Class was observed in 22 patients (31%) which is a statistically significant difference (Femp = 3.915, $p < 0,01$). There were 3,3% of de novo seizures in our series.

Conclusion: Total AVM embolization provides the best seizure control. Partial embolization also decreases the number of seizures. The risk of de novo seizures following endovascular treatment is low.

Keywords: Arteriovenous malformations, Seizures, Embolization

OP-NV.05-02

Brain Stem Cavernomas. Radical Removal Using Functional Microsurgery

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Background: Brainstem cavenomas (BSC) require radical surgery because of fatal outcome due to rebleeding. Surgery inside the brain stem (BS) is a most challenging problem. Hence the usual course is to remove only those cavernomas (C) solely close to the BS pial surface. The aim of this study was to minimize the risk of surgical injury to the adjacent neural and vascular structures.

Method: For this purpose all BSC they were pre-, intra-, and postoperatively examined by all available methods for the anatomical and functional localization of BSC. The blood supply to the BS requires a sparing approach. Operative planning is done in two phases. Preoperatively we tried to find the best approach to the BS. During the operation to find the safest approach inside of BS. Microsurgery must be accompanied by special intraoperative

monitoring. This combined approach with microsurgery has been termed functional microsurgery.
Results: 40 patients were monitored since 1991, followup 1- 21y. All C were removed by radical microsurgery. There was no operative mortality and temporary new morbidity was found due to the surgery.
Conclusion: Miscrosurgery of BSC must be accompanied by special intraoperative monitoring. This combined approach has been termed functional microsurgery. Not only BSC located near the pial surface but also deep seated ones can be successfuly removed. In spite of distorted anatomy, BS nuclei, pathways and vascular supply, especially venous, should be spared. Treatment by stereoradiosurgery does not seem to be justified.
Keywords: Cavernous malformations, Brainstem, Microsurgery, Intraoperative monitoring

OP-NV.05-03

Surgical Management and Strategies for Treating Brainstem Cavernous Malformations

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Background: Optimal surgical approaches and strategies for brainstem cavernous malformations (BSCMs) treatment remains in controversy. Here we reviewed our experiences in surgical management for treating these lesions.
Method: Clinical courses were retrospectively analyzed for twenty-eight consecutive patients harboring BSCMs who received surgical treatment from 2010-2015. The key surgical strategies were to perform total lesion resection, to preserve normal brainstem tissue with minimal functional sacrifice and to prevent severe postsurgical complications. The operative related decision making, surgical procedures and outcomes were evaluated.
Results: All patients (14 women, 11 men; mean age, 41 years) were presented with hemorrhagic, symptomatic cavernous malformations. Surgical approaches were endoscopic endonasal tranclival approach for two ventral, one ventrolateral mesencephalic, and four pontine cavernomas, while occipital transtentorial approach for two thalamomesencephalic cavernomas. Retrosigmoid approach for four lateral mesencephalic, nine pontine cavernomas, and midline suboccipital approach for one medullary cavernomas. Total lesion resection were achieved in 24 patients with subtotal resection in 1 patient. No mortality was encountered in this study. Early postoperative neurological deficit occurred in eight patients, while seven patients was in transient state. The final follow-up showed complete recovery rate of motor deficits and sensory disturbances were 72% and 60% respectively. Neurological state unchanged in six (24%) patients and worsened in one (4%) patients.
Conclusion: Surgical resection remains the primary consideration for the symptomatic BSCMs. Proper selection of surgical approach is vital to assure optimized surgical outcome. Especially endoscopic endonasal transclival approach provide a more safe and effective corridor for lesions in ventral brainstem.
Keywords: Brainstem cavernous malformations, Surgical approach, Endoscopic surgery, Vascular malformation

OP-NV.05-04

Novel Hydrogel Material as a Potential Embolic Agent in Brain Arteriovenous Malformations Treatments

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We report a novel graphene-oxide (GO) enhanced polymer hydrogel (GPH) as a promising embolic agent capable of treating arteriovenous malformations (AVM), using the trans-catheter arterial embolization (TAE) technique. Simply composed of GO and generation five poly(amidoamine) dendrimers (PAMAM-5), our rheology experiments reveal that GPH exhibits satisfactory mechanical strength, which resist the high pressures of blood flow. Subcutaneous experiments on Sprague-Dawley (SD) rats demonstrate the qualified biocompatibility of GPH. Finally, our in vivo experiments on swine AVM models, which mix GPH with the X-ray absorbing contrast agent, Iohexol, reveal complete embolization of the artery. There is no recanalization in the angiography review 6 weeks later. No significant side effects were found in the follow-up and pathological examinations. Comparing to the traditional embolic agents, the GPH has the following advantages. 1) GPH had no adhesion to the delivery system (catheter, needle) when the embolic agent recurrence surrounds the microcatherter. 2) The advanced chemical and physical characteristics guarantee the convenient injection of GPH, which allows the surgeon to practice the use easily. 3) The follow-up and pathological examination demonstrated the reliable treatment results of GPH with low toxicity and recanalization. 4) No disturbance would be left in the imaging examinations (i.e. CT and MR). Altogether, our study demonstrates that GPH has many advantages over the currently used embolic agents and has potential applications in AVM treatments.
Keywords: Graphene oxide, Trans-catheter arterial embolization, Arteriovenous malformations, Toxicity

OP-NV.05-05

400 AVM Microsurgery Resection Exprience from 1999 to 2016 in the Hospital Nacional Edgardo Rebagliati Martins, Lima, Peru

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The Edgardo Rebagliati Hospital is a national reference hospital in Lima, Peru. With a rich vascular patology. We aimed to describe our single-center experience in treating cerebral arteriovenous malformations with microsurgical resection, 400 in 30 years. The AVM were diagnosed due to a brain haemorrhage, and the second most frequent presenting symptom of them, epileptic seizures. They were classified using the Spetzler Martin classification, by RMN and cerebral angiography. All of them were treated by microsurgical resection and follow up with cerebral angiography to probe the total resection.
Keywords: Arteriovenous malformation, Microsurgery

OP-NV.05-06

Brainstem Hematomas and Cavernous Angiomas: Early Outcome and Long – Termed Results of Surgical and Conservative Management

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We present the series of 447 patients with BH and CA, that were examined in the period 1986 -2016 (304 underwent surgery, 143 were managed conservatively). Neurological examination, MRI were perfomed on admission, after surgery (in surgically treated patients) and yearly in the follow up period. According to MRI, pathology revealed during surgery and histological examination we outlined two main groups**:** I. hematomas (180 patients; 59%); II. malformations (124 patients; 41%). The results of surgery strictly depended on pathological characteristics of the lesion. After removal of hematomas, 63% of patients improved immediately after surgery, 21% - remained unchanged, 16% - deteriorated, mortality was 0%. Less favorable results were observed in patients suffering CA with no MRI signs of hemorrhage**:** 73% of them worsened, and only 5% of patients improved. Clinical improvement after surgery continued for 6 months; 92% of patients with haematomas and 56% of patients with CA became significantly better than before surgery. Hemorrage after surgery occurred in 15%. There were no hemorrhages in the follow-up period In cases of CA with no signs of hemorrhages to the time of surgery. Rehemmoragerate per patient per year after surgery was 0.3%. The main reasons for conservative management were**:** significant regress of neurological deficit to the time of admission or mild neurological signs from the beginning of the disease with no tendency of increasing; Small size of hematoma (< 2cm3); High risk of neurological deterioration after the surgery. Hemorrages in the follow –up period occurred in 9% of patients.

Keywords: Brainstem, Cavernous angioma, Brainstem hematoma, Brainstem malformation

OP-NV.05-07

Arcus Aorta Branching Variations: An Angiographic Study of 90 SAH Patients

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Background: During embriyological vascular development some differences leads to variations in the branching pattern of arcus aorta. This study aims to reveal the type and frequency of this variations in a group of SAH patients.

Method: Between March 2016- December 2016, 90 patients which were diagnosed SAH was included for this study. For each case we performed Digital Subtraction Angiography. Type 1 arcus aorta is the most frequent type. It is the usual pattern with an arrangement from right to left the arising branches on Arcus Aorta (AA) are, Truncus Brachiocephalicus (TB), Left Common Carotid (LCC) and Right Subclavian Artery (RSA). In this pattern TB gives rise to Left Subclavian (LSA) and Right Common Carotid (RCC) arteries. Type 2 is characterized by LCC's rising from TB also.

Results: In Type 3 variation, Left Vertebral Artery (LVA) arises directly from AA instead of LSA. In our study, 82.22% of the patients demonstrated Type 1 variation. Type 2 was shown in 16.7% of the cases; where Type 3 consisted 1.12% of them.

Conclusion: Some cadaveric studies revealed that cerebrovascular disease related deaths are more frequent in Type 2 and Type 3 variations. On the other hand catheterization procedures are more challenging in Type 2 and Type 3 AA variations. But these types are not as frequent as expected in a SAH population, our study reveals.

Keywords: Arcus aorta, Angiography, Variation, SAH

OP-NV.05-08

Is Temporary Proximal Artery Clipping in AVM Surgery Safe?

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Background: Surgical excision of AVMs still poses a challenge with uncontrolled bleeding and brain swelling being the dreaded intraoperative complications. Authors describe their experience in surgical excision of cerebral AVMs using technique of temporary proximal artery clipping to reduce intraoperative bleeding and excision time.

Method: Using temporary proximal artery clipping 13 patients with cerebral AVMs were operated by the authors in a public-sector teaching institution. Six AVMs were situated in the eloquent areas like the motor and speech areas while seven were present in non-eloquent areas. There were four patients in Spetzler grade 2 while three each in Grades 3,4 and 5 respectively. A large craniotomy flap was fashioned so that the proximal feeding arteries could be reached along with the AVM. After wide dural opening the proximal feeding arteries were first approached. The proximal middle cerebral artery (MCA) was approached by opening the proximal sylvian cistern; the distal anterior cerebral artery (ACA) through an interhemispheric approach and the P2 portion of the posterior cerebral artery (PCA) through a subtemporal route. After placing a temporary aneurysm clip on the proximal feeding artery, excision of the AVM was performed employing the basic principles of AVM excision.

Results: Total excision of the AVM was achieved in all cases. There were no instances of any cerebral infarction or neurological deficits attributable to the temporary proximal artery clipping. There was no mortality in this series.

Conclusion: Temporary proximal artery clipping helps in surgical excision by reducing intraoperative bleeding and resection time.

Keywords: Arteriovenous malformation, AVM excision, Cerebral AVM, Normal perfusion pressure breakthrough, Temporary arterial clipping

OP-NV.05-09

A Comprehensive Review of Endovascular Treatment of Brain AVM

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We present a study of patients undergoing endovascular treatment of symptomatic brain AVMs circulation of grade one to grade three of Spetzler-Martin AVM types. Treatment in the form of embolisation using embolic agents either Onyx or Glue from year 2010 till date in the department of neurosurgery in King Edward Memorial and Lilavati tertiary care hospitals, Mumbai, India is presented.
Patients history, clinical presentation, investigations, endovascular approach, different treatment strategies and results are discussed. The advantages and concept of embolisation of avm under local anaesthesia alone in select patients are discussed. Also different techniques post procedure outcome, safety and results are discussed.
Keywords: Endovascular, Arteriovenous malformation, Embolisation

OP-NV.06-01

A Simple Clinical Risk Score Predicting Long-Term Outcome After Poor-Grade Aneurysmal Subarachnoid Hemorrhage: Results from a Multicenter Prospective Registry

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Background: Despite advances in the treatment of aneurysmal subarachnoid hemorrhage (aSAH), poor-grade aSAH is associated with high rates of mortality and mortality. We aimed to develop a risk score for predicting long-term outcomes with a multicenter poor-grade aneurysm study (AMPAS) data.
Method: The AMPAS was a prospective multicenter observational registry of patients with poor-grade aSAH defined as a World Federation of Neurosurgical Societies (WFNS) grade of IV or V. Outcome was assessed by modified Rankin Scale (mRS) at 12 months, and poor outcome was defined as a mRS of 4, 5 and death. Multivariate logistic regression models were used to develop prognostic models. Area under receiver operator characteristic curves (AUC) and Hosmer-Lemeshow tests were used to assess discrimination and calibration.
Results: Of the 324 patients, 190 (58.6%) had poor outcome at 12 months. Older age, lower Glasgow coma score (GCS), absence of pupillary reactivity, higher modified Fisher grade, and conservative treatment were independent predictors of poor outcome. A simple model that included age, pupillary reactivity and GCS score had an excellent discrimination (AUC=0.81). The discrimination improved with increasing complexity if we added radiologic findings and type of treatment. The 5-point score (WAP**:** WFNS grade, Age, Pupillary reactivity) showed good discrimination (AUC 0.77, P<0.001) and good calibration (P=1.000). The predicted risk of poor outcome at 12 months ranged from 25.5% for a WAP score of 0 to 96.2% for a WAP score of 4.
Conclusion: The WAP risk score may be a simple tool for predicting long-term outcomes after poor-grade aSAH.
Keywords: Intracranial aneurysm, Subarachnoid hemorrhage, Poor-grade, Prognostic factor, Risk score

OP-NV.06-02

Internal Maxillary Artery by Pass Surgery for the Treatment of Serpentine/ Dolichoectatic Aneurysms in 64 Patients

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Aim: To study the effectiveness of internal maxillary artery bypass surgery for the treatment of huge/dolichoectatic aneurysms.
Method: 64 patients with huge or dolichoectatic aneurysms, 41 males and 23 females; mean age is 44.13 years. Angiographic studies showed the aneurysms are located in cavernous sinus segment of the internal carotid artery in 21 patients, the middle cerebral arteries in 17 patients, supraclinoid carotid artery in 14 patients, cervical and petrous carotid artery in 2 patients, basilar tip-posterior cerebral artery in 6 patients, basilar trunk in one patient, and vertebrobasilar artery in 3 patients. Surgical technique**:** Of the 64 cases, aneurysms without perforators were trapped after the bypass in 39 cases. In 25 cases, aneurysms connected to perforators were managed through proximal occlusion with distal bypass so the perforating arteries would still be perfused.
Results: Neurological outcomes were measured on the basis of Glasgow Outcome Score (GOS). Recovery rate to normal daily life after surgery in trapped aneurysms without perforators and reversal flow of the aneurysm with perforators was 28/29 (93.1.%), and 23/25 (92%) respectively. In 47 patients with mean follow-up of 3.0 years (0.5–6.5), 41 patients had bypass grafts of proximal M2 segment of MCA and 6 had PCA bypass grafts. Of those, 50 patients had good outcome, 2 patients needed assistance for daily living, and 1 death occurred unrelated to surgery.
Conclusion: Huge /dolichoectatic aneurysms pose unique therapeutic challenges that require thorough surgical planning, individualized treatment strategies, and refined neurovascular techniques for successful outcome.
Keywords: Internal maxillary artery, Bypass surgery, Serpentine/ dolichoectatic aneurysms

OP-NV.06-03

Risk Factors of Symptomatic Vasospasm and Cerebra Infarction After the Treatment of Poor-Grade Aneurysmal Subarachnoid Hemorrhage

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Background: Symptomatic vasospasm and cerebral infarction are serious complications after aneurysmal subarachnoid hemorrhage (aSAH) and often occur in patients with poor-grade aSAH. We investigated independent risk factors of symptomatic vasospasm and cerebral infarction with data from a Multicenter Poor-grade Aneurysm Study (AMPAS).
Method: The AMPAS was a prospective multicenter registry of patients who presented with poor-grade aSAH. 262 patients underwent surgical clipping or endovascular coiling within 18

days after ictus and were included in the study. Multivariate logistic regression models were used to identify risk factors of symptomatic vasospasm and cerebral infarction in all patients, clipped patients, and coiled patients, respectively.
Results: In all patients, history of hypertension, current smoking, preoperative radiologic vasospasm, ruptured posterior circulation aneurysms, and a higher Fisher grade were independently associated with symptomatic vasospasm, and a higher modified Fisher grade was independently associated with cerebral infarction. In clipped patients, history of subarachnoid hemorrhage and preoperative radiologic vasospasm were independently associated with symptomatic vasospasm, and preoperative radiologic vasospasm and larger ruptured aneurysms were independently associated with cerebral infarction. In coiling patients, history of hypertension, ruptured posterior circulation aneurysms and a higher modified Fisher grade were independently associated symptomatic vasospasm, and ruptured middle cerebral artery aneurysms, a higher modified Fisher grade and symptomatic vasospasm were independently associated with cerebral infarction.
Conclusion: Our results showed no significant difference of symptomatic vasospasm and cerebral infarction but different risk factors in clipped and coiled patients. The different sets of risk factors of these complications may be considered regarding the treatment strategy.
Keywords: Subarachnoid hemorrhage, Poor-grade, Symptomatic vasospasm, Cerebral infarction, Risk factor

OP-NV.06-04

Microsurgical Treatment of the Fusiform Aneurysms Located in M1 Segment of the MCA

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From January, 2014 to December, 2016, 28 surgical procedures were performed in patients with fusiform aneurysms of M1 segment of middle cerebral artery (MCA). In 11 patients the aneurysms extended to the entire of M1 segment, in 12 cases – only proximal part of M1 segment, in 4 cases – only distal part of M1 segment, in one patient the aneurysm extended from distal part of M1 segment to both M2 segments.
As a method of revascularization in 25 of 28 patients were created single- or double-barrel extra-intracranial bypasses between the branches of the superficial temporal artery and M2-M3-M4 segments of the MCA. Single-barrel STA-MCA bypasses were created in 6 patients**:** in 3 – with M2 segment, in 2 – with M3 segment, in one case – with M4 segment of the MCA. Double-barrel bypasses were created in 19 cases**:** in 15 cases with both M2 segments of MCA, in 1 the case of M2 and M3 segments, in 1 case with two M3 segments, in 1 the case with M3 and M4 segments, and in 1 case with two M4 segments. In other three cases were created high-flow bypasses**:** in one case with M1 segment of MCA, in 2 cases with M2 segments of MCA.
With the aim of reduction or complete termination of the blood flow in aneurysm after creation of the bypasses we use a proximal clipping of a parent artery in 22 cases, distal clipping – in 2 cases, trapping of aneurysm – in 4 cases.
Keywords: Fusiform M1 aneurysm, Revasculaization, EC-IC bypass, MCA aneurysm

OP-NV.06-05

Internal Maxillary Artery Bypass Treatment of Giant Intracranial Aneurysms in a Cohort of 23 Patients with Long-Term Follow-Up

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Background: Giant intracranial aneurysms (GIAs) can be approached via microsurgical and endovascular techniques. The utilization of flow diversion devices (FDDs) has resulted in favorable outcomes, and indications for cerebral revascularization have dramatically decreased. The aim is to describe the safety and validity of using internal maxillary artery (IMA) bypass with an interposed graft to treat GIAs.
Method: During a 6-year period, 23 GIAs were treated with high-flow IMA bypass at our institute. Intraoperative Doppler sonography and postoperative angiography were used to assess the patency of the graft conduit and the stability of the aneurysm. Neurologic function was assessed with the modified Rankin Scale (mRS).
Results: The mean GIA size was 35.3 mm (range**:** 25.3 to 64 mm), and all GIAs exhibited fusiform morphology with the exception of one patient. All GIAs were completely resolved (78.3%, n=18) or greatly diminished (21.7%, n=5) in postoperative angiograms, and the graft patency rate was 82.6% (n=19). Favorable outcomes (mRS 0-2) were recorded in 78.3% of patients at discharge, and the rate increased to 91.3% at the last follow-up (mean, 52.4 months). Surgical-related complications that involved ischemic and hemorrhagic episodes were encountered in 5 patients at discharge. Complications were completely resolved in all but one patient at follow-up.
Conclusion: Despite advances in endovascular and neuro-interventional techniques, EC-IC bypass remains an essential and important solution in the treatment of GIAs and is associated with excellent results when used by experienced practitioners.
Keywords: Giant intracranial aneurysm, Internal maxillary artery, Bypass surgery

OP-NV.06-06

Extracranial-Intracranial Bypass in the Management of Complex Internal Carotid Artery Aneurysms

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Background: Complex intracranial aneurysms are relatively rare lesions with poor natural history, high risk of postoperative morbidity and mortality in case of direct surgical clipping. Our aim is to evaluate the results of combined strategy in the series of complex aneurysms of the internal carotid artery treated at our center.
Method: We conducted retrospective analysis of the patients treated at our center between 2008 and 2016 years. Patients who did not tolerate balloon test occlusion of the parent vessel were selected for trapping the aneurysm by bypass surgery. Clinical, radiological and

angiographic data was evaluated during the follow up period.
Results: Medical records of 26 patients (5 patients were male, 21 female, mean age 52 years) with complex internal carotid aneurysms were analyzed. 8 aneurysms were located in the cavernous part, 8 in paraclinoid segment, 9 aneurysms in the supraclinoid part and 1 in ICA bifurcation. Clinical symptoms were headache, seizures, cranial nerves palsy and visual disturbances. Single STA-MCA bypass was done in 19 cases, high flow bypass using radial artery graft was performed in 6 cases. In 1 case we created double STA-MCA bypass. During the follow up period (3-60 months) bypass occlusion occurred in 2 cases. Aneurysms were occluded completely in 25 cases. Surgical morbidity was 19% and ranged between 1 to 3 points by mRS. We did not experience any mortality in our series.
Conclusion: Our experience shows high rates of bypass patency and aneurysm occlusion, acceptable level of postoperative morbidity and no mortality.
Keywords: EC-IC bypass, Complex aneurysm, Internal carotid artery

OP-NV.06-07

Surgical Treatment of Dorsal Aneurysms of the Internal Carotid Artery (Blood-Blister Like): Experience in a Series of 14 Cases

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Background: Aneurysms of the dorsal wall of the internal carotid artery (ICA) are rare. They arise from non-branching ICA points, are often non-saccular, caused by focal dissection, have fragile walls, with a half-domed morphology, and are therefore referred to as blood-blister like. They have high morbidity due to a high probability of intraoperative rupture. Several types of treatment have been proposed including surgery and endovascular techniques. The aim is to describe our experience with the surgical treatment of aneurysms of the dorsal wall of ICA.
Method: Retrospective charts and radiological examinations, surgical photos and videos were analyzed.
Results: 14 patients with SAH secondary to ACI dorsal wall aneurysms were identified, of which 10 were women. The average age was 45 years. Hemorrhage was classified as Fisher III in 13 cases and Fisher I in a Fisher case. The mean Hunt-Hess pretreatment was 2.0. The mean time between stroke and treatment was 8.6 days. In 13 cases it was possible to reconstruct the ACI with the use of clips and in one case it was necessary to use the clip wrapping technique. Control angiography demonstrated complete exclusion of the aneurysm in all but one cases where re-attachment was required for clipping of residual aneurysm. The mean Glasgow Outcome Scale (GOS) score at the last follow-up was 4.4 with an average follow-up of 23.4 months.
Conclusion: In our experience, surgical repair of aneurysms of the dorsal wall of the ACI (Blood-Blister Like) was associated with high rates of permanent occlusion and low surgical morbidity.
Keywords: Aneurysm, Blister, Internal carotid artery

OP-NV.06-08

Clipping Versus Coiling, in Anterior Circulation Ruptured Intracranial Aneurysms: A Meta-Analysis

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Background: Decision making in the management and treatment, using open surgical or endovascular repair, in anterior circulation ruptured intracranial aneurysms, is a complicating process. Our study tries to evaluate the possible superiority on outcomes, studying operative mortality, permanent neurologic deficit, late mortality and need for re-intervention, after open surgical and endovascular repair in anterior circulation ruptured intracranial aneurysms.
Method: This Meta-Analyses study included articles compared outcomes of the two methods, published in full text form (last search performed on 06 December 2016). Extracted data was organized on a standard table form, including first author, country, covered study period, publication year, general number of patients and patients at follow-up, operative mortality rate (with 30 days from the selecting treatment), permanent neurological deficit (appearing after surgery), late mortality (after 1 month) and re-intervention (surgery or coiling), for both group patients. Follow-up included a period of at least 1 year.
Results: There were 284 articles, identified for our study. The total study population was 1834 patients, 932 of which were treated by surgical clipping and 902 endovascular using coiling. The pooled results saw no statistical significant difference between the two groups [Odd ratio (OR)**:** 0.97, 95% confidence interval (CI)**:** 0.42 – 2.25, p=0.94], with no heterogeneity (p= 0.70, I2 = 0%).
Conclusion: There is no superiority of the one method over the other. Selection of the appropriate procedure in case of anterior circulation, ruptured intracranial aneurysms, must be taken case by case, considering its special characteristics.
Keywords: Intracranial aneurysms, Anterior circulation, Ruptured aneurysms, Clipping, Coiling

OP-NV.06-09

Treatment of Giant ICA Aneurysms Other than Direct Clipping: Single Center Experience

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Background: Management of complex paraclinoid aneurysms is still controversial. The aim is to evaluate the results of treatment of complex paraclinoid aneurysms at single institution.
Method: Retrospective analysis of cases treated at our center between 2008 and 2016 years was conducted. Evaluation of cerebral collateral flow was done by balloon test occlusion (BTO). During the follow up period neurological, radiological and angiographic data was evaluated.

Results: We reviewed records of 20 patients (2 patients were male, 18 female, mean age 53 years) with complex internal carotid paraclinoid aneurysms. 8 aneurysms were treated by endovascular deployment of flow diverter device (FDD), in 12 cases we trapped the aneurysm by parent artery occlusion with or without preliminary extra-intracranial (EC-IC) bypass. Patients presented with headache, cranial nerves palsy and visual disturbances. Follow up period ranged between 6 to 24 months (mean 10 months). In 10 cases we performed parent artery occlusion. 2 cases underwent preliminary EC-IC bypass surgery. In 2 cases emergency EC-IC bypass was performed due to signs of cerebral blood flow insufficiency. 8 patients underwent deployment of FDD. In this group we experienced one fatal complication due to the FDD occlusion and severe ischemic stroke. Aneurysms occlusion rate was 100%. Neurological symptoms improved in 17 cases (85%).
Conclusion: Despite one fatal outcome in our initial experience, precise assessment of cerebral collateral flow, aneurysm and parent vessel morphology, resistance to antiplatelet therapy the endovascular deployment of FDD or parent vessel trapping can show neurological improvement and high rates of aneurysm occlusion.
Keywords: Complex aneurysm, Internal carotid artery, Paraclinoid, Flow diverter, Trapping

OP-NV.07-01

Relation of Gray-White Matter Ratio with Long-Term Cognitive Functions and Quality of Life in Patients with Mild to Moderate Aneurysmal Subarachnoid Hemorrhage: A Prospective Observational Study

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Background: In the present study, our hypothesis was whether low gray matter–white matter ratio (GWR) is the predictor of poor cognitive function and low quality of life in patients with mild to moderate aSAH.
Methods: All patients with aSAH who were admitted to NICU and whose WFNS score≤3 were enrolled to study. During NICU follow-up, following variables were recorded**:** demographics, neurological status, comorbidities, treatment method, the number of day with vasospasm symptom (DVS) and vasopressor usage. One year after bleeding, all patients were administered MoCA and SF-36 tests, and brain magnetic resonance imaging and then volumetric brain analysis were performed.
Results: Eighty-two patients completed the study. One year after aSAH, cognitive dysfunction and low quality of life were observed in 59.8% and 25.6% patients, respectively. Among the variables obtained during NICU follow-up, DVS was found as risk factor for cognitive dysfunction (OR**:**3.9, 95%CI**:**1.9–7.8;p<0.001), for poor quality of life (OR**:**2.8, 95%CI**:**1.4–5.3,p=0.002) and for lower GWR value (p<0.001, correlation coefficient= −0.410,R2=0.234). One year after aSAH, higher GWR value associated with higher MOCA (R2 = 0.506 for male, R2 = 0.413 for female) and SF-36 (R2 = 0.270 for male, R2 = 0.364 for female) scores. Also GWR≤ 1.35 in male and GWR≤1.33 in female were predicted MOCApoor patients with over 80% specificity and sensitivity.
Conclusion: GWR has good correlation with MOCA and SF-36 score and also, GWR can predict cognitive dysfunction. So GWR can be used as an alternative method to evaluate patients' status one year after aSAH.
Keywords: Subarachnoid hemorrhage, Intracranial aneurysm, Cognitive function, Quality of life, Neuroimaging, Gray-white matter ratio

OP-NV.07-02

Genetic Predisposition to Intracranial Aneurysm in Kazakh Population

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Background: Intracranial aneurysm (IA) is common vascular disease characterized by pathological remodeling of the aortic extracellular matrix. In this sense, arterial endothelial dysfunction genes are potential genetic risk factors of IA. The purpose of the present case-control study was evaluated whether different genetic predictors are involved in the formation of IA in the Kazakh population.
Method: 249 patients with IA and 180 healthy controls 16-83 years old (mean age – 53 years, male/female distribution – 181/248) were included in this study. Individuals from both case and control groups were ethnic Kazakhs. Genotyping of 60 single nucleotide polymorphisms (SNPs) was performed on the QuantStudio 12K Flex (Life Technologies).
Results: We found that the CDKN2B-AS1 rs2383207 was associated with a significantly increased risk of developing IA in a dominant (OR 2.59, 95% CI, 1.38–4.86, P=0.002) and recessive models (OR 8.01, 95% CI, 2.6–24.66, P=0.0001). The second strongest association was at rs1333040 in a dominant model (OR 5.21, 95% CI, 2.61–10.37, P=0.0001). NOS3 rs2070744 (OR 6.63, 95% CI, 2.26-19.45, p = 0.0001), CNNM2 rs12411886 (OR 9.85, 95% CI, 1.27–76.60, P=0.003) and RRBP1 rs1132274 (OR 16.31, 95% CI, 3.78-70.30, p = 0.0001) was also highly associated with development of IA in dominant model. Moreover, multivariate analysis demonstrated increasing age, gender, and mutant or heterozygous genotypes were significant predictors IA.
Conclusion: These findings indicate that the two polymorphisms rs2383207 and rs1333040 of CDKN2B-AS1, NOS3 rs2070744, CNNM2 rs12411886 and RRBP1 rs1132274 is a predisposition risk factor for the development of IA in Kazakh population.
Keywords: Intracranial aneurysm, Genetic risk factors, Kazakh population, Single nucleotide polymorphisms.

OP-NV.07-03

Early Plasma Creatinine Levels After Aneurysmal Subarachnoid Hemorrhage Correlate with Functional Neurological Outcome – A Single Center Series

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Background: Acute kidney injury is common in critically ill patients and may contribute to poor outcome. However, data on the potential influence of early plasma creatinine (pCr) in patients suffering from aneurysmal subarachnoid hemorrhage (SAH) on neurological outcome is scarce. We therefore analyzed our neurovascular database in order to study the association between early pCr and functional outcome after SAH.
Method: From 2011 to April 2016, 330 consecutive patients suffering from aneurysmal SAH were included in this retrospective cohort study. Information, including patient characteristics, treatment modality, aneurysm size and location, laboratory values, radiological features, and functional neurological outcome were assessed and further analyzed. Patients suffering from SAH were divided into good-grade (WFNS I-III) versus poor-grade (WFNS IV-V) on admission. Outcome was assessed according to the modified Rankin Scale (mRS) at 6 months and stratified into favourable (mRS 0-2) versus unfavourable (mRS 3-6).
Results: Overall 163 of 330 patients suffering from aneurysmal SAH achieved favourable outcome (49%). Patients with SAH and initial pCr levels < 1.0 mg/dl achieved significantly more often favourable outcome compared to patients with SAH and initial pCr levels ≥ 0.8 mg/dl (p<0.01). In the multivariate analysis, higher levels of pCr (p=0.09, OR 2.8, 95% CI 1.3 – 6.1), poor grade at admission (p<0.01, OR 8.8, 95% CI 4.7-16.3), and aneurysm size (p=0.03, OR 1.1, 95% CI 1.01-1.2) were predictors of unfavourable outcome.
Conclusion: Increased early plasma creatinine levels are associated with unfavourable functional outcome after SAH, which is a readily marker available in this patient population.
Keywords: SAH, Aneurysmal subarachnoid hemorrhage, Plasma creatinine, Neurological outcome, pCr, Aneurysm

OP-NV.07-04

Ratio of Nitric Oxide Metabolite Levels in CSF and Serum and Their Correlation with Severity and Outcome in Patients with Subarachnoid Hemorrhage

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Aim: To study nitric oxide metabolite (NOx) levels in CSF and Serum in patients with spontaneous subarachnoid hemorrhage (SAH), based on the World Federation of Neurosurgeons (WFNS) grading on admission, CT Scan findings of patients classified according to the Fisher Grading System for SAH, and outcome based on Glasgow Outcome Score (GOS) of patients at 6 months post ictus.
Method: 40 adult patients aged 18 years to 77 years old were admitted to Hospital Universiti Sains Malaysia with Aneurysmal Spontaneous SAH from March 2013 until June 2015, were included in the study. Mean levels of CSF and Serum NOx were compared with indicators of severity grading, vasospasm and outcome severity in aneurysmal SAH, including Glasgow Coma Scale score on admission, vasospasm according to CT scan findings and clinically and Glasgow Outcome Scale.
Results: Median (IQR) of CSF and Serum NOx was 0.5231 µmol/L and 2.397 µmol/L. The highest measured values for CSF and Serum NOx was 4.35, 13.27 µmol/L while lowest was 0.17, 0.37 µmol/L The mean level in ratio of CSF/Serum over Day 3 only, were found to be significantly difference in patients correlate with poor outcome grading (p = 0.030) based on GOS score. Otherwise there was no significant difference in mean level of ratio CSF/Serum in the subgroups of severity grading (p = 0.582) and vasospasm status (p = 0.888).
Conclusion: It can be concluded that ratio of CSF/Serum NOx levels may serve as a potentially useful biomarker in SAH given its significant association with outcome grading.
Keywords: Nitric oxide, Cerebral spinal fluid, Serum, Spontaneous subarachnoid haemorrhage, Biomarker

OP-NV.07-05

Angiogram-Negative Subarachnoid Hemorrhage: Comparison Between Diffuse and Perimesencephalic Distribution

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Background: Angiogram-negative subarachnoid hemorrhage (SAH) accounts for 15% of spontaneous SAH and is subdivided into diffuse angiogram-negative SAH (d-SAH) or perimesencephalic SAH (p-SAH) depending on the bleeding distribution. P-SAH is known to have a benign natural course unlike d-SAH, which tend to mirror aneurysmal rupture.
Method: This is a retrospective comparative study carried out in the department of Neurosurgery of Fattouma Bourguiba University hospital, Monastir, Tunisia between January 1995 and February 2016.
Results: We collected a total of 86 angiographically negative SAH**:** 45 (52.3%) with p-SAH and 41(47.7%) with d-SAH. Age and gender distribution was similar in both groups. The major risk factors observed were tobacco, high blood pressure and diabetes mellitus. All patients with p-SAH had mild neurological condition (WFNS grades I, II) whereas 5% of patients with d-SAH had WFNS grade III, IV or V. The amount of bleeding varied between grade 1 and 2 in the modified Fisher scale in p-SAH group whereas in the d-SAH group, severe grades were noticed (21.9%). DSA was performed in 29 cases of p-SAH and 34 cases of d-SAH and MRA in 7 cases in p-SAH and 6 cases of d-SAH. None of the aforementioned

radiological exams showed a vascular malformation. Few cases experienced complications, most of them in d-SAH group. The outcome was evaluated according to the Glasgow Outcome Scale and was favorable in both groups.
Conclusion: Angiogram-negative SAH whether diffuse or perimesencephalic has almost an uncomplicated clinical course and favorable outcome.
Keywords: Angiogram negative, Subarachnoid haemorrhage, Perimesencephalic haemorrhage, Non-aneurysmal, Outcomes

OP-NV.07-06

Intracranial Aneurysms and Metabolic Syndrome: Multiplicity and Risk of Rupture

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Background: Hypertension and cigarette smoking are well known risk factors for intracranial aneurysm occurrence and rupture. However, literature regarding diabetes mellitus, hyperlipidemia and obesity is controversial. In this study, we aimed to investigate whether there is an association between metabolic syndrome (MetS) and intracranial aneurysms.
Method: We retrospectively collected data of the patients with intracranial aneurysms treated either surgically or endovascularly at our institution between 2006-2016. Data collected included age, sex, BMI, presence of hypertension, diabetes or impaired fasting glucose, hyperlipidemia and use of antihypertensive, antidiabetic and antilipidemic drugs, aneurysm multiplicity, size and locations, and rupture status.
Results: A total of 585 patients (177 male, 408 female) had 826 aneurysms. Nearly half of the patients (47.9%) had SAH. One hundred and one patients (27.5%) had multiple aneurysms. Metabolic syndrome (obesity plus 2 other criteria) was encountered in 37.9%. Regarding its components, obesity (BMI>30) was observed in 36.8%, hypertension in 68.0%, dyslipidemia/hyperlipidemia or the use of antilipidemic medication in 54.5% and raised plasma fasting glucose or diabetes mellitus or antidiabetic medication in 33.7%. No association was found between MetS and aneurysm multiplicity or rupture risk. When components of MetS were assessed separately, only association found was inverse relationship between impaired fasting glucose/diabetes and aneurysm rupture risk (p=0.003).
Conclusion: Metabolic syndrome has no effect on aneurysm multiplicity or rupture risk. Nevertheless, diabetes or impaired fasting glucose seems to confer a protective effect for the risk of intracranial aneurysm rupture.
Keywords: Aneurysm, Multiplicity, Rupture, Metabolic syndrome, Diabetes, Hyperlipidemia

OP-NV.07-07

Outcome of Poor-Grade Aneurysmal Subarachnoid Hemorrhage Patients After Aggressive Treatment

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Background: Patients with high-grade subarachnoid hemorrhage (WFNS 4-5) traditionally have poor outcome and their treatments are controversial. Here we report our experience in management of these patients and their clinical outcome after aggressive treatments.
Method: We retrospectively reviewed the medical records of patients with aneurysmal SAH and included the patients with following criteria patients**:** high grade aneurysmal SAH (WFNS 4-5) and age between 18-85 years old. The exclusion criteria were**:** GCS 3, bilateral and non-reactive pupils, non-aneurysmal SAH, and age more than 85. Based on the patients' condition, aggressive treatment included EVD insertion and ICP monitoring, decompressive craniotomy, full sedation, and endovascular treatment for vasospasm. Outcome is assessed by modified rankin scale (mRs) at last follow-up. The outcome was dichotomized into good outcome (mRs 1-3) and poor outcome (mRs 4-6).
Results: From a total of 502 patients with aneurysmal SAH, treated at our hospital, 97 patients were classified as poor-grade (WFNS 4-5). Mean age was 55.4 years and female included 61%. External ventricular drainage was used in 74%, including 71% in patients with WFNS 4 and 83% in WFNS 5. All aneurysms were managed with endovascular treatment). Anterior communicating artery was the most common location of aneurysm (41%). Vasospasm was noted in 32% of patients and delayed cerebral ischemia occurred in 21%. Good outcome occurred in 56% and poor outcome in 44%.
Conclusion: This study showed that aggressive treatment of high grade SAH patients may result in good outcome in more that 50% and they should not be abandoned.
Keywords: Subarachnoid hemorrhage, Endovascular, Aneurysm

OP-NV.07-08

Is there a Relationship Between Neutrophil / Lymphocyte Ratio and Mean Platelet Volume (MPV) with Prognosis in Aneurysmal Subarachnoid Hemorrhage Patients

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Background: Hemorrhages in the subarachnoid space of the brain, usually due to arterial causes, can often occur as trauma, aneurysm, vascular malformations, bleeding disorders, brain tumors and anticoagulant treatment complications. The importance of inflammation in the event of subarachnoid hemorrhage (SAH) is emphasized. We investigated early leukocyte, neutrophil and lymphocyte counts, neutrophil / lymphocyte (N / L) and mean platelet volume (MPV) ratio and prognosis in patients with aneurysmal subarachnoid hemorrhage.
Method: This study was carried out to investigate 50 patients

who were followed-up and treated with Neurosurgery Clinic of Kırıkkale University Faculty of Medicine between 2015 and 2016 with recognition of aneurysmatic SAH. The blood count parameters of these cases, clinical status after admission and discharge were compared retrospectively with healthy control group.
Results: Early leukocyte and neutrophil counts and neutrophil / lymphocyte ratio were significantly higher in the patient group with aneurysmatic SAH than in the control group. There was statistically significant difference between N / L ratio and prognosis. There was no difference in MPV ratios.
Conclusion: There is a relationship between the level of inflammation and the severity of the disease in patients with aneurysmatic SAH, and this relationship may play an early predictor of treatment and prognosis.
Keywords: Aneurysm, Subarachnoidal hemorrhage, Neutrophils, Leukocytes, Mean platelet volume

OP-NV.07-09

Prognostic Value of S100B Protein and Neuron-Specific Enolase in Patients with Poor Grade Aneurysmal Subarachnoid Haemorrhage

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Aim: To investigate the value of S100b protein (S100) and neuron-specific enolase (NSE) in prognosticating outcome in patients with high grade aneurysmal subarachnoid haemorrhage (SAH).
Method: Between 2012- 2014, patients SAH (Hunt & Hess grade 3-5) who were admitted within 24 hours after haemorrhage were prospectively enrolled. Serum NSE and S100 levels were assayed once daily during the first 3 days after haemorrhage. Patient characteristics, Glasgow Coma Scale, Hunt & Hess and Fisher grade at admission were recorded. Glasgow outcome scale was obtained at 6 months and dichotomized as poor (1–3) or good (4–5). Logistic regression and ROC curve were used to assess the predictive value of S100 and NSE and cut-off values were calculated using conditional interference trees.
Results: 52 patients were included. Hunt & Hess grading was 3 in 23 patients, 4 in 15 and 5 in 14 patients. S100 ranged from 0.07 to 5.62µg/l (mean 0.87±1.06µg/l). NSE range was 5.7 to 94.2µg/l (mean of 16.1±10.5µg/l). At 6 months follow-up, 23 patients (44.2%) had poor outcome and 29 (55.8%) showed good outcome. Both S100 at day one (p=0.004, cut-off 0.202µg/l) and NSE at day one (p=0.047, cut-off 9.4µg/l) predicted good outcome with a specificity of 100%. The specificity of mean S100 in predicting poor outcome reached 100% (p=0.003) when combined with mean NSE levels.
Conclusion: S100 and NSE measured during the first 3 days after haemorrhage showed separately and combined a significant predictive value in prognosticating clinical outcome in patients with high grade SAH.
Keywords: Intracranial aneurysm, Subarachnoid haemorrhage, S100, NSE

OP-NV.08-01

Prognosis and Surgical Decision Making for ICH Operative Treatment Candidates – A Multivariable Regression Analysis

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Background: Intracerebral hemorrhage surgery still remains one of the most controversial issues in neurosurgery. This is an enhanced version of previous studies in the fact that it also assesses the validity of estimates.
Method: We have retrospectively analyzed our results of 234 large intracerebral hemorrhages patients. After initially assessing the correlation between each of the suspected prognostic factors and both survival rates and GOS with bivariate analysis, a multivariable regression analysis was used to estimate their relative impact to the outcome. The prognostic factors were (a) radiologic**:** Size of lesion, location, depth, edema (b) demographics**:** Age (c) clinical**:** GCS, rate of deterioration, anisocoria, dilation, pupillary response (d) monitoring**:** ICP (e) surgery type.
Results: All prognostic factors were found to have a statistically significant correlation to both survival rate and GOS ($p < 0.05$). The multiple regression model comprising of all the significant factors has a predictive value of $R2 = 0.87$ – which means 87% correct GOS prognosis), but still suffered of severe multicolinearity problems because many of the examined predictors are highly intercorrelated. (E.g**:** mydriasis without pupillary reactivity to light almost unavoidably coexists with very elevated ICP and GCS = 3).
Conclusion: After modifying our initial stepwise regression analysis practical model - (1) GCS (2) lesion location (3) age (determining operation solely in terms of GCS since for any given patient lesion location and age are constants),- the enhanced version provides 0.85 predictive value with the addition of ICP and Operation type only for few preselected patients!
Keywords: ICH, Prognosis, Multivariable, Decision

OP-NV.08-02

Outcome of Surgery of Chronic Subdural Hematoma Done Under General Anesthesia Versus Monitored Anesthesia Care

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Background: Chronic subdural hematoma (CSDH) is one of the most common clinical entities in neurosurgical practice especially in elderly. Surgical treatment of CSDH can be done under different types of anesthesia. This study was conducted to compare the surgical outcome done under General Anesthesia (GA) versus Monitored Anesthesia care (MAC).
Method: Total 80 patients were operated for CSDH, half of them were given GA and the rest were given MAC and the surgical

technique was burr hole craniostomy with closed system drainage. Surgical and anesthetic complications were compared between two groups and Glasgow Coma Scale (GCS), Markwalder's Neurological Grading Scale MGS) and Glasgow Outcome Scale (GOS) were used to assess the patients on follow up.
Results: Peri-oral trauma (10%) and delayed recovery (7.5%) were the per-operative complications for GA whereas respiratory depression (5%) and restlessness (7.5%) were the complications for MAC. Nausea/vomiting, muscle pain and sore throat were the statistically significant postoperative complications for GA. Mean operation time was 63.05 minutes in GA group and 54.80 minutes in MAC group. The final outcome was good recovery 82.75% GA and 83.87% in MAC group, recurrence rate was 6.90% in GA and 9.68% in MAC group, mild to moderate disability was found 6.90% in GA whereas it was 6.45% in MAC group and death occurred 3.45% in GA group.
Conclusion: In this study, the surgical outcome of chronic subdural hematoma between GA and MAC group was found same but anesthesia related complications and operation time was more in GA group.
Keywords: Chronic subdural hematoma, General anesthesia, Monitored anesthesia care, Surgical outcome

OP-NV.08-03

The GVS: Glasgow Coma Score, Volume & Site of Hemorrhage as a Simple Scoring System for Intracerebral Hemorrhage

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Background: Hemorrhage within the brain parenchyma (ICH) has the worst impact on human life and accounts for 10-17% of all strokes seen in the mid and later age of life. The goals of this research were to develop a new score to predict mortality and morbidity of ICH also to check the efficacy and simplicity of the new score.
Method: We performed a prospective observational cohort study of all patients with spontaneous ICH admitted to the inpatient departments of KMCH, KSH and IBH from June 1, 2010, to May 31, 2011 and follow-up for each patient was for next one year where patient assessed with the modified Rankin Scale (mRS) at 1 month, 3 months, and one year. The proposed score (GVS) was developed by check the association of independent variable and outcome. We also checked the efficacy of proposed scoring system; compare this one with previous conventional scoring system.
Results: Of 209 total patients, 56 were lost to follow-up, thus we concluded the study with 153 cases. GVS was significant at p= <0.05(95% CI), CAT-PCA test revealed age, midline shift, and IVH weakly related with outcome. The interrater reliability for the raters was found to be Kappa = 0.75 ($p < 0.001$) reveal substantial agreement between GVS and ICH. Change in outcome after three months is less though there were some noticeable changes from three months to one year.
Conclusion: The GVS is a simple scoring system for outcome prediction after spontaneous ICH.
Keywords: Intracerebral hemorrhage, Score, Outcome, GCS

OP-NV.08-04

Spontaneous Intracerebral Hemorrage: Diagnostic Difficulties Between Neoplastic or Arterial Hypertension

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Background: Spontaneous intracranial hemorrhage (SIH) may be the first clinical manifestation of a brain tumor, whose symptoms and CT characteristics mimic a typical hypertension bleeding. Complicating and delaying a possible early diagnosis, fundamental to a favorable outcome in those cases. We will expose the diagnostic difficulties among spontaneous intracerebral hemorrhage and those resulting from secondary lesions of brain's expansive processes.
Method: 26 cases, between 1979 and 2012, of doubtful diagnosis between neoplastic bleeding and hemorragic stroke. Demonstrating the clinical symptoms, location of intra-cerebral hematoma with pathological studies, more frequent metastases, most common locations of intracranial hemorrhage, and, the resolution of those cases.
Results: Metastasis were the tumors most often founding in these casuistic, and Glioblastoma was the most common brain primary tumor.
Conclusion: The intratumoral hemorrhage may be the initial manifestation of brain tumors, and sometimes, they are indistinguishable from typical SIH (hypertensive), both in clinical and tomographic image, making the diagnosis more difficult. The intratumoral hemorrhage is more frequent in brain metastasis than in gliomas, the Glioblastoma is the most common bleed Glioma. It´s important for the patients good outcome, that we never loose sight of bleeding tumors as a differential diagnosis.
Keywords: Spontaneous intracerebral hemorrhage, Brain intratumoral bleeding, Differencial diagnoses

OP-NV.08-05

Primary Putaminal Hemorrhage: Surgical Evacuation of Hematoma via Transcortical Transfrontal Approach Using Single Brain Retractor

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Patients with putaminal hemorrhage secondary to uncontrolled hypertension may require surgical treatment. The aim is to describe surgical technique of evacuation of putaminal hematoma via middle frontal gyrus approach using single brain retractor at Department of Neurosurgery, Hospital Sungai Buloh, Malaysia. Patient is positioned in supine with head tilted to the opposite side of the surgical site with almost 60 degree from the vertical plane. The head end is propped up about 20 degree from the horizontal plane. Frontal skin incision is made. A five centimetres in diameter

frontal craniotomy is made. Dura is opened in cruciate fashion. Small middle frontal gyrus corticotomy is made with length of one to 1.5 cm. Poppen ventricular needle is inserted just lateral to the frontal horn of ipsilateral ventricle till reaches the hematoma. Poppen ventricular needle is removed. The corticotomy is extended in depth towards the white matter following the trajectory of the poppen needle by using controlled suction and 1 cm brain retractor. Once the hematoma is visualized, a thin patty is placed medially and brain retractor is on the opposite side (laterally). Left hand is holding the brain retractor while the right hand is holding the controlled sucker. The sucker is pushed onto the patty medially if a bigger tunnel is needed to visualize the hematoma. The hematoma is evacuated via direct visualization. Post-operatively, significant amount of hematoma was evacuated without any vascular injury. The brain damage was minimal with small tract was seen post-operatively, sized about one to 1.5 cm.

Keywords: Primary hypertensive putaminal hemorrhage, Surgical evacuation, Craniotomy, Single retractor

OP-NV.08-06

Analysis of Spontaneous Intracerebral Haemorrhage in Sarawak (Borneo) and a 9 Year Review of Survival and Outcome

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The purpose of the study was to perform analysis of predictors and outcome of all patients presenting with spontaneous intracerebral patients at the Sarawak General Hospital during a 1-year period(2007-8). A second stage of the report looks at the 9 year outcome using the Glasgow Outcome Score (GOS).

A total number of 118 patients were admitted and 19 patients were subjected through surgery. The indication for surgery was influenced by patient factors and scan findings. The variables studied for both groups of operated and non operated cases included; Glasgow Coma Scale(GCS) on admission, anisocoria, clot size, Intraventricular haemorrhage(IVH), hydrocephalus, midline shift, presence of hypertension. A GOS at 6 months was performed. The outcomes of operated patients are reported. Clot size, anisocoria and age seemed to have strong impact on decision to operate in our practice. Other factors influencing the outcomes are also reported. The 9-year period analysis will be completed in June 2017 and reported. As the sample size is small and the nature of study is single institutional we will also discuss the interpretation of results, strength of conclusions, comparison with similar studies and landmark trials and also the challenges faced in a then resource poor environment. We have also acknowledge that the high incidence of spontaneous haemorrhage is a reflection of sub-optimal control of hypertension in most cases and creates a platform for us neurosurgeons to feedback to the primary healthcare providers.

Keywords: Hypertensive intracranial haemorrhage, Surgery, GOS

OP-NV.08-07

Spontaneous ICH in Young Adults: Incidence, Causes, and Outcome

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Background: Spontaneous intracerebral hemorrhage (ICH) in young adults< 40 years is rare, and the true incidence has been poorly studied. There is traditionally risk of harboring an underlying vascular etiology in these cases. Although DSA is the golden diagnostic tool for such patients, but CTA is noninvasive, fast, and available at any time. Different pathologies could be addressed. We conducted a two-center study to evaluate incidence, causes, locations, and surgical outcomes ICH of ICH in young adults.

Method: We enrolled young adults with spontaneous ICH who underwent emergent surgical management. Patients with ruptured intracranial aneurysms or GCS < 8 were excluded. At three-month follow-up, GOS score >3 were considered as a good outcome.

Results: A total of 67 adults (between 15 and 35 years old) underwent surgical evacuation of their ICH during the period from July 2013 till June 2016. There was underlying structural lesions in 43 (64%) of these patients, illicit drug abuse in 14 (21%) and undetermined etiology in 10 (15%). All patients (100%) had good outcome at 3-month follow-up evaluation. Persistent neurologic deficits were present in 36 (54%) patients. Hemi-paresis in 10 (15%), Hemi-hypoesthesia in 7 (10%), ataxia in 1 (1.5%), dysphasia in 5 (7.5%), visual field impairment in 7 (10%) and diplopia in 3 (4.5%).

Conclusion: ICHs in young people are mainly lobar in location and result from vascular malformation. Cerebral CTA provides sufficient data for safe surgical management. Surgical hematoma evacuation and management of the underlying structural lesions is associated with good prognosis.

Keywords: Spontenous ICH haemorrage, Young, Vascular, Incidence, Causes, Prognosis

OP-NV.08-08

Endovascular Treatment for Acute Ischemic Stroke: A Regional Centre Experience

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Background: Endovascular treatment has been established as an effective therapy for acute ischemic stroke caused by proximal intracranial occlusion. Variabilities in treatment protocols exist among recently published trials, however timely successful reperfusion has been shown to improve outcome. By studying into each critical step of patients undergoing endovascular treatment, we aim to review the workflow of our practice and to investigate on factors influencing clinical outcome.

Method: This is a retrospective review of patients who were admitted for acute ischemic stroke due to proximal intracranial occlusion with endovascular treatment performed from January 2013 to August 2016. The angiogram findings, endovascular treatment

technique, workflow time interval, outcome and complications were studied. Primary outcome was assessed using the modified Rankin scale (mRS) at 90 days.
Results: 30 patients were included, 25 of anterior circulation stroke and 5 of posterior circulation stroke, with median age 68. Thrombolysis in cerebral infarction (TICI) 2b/3 recanalization rate was 80%. At 24 hours after recanalization, there was an improvement of median National Institutes of Health Stroke Scale from 21 to 17. The emergency room to groin puncture time interval appears to be a significant factor in influencing clinical outcome, with median time of 116 minutes in the good outcome group (mRS 0-1) compared to 172 minutes in the poor outcome group (mRS 2-6).
Conclusion: We have also observed a longer time interval between emergency room arrival to CT cerebral angiogram compared to other international studies. This may have implications on future restructuring of an efficient acute stroke pathway.
Keywords: Endovascular treatment, Mechanical thrombectomy, Ischemic stroke

OP-NV.08-09

An Internal Carotis Artery Infarction Case Which Responses to Decompressive Surgery

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The hemicraniectomy attempts, which were made for the first time by Cushing, are life-saving for many different pathologies. Malign cerebral infarctions are wide hemispheric lesions and have high mortality rates up to 80% despite maximum preventive care. 38 years old woman came to emergency service with the sudden onset left hemiparesis, deterioration in speech and impairment of consciousness. Her neurological examination (NE) were; mild confusion, left central fasial paralysis, dysarthric speech and hemiparesis in left hand and leg in 2/5 rate. In DWI-MRI; there was diffusion abnormality which was compatible with acute infarction in the right internal carotis artery (ICA) supply area. 20 hours later the event, decompressive hemicraniectomy+ duraplasty surgery was carried out. A month after the event, her NE; she has left hemiparesis (2/5), left central fasial paralysis and left hemihypoesthesia excluding face. In her second year control NE; she has left hemiparesis (4/5), mild left central fasial paralysis, mild dysarthric speech, left hemihypoesthesia excluding face. Decompression surgery has a definite role to reduce mortality rates in malign cerebral infarction and to improve functional outcomes, but most of the studies were made on middle cerebral artery (MCA) infarctions. Acute ICA infarction is rare but quite fatal; 40% of patients have severe disability, and approximately 20% of the patients die. Although our patient has many poor diagnostic factors; thanks to her young age, she has proved the importance of age factor in obtaining favorable results from decompressive surgery in compliance with the literature.
Keywords: Stroke, Decompression, Surgery, Internal carotis artery

OP-NV.09-01

The Search of the Genetic Predisposition with the Development of Arteriovenous Malformations in the Residents of Russia

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Background: Arteriovenous malformations - it a congenital patology of vessels of brain which existence of hypertrophied arterial vessels (afferent, feeders) a large number the arteriovenous shunts which ball forms a body of malformation and the expanded draining veins. According to literary data, various factors initiating pathological process in the field of future malformation, including the genetic factors can take part in development of AVM. The genes which are taking part in angiogenesis (CDKN2A, CDKN2B, VEGF, ANGPTL), genes of inflammatory cytokins (TNFa, IL1a) etc. The aim of this work is to study the role of allelic polymorphism of genes involved in angiogenesis**:** CDKN2A (rs7865618), CDKN2B (rs1333040), ANGPTL4 (rs11672433), VEGF (rs2010963), TNFa (rs1800629), IL-1a (rs1800587), IL-1b (rs16944), IL-8 (rs4073), MMP3 (rs3025058) in the genetic predisposition to the development of AVM.
Method: The study included 191 patients with brain BAVM`s, confirmed with Magnetic resonance imaging (MRI) and cerebral angiography (CAG) in the clinical centers in Novosibirsk. The control group consisted of 480 residents of Novosibirsk without BAVM. Determination of polymorphic variants of genes was performed by Real Time qPCR using TaqMan-competing probes. The frequency of occurrence of genotypes for all studied polymorphic loci corresponded to the law of Hardy-Weinberg equilibrium.
Results: For the polymorphic locus rs7865618 CDKN2A gene revealed statistically significant differences of frequencies of occurrence of genotype GG in the control group and the group of patients with AVM ((OR=1,915, 95% CI=[1,158-3,167], p-value =0,01).
Conclusion: Thus, the genotype GG may be a risk factor for the development of AVM among residents of the Russian Federation
Keywords: Arteriovenous malformation, Gene, Polymorphic variants

OP-NV.09-02

Outcome of the Treatment of 155 Basilar Apex Aneurysms Using Advanced Transcavernous Microsurgical Clipping

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Aim: To present the outcome of our experience in treating complex basilar apex aneurysms using advanced microsurgical techniques utilizing variations of the transcavernous approach.
Method: Data on 155 surgically clipped basilar apex aneurysms were prospectively collected and retrospectively analyzed. Clippability,

outcome (clinical and radiologic) were analyzed at discharge, 6 months and one year.
Results: 131 out of 155 were basilar tip aneurysms. 54 were ruptured, 6 associated with rupture and 71 unruptured. Of the ruptured aneurysms 51% presented Hunt and Hess Grade 3 or worse, and 57% were large or giant. Mortality was 12% and 81% of patients were at mRs 0-1 on one year follow-up. The surgical mortality for the unruptured group was 0% and discharged; and 84% were mRs 0-1 at discharge. At one year follow-up 95% were mRs 0-2.
Conclusion: Microsurgical clipping of basilar tip aneurysm using advanced microsurgical techniques continues to be a very durable and safe modality when done in the proper set-up by an experienced team. It should continue to be utilized and promoted especially for aneurysms that have a high endovascular recurrence rate.
Keywords: Basilar, Apex aneurysm, Transcavernous approach

OP-NV.09-03

Outcome of the Microsurgical Treatment of 221 Paraclinoid Aneurysms

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Aim: To present our experience with the management of 325 paraclinoid aneurysms. 62 out of 325 (19%) were treated conservatively.
Method: A pretemporal predominantly extradural approach and wide exposure of the paraclinoid region was used in each patient. The microsurgical outcome of 221 clipped aneurysms was evaluated including Rankin scales and visual outcome obtained post-operatively, 6 months and one year. Data was prospectively collected and retrospectively analyzed.
Results: 263 patients received treatment (clipping = 221, wrapping = 17, trapping = 4, endovascular = 32, EC-IC bypass = 5). Female/male ratio = 6.5/1. Median age 54 (average 53.7). 55% were superior 26% inferior 9% lateral, 10% medial). 30 of the microsurgically clipped patients presented with rupture and 191 with unrupture. Perioperative mortality was 7% for the ruptured group and 0% for the unruptured. mRs 0-1 was 93% at DC and 99% at six months to one year for the unruptured group for an average hospital stay of 3.5 with +/- 1. Residual aneurysm due to calcification occurred in 3 with no regrowth or recurrence. Visual changes occurred in 8 patients with significant deficit in only 2 of the first 100 cases and with improvement in the others six of which needed re-exploration for technical reasons with an overall excellent visual outcome in all but 2 patients.
Conclusion: In depth understanding of the anatomy of the clinoid region makes microsurgical clipping of paraclinoid aneurysms safe and presents the most durable treatment modality.
Keywords: Aneurysm, Paraclinoid, Microsurgical clipping

OP-NV.09-04

Clip Ligation of AcomA Aneurysms: A Prospective Long-Term Outcome Study

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Background: We conducted a prospective study to investigate the clinical and radiological outcome in a surgical case series of 516 patients with ruptered and unruptured anterior communicating artery (AcomA) aneurysms.
Method: Patients were checked two weeks, one and five years after surgery by digital-subtraction-angiography(DSA). Clinical outcomes were assessed using Fisher, Hunt-Hess and the modified-Rankin-Scale(mRS).
Results: Five hundered sixteen patients were treated by pterional approach between 1997 and 2015 with AcomA aneursym. Four-hundered and three patients were opereted right side craniotomy whereas 445 patients were clipped only; 59 were clipping with wrapping and 12 were only wrapping. Mainly, 119 patients were Fisher II, 112 were Hunt-Hess 2, and 279 were 11-25 mm diameter of aneurysm. Overall the ruptered aneurysm of AcomA, 67.3% of the patients has good outcome(mRS score 0 or 1); 21.2 % of the patients had forable outcome(mRS 2 or 3), and 11.5 % of the patients had poor outcome(mRS 4 or 5). The mortality rate was 2.7 % overall of ruptered AcomA aneurysm. The most important predictors of outcome was presence of preoperative Fisher and Hunt-Hess-scala score for ruptered AcomA aneurysms. Fifty five percent of treated aneurysms were checked with late follow-up DSA. Ruptered and unruptered AcomA aneurysm were documented in this series during the 6.3±1.2(SD)-year follow-up period.
Conclusion: Surgery is acceptable for ruptered or unruptered AcomA aneurysm to achive good results by using pterional approach with microsurgical techniques; however patients should be selected carefully; individually assigned to preoperative conditions; and they should be treated by experienced neurosurgeons.
Keywords: Anterior communicating artery aneurysm, Pterional approach, Long-term clinical outcome

OP-NV.09-05

Analysis of Factors that Influence Long-Term Independent Living in Very Elderly Subarachnoid Hemorrhage Patients

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Background: The number of elderly subarachnoid hemorrhage (SAH) patients has been increasing. The aim of this study was to analyze long-term outcome for very elderly (≧75 y) SAH patients and to establish a treatment strategy.
Method: From January 2005 to December 2013, 86 consecutive cases were treated. We used a modified Rankin scale (m-RS) at the outpatient clinic, or a telephone interview of patients and/or families. Kaplan-Meier plots were done for mortality and independent (m-RS 0 ~ 2) state. Multivariate analysis was done to distinguish factors that influence on outcome.
Results: Median age was 79, Hunt-Kosnik grade 1 ~ 3 was 79% and the radical intervention (clipping or coiling) rate was 78%. Mean follow-up period was 28.7±3.4 se months. Half of deaths occurred during the first two months. The number of cases of independent living gradually decreased to 50% at 28 months after SAH. Half of patients lived independently for 36 months at HK grades 1 to 3, and 3 months at HK grades 4 to 5 ($p<0.05$). Half of patients lived

independently for 40 months in the radical intervention group, and 14 months in the conservative treatment group ($p<0.05$). Multivariate analysis for independent living revealed that gender, pre-morbid condition, HK grade, and postoperative complication were significant ($p<0.05$).
Conclusion: Good-grade elderly SAH cases that were independent pre-stroke should have radical intervention performed for aneurysm. Avoiding perioperative complications have a positive influence on long-term independent living.
Keywords: Cerebral aneurysm, Elderly patient, Independent living, Radical intervention, Subarachnoid hemorrhage

OP-NV.09-06

Blood Blister-Like Pseudo-Aneurysms: Surgical Experience

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Background: Blood blister aneurysm(BBA) locates on dorsal or anterior wall of ICA. Represents 1% of all intracranial aneurysms, 0.5-2% of ruptured aneurysms. Small, hemispherical-shaped and bulging from non-branching site on ICA, originating from a dissection. Affects younger patients than saccular aneurysm, and presents with acute SAH.
Method: From 2013 to 2016, 20 patients were reviewed. 14 were women, and 6 were men, mean age 48.8 yrs. SAH was present in all patients, and 1 BBA was incidentally found following rupture of anterior communicating aneurysm. 14 were in Hunt-Hess grade 2-3, and 3 was in grade 4 and 5, respectively.
Results: Direct clipping in 12 patients. Trapped and ICA occlusion by using coils in 2 patients, respectively (after BOT). Aneurysm filled with coils in 1 patient, but recanalization led to ICA occlusion with balloon. Wrapped with artificial dura in 1 patient after incidentally discovery of BBA following anterior communicating a. aneurysm clipping. Emergent operation with aneurysm trapping in 1 patient was followed by decompressive craniectomy. Palliative treatment (decompressive craniectomy) was done in 1 patient with malignant brain infarction after spontaneous ICA dissection and occlusion. At 6-month follow-up, 14 patients had good outcome (mRS≤ 2). 5 patients were disabled, and among them, 3 were not prepared and operated in emergent fashion. 1 patient was dead.
Conclusion: Aneurysm trapping and internal carotid artery occlusion is aggressive, but definite treatment for BBAs, with minimal risk of aneurysm recurrence and rebleeding. Emergent trapping or internal carotid artery occlusion without proper preparation leads to unfavorable outcome.
Keywords: Blood Blister-like, Pseudo-aneurysms, Surgical experience

OP-NV.09-07

Open Microsurgery for Ruptured Anterior Communicating Artery Aneurysms. An Experience of Two Neurosurgical Centers

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Background: The authors present two open microsurgical management strategies for ruptured AComA aneurysms using two cohorts of patients.
Method: Cohort A (Bucharest) was composed of 182 cases operated between January 1999 and December 2016 - 18 years. Most patients were Hunt-Hess grade I-III (166 patients, 91.2%). There were 16 (8.7 %) cases in Hunt-Hess grade IV. Cohort B (Timisoara) consisted of 331 patients operated between 2000 and 2016 (15 years). There were 268 patients in Hunt-Hess grade I-III (81%), 46 patients in Hunt-Hess grade IV (14%) and 17 patients in Hunt-Hess grade V (5%). In both cohorts (513 patients) most patients were aged between 41 and 50. Males were preponderant (68%) with a M/F ratio of 1.46/1. The symptoms were dominateed by headache (98%), neck stiffness (94%), focal neurological deficits (71%), seizures (52%), impaired consciousness (15.3%). All cases received early neurosurgical interventions. The difference between cohorts lied in**:** Cohort A - strict patient selection and early / delayed intervention, (Hunt-Hess I-III) Cohort B - nonselected patients opperated immediately (Hunt-Hess I-V). The authors suggest a new classification regarding timing of surgery - immediate, early, delayed and late.
Results: The GOS at 6 months shows**:**
Cohort A**:** - Good Recovery - 103 cases (56.73%) // Death - 7 cases (3.89%). Cohort B**:** Good recovery**:** 127 cases (38.3%) // Death**:** 52 patients (15.7%).
Conclusion: By comparing the two series we noticed that patient selection and correct timing (exclusion of cases in Hunt-Hess IV or V) increased the value of the prognosis in such situations.
Keywords: Intracranial aneurysms, Management strategy, Timing, Patient selection, GOS, Microsurgery

OP-NV.09-08

Demographic Distribution and the Factors Affected Prognosis of Patients Who Diagnosis as Cerebral Aneurysm in a Single Center: Retrospective Evaluation of 398 Patients

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Background: Cerebral aneurysms are diagnosed incidentally or

after SAH. This study aims to evaluate demographic distribution and the factors may affect the prognosis of cerebral aneurysms.
Method: Medical records were retrospectively reviewed in 398(216women, 182men) patients of aneurysm who underwent 409 microsurgical clipping operations between the years 2011 and 2013. 274 SAH, and124 incidental. Single aneurysm was detected in 308 patients, and in 90 patients diagnosed as multiple aneurysm. The mean age was 50.4 (11-82).
Results: There were 61 patients (36 women, 25 men) from Istanbul, while the most patients were from marmara region (71 women, 49 men) as they account for 14.57% of our patients. The most common localisation was ACoA (SAH:78, Ins:32), MCA (SAH: 74, Ins:45), ICA (SAH:24, Ins:22), PCoA (SAH:13, Ins:1), ACA (SAH:7, Ins:1), PCA (SAH:5, Ins:1), SCA (SAH:6, Ins:0) and there were (SAH:67, Ins:23) presented as multiple aneurysms. Mortality rates were(%15: %3), morbidity rates were (%16.7: %10.6) and (%68.3:%86.4) patients were returned to normal their job and daily activities. The complications were Postoperative infections were detected in 58 (SAH:50, Ins: 8), hydrocephalus (SAH:15, Ins: 3), Hematoma (SAH:10, Ins:3), infarction due to vasospazm were seen in (SAH:15, Ins: 3), and generalized seizures (SAH:8, Ins: 1).
Conclusion: High Hunt-hess scale, increases the rates of mortality and morbidity. High morbidity rate and hydrocephalus as a complication are seen especially in multiple aneurysms. Morbidity rate of SAH patients is high. Advanced age and MCA location increase the mortality rates while ICA (especially paraophthalmic) increases the morbidity rates.
Keywords: Aneurysm, Demographic distribution, Subarachnoid hemorrhage, Prognosis, Incidental aneursym

OP-NV.09-09

Intracranial AVM: Microneurosurgical Management

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Background: Intracranial AVM are the lesions that challenge vascular neurosurgeon in skill, knowledge and philosophy. Though there is multimodality of treatment of AVM but surgery is the treatment of choice. Here this paper is our experiences of surgical management of intra cranial AVM.
Method: Data of operated cases of intracranial AVM were recorded prospectively and studied from 211 to 2016.
Results: Total cases 26. Male 15 and female 11 cases. Mostly presented with hemorrhage and epilepsy. Investigations were cerebral DSA/+CTA/+MRA with CT or MRI of brain. 12 were small AVM and rests were giant AVM and high flow. One patient expired and one developed new persistent hemiparesis after operation. Rests were in good health without neurodeficit or recurrent til last follow up.
Conclusion: Intracranial AVM surgery should be properly evaluated and executed that can give the patient a better out come.
Keywords: Intracranial AVM, Microneurosurgical, Management

OP-NV.10-01

Predictive Factors of Shunt Dependency After Aneurysmal Subarachnoid Hemorrahage in 190 Consecutive Patients

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Background: Hydrocephalus is a common complication of aneurysmal subarachnoid hemorrhage (aSAH). Nonetheless, strict guidelines for the selection of patients in need of permanent shunting are lacking.
Method: 190 patients with a diagnosis of aSAH were retrospectively evaluated. Pertinent clinico-radiological characteristics, management, and outcomes were reviewed. Relevant statistical analyses were performed in order to identify: 1) predictors for chronic hydrocephalus development after aSAH; 2) any significant difference in clinical outcomes between the shunted and the non-shunted patients; 3) prognostic predictors for the shunted patients.
Results: Thirty (15.79%) of the 190 patients developed shunt-dependent hydrocephalus following aSAH, 14 (46.67%) of these improved after permanent shunting. Previous aSAH history, severe clinical conditions as well as hyponatremia at admission, a third ventricle index > 0.09, and the execution of decompressive craniectomy were significant independent predictors of shunt dependency. Non-shunted patients had significantly better outcomes than shunted patients, both at discharge and at 1 year follow-up. Nevertheless, there was no significant difference in Glasgow Outcome Score rise at 1 year between the two groups. No clear predictor for 1 year clinical improvement was found in the shunted patients.
Conclusion: Previous aSAH, severe clinical conditions at admission, a third ventricle index > 0.09, and the execution of decompressive craniectomy could help to predict chronic hydrocephalus development. A careful clinico-radiological surveillance is paramount for a well-timed selection of patients for shunting. Indeed, this may allow patients with chronic hydrocephalus to have 1 year improvement rates similar to those of patients that do not develop shunt dependent hydrocephalus.
Keywords: Shunt dependency, Subarachnoid hemorrhage, Hydrocephalus

OP-NV.10-02

Middle Cerebral Artery Pressure Changes Following Pipeline Flow Diversion

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Background: Pipeline embolization devices (PED) are commonly used for endovascular treatment of cerebral aneurysms but can be associated with delayed ipsilateral intraparenchymal hemorrhage. Changes in intracranial hemodynamics after PED deployment are poorly understood. Here, we assess middle cerebral artery (MCA) pressure before and after PED treatment.

Method: Records of patients with cerebral aneurysms proximal to internal carotid artery terminus treated with PED at our institution between 2015-2017 were retrospectively reviewed. Ipsilateral MCA pressure was recorded before and after PED deployment. Systemic blood pressure was also simultaneously recorded. MCA pressure and ratio of MCA to systemic blood pressure were compared before and after treatment using the paired student t test.
Results: 11 patients were included. Mean age was 48 years. Systolic, diastolic, and mean MCA pressures did not significantly change after PED (90.1 vs. 86.2 mmHg, P=0.25; 66.3 vs. 64.0 mmHg, P=0.38; 75.8 vs. 74.2 mmHg, P=0.44). However, ratio of systolic MCA to systolic systemic pressure was significantly higher after treatment (0.77 vs. 0.71, P=0.05), and ratio of diastolic and mean MCA to diastolic and mean systemic pressures tended to increase after PED (1.06 vs. 1.01, P=0.11; 0.93 vs. 0.89, P=0.08).
Conclusion: Following PED deployment, the ratio of systolic MCA to systemic pressure increased significantly, indicating possible disruption of cerebral autoregulation. Further study may reveal that these altered hemodynamics are responsible for delayed ipsilateral intraparenchymal hemorrhage after PED.
Keywords: Cerebral aneurysm, Flow diversion, Hemodynamics, Pressure, Pipeline

OP-NV.10-03

Comparison of Preoperative Prothrombin Complex Concentrate and Fresh Frozen Plasma Treatment for Warfarin-Associated Intracranial Hemorrhage

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Background: Warfarin is frequently used for its anticoagulant effects in cardiovascular and neurovascular diseases. It can cause life-threatening intracranial bleeding if blood levels are higher than the effective anticoagulant dose. We compared the treatment of prothrombin complex concentrate (PCC) and fresh frozen plasma (FFP) on reversing the warfarin induced bleeding in neurosurgical practice.
Method: We discussed 16 cases whom using warfarin and brought to hospital with different types of intracranial hematoma. Urgent cases'(6) mean age was 56 and had herniation symptoms. Mean INR value was 4,2. All cases were administered PCC and underwent surgery after lowered INR value below 1.5, within a mean 1h-30min. Elective cases'(10) mean age was 63 and mean INR value was 3.3. We administered FFP to this group up to 400 cc in a day to avoid volume overload and achieved target INR within a mean 47 h.
Results: There were no evidence of new hemorrhage in postoperative control CT scans of all cases.
Conclusion: Common ways to antagonize warfarin associated coagulopathies are FFP and PCC up to date. But with FFP it is so difficult to reverse the effect of warfarin for emergency cases on time. Moreover especially for older patients, the usage of FFP has risk of volume overload. On the other hand PCC is a dense preparation that produced from blood which contains vitamin K-dependent coagulation factors. Contrary to FFP, PCC helps us to reduce the INR value to the appropriate levels for surgery rapidly and safely without volumetric overload.
Keywords: Fresh frozen plasma, Prothrombin complex concentrate, Warfarin associated intaracranial hemorrhage

OP-NV.10-04

Spontaneous Supratentorial Intracerebral Haematoma: Decompressive Hemicraniectomy without Haematoma Evacuation Versus Craniotomy and Evacuation of Haematoma - A Retrospective Comparative Outcome Study

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Background: Spontaneous supratentorial intracerebral haematoma represents 10-15% of all strokes and often carries a poor prognosis. There are many debates regarding the treatment. This study was done to compare outcome between decompressive hemicraniectomy without haematoma evacuation and craniotomy with haematoma evacuation in patients of spontaneous supratentorial intracerebral haematoma.
Method: We divided the 54 patients of spontaneous supratentorial intracerebral haematoma admitted and treated in Chittagong Medical College Hospital in between 2012 and 2015 into two groups. Group A - patients treated by decompressive hemicraniectomy without evacuation of haematoma. Group B - patients treated by craniotomy and evacuation of haematoma. We analyzed clinical (age, sex, pathogenesis, Glasgow Coma Scale), radiological (signs of herniation, side and size of haematoma, midline shift, haematoma expansion, distance to surface) and surgical characteristicss. We compared the data of two groups. Outcome at 6 months was divided into good (modified Rankin Scale 0-4) and poor (modified Rankin Scale 5-6).
Results: 13 patients (median age 50 years) with spontaneous supratentorial intracerebral haematoma were treated by decompressive hemicraniectomy without haematoma evacuation. Median haematoma volume was 59.3 ml and median pre-operative GCS was 7. Six patients showed signs of herniation. 9 patients had good and 3 had poor outcomes. 31 patients (median age 58 years) were treated by craniotomy and evacuation of haematoma. Median haematoma volume was 54.6 ml and nedian pre-operative GCS was 8. 21 patients had good and 10 patients had poor outcome.
Conclusion: Decompressive hemicraniectomy is more effective than haematoma evacuation in patients with spontaneous supratentorial intracerebral haematoma.
Keywords: Spontaneous supratentorial intracerebral haematoma (SICH), Decompressive hemicraniectomy (DHC), Glasgow coma scale (GCS), Glasgow outcome scale (GOS), Modified rankin scale (MRS)

OP-NV.10-05

Immunological Changes in ICH

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Background: Intracerebral hemorrhage (ICH) is a one of the stroke subtype with high morbidity and mortality. The aim of this prospective study was to assess immunological changes and their clinical significance in patients with ICH.

Method: Sixty patients with spontaneous ICH were evaluated regarding immunological changes by measuring peripheral blood lymphocytes subsets CD3+, CD4+, CD8+, CD4+/CD8+, white blood cell count, lymphocytes count and immunoglobin IgA, IgG, IgM, IgE and IgD level. The relationships of immunological to clinical and radiological parameters were evaluated at hospital admission (t0), 3-5 days (t1) later, and at least 7-10 days (t2). The results were statistically analyzed.
Result: An immunological parameters were significantly changes with severity of diseases. There were significant changes were observed for leucocyte count, lymphocytes sublets CD4, CD8, and CD4/CD8 at hospital admission (t0), 3-5 days (t1) later, and 7-10 days (t2) in both operative and conservative patients. But there was not statistically significant in immunoglobin level. There were significant positive correlations between leukocyte with GCS(r=0.29, 0.30), Volume(r=0.55, 0.37) and mRS (r=-0.30,-0.47) during admission and discharge time respectively ($p<0.05$). But Leucocyte was negative correlation with CD4 at hospital admission (r=-0.80,-0.33) and discharge (r=-0.37,-0.45).There were negative correlations between CD 4 with GCS(r=-0.28,-0.34), volume of hematoma (r=-0.32,-0.56), mRS (r=-0.38,-0.46) during admission and discharge time ($p <0.05$).
Conclusion: An immunological status are associated with the severity of ICH. This may denote potential targets for ICH therapy.
Keywords: CD4+/CD8+, ICH, Lymphocyte, WBC

OP-NV.10-06

Decompressive Craniectomy in Massive Cerebral Infarctions; Outcome of 15 Cases

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Background: Large space-occupying infarctions with signs of elevated intracranial pressure and brain herniation usually occurs in the second to the fifth day leading to a high mortality rate. Several studies have suggested that decompressive surgery, consisting of a hemicraniectomy and duraplasty, reduces mortality and improves outcome in patients with massive brain infarctions. Evaluation of the clinical and radiological outcome of decompressive craniectomy for massive cerebral infarctions.
Method: Fifteen cases were submitted to decompressive craniectomy and duroplasty for massive cerebral infarctions. Inclusion criteria included radiological evidence of a massive cerebral infarction with a midline shift ≥ 5mm and deterioration of the Glasgow Coma Scale Score. All patients were operated within 6 hours from the deterioration of Glasgow Coma Scale Score.
Results: In all patients radiological improvement of the midline shift occured. Clinical improvement occured in 12 patients (80%), however 2 of them died in the postoperative period due to chest infection and myocardial infarction. Three patients (20%) showed no clinical improvement with subsequent mortality in the postoperative period.
Conclusion: Early decompressive craniectomy for large space-occupying infarctions increases the probability of survival and good functional outcomes in some cases.
Keywords: Decompressive craniectomy, Cerebral infarction, Clinical outcome

OP-NV.10-07

Today Science can be the Tomorrow Mistake (Back to Open Embolectomy in Stroke)

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Background: Recent studies prove definite evidence the superiority of mechanical embolectomy and lysis against only lysis in case of MCA occlusion. There are two choice of mechanical embolectomy**:** endovascular and exovascular route. The acute endovascular embolectomy seems the best, but not available of the 4/5 of the world. Even in the rich countries at more than 60% of cases cannot be available free equipment and expert in any time. The one use devices relatively expensive (2-3000 EU/ procedure) depends on country. Direct surgical embolectomy, it has not spreed because of surgical insufficiency „only expert neurosurgeons could perform it quickly enough" (Gobin et al**:** phase1 study of Mechanical Embolus removal in Cerebral Ischaemia Stroke 2004).
Method: No one well experienced microvascular surgeon report about exovascular route same good results as endovascular approach.
Results: The time to reperfusion from skin incision became shorter (within 30 min.). The danger of further microembolization also reduced, because of the total removal of embolus happens in flow direction, without tearing of small particles of clot. Easier availability of neurosurgeons and free OR in any time. The price of one use devices 1000x times cheaper.
Conclusion: Reduction of the number of microvascular surgery led to reduction of well experienced microvascular neurosurgeon in the last two decades because of the endovascular breaktrough. Our experience, daily fresh cadaver excerises prove very fast recollection of microsurgical experience. Fresh cadaver situations in brain, modellize life like stiutaions of ischemic stroke almost completly.
Keywords: Microsurgical embolectomy, Fresh cadaver excersise, Bypass surgery

OP-NV.10-08

Operating on Large Intracerebral Haemorrhage Clot: How much is "Enough"

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Background: The obvious goal of intracerebral hemorrhage surgery is the removal of an "adequately large" part of the blood clot, in order to reduce the intracranial pressure. But, how much is "adequately large"? How much is "enough"?
Method: We are reviewing our last 5 years results for 85 patients, age range 42–82 yrs, mean 71.3 yrs, operated for large (>5 cm) ICH. We are dividing them in 2 subgroups**:** Subgroup A, consisting of 50 patients where we have achieved near total clot removal and SubGroup B, 35 patients where we opted for 'adequate' (in the 50% range) subtotal clot removal and we compare the results.
Results: Group A produced significantly better results, both in

terms of survival rates (20.2% vs 12.6%, p < 0.01) and in terms of survivors GOS (Mean = 3.6 vs 2.6, p< 0.01). Additionally, the postoperative CT scans for Gr. A demonstrated significantly less perilesional edema then Gr. B patients.
Conclusion: (1) Our initial interpretation that Near-total clot removal minimized an alleged significant irritating effect on brain tissue was WRONG. (2) The true explanation– as proved by post op ICP measurements –is that what we considered "adequate" for Gr. B patients was in reality marginal at the time of the operation and evolved to "insufficient" shortly afterwards. (3) The post-op edema definitely has a lot to do with the above statement.(4) Eventually the answer to the question**:** "How much is "enough?" should probably be**:** "More than you initially estimate"... except for an underlying aneurysm!
Keywords: ICH, Clot, Intraparenchymal

OP-NV.10-09

A Retrospective Clinical Study of 98 Adult Idiopathic Primary Intraventricular Hemorrhage Cases

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Aim: To define the clinical features, risk factors, treatment and prognosis of idiopathic primary intraventricular hemorrhage (IPIVH).
Method: We retrospectively collected the data of consecutively admitted patients who were diagnosed and treated for IPIVH in our hospital from 2010 to 2014. The clinical information, treatment, and prognosis at the 6-month follow-up were analyzed. Among the 3798 cases of spontaneous intracranial hemorrhage (ICH), 98 IPIVH (2.58%) patients were recruited for the study.
Results: The study population consisted of 60 males and 38 females, with an average age (± standard deviation, SD) of 51.20 ± 15.48 years. The initial symptoms were headache (75 cases) and impaired consciousness (23 cases). The surgical treatments included hematoma evacuation under a microscope or an endoscope in 8 cases (8.16%), external ventricular drainage (EVD) in 11 cases (11.22%), lumbar drainage (LD) in 10 cases (10.20%), and a combination of EVD and LD in 11 cases (11.22%). In total, 4 patients died in the hospital (4.08%). At the 6-month follow-up, 73 patients (74.49%) had an improved outcome (modified Rankin scale [mRS] < 3), and 21 patients (21.43%) had a poor outcome (mRS ≥ 3 points) at the end of the 6-month follow-up. IPIVH is rare in clinical practice, and hypertension is the most common risk factor.
Conclusion: The treatment of IPIVH is controversial. Hematoma evacuation under a microscope or endoscope, EVD, LD and combination of EVD and LD could be surgical options for the treatment of IPIVH. The outcomes for IPIVH could be relatively favorable with individualized treatment.
Keywords: Etiology, Hypertension, Intracerebral hemorrhage, Primary intraventricular hemorrhage, Prognosis, Treatment

OP-NV.11-01

New Paradigm of Relationship Between Ruptured and Unruptured Cerebral Aneurysm

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Background: Japanese people have a 2.8-times increased risk of rupture in western. So, in this paper, we discuss about the relationship between the number of ruptured and unruptured cerebral aneurysm (RCA and UCA) in Japan.
Method: We investigated 5344 cases of subarachnoid hemorrhage (SAH) in Japanese stroke data bank (JSDB) from 2000 to 2014 and 475,397 cases of aneurysm survey in Japan neurosurgical society (JNSS) from 2001 to 2015. Furthermore, annual population and number of death due to SAH were evaluated by records from the Ministry of Health, Labour, and Welfare (MHLW) in Japan. Also, the change of prevalence of hypertension and habitual smoking was evaluated.
Results: The highest incidence in size of RCA was 56% under 6mm size group in JSDB. The estimated incidence of SAH according to the data of JNSS, MHLW was 23.8 per 100,000, highest in 2003, and decreasing gradually to 21.3 in 2012 in spite of the peak population in 2008. The number of treatment of UCA was increasing rapidly recently, however, the estimated treatment rate of total UCA was only 0.2 to 0.5 %. The prevalence of hypertension and habitual smoking have declined significantly from 2003 through 2012 (Cochran-Armitage test, p<0.001).
Conclusion: We must focus not only the high rupture risk of large sized UCA but also small UCA. We cannot reduce the incidence of SAH only by increasing treatment number of UCA. The real reason of rupture in small UCA should be searched more in the future.
Keywords: Unruptured cerebral aneurysm, Ruptured cerebral aneurysm, Incidence of subarachnoid hemorrhage, Epidemiology, Hypertention

OP-NV.11-02

Unruptured Paraclinoid Aneurysm Treatment Effects on Visual Function: A Systematic Review and Meta-Analysis

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Background: Postoperative visual outcomes following repair of unruptured paraclinoid aneurysms (UPAs) are not well defined. This study aims to investigate the influence of treatment modality on visual function.
Method: A systematic literature analysis using the Ovid Medline and EMBASE databases was performed, encompassing English

language studies (published between 1996 - 2016) reporting treatment outcomes for UPAs. Rates of visual morbidity (new, permanent postoperative deficit, worsening preoperative deficit), angiographic (recurrence, retreatment) and clinical outcomes (death, dependency, post-treatment SAH) were recorded. Random effects meta-analysis was performed.
Results: Twenty-eight studies reported visual outcomes, with data for 1,013 endovascular and 691 microsurgical patients. In patients with normal vision undergoing repair of UPAs, rates of postoperative visual morbidity were higher following microsurgical (10.8%; 95%CI 8.5-13.7) than endovascular (2.0%; 95%CI 1.2-3.2) interventions, p<0.001. In those with preoperative visual impairment, surgery was associated with a modest advantage in visual recovery compared to endovascular therapies (65.2% vs 48.9%, p<0.03). There were no differences in visual morbidity following treatment with any of the endovascular modalities (coiling, stent-assisted coiling, flow-diverters). Meta-analysis of comparative studies suggested a trend towards poor visual (ES=0.42; 95%CI 0.08-2.09) and clinical outcomes (ES=0.57; 95%CI 0.07-4.44) following microsurgery, and a trend towards angiographic recurrence (ES=2.52; 95% CI 0.80-7.90) and retreatment (ES =1.62; 95% CI 0.46-5.67) after endovascular interventions.
Conclusion: In patients with normal vision undergoing repairs for UPAs, there is a positive correlation between visual outcomes and endovascular treatments. When visual compromise is present, surgery provided modest advantage in visual recovery. However, definitive conclusions were not possible due to data heterogeneity.
Keywords: Microsurgery, Endovascular, Intracranial aneurysms, Paraclinoid aneurysms, Visual complications, Meta-analysis

OP-NV.11-03

"Live Cadaver" for Neurosurgical Training

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Background: The live cadaver model has proved efficient in providing the highest level of surgical simulation by combining the real human anatomy with the life-like conditions of the living body. In this report we will show the preparation and proper use this model for residents training on neurovascular procedures.
Method: The major vessels in the neck section were cannulated and connected to blood simulant reservoirs the arterial reservoir was further connected to a pulsatile pump, and the subarachnoid space was cannulated and connected to a clear liquid to simulate the cerebro spinal fluid. An arterial pressure of 80-120 mm Hg, a pulse rate up to 100 beats per minute, and a venous pressure of approximately 15 mm Hg were applied.
Results: Residents and faculty members were able to practice neurovascular procedures under life-like conditions on the same human anatomy simulating actual surgical procedures. Aneurysm clipping, endovascular procedures, vascular bypass, management of intraoperative vascular complications and aneurysmal rupture, and neurovascular surgical maneuvers were practiced in the same manner as in a live patients. Improvement of surgical skills after several sessions of practice on the model was noticed and documented.
Conclusion: The live cadaver model replicates live surgery and management of intraoperative complications with higher fidelity and more realistically than available simulators, and thus is a major advance in producing best training outcomes. It is readily available, cost-effective when compared with other training models, and of great value in teaching rare and difficult cases, as well as management of complications.
Keywords: Cadaver, Simulation, Neurovascular, Aneurysms, Live cadaver, Perfused cadaver

OP-NV.11-04

Management of Intracranial Aneurysms in Developing Country: Cost, Length of Stay and Outcome of Endovascular Versus Neurosurgical Procedure

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Background: Since the results of the ISAT study published in 2002, several studies conducted in developed countries compared the results of both endovascular and microsurgical techniques. Our study aims to draw attention to the cost and effectiveness of both treatment modalities in a developing country.
Method: Retrospective study is conducted from 2008 to 2014. The population consisted of 202 Patients (138 men, 64 women) with intracranial aneurysms were enrolled. Clinical outcome at discharge and at 6 months, and treatment related costs were evaluated in both groups. Statistical analysis was performed using the software Epi Info version 3.5.4 for Microsoft Windows XP.
Results: One hundred sixteen patients underwent surgery and 86 received endovascular treatment. Most patients (145) were WFNS grade I-II, of these patients 60 received endovascular treatment and 85 were clipped. The quality of exclusion was complete in 51% of coiling and 73% in clipping. The average hospital stay was 8 ± 5 days for patients who underwent endovascular treatment against 14 ± 7 days for surgery (P = 0.02). The average total cost of treatment was 4181Euros (26% of cost was for Coils) for endovascular against 3227Euros (10% of cost was for clips) for surgery. The clinical outcome base on modified ranking scale score was good in 86% of coiling and 78% in clipping (P = 0.09).
Conclusion: We found there is no difference in outcome between clipping and coiling in our series. Total cost of resources used in endovascular procedure was significantly higher than surgery.
Keywords: Aneurysms, Clipping, Coiling, Cost and effectiveness, Developing country

OP-NV.11-05

Training Model for Cerebral Aneurysm Clipping

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Clipping of cerebral aneurysms is an important skill in neurosurgery. For accurate surgery, skillful operators are necessary; however, because the number of clippings is decreasing, young neurosurgeons cannot operate on cerebral aneurysms often enough. Therefore, a training model for clipping is needed. Here, we have made a training

model for the clipping of cerebral aneurysms. The concepts for the model are 1**:** training model for clipping of cerebral aneurysms for beginners, 2**:** three dimensional manipulation using an operating microscope, 3**:** the aneurysm model is to be perfused by simulated blood causing premature rupture. The skull, brain, arteries, and veins are made using a 3D printer by data of DICOM. The brain and vessels are made from polyvinyl alcohol (PVA). The softness of the brain and vessels were characteristic. This model is useful for training of cerebral aneurysm surgery for young neurosurgeons.
Keywords: Cerebral aneurysm, Training model, Polyvinyl alcohol

OP-NV.11-06

A New Horizon in Cerebral Aneurysm Surgery Education: Virtual Reality

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Performing cerebral aneurysm surgery, though basic, is by far one of the most challenging practices for every neurosurgeon in the world, yet its learning curve is steep. Virtual Reality and Augmented Reality technology has not been used in this field of medicine but can dramatically reduce this learning curve. By wearing special goggles and pressure sensitive gloves, the person is attached to a computer which detects every head and hand movement and the computer creates a real-time brain and operating room environment. We aim to instruct neurosurgery residents and young neurosurgeons in gaining experience through the use of this device. This technology; which is an on-going project in our University, can make huge difference not only in neurosurgery but in the instruction and examination of all surgical disciplines.
Keywords: Education, Virtual, Reality, Aneursym

OP-NV.11-07

Aneurysm Surgery in Zimbabwe

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Aneurysmal subarachnoid haemorrhage (SAH), is a devastating disease associated with a high mortality. The condition was previously thought to be rare in black people in Zimbabwe due to under diagnosis. Non- and delayed presentation by most black people in Zimbabwe has been a challenge to the diagnosis and treatment of aneurysm patients. Practitioner and patient education are helping change the population perception and surgery for brain aneurysms is getting more accepted in Zimbabwe.
Keywords: Zimbabwe, Brain aneurysm, Subarachnoid hemorrhage

OP-NV.11-08

Validation of Effectiveness of Keyhole Clipping in Non-Frail Elderly Patients with Unruptured Intracranial Aneurysms

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Background: Advanced age is known to indicate poor prognosis after surgical clipping of unruptured intracranial aneurysms (UIAs). This study compared the complications, and clinical and radiological outcomes after keyhole clipping between non-frail elderly patients (≥70 years) and non-elderly patients.
Method: Keyhole clipping (either supraorbital or pterional) was performed to treat 260 cases of relatively small (≤10 mm) and anterior circulation UIAs, including 62 cases in the non-frail elderly group (72.9±2.6 years) and 198 cases in the non-elderly group (59.5±7.6 years). The study evaluated mortality and morbidityat 3 months and 1 year after the operation, the general cognitive function by MMSE at 3 months and 1 year, the anxiety and depressive mood by BDI and HAM-D at 3 months, and radiological abnormalities and recurrence at 1 year.
Results: Rates of complications including stroke and epilepsy were not significantly different. Lacunar infarct occurred in 3.2% of the elderly group and 3.0% of the non-elderly group. No patient in the elderly group required retreatment or showed recurrence of clipped aneurysms. The MMSE at 3 months significantly improved in the non-elderly group but did not change in the elderly group. The BDI and HAM-D at 3 months were significantly improved in both groups. No patient died in either group. The morbidities at 3 months and 1 year in the elderly group (1.6%, 4.8%) were not significantly different from those in the non-elderly group (2.0%, 1.5%).
Conclusion: Keyhole clipping to treat UIAs in the non-frail elderly is an effective and long-lasting treatment.
Keywords: Unruptured aneurysm, Keyhole clipping, Frailty

OP-NV.11-09

Pittfalls of Surgical Indications for Unrupted Anterior Communicating Artery Aneurysms! Which One Should We Operate ?

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Background: This presentation shows the analisis of 231 cases of aneurysms of the anterior communicating artery complex in the last 10 years. we compare the nature of the lesion in both situations to try to predict wich one will have more bleeding chance, and in this way, be a surgery candidact.
Method: In this universe of cases, we have 77 unrupted aneurysms x 154 bleeding aneurysms. Those aneurisms were classified by size, domus direction, side of blood flux domination, position to the optic chiasm, lobulated domus. We did a retrospective analysis of those informations comparing the two groups of aneurysms (rupted an unrupted) with the objective to try to find a way to predict wich unrupted aneurysms are more like to bleed, and in this way, to do a better patience orientation in order to do a better selection of surgical cases. We also tried to manage a protocol of wich unrupted aneurysm should we operated.
Results: We manage a smal protocol for unrupted anterior communicating artery aneurysms, selecting the cases with higher risk of rupture, in order to indicate surgery treatment for those patience.
Keywords: Aneurysm, Anterior communicatig artery, Unrupted

OP-NV.12-01

Long Term Physical and Functional Outcome of Moyamoya Patients in the Western Population Post Revascularization Surgery

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Background: Moyamoya disease (MMD) is rare in the western population, and the long-term physical, functional, and social well-being of these patients post revascularization are not well documented.
Method: This is a single institution, combined MMD database, questionnaire study, with prospective clinical and radiological follow-up. The subjects were MMD patients with post-revascularization surgery. From 1991–2014, 1307 revascularization procedures (1170 direct bypass, 137 indirect bypass) were performed in 769 patients. We received and analyzed 454 completed patient questionaires, and has follow-up for 95% (730/769) of patients.
Results: 548 female, 224 male patients, mean age was 32 years (range 1–68). 344 revascularizations in 197 pediatric patients (73% direct bypasses), and 963 revascularizations in 572 adults (96% direct bypasses). With a mean follow-up of 7 years (0.5–25 years), long term overall ischaemic or haemorrhagic stroke risks were 2.7%(21/769) and 1.5%(12/769) respectively. 45 deaths were recorded, 6 within 30 days postoperatively, and 10 patients died from stroke at long term follow-up. Of the returned questionaires, 372 patients reported preoperative headache and 242 (65%) of these experienced post-revascularization headache improvement. At long term follow-up, 80% (361/454) of patients remained employed or in school, pregnancy or normal childbirth were recorded in 41 patients, 83% of patients had excellent outcomes (mRS 0–1), with 99% bypass grafts patency.
Conclusion: Headache could be the presenting symptoms in some MMD patients, as subgroups experienced improvement postoperatively. About 80% of MMD patients had excellent long-term physical, radiological and functional outcomes post revascularization, with up to 25 years of follow-up.
Keywords: Moyamoya disease, Western population, Long term outcome, Revascularization

OP-NV.12-02

Epidemiological Features of Moyamoya Disease in Denmark

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Background: Originally considered primarily to affect Asians, moyamoya disease (MMD) is increasingly recognised as a rare cause of stroke in people of many ethnic Backgrounds around the world. Taking advantage of nation-wide registers we conducted a population based study of MMD in Denmark.
Method: Cases were identified in The Danish National Patient Register from 1994 to 2015. We looked at demographics, incidence and at clinical presentation.
Results: 64 patients were identified with the international classification of diseases version 10 diagnosis of MMD. 8 patients had other conditions (neurofibromatosis, Down´s syndrome) indicating quasi-moyamoya disease. Thus, 56 patients (35 females, 21 males) were diagnosed with MMD. Only 4 patients were immigrants or their descendents from countries outside Europe. The overall incidence was 0.05 per 100 000 person-years with an upward trend in recent years. There were two peaks in the age distribution**:** 0 - 9y and 30 - 39y. The most common presentation was ischaemia followed by haemorrhage, headache and seizures.
Conclusion: The incidence of MMD in Denmark is about one tenth of reported in Japan, but otherwise the epidemiological features are comparable. This represents the first population based study on moyamoya disease in Europe.
Keywords: Moyamoya disease, Epidemiology, Stroke

OP-NV.12-03

Contrast Transit Time Changes on Digital Subtraction Angiography Following Pipeline Flow Diversion

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Background: Pipeline embolization devices (PED) are used for endovascular treatment of cerebral aneurysms but can be associated with delayed ipsilateral intraparenchymal hemorrhage (DIPH). Changes in intracranial hemodynamics after PED are poorly understood. Here, we assess hemodynamic changes after PED in patients with and without DIPH.
Method: Records of patients with distal internal carotid artery (ICA) aneurysms treated with PED at our institution between 2012-2017 were retrospectively reviewed. Regions of interest were selected proximally to PED over the cavernous ICA and distally over the middle cerebral artery (MCA), and then transit times were determined using syngo iFlow software (Siemens). Ratio of MCA to ICA transit time was compared before and after treatment using Wilcoxon matched-pairs signed-ranks test. Ratios were also compared between patients with and without DIPH using 2-sample Wilcoxon rank-sum test.
Results: 53 patients were included (mean age 56 years). Ratio of MCA to ICA transit time decreased significantly after PED deployment (1.13 vs. 1.23, P< 0.01). Ratio in DIPH + group (n=4) was significantly lower (1.00 vs. 1.13, P=0.01) and decreased significantly more (21% vs. 4.4%, P=0.02) compared to DIPH - group (n=49). The ratio tended to be higher in larger aneurysms at baseline (P=0.07) but not after PED treatment (P=0.15).
Conclusion: Ratio of MCA to ICA transit time decreases more in patients with DIPH following PED treatment. These contrast transit time changes can be detected in real-time in the neuroangiography suite.
Keywords: Cerebral aneurysm, Contrast transit time, Hemodynamics, Pipeline, Syngo iFlow

OP-NV.12-04

Thrombotic and Hemorrhagic Complications in Patients with Cerebral Aneurysms Treated by Endovascular Approach and Its Relation with the Use of Antiplatelet Agents: Descriptive Evaluation

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Background: The protocol for optimal antiplatelet therapy to prevent thrombotic complications following brain aneurysm embolization is not clear (1). Our objective is to describe the most frequent characteristics of the patients presenting with thrombotic or hemorrhagic complications secondary to endovascular treatment, with regard to the different premedication antiplatelet schemes.
Method: A cross sectional descriptive study was performed where we compiled all patients that required endovascular treatment for brain aneurysm at San Ignacio University Hospital from November 2007 to January 2016. We evaluated the frequency of both thrombotic and hemorrhagic complications based upon the premedication scheme for platelet antiaggregation, localization, size of the aneurysm and embolization technique.
Results: We evaluated a total of 122 patients in which 130 procedures were performed for endovascular treatment of brain aneurysms. Thrombotic complications were more frequent in patients who did not receive antiaggregation protocol (25%) than in the group that did receive some type of scheme (standard dose 3.87% or loading dose 8.70%), finding this difference to be statistically significant (p=0.043).
Conclusion: Thrombotic events are the most common complication of coil embolization in the treatment of brain aneurysms (3-6). The use of dual antiplatelet therapy with aspirin and clopidogrel has shown to lower the symptomatic thromboembolic complication rates independent to the drug administration protocol and it should be used routinely.
Keywords: Antiaggregants therapy, Cerebral aneurysm, Endovascular treatment, Intracerebral hemorrhage, Cerebral infarction

OP-NV.12-06

Efficacy of Neuroform Atlas Intracranial Stent in the Treatment of Intracranial Aneurysms

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Background: Neuroform Atlas intracranial stent was introduced into the market in 2015. Target vessel diameter is 2 to 4 mm intracranial vessels. The stent is designed to be delivered through 10 microcatheters which are the smallest microcatheters for the treatment of intracranial aneurysms. Navigation, deployment and stent-vessel wall conformability were the pioneer excellent features of Atlas intracranial stent.
Method: The study includes 101 aneurysms which were treated between August 2015 and November 2016. Most of these aneurysms were localized in MCA (36) and ACoM (32). Remaining localizations were ICA, PCoM, SCA, PCA, ACA, PICA, basilar tip and trunk.
Results: Complications were listed as stroke in 5 (3 of these were asymptommatic) and peroperative aneurysm rupture in 3 (2 of these were asymptommatic) patients. Two mortality and 1 severe morbidity were recorded in total.
Conclusion: Overall results of Atlas intracranial stent were similar to or better than the results of previous low profile intracranial stents in the literature. A higher proportion of reported SAH in the present series were responsible for the major complications in the present series.
Keywords: Neuroform Atlas intracranial stent, Endovascular treatment, Endovascular surgery, MCA, ACOM

OP-NV.12-07

Surgical Treatment of Supratentorial Cavernous Malformations

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Background: 80% of cavernous malformations of central nervous system are localised above the tentorium. They can present with seizure, haemorrhage and headache. The most frequent symptom is seizure, which is seen in 40-80% of cases.
Method: A total of 39 supratentorial cavernous malformations were resected in 37 patients between November, 2010 and January, 2017 in Uzhhorod Regional Centre of Neurosurgery and Neurology. 27 patients presented with seizure (73%), in 6 cases the symptoms were caused by extralesional haemorrhage (16.2%) and 4 patients presented with a headache (10.8%). Their postoperative follow up was of 1 to 75 months (mean 35.2 months). Male to female ratio was 14**:**23. Mean age of the patients was 32.2 years.
Results: Outcome in patients with epilepsy was assessed according to Engel scale**:** Engel I - 22 patients (81.5%), Engel II - 3 patients (11.1%), Engel III and IV - 1 patient each (3.7%). The subgroup analysis showed that excellent outcome was achieved in patients with rare seizures - 100% seizure-free (Engel I). Negative prognostic factors were preoperative secondary-generalised seizures and drug-resistant epilepsy. Cavernous malformations which manifested with haemorrhage presented with focal neurological deficit in all cases. They were removed in subacute stage of the haemorrhage. Only one patient deteriorated after surgery (2.7%).
Conclusion: Surgical treatment of supratentorial cavernous malformations is safe (morbidity/mortality - 2.7%) and effective in management of various presenting symptoms - 81.5% seizure-free, 83.3% improvement in patients with neurological deficit.
Keywords: Cavernous malformation, Seizure, Haemorrhage

OP-NV.12-08

Preliminary Results of Carotid Revascularization with and without Embolic Protection Device in Pakistan

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Aim: To assess the safety and efficacy of Carotid Artery Stenting [CAS] with and without Embolic Protection Device [EPD] for patients with symptomatic and asymptomatic carotid disease.
Method: Retrospective analysis from 2014 to December 2016 involving fifty four patients with extracranial carotid stenosis undergoing carotid stenting/angioplasty revascularization having both Symptomatic (≥50% occlusion by digital angiography (DA), ≥70% by ultrasound, computed tomography [CT], magnetic resonance angiography [MRA]) and Asymptomatic patients (≥60% by DA, ≥70% by ultrasound, ≥80% by CT, MRA]. Symptomatic patients were followed-up post procedure per CREST criteria [Carotid Revascularization Endartrectomy vs Stenting Trial]. The Primary endpoints were a peri-procedural any stroke, myocardial infarction (MI) or death, and ipsilateral stroke during the follow-up period.
Results: Of the 54 patients 40 were males and 14 females; mean age 67 years. Eight percent were asymptomatic and 92% symptomatic with mean stenosis of 70%. There was no difference in age or cardiovascular risk factors. Embolic Protection Device [EPD] was used in only eight cases [14.8%]. Minor stroke rate during the first 30 postoperative days was 1.8 % with EPD with no MI or mortality. There was no difference in outcomes in those under 69 years of age or older than 70. No stroke occurred during the median 1.5 years of follow-up.
Conclusion: Carotid revascularization with stenting and angioplasty in experienced hands is both safe and effective. Our results are comparable to those of previously reported major trials and well within the complication thresholds suggested in current guidelines for both symptomatic and asymptomatic patients.
Keywords: Carotid stenting, Angioplasty, Embolic protection device

OP-NV.12-09

SAH in Young Adults in KSA

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Aim: To review a series of aneurysms occurring in young adults all of which presented with subarachnoid hemorrhage.
Method: Retrospective review of prospectively collected data from Jan 2014 to Jan 2017. Included were any patient with an aneurysmal SAH. We excluded non-aneurysmal SAH and fusiform aneurysms. Parameters of location, size, complexity and mode of therapy and clinical course were reviewed. Chi square contingency analysis was used with significance below 0.05.
Results: A total of 96 patients harboring 114 aneurysms were reviewed. A total of 30 patients harboring 36 aneurysm were aged between 18 and 36 years (31.5%). 2/3 were anterior circulation and 1/3 were posterior circulation aneurysms. 60% males and 40% female, 50% of males died due to SAH compared to 25% of females. 9 patients suffered a rebleed (30%), 6 of those died. 21 out of 27 patients developed vasospasm, 3 died early due to a rebleed. 15 out of 27 patients were coiled, no significant difference in outcome was observed whether with coiling or clipping.
Conclusion: Microsurgical or endovascular obliteration of the aneurysms produced equal results in the young adults presenting with SAH. Maintaining aggressive medical/INR therapy during vasospasm is key to preserving good outcome. Rebeleed is a key factor in poor outcome and death. This group of SAH patients deserves further study in terms of their genetic influences which might alter the recommendation for longitudinal follow up for each patient and the screening of their families.
Keywords: Young adults, aneurysm, SAH

OP-NV.13-01

Comparison of TOF MRA, Contrast-Enhanced MRA and Subtracted CTA from CTP in Residue Evaluation of Treated Intracranial Aneurysms

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Aim: To compare effectiveness of contrast-enhanced MRA (CE-MRA), 3D-Time-of-flight MRA (TOF-MRA) and subtracted CTA from CTP (sub-CTA) in residue evaluation of intracranial aneurysms treated either with coiling or clipping.
Method: Seventeen treated aneurysms, which were evaluated with three methods within two weeks after the operation, were enrolled. Among three, the success of each imaging techniques in demonstration of residue aneurysm and nearby vessels was compared by Fisher's Exact Test. The differences among three was evaluated by Cochran's Q test ($p \leq 0.05$).
Results: Perfusion abnormality was noted in % 81 of clipped and none of coiled patients. In all, vessel visualization in the vicinity of aneurysm was better in sub-CTA, followed by CE-MRA. In clipped aneurysms, sub-CTA revealed residue aneurysms in 16.7% of the patients, TOF-MRA and CE-MRA revealed none. In coiled aneurysms, CE-MRA revealed residue aneurysms in 100%, and TOF-MRA in 33.3%, sub-CTA revealed none. Although dramatic differences were noted in the evaluation of residue aneurysm as well as nearby vessel visualization, no statistical significance noted due to very few patients in subcategories.
Conclusion: This is first study comparing the effectiveness of CE-MRA, TOF MRA and sub-CTA in residue aneurysms evaluation. Vessel visualization in the vicinity of aneurysm was better in sub-CTA in all regardless of coiling or clipping. Residue aneurysms were more commonly revealed by CE-MRA in coiled patients and more commonly and better shown in sub-CTA in clipped patients in addition of showing perfusion abnormality that's is more common in clipped patients
Keywords: Aneurysm, Coiling, Clipping, CE-MRA, TOF-MRA, CT perfusion

OP-NV.13-02

Synchronous Microsurgical Clipping of Cavernous Carotid Aneurysms Associated with Concurrent Aneurysms: Surgical Technique and Illustrative Cases of 5 Patients

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Background: Cavernous sinus (CS) surgery has been increasingly performed and is considered technically feasible and safe. Microsurgical clipping of paraclinoid and basilar aneurysms has become safer as a result of approaches through the CS. The concurrent presence of cavernous carotid aneurysms(CCAs) with basilar or paraclinoid aneurysms, which can be approached through or around the CS, makes it reasonable to treat them surgically as the approach is already done. We describe our experience with clipping 5 CCAs while treating other aneurysms in the vicinity of the CS with minimal to no morbidity.
Method: Using the pretemporal extradural approach, we usually open the roof or the lateral wall of the CS to gain access to paraclinoid and basilar aneurysms, respectively. Treating concurrent CCAs require few additional steps like mobilizing the occulomotor and trochlear nerves. This opens up three surgical corridors to the cavernous carotid artery. Opening the carotid-occulomotor space while widely opening the supratrochlear and Parkinson's triangles gives the right space and maneuverability to safely clip CCAs.
Results: Complete occlusion of all aneurysms was attained in all patients. Transient 3rd nerve palsy in 4 patients completely resolved on follow-up.
Conclusion: The concurrent presence of CCAs with paraclinoid or basilar tip aneurysms justifies the surgical clipping of these aneurysms given the low morbidity and few additional steps involved. This is an option which has become safer and should be included in our armamentarium of options especially that there will be situations in patients who have symptomatic CCAs but are not amenable to endovascular therapy.
Keywords: Cavernous carotid aneurysms, Cavernous sinus, Microsurgical clipping

OP-NV.13-03

Does Size Matter? – Risk of Rupture of Small Anterior Circulation Aneurysms

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Currently, aneurysmal risk assessment is mainly based on aneurysm size, that is, smaller aneurysms are less likely to rupture than larger aneurysms. There is great disagreement in the literature regarding a critical size for rupture of intracranial aneurysm. The aim of this study was to determine the most common size of ruptured aneurysms in our patient population and to review the literature whether there is a critical size at which the incidence of rupture of intracranial aneurysm increases. A retrospective analysis of patients with ruptured intracranial aneurysms admitted in a tertiary care hospital between January 2011 and December 2014 was done. Our review included 265 patients with ruptured intracranial aneurysms in which 324 aneurysms were identified. In this series, 87.10% (231/265) of the patients had ruptured aneurysms sized less than 10 mm, and 190 out of 265 patients (71.6%) had ruptured aneurysms sized less than 7 mm. There is striking mismatch between our data and the natural history of unruptured intracranial aneurysms as found by the International Study of Unruptured Intracranial Aneurysms (ISUIA) in terms of size of ruptured cerebral aneurysms. Ruptured aneurysms less than 7 mm located in the anterior circulation constitute majority of all ruptured intracranial aneurysms found in our retrospective analysis, but unruptured aneurysms less than 7 mm located at the anterior circulation bear risk of rupture of 0% according to prospective ISUIA data. Our study suggested that we need to recommend surgical treatment for even small unruptured aneurysms with irregular shape, especially anterior circulation aneurysms.
Keywords: Subarachnoid hemorrhage, Aneurysm, Unruptured

OP-NV.13-05

Low-Cost Device for Intraoperative Fluorescein Videoangiography for Clip Ligation of Cerebral Aneurysms

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Background: Intraoperative digital subtraction angiography remains the gold standard to assess parent vessel patency and aneurysm obliteration, but is a time consuming technique that carries procedural risk and may not assess small perforating vessels. The use of indocyanine green and fluorescein video angiography is a useful tool for confirmation of aneurysm occlusion and patency of all the branches and perforating vessels.
Method: We have built a 3D printed device with an excitation and a barrier filter to use in surgical microscopes. After the clip ligation of the aneurysm the patients received an intravenous or intra arterial dose of sodium fluorescein in bolus. We evaluated aneurysm occlusion and patency of the perforators and branches.
Results: In all cases fluorescence was clearly visualized in cerebral arteries, capillaries and veins, even in deep surgical field. These images allowed us to successfully evaluate the aneurysm occlusion and patency of all the branches and perforating vessels.
Conclusion: This is a low-cost option for intraoperative fluorescein videoangiography. It is easy to use, fast and with sufficient image quality for the evaluation of the blood flow even in small vessels and in deep surgical field. It allows to asses the flow in the branches and perforating arteries, and to confirm aneurysm occlusion.
Keywords: Aneurysm surgery, Fluorescence angiography, Fluorescein, Clip ligation

OP-NV.13-06

Hybrid Operation in Treating Complex Intracranial Aneurysms

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Background: Complex intracerebral aneurysms (cIAs) are imperative to be excluded out of circulation system due to their high rupture risk. Suboptimum prognosis and aneurysmal remnants are common outcomes of cIAs. hybrid operation is an ingenious combination of the advantage in both microsurgical and endovascular therapies in treating cIAs.
Method: cIAs patients who was admitted in Beijing Tiantan hospital and underwent hybrid operations between Dec, 2015 and Dec, 2016 were registered in our research. General information, features of aneurysms, details of operations, perioperative estimation and outcomes were recorded.
Result: 56 patients (male**:** female=16**:**40) were included harboring 70 aneurysms. Ages arranging from 32 to 69 years old (mean 55.3±8.8y). Majority of the cIAs located in internal carotid artery (n=51) with an average diameter of 13.27±10.66mm (2.34-60.00mm). 6 types of procedures were performed. Parental arterial balloon occlusion (n=28) and coinstantaneous coiling embolization (n=6) were the most conventional usage of endovascular techniques in hybrid operation. 2 cases of neurysmal remnant, 2 hemorrhagic and 11 ischemic stroke occured. 32.1% (n=18) got mRSa reduced when discharge, while 26.8% (n=15) got increased.
Conclusion: Hybrid operation is a novel, efficient and relatively secure method to manage cIAs. The procedure patterns got enriched due to the combination of microsurgical and endovascular techniques. The indicating population expended to those who could never be cured before. Meanwhile, procedure routine and technical process should be optimized furthermore to reduce the incidence of operation-related complications and mortalities.
Keywords: Hybrid operation, Intracranial aneurysm, Microsurgery, Endovascular intervention

OP-NV.13-07

Protocol and Evaluation for Aneurysm Management in Acute SAH with Same Team Doing Clipping and Coiling: A 24 Months Prospective Institutional Analysis

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Background: Definitive treatment of ruptured aneurysm is a priority in SAH management. Clipping and coiling are proven effective method of aneurysmal obliteration. However, optimizing the modality of aneurysm obliteration for each aneurysm improves the rate of successful treatment offered to the patient. Equally important is the post procedural management of these patients which otherwise the jeopardize the good surgical/endovascular procedure and final result. We share our experience and protocol of management of these case where both the procedure are done by same team members.
Method: We prospectively evaluated patients with aneurysmal SAHpatients from June April 2014 to March 2016. A total of 63 patients with 70 aneurysms were treated either with microsurgical or endovascular technique depending upon various factors.. A note was made of initial admission status, delay between definitive admission and definitive procedure, procedural complications, need of IA nimodipine therapy, and discharge status.
Results: Six aneurysms were in posterior and rest in anterior circulation. Five patients had multiple aneurysm. Thirty one aneurysm were coiled while 36 aneurysm were clipped, one was both clipped and coiled and two underwent parent vessel occlusion. At discharge 6 patients had poor outcome (GOS 1, 2), 6 had moderate outcome (GOS 3) and 41 had good outcome (GOS 4,5).
Conclusion: Same team involved in decision of coiling or clipping offers a bias free opinion for definitive treatment and dedicated team involved in the post operative period can effectively reduce complication in the post operative period leading to better outcome.
Keywords: Aneurysmal SAH, Coiling, Clipping, IA minodipine

OP-NV.13-08

Influence of Bifurcation Geometry on Flow and Rupture Risk of Basilar Tip Aneurysms

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Background: Risk factors for aneurysm rupture have been studied extensively in the past, with several factors showing significant correlations with rupture status. In this study we focused on a static factor, the bifurcation angle, which did not change after rupture, and attempted to understand its impact on rupture and aneurysmal hemodynamics.
Method: 71 basilar tip aneurysms were included in this study, 22 ruptured and 49 unruptured. After acquiring 3-dimensional rotational angiographic data, 3-D STL models were created and computational fluid dynamic analysis was done using commercially available software. Patient data (age and sex), morphometric factors (aneurysm maximum height and volume, aspect ratio, bifurcation angle, bottleneck ratio, and neck-parent artery ratio) and hemodynamic factors (inflow coefficient and wall shear stress) were compared between ruptured and unruptured groups.
Results: Aspect ratio, bifurcation angle, bottleneck ratio, and inflow coefficient were significantly correlated with the rupture status on univariate analysis. Logistic regression analysis showed that aspect ratio and bifurcation angle were significant predictors of rupture status. Bifurcation angle correlated inversely with inflow coefficient ($p< 0.0005$) which in turn correlated directly with wall shear stress ($p= 0.005$) on Pearson's correlation coefficient, while Aspect ratio correlated inversely with wall shear stress ($p = 0.013$).
Conclusion: Bifurcation angle and aspect ratio are the independent predictors for aneurysm rupture. Especially, bifurcation angle, which does not change after rupture, correlates with hemodynamic factors including inflow coefficient and wall shear stress as well

as rupture status. Aneurysms harboring Hands-up bifurcation configuration are more prone to rupture than others.
Keywords: Aneurysm, Rupture, CFD

OP-NV.13-09

Selective Extradural Anterior Clinoidectomy for Ophtalmic Artery Aneurysms

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Background: Drilling of the anterior clinoid process (ACP) improves complete clipping of the aneurysms in the paraclinoid segment of the internal carotid artery (ICA). This is provided by extensive dissection of the ICA and early controlling the proximal part of the ICA prior to the neck of the aneurysm. Early mobilization and less operative manipulation of the optic nerve and less brain retraction are additional benefits.
Method: Between 2013 and 2016, intradural anterior clinoidectomy was performed in 12 ophthalmic artery aneurysm patients. Between 2016 and 2017, extradural anterior clinoidectomy was performed in 4 ophthalmic artery aneurysm patients. 3 of the patients had unruptured and one patient had ruptured aneurysms.
Results: Lumbar drain was placed for all patients and lateral supraorbital approach was performed. Total removal of the clinoid process was achieved in all cases and there were no complications associated with drilling of the anterior clinoid process.
Conclusion: Drilling of the anterior clinoid process extradurally is much more rapid and safe procedure when considered with intradural route even in aneurysm cases. The operative exposure is wider because this technique allows much more extensive area as a result of wider removal of the clinoid and lesser wing.
Keywords: Extradural, Clinoidectomy, Ophtalmic artery, Aneurysms

OP-PED.01-01

Factors Determing the Cerebrospinal Fluid Volume Regulation

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Background: According to the new hypothesis of cerebrospinal fluid (CSF) physiology, hydrostatic and osmotic forces between blood and interstitial/cerebrospinal fluid (ISF/CSF) across the vast surface of central nervous system (CNS) capillaries are main factors in regulation of ISF/CSF volume.
Method: To test this hypothesis at the level of ventricles, experiments were performed on anesthetized cats. Three different experimental models were used (ventriculo-cisternal perfusion, model of spontaneous CSF leakage, ventriculo-aqueductal perfusion). In the ventriculo-aqueductal perfusion model (developed in our laboratory), it has been noticed that there is no net formation of CSF volume inside isolated ventricles even during the period of several hours.
Results: During perfusion of isolated ventricular system by isoosmolar mock CSF in ventriculo-aqueductal perfusion model, the same volume that was infused was also collected. However, increase of the perfusate osmolarity instantly lead to an increase of the output volume, and even greater output volume was collected if the same hyperosmolar mock CSF was used to perform a ventriculo-cisternal perfusion (perfusion accross the greater/wider CSF system surface). It was noticed on models of spontaneous CSF leakage that an increase of blood osmolarity decreased the output CSF volume, and that a decrease of blood osmolarity increased the output CSF volume, together with a decrease in cerebral metabolites concentration, such as 5-HIAA and HVA.
Conclusion: These results clearly indicate that CSF volume inside the isolated ventricles, as well as inside the entire CSF system, is under the influence of/controlled by osmotic forces that exist inside the CSF system and CNS microvessels.
Keywords: Cerebrospinal fluid volume, New hypothesis, CSF volume regulation

OP-PED.01-02

Intracranial CSF Diversion for Obstructive Hydrocephalus a Old Concept Revisited with a New Technique of Ventricle-Sylvian Fissure Shunt

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Relief of the obstruction to CSF flow should be the primary goal of surgical treatment of obstructive hydrocephalus, The ideal shunt procedure should be simple, universal cost effective and attempt to address previously described complications.
CSF in the human brain has a well studied route confirming the final pathway involves the Sylvian cistern before travelling on to the cerebral convexity subarachnoid space to enter the blood stream in the superior saggital sinus. Opening of lamina terminalis during shunt surgery has been recommended to bypass the intra ventricular obstruction of CSF. Endoscopic third ventriculostomy also directs the CSF to the suprasellar cistern so that it reaches the sylvian cistern.
Diverting CSF from the lateral ventricle to the sylvian fissure using an inexpensive shunt catheter seems to be easy as microsurgical dissection of sylvian fissure is standard part of neurosurgical training. As both ends of the shunt are intracranial, over drainage seems to be an unlikely complication. The surgical field is small and duration of procedure being short it would translate in to lesser chances of infection. All the complications of the peritoneal catheter of a ventricle-peritoneal shunt seem preventable. Our initial experience of this new technique is presented.
Keywords: Hydrocephalus, Ventriculoperitoneal shunt, Shunt complications

OP-PED.01-03

Assessing Health-Related Quality of Life in Mothers of Children with Meningomyelocele

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Aim: To explore various aspects of health- related quality of life (HRQOL) in mothers of children with meningomyelocele.
Method: This prospective study was conducted between January 2012 and December 2014. During 2-years period, 50 neonates with meningomyelocele underwent surgical repair. At one year evaluation that their mothers completed WHOQL-BREF international quality of life surveys.
Results: When their mothers questioned the quality of life WHOQL-BREF mothers of paraplegic children's were found to have lower scores in physical and social area. They also had lower scores in social and environmental areas who present retardation than their peers.
Conclusion: Meningomyelocele; affecting both parents and babies is a serious disease that causes severe neurological and social morbidity. Giving families often accompanied by social support programs for severe morbidity is important in terms of improving quality of life.
Keywords: Meningomyelocele, Health-related quality of life, HRQOL, WHQOL-BREF

OP-PED.01-04

Trans Ventricular Procedures in Hydrocephalus: Past and Present

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Aim: To evaluate the long-term efficacy of the role of different endoscopic techniques in patients with hydrocephalus.
Method: From 1998 to 2016, 250 patients with hydrocephalus underwent trans-ventricular endoscopic techniques**:** Endoscopic Third Ventriculostomy (ETV), Endoscopic Aqueductoplasty (EAP), Endoscopic Shunt Implantation (ESI), Endoscopic Cystostomy (EC), Endoscopic Colloid Cyctectomy (ECC) and Endoscopic Biopsy (EB). Age ranges between 3 months to 45 years.
Results: Successful outcome is reported in 175 patients (70%) with aqueduct stenosis, 150 patients (60%) with obstructed shunt, and 125 patients (50%) with encysted hydrocephalus. In group II of secondary hydrocephalus, 25 patients (10%) with ventricular tumors, and 15 patients (100%) with colloid cysts demonstrated successful outcome.
Conclusion: TVEPs reported a high success rate and low morbidity and mortality. TVEPs reported a different success rate in 2 different eara due to the difference of instruments, techniques and technology.
Keywords: Hydrocephalus, Endoscopy, CSF

OP-PED.01-05

Patient Management in Myeloschisis; Clinical Evaluation of 40 Cases

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Background: Myeloschisis is a serious closure defect. However, accompanying pathologies, skin lesions, size of the skin defect, presence of hydrocephalus, CSF leakage, baby's immaturity make it difficult to treat.
Method: 40 cases who operated between 2014 and 2016, were evaluated retrospectively.
Results: 28 male and 12 female patients were operated. 27 patients were paraplegic. There were 34 lumbosacral, 4 thoracic, 1 cervical, 1 both thoracic and cervical lesions. The lesion average size was 4x6cm. 9 had pes equinovarus, 1 had ASD, 1 had Chiari Syndrome, 1 had Down Syndrome, 1 had cleft lip. 24 Patients were operated in the first 24-48 hours but 16 patients were operated between 3 days and 4 weeks. One of the syndromic patients died after 15 days from operation. In follow up, 2 patients were operated due to subdural effusion. CSF leakage occurred in 2 patients but leak was cut when shunt was attached. 1patient had infection, 1patient had cefal hematoma. They were treated with medical therapy. Hydrocephalus was present in 18 patients before operation, and develeped in 6 patients after operation. They were treated with V-P shunt. Skin defect primary sutured after sac excision. Partial necrosis developed on the wound lips in 3 patients. The defect was closed without surgery.
Conclusion: Early surgery in the first 24-48 hours is recommended in the literature. Our surgical results are consistent with the literature. With sufficient experience, there is no need for plastic surgery support to repair skin lesions. V-p shunt procedure is recommended as gold standard therapy in the presence of hydrocephalus.
Keywords: Myeloschisis, Myeloschisi repair, Spinal closure defect

OP-PED.01-06

Epidemiology of Spina Bifida Cystica in Sohag, Hospital-Based Study

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Background: Neural tube defects (NTDs) include a wide variety of pathologies due to the intrauterine failure of neural tube closure. It compromises the patient's life quality. Its incidence varies from 3% from total live births to 0.003 % in the Unites States (US), while no accurate data recording its incidence in Egypt. Spina Bifida has many hazardous complications as repeated urinary tract infection which is the major cause of deaths in these cases. Our aim in this study is to study patients' epidemiological data and possible risk factors in our locality.
Method: A descriptive prospective and retrospective study reporting 122 babies with spina bifida cystica came to neurosurgery clinic in Sohag University hospital between January 2009 and January 2015.

We collect their epidemiological data and ask their parents about the possible factors.
Results: In 122 patients with spina bifida cystica, the age range varies from 1 day to 8 months (the mean age was 2 months). The study involved 66 males (54%) and 56 females (46%). 71 cases had associated hydrocephalus (58%), 33 had congenital talipus deformity (27%) and 26 cases had the associated cardiovascular disease (21%). In 73% of cases (n= 89) were from rural area.
Conclusion: Myelomeningocele (MMC) is a common disease in Sohag government. Both sexes affected equally. Incidence was higher in rural areas, mothers who took medication in the first trimester and those who were not on regular folate intake. There is higher incidence of MMC in families who had a previous baby with MMC.
Keywords: Spina bifida, Myelomeningeocele, Congenital anomaly, Neural tube defect, Neurological deficit

OP-PED.01-07

Prospective-Observational Evaluation of the 50 Meningomyelocele Neonates

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Aim: To analyze the clinical outcomes and maternal sociodemographic features followed in the neonatal unit with diagnosis for meningomyelocele.
Method: Babies followed in the unit between January 2012 and December 2014 were analyzed prospectively and observationally. Perinatal data, maternal sociodemographic fetaures, prenatal diagnosis, features of the sac, operation time, hospitalization duration, associated abnormalities, need of ventriculoperitoneal shunt, shunt infection, controls of policlinic, rehospitalization frequency and causes for each baby were recorded.18 months after the birth, children were assessed by the Denver Development Screening Test-II (DDST-II) for psychomotor delay.
Results: 50 neonates admitted to the unit were diagnosed as meningomyelocele during the study period. Mean birth weight and gestational age were 3012±485 gram and 37.9±1.4 weeks, respectively. The mean age of mothers was 30.1±5.6 years. When maternal education status was questioned, it was observed that 27 had illiterate,20 secondary school graduates,3 high school/University graduates. There was no used folic acid preconceptionally.90% of the mothers had never used folic acid during pregnancy.25 of sacs were located in the lumbosacral,24 in the thoracolumbar, and 1 in the cervicothoracic regions.Paraplegia was determined in 27 neonates. Mean operation time was within 4.9±3 days.Of all neonates 35 were diagnosed as hydrocephalus, 33 as hydronephrosis, 24 as Chiari type 2 malformation,22 as pes equinovarus,and 16 as kyphosis. DDST-II were normal in 14 babies whereas borderline delay in 31 and significant delay in 5.When calculating the rehospitalization frequency,there were 1-5 times in 21 babies and more than 5 times in 10 babies within during period.
Conclusion: Educating women, folic acid use during pregnancy and fortification of food seem to be the important for reducing incidence of meningomyelocele.
Keywords: Folic acid, Meningomyelocele, Neural tube defect, Neonate

OP-PED.01-08

Clinical and Surgical Management of the Cervical Meningomyelocele in the Neonates

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Background: Meningomyelocele of the cervical region different from thoracal, lumbar, and sacral. In our study, we aimed to evaluate the clinical characteristics, radiology, associated anomalies, surgical strategy, and prognosis with cervical meningomyelocele.
Method: From January 2012 to December 2016, a total of 88 neonates were diagnosed as meningomyelocele our hospital, and 2 of them recognized to be cervical region. The clinical symptoms, radiological features, operative approaches, preoperative care, postoperative management and prognosis were noted prospectively. At 18 months postnatal period the children were assessed by the Denver Development Screening Test-II(DDST-II) for psychomotor delay.
Results: The procedure was performed on one female and one male. Mean birth weight and gestational age were 3635 gram and 39.5 weeks, respectively. The mean size in sac was 5x5 cm. There was no neurological motor deficits in our two neonates. Magnetic resonance imaging showed that neural tissue within the sac, hydrocephalus and Chiari type 2 malformation. Hemivertebrae and rotoscoliosis was present in patient 1. Syringomyelia of the thoracal region was present in patient 2.The mean age of the neonates at the time of surgery was 4.5 days. The mean lenght of the combined anesthesia and surgery procedure was 2.5 hours. The mean hospital stay, determined by the neonatology and neurosurgery team, was 33 days.The mean follow-up period for our cases was 2.5 years. There were no mortality, wound problems,cerebro-spinal fluid fistula and wound infection. No additional neurological deficits were present postoperatively. There was no problems of ventriculoperitoneal shunt during the follow-up in our patients. Neurological examination and pyschomotor examination with the DDST-II was normal in two cases.
Conclusion: The clinical presentations, results of surgery, prognosis, and psychomotor development of cervical meningomyelocele is better than of patients with thoracolumbar and lumbosacral locations of meningomyelocele
Keywords: Cervical meningomyelocele, Denver development screning test, Meningomyelocele, Neural tube defect

OP-PED.01-09

Strict Pre, Intra and Postoperative Protocol for Lowering VP Shunt Infection Rate in Pediatric Age Group: Have We Achieved the Unattainable?

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With the marked improvement in the antenatal and postnatal settings with highly sophisticated Neonatal intensive care units in Saudi Arabia many of the surviving severely premature babies with birth weights of as low as 600 mg are seen in the neurosurgical practice. Most of these babies are referred because of IVH (intraventricular hemorrhage) with subsequent hydrocephalus for VP shunt insertion. As we know, the incidence of shunt infection are still high as per the reviewed literature. In this paper we thoroughly described strict pre, intra and postoperative protocol which we have noticed to markedly decrease the rate of shunt infection among premature and immuno-compromised neonates.

Keywords: Shunt infection, premature, VP shunt, Hydrocephalus, Post IVH hydrocephalus

OP-PED.02-01

3D Printing in Pediatric Neurosurgery: An Optimizing Tool for Surgical Interventions of Pediatric Spinal and Cranial Pathologies

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Background: Despite the recent developments in neuroradiology, conceptualize 3D anatomy for complex spinal and cranial/craniofacial pathologies can be difficult. Since digital files utilized in modern neuroimaging are readily adaptable to 3-D printing, it is possible to produce 3D printed models of the skull, spine, cerebral vasculature, and brain that can significantly assist surgical planning, reducing operating time and increasing safety. Moreover, with the digital revolution computing power sufficient to create these 3-D models is now available in "desktop" scale.
Method: We present a series of pediatric neurosurgical cases in which 3D models provided manifest improvement in conceptualization of the relevant anatomy significantly aiding surgical planning. MRI and CT studies of these cases were processed with specialized software. Models for each case were then produced on a 3D printer.
Results: 3D printed models were created for 10 pediatric cases including split cord malformation, intracranial AVM/AVF, and craniofacial abnormalities were studied. High accuracy was observed between patient-specific 3D printed models and the source anatomy.
Conclusion: We demonstrated both confirmation of model accuracy with assessing during operations and potential benefit through shortened operative time. We further discuss the software and hardware requirements, as well as costs involved in producing custom 3-D models using "desktop" computing and 3D printer.
Keywords: 3D model, 3D printing, Pediatric, Neurosurgery, Surgical technique

OP-PED.02-02

Endoscopic Endonasal Transsphenoidal Fenestration of Rathke's Cleft Cysts in Children

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Background: With improved access to advanced neuroimaging, Rathke's cleft cysts (RCCs) are increasingly being diagnosed in the pediatric population. For children with medically refractory headaches, visual changes or progressive enlargement, surgical intervention may be appropriate to reduce symptoms and prevent visual decline.
Method: We retrospectively reviewed the neuroimaging, operative notes and pathology reports of all pediatric patients with a RCC treated with an endoscopic transsphenoidal approach at the University of Virginia since 2005.
Results: Nine patients underwent endoscopic transsphenoidal cyst fenestration. One was excluded from this study due to lack of follow up. The mean age was 15 years and median follow-up was 81 months. Primary symptomatology was medically refractory headache in all patients and two also presented with visual deficits. Three patients had mild elevations in prolactin levels and one was found to have adrenal insufficiency at presentation. Mean cyst diameter was 12 mm. The RCCs were completely intrasellar in 5 patients; the remaining three had suprasellar extension. All patients underwent an endoscopic transsphenoidal fenestration and cyst wall biopsy. Headaches improved in 7 of 8 patients postoperatively. The visual deficits in the two patients completely resolved. One patient developed diabetes insipidus postoperatively. There was radiographic evidence of complete cyst drainage in 5 patients. In the remaining 3, small residual cysts were observed. One patient experienced a symptomatic recurrence after 6 months and underwent second fenestration.
Conclusion: The endoscopic transsphenoidal fenestration of RCCs provides symptomatic relief in the majority of properly selected children with a low incidence of new endocrinopathy.
Keywords: Endoscopic, Transsphenoidal, Rathke's cleft cyst

OP-PED.02-03

Pediatric Neuroanesthesia: Retrospective Analysis of 631 Cases, A Single Institution Experience

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Background: Because of the anatomical, physiological and pathophysiological differences between children and adults,

pediatric neuroanesthesia has some special considerations the practice of anesthesiology. We aim to report our anesthetic experience on pediatric neurosurgical cases in a department which high technology neurosurgical techniques and advances are routinely used.
Method: We retrospectively analyzed 631 pediatric patients who underwent neurosurgical procedures. Anesthetic data includes age, sex, body weight, ASA physical status, fluid resuscitation, blood transfusion, anesthetic management, drugs, monitoring, choice of intraoperative airway device, postoperative analgesic management. Surgery spesific data includes, whether surgery was urgent or not, diagnosis, surgical position, mayfield application, the use of intraoperative neurophysiological monitoring (IONM), neuronavigation and intraoperative magnetic resonance imaging (IOMR).
Results: There were 273 girls and 348 boys. The median age was 79.5 months. 64.7% of the cases had cranial and 35.3 of them had spinal operations. 36.2% of the patients were operated for brain or spinal tumor. ASA grades were as follows 7.2% ASA-I, 54.3% ASA-II, 36.1% ASA-III, 2.4% ASA- IV. For induction phentotal (34%), propofol (40.6%) sevoflurane (25.4%) were used. Muscle relaxants were not used in 37% of the patients because of IONM. 10.6 % of the patients required blood transfusion. In 2.9% of the patients IOMR were used.
Conclusion: Anesthesiologists need to be aware of challenges and in the anesthetic management of pediatric neurosurgical cases. They also adopt themselves for the technical advances in the field of neurosurgery. This study highlights the challenges and anesthetic management of pediatric neurosurgical patients.
Keywords: Pediatric neuroanesthesia, Neurosurgery, Neuromonitoring

OP-PED.02-04

Lumbosacral Lipoma - Strip Removal Technique

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Background: Total and safe resection of lumbosacral lipomas is main important for success surgery. Since 2015, we have performed 31 total/near-total resections of lipomas by the traction bicoagulation dissection (strip technique).
Method: From 2015 to 2017, 31 patients (age range, 2 months-52 years) with dorsal, transitional, caudal lipomas, lypomielomeningocele underwent total or near-total lipoma resection. Ninety percent of the patients were children younger than 18 years and 10% were adults. The technique consisted of using traction bicoagulation dissection (strip technique) between the fat and the neural plate along a white fibrous plane. Professor Sufianov A.A. created this technique. Elaborate electrophysiological monitoring was used.
Results: Three postoperative observations concern us. 31 patients, 18 (59%) had no residual fat on postoperative magnetic resonance imaging; 10 patients (35%) had less than 20 mm3 of residual fat; and 3 patients (6%), had more than 20 mm of fat. We used Spina Bifida Neurological Scale (SBNS) for test patients before and after surgery. 21 (68%) had the same level, 7 (23%) had improving their condition, and 3 (9%) had deterioration.
Conclusion: Traction bicoagulation dissection (Strip technique) for resection of lumbosacral lipoma is effective surgical procedure in 91%.
Keywords: Lumbosacral lypoma, Strip technique, Bicoagulation dissection

OP-PED.02-05

The Internal Helmet: A Novel Technique for Immediate Correction of Sagittal Synostosis

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Background: Current techniques for correction of Sagittal synostosis (endoscopic correction, springs, distractors) require time to achieve the correction needed. The use of helmet, the need for a second surgery add to the inconvenience. In this work, we are presenting a novel technical modification that allows immediate correction without the need for helmet or the use of metal device.
Method: Fifteen children have been operated so far. The age was less than 6 months, except for two**:** 9 and 10 months. Surgery is done in the sphinx position. Suturectomy and barrel stave osteotomies are done first, as in minimal invasive technique. Then, two vicryl stitches are used to pull the frontal and occipital bone together, while under gentle bimanual skull compression. These stitches produced both compression and distraction of the skull.
Results: The technique described proved to be tolerable and safe. There was no mortality, and two small Dural tears, repaired immediately. We were able to achieve imediate correction in all cases by the end of surgery. The cephalic index moved from the sixties to the late seventies and eighties right on the operating table. The correction is maintained throughout folllow up period of one year. Blood transfusion was needed and used in all cases.
Conclusion: The "internal helmet" technique is safe effective and probably superior to currently used techniques. It is recommended to treat Sagittal synostosis up to age 10 months. The need for blood transfusion is its only drawback when compared to the endoscopic technique.
Keywords: Craniosynostosis, Sagittal, Minimal invasive, Helmet, Distractor

OP-PED.02-06

Minimally Invasive Spring Assisted Cranioplasty in Management of Scaphocephaly. The First 15 Cases in Egypt

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Background: Spring assisted Cranioplasty is relatively new technique introduced in 1998 in Gothenburg, Sweden. The technique includes implantation of springs which were developed to dynamically remodel the cranial vault. A spring is applied to midline osteotomy made between the anterior and posterior fontanelle, to force the bone ends apart meanwhile remodelling the cranial vault. We introduced for the first time this techniques

in Egypt and reporting our initial experience in a series of sagittal synostosis cases.
Method: 15 consecutive patients with isolated sagittal synostosis were operated by spring assisted cranioplasty were evaluated retrospectively. Records of operative details, hospitalization time, blood loss, and complications were reviewed.
Results: Forty-five springs were used in the 15 patients. Mean age at surgery was 7 month and mean follow up was 1 year. The mean of hospitalization time was 3 days. Mean operative time was 75 minutes, while the mean of blood loss was 70 cc. One case had partial exposure of one spring around the timing for spring removal without any clinical sequence or affection of the final result. One patient had seroma collection that resolved with no further surgical intervention. No mortality was recorded.
Conclusion: Spring assisted cranioplasty offered effective and safe operation with minimal surgical intervention. The procedure is suitable for developing countries as it is less invasive and safer than the conventional cranial remodelling. The only challenge is the community education to increase awareness for the early timing of surgery.
Keywords: Scaphocephaly, Springs, Remodelling, Cariosynostosis, Cranioplasty

OP-PED.02-07

Posterior Fossa Tumours Associated Hydrocephalus in Children - Neuroendoscope Dominance

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Background: In this study designed to assess and present our experience over the last ten years to treat hydrocephalus secondary to posterior fossa tumors. This article condenses our long-term experience with neuroendoscopy in the treatment of obstructive Hydrocephalus associated with posterior fossa tumors in Children, highlighting the prominent challenges and outcomes.
Method: A retrospective study undertaken to assess our patients operated between January 2006 and January 2016, 159 children with posterior fossa tumor were managed. One Hundred fourty-eight patients had symptomatic hydrocephalus. The other 11 cases had no hydrocephalus or non-symptomatic mild dilatation of ventricles, they were excluded from the study. There were 69 males and 79 females, mean age**:** 4.69±2.9. Mean follow-up 22± 6 months. ETV was performed in all cases to relieve intracranial pressure as an urgent procedure after admission.
Results: ETV in principle is efficacious, the procedure resolves the increased ICP before posterior fossa surgery in all cases, reduces the risk of post-operative hydrocephalus, eliminate the risk of upward herniation, and provides a burr hole that can be used as an emergency portal for CSF drainage. Seven cases developed post-operative hydrocephalus and treated by VP shunt insertion.
Conclusion: Endoscopic third ventriculostomy is a rapidly evolving field in the management of obstructive hydrocephalus due to its simplicity, minimally invasive and high success rate. It is a feasible option for the emergency control of severe hydrocephalus; it eliminates reliance on mechanical shunts. It re-establishes CSF dynamics to essentially normal status.
Keywords: Endoscopic third ventriculostomy, Neuroendoscopy, Posterior fossa tumors

OP-PED.02-08

Technique with Minimally Invasive Surgery for the Treatment of Scaphocephaly without Endoscope Use Nor Postoperative Helmet Experience in a Pediatric Hospital in Mexico

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Background: Surgical techniques with minimal invasion have been described, most of these techniques using an endoscope and the use of a postoperative case. A surgical technique is used in which the authors affirm that it is safe and effective, it is possible without the use of an endoscope or use of postoperative helmet.
Method: We performed a cohort analysis of a single pediatric institution of eight patients operated for correction of sagittal, non-syndromic craniosynostosis using a minimally invasive surgical technique between 2013 and 2015 without endoscope use nor postoperative helmet. The variables analyzed were**:** age at surgery, sex, surgical time, estimated blood loss, intraoperative and postoperative complications, days of in-hospital stay, and cephalic index measurement.
Results: Patients included were four female and four male patients, the mean age was 6.3 months, the mean follow-up duration was 12.6 months, with a range (6 - 24 months), the average procedure time was 79 minutes with a range between (100-65 minutes). The mean time of in-hospital stay was 2.75 days (2-4 days). The average bleeding was 91ml with a range between 70 and 110ml, there were no intraoperative or postoperative complications. The preoperative cephalic index was 66 and the average postoperative index was 77.
Conclusion: We present a small series of cases of a minimally invasive procedure for the treatment of scaphocephaly, not endoscopic, without postoperative helmet use. Proving to be a simple technique with satisfactory results, improving the Cephalic Index, with low cost comparable with other surgical techniques open and minimally invasive
Keywords: Scaphocephaly, Minimal invasive technique, Craniosynostosis

OP-PED.02-09

Endoscopic Endonasal Skull Base Surgery for 40 Pediatric Cases: An Instutional Experience

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Aim: To discuss the endoscopic endonasal approach in pediatric age group with its advantages and disadvantages.
Method: Retrospective analysis of 40 pediatric patients that are operated via endonasal endoscopic approach in Ankara University Medical Faculty between years 2010 to 2016 December.
Results: 25 patients (62.5%) were male and 15 patients were female (37.5%). The main age was 10.4 (2-18). Twelve of the cases

were craniopharyngioma (30%), 8 pituitary adenoma (20%), 4 traumatic CSF rhinorrhea (10%), 4 meningocele (10%), 2 germinoma (5%), 2 malign tumors (5%), 2 pituitary inflammation (5%), 1 odontoidectomy (2%), 1 fibrous dysplasia (2%), 1 hemangiopericytoma (2%), 1 neurocytoma (2%), 1 dermod cyst (2%), 1 fibrous dysplasia (2%) and 1 capillary hemangioma (2%). Among 27 patients with pathological results; total or gross total excision was achieved in 23 (85%), subtotal resection was achieved in 2 (7%). No patient had a postoperative CSF leak or meningitis. 9 patients had transient diabetes insipidus, 1 patient had temporary loss of lateral gaze and the case after odontoidectomy had pneumocephalus one week after surgery following a sneeze attack. One patient was died because of endocrinological failure and hypo-hypernatremia imbalance.

Conclusion: Endonasal endoscopic approach is an effective method for surgery in managing various pathologies of the pediatric age group. Due to its less invasive nature, it protects the developing bony structures of the face and the skull, while achieving satisfactory outcomes. Nevertheless narrow transnasal corridor as well as inadequate sphenoid sinus pneumatization could be the main handicaps of this approach in pediatric patients.

Keywords: Endoscope, Transnasal approach, Skull base, Child, Advantage-disadvantage

OP-PED.03-01

Development of the Pediatric Cranial Venous System and Its Clinical Relevance: A Comprehensive Multicenter Study

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Background: Development of the cranial venous system continues into the post-natal period, such that a neonate or an infant may display venous anatomy not seen in adults. Precise understanding of the stages of development of the cranial venous system and dura, and the duration of each, is not yet fully understood. We perform a comprehensive anatomosurgical and histopathological study of the development of the cranial venous system and dura and correlate that with known developmental milestones of the cranium in order to enhance clinical understanding of the pre- and post-natal dura and venous system and how it changes through cranial development.

Methods: A multicenter retrospective study of postnatal magnetic resonance imaging, ultrasonography, and angiography data is currently being undertaken to develop a model of the gross structural development of the cranial venous system during specific developmental periods in order to identify the formation of common surgical targets including but not limited to the tentorium, cavernous sinus, ophthalmic vein, perivertebral and peribasilar plexuses, and jugular bulb. For prenatal subjects, histopathological studies were performed on cadaveric specimens and correlated with available magnetic resonance imaging.

Results: Complete understanding of the structural development of the cranial venous system allows for stratification by developmental milestones that allows for enhanced surgical understanding during neurosurgical interventions in neonates and infants.

Conclusion: Complete description of the development of the cranial venous system will expand understanding of the associated surgical anatomy and facilitate the study of the development of acquired as well as congenital vascular anomalies observed in adults.

Keywords: Venous, Vein, Development, Pediatrics, Anatomy, Sinus

OP-PED.03-02

Kyphectomy in Neonates with Meningomyelocele

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Background: Kyphosis is the most severe spinal deformity associated with meningomyelocele (MMC) and is seen in approximately 15% of neonates. Our aim is to present our clinical experience, discuss the technique and deformity correction in kyphectomy in neonates with MMC and to assess its long-term outcomes.

Method: The authors reviewed eight cases submitted to surgery between 2013 and 2015.We evaluated clinical characteristics were analyzed, as were the operative technique employed, and angle range of the kyphosis deformity postcorrection follow-up.

Results: Neonatal kyphectomy was performed of six females and two males. The average birth weight was 2780 gr, and the average age at the time of surgery was 5.6 days.There were S shaped type deformity in lumbar region in all neonates.In the correction of the kyphotic deformity, a total vertebrae were removed from four patient, whereas a partial vertebrectomy were done in four.The average operative time was 116 minutes.No patients did not required the blood transfusion.There were no serious complications, and wound closure was succesful in all patients.The average follow-up period was 3 years and 3 months (range 24-49 months), except one patient who died one week after discharged.The average preoperative kyphosis of 75.6° (range, 50°-90°) improved at last follow-up to 35° (range 15°-55°).All patients had had surgical procedures for hydrocephalus.Three patients had had surgery for Chiari type II malformation.The average hospital stay was 27.7 days.

Conclusion: Kyphectomy performed at the time of dural sac closure in the neonate is a safe procedure with excellent correction.

Keywords: Kyphectomy, Meningomyelocele, Neonate

OP-PED.03-03

Management of Cases of Chiari Malformation Type I Associated with Hydrocephalus

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Background: Hydrocephalus may be associated with Chiari Malformation Type I and its management remain controversial.

Method: This prospective study was carried out on 16 patients with Chiari Malformation Type I who had been associated with hydrocephalus. There were 10 males and six females and their ages ranged from 10 to 48 years with mean age of 23.5 years.

Syringomyelia was observed in 5 patients (31%). The most common presenting symptom was headache found in 12 patients (75%). The most common signs were papilledema and neurological deficit. Endoscopic third ventriculostomy was performed in all our patients for initial management of hydrocephalus. Further surgical management depended upon the clinical and radiological improvement following endoscopic surgery. The mean follow-up period was 24.3 months (range, 14–52 months) including both clinical and radiological examinations.

Results: Thirteen patients (81%) showed improvement of their clinical manifestations after endoscopic third ventriculostomy. This was associated with normal ventricular size in the postoperative imaging as well as improvement of tonsillar herniation. Four out of five patients with syringomyelia showed radiological signs of reduction of size of the syrinx in the postoperative follow-up which was concomitant with clinical improvement. Three patients (19%) required a second surgery for posterior fossa decompression and duroplasty.

Conclusion: Endoscopic third ventriculostomy is very efficient in management of cases of Chiari Malformation Type I associated with hydrocephalus and is associated with both clinical and radiological improvement.

Keywords: Chiari malformation type I, Endoscopic third ventriculostomy, Hydrocephalus, Tonsillar herniation

OP-PED.03-04

First 50 Fetal in-Utero Microsurgical Myelomeningocele Repairs: Critical Comparison of Neurosurgical and Maternal Outcomes to the MOMS Trial

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Background: The Management of Myelomeningocele Study (MOMS) trial results showed improved hydrocephalus and motor outcomes in prenatal repair group compared to the postnatal group. We report our initial 50 case series of fetal in-utero myelomeningocele (MMC) microsurgical repair experience and outcomes at the Saint Louis Fetal Care Institute. The learning curve was also observed and assessed.

Method: A multidisciplinary fetal MMC repair team performed 50 repairs between May 2011 and May 2016. We prospectively followed maternal, fetal and neonatal data.

Results: All MMC defects underwent successful in-utero repair. Average GA at time of MMC repair was 24+3/7 weeks and 34+4/7 weeks at delivery. Neurosurgical operative MMC repair time after hysterotomy averaged 43 minutes. Two perinatal mortalities 2/50(4%) were due to complications of prematurity. CSF diversion rate of all surviving children via VP shunt or ETV was 20/48 (41.6%), MOMS trial was 40%.ETV success rate was 8/17(47%).When statistically compared to MOMS trial, maternal outcomes were either equivalent or improved for all categories except pulmonary edema, chorioamnionitis and preterm labor. Fetal outcomes were also improved or equivalent. Surgical skin to skin time significantly increased from the first 10 cases to the next 37 cases ($p<.001$) which then led to significantly increase in days between repair and delivery ($p <0.05$) and increase in infant birth weight ($p<0.05$). Ten cases appear to be the threshold for our center to consistency in equivalent results.

Conclusion: Fetal, maternal and neurosurgical outcome equivalency was shown between Saint Louis series and the MOMS trial. Ten cases appear to be the point at which this equivalency is reached. ETV deserves a closer look and may show promising results in the setting of improved hindbrain herniation.

Keywords: Fetal surgery, Spina bifida, Myelomeningocele, Microsurgery

OP-PED.03-05

Correlation Between Magnetic Resonance Cerebrospinal Fluid Flowmetry with the Clinical Outcome of Craniocervical Decompression Surgery for Chiari Type One Patients

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Background: Patients having chiari 1 have caudal displacement of the cerebellar tonsils more than 5mm below the foramen magnum. The brainstem is in a normal position. They may or may not have a syrinx. The 5-mm "rule" concerning the definition of the pathologic extent of the caudal migration of the tonsils is arbitary. Patients with a Chiari1 Malformation may present with a variety of symptoms and signs ranging from headache to severe myelopathy and brainstem compromise. Chiari malformation type I develops as the skull and brain are growing. As a result, signs and symptoms may not occur until late childhood or adulthood Structural MRI is the main imaging diagnostic tool, often accompanied by cine phase-contrast (PC) MRI of the cerebrospinal fluid (CSF) flow. Our aim is to establish a correlation between clinical and MRI flowmetry following craniocervical decompression surgery

Method: Twenty patients with symptomatic chiari 1 malformation had mri flowmetric studies prior to surgery and six months postoperatively and the flowmetry results are assigned to each patient in comparison with clinical improvement.

Results: Sixteen patients had clinical and radiological improvement, one patient clinically stayed the same though radiologically improved and 3 patients deteriorated clinically with radiological evidence of CSF flow obstruction needed resurgery.

Conclusion: CSF flowmetry is a good diagnostic and prognostic tool in chiari type 1 malformation

Keywords: Chiari type 1, cine MRI, CSF flowmetry, Craniocervical decompression

OP-PED.03-06

Surgical Intervention in Patients of Myelomeningocele with Hydrocephalus: One Stage Versus Sequential Operation" - A Comparative Outcome Study

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Background: Timing of V-P shunt insertion in patient of myelomeningocele with hydrocephalus remains controversial. We did this study to determine whether there was a difference in either complication rate or mean hospital stay for patients undergoing

myelomeningocele repair and V-P shunt insertion in single stage versus sequential stages.
Method: We reviewed the results obtained with these two approachees in series of 68 patientss who underwent both surgeries at Chittagong Medical College Hospital and other renowned private hospital in Chittagong city between 2014 and 2016. The fequency and type of complications (e.g. wound leak, infection, shunt malfunction), hospital stay and cost were compared between these two groups.
Results: There is no significant difference in overall frequency of infection (e.g. meningitis, ventriculitis), wound dehiscence and shunt malfunction in these two groups. But mean hospital stay for the sequential group was significantly longer than the single stage group (29 days versus 17 days; p= <0.0001). Mean cost for the sequential group was also significantly higher than the single stage group (48000 BDT versus 35000, p= < 0.001).
Conclusion: Single stage myelomeningocele repair and V-P shunt insertion offers considerable advantage in the form of reduction in hospital stay which indirectly reduces the hospital burdens, costs and morbidity.
Keywords: Myelomeningocele, Hydrocephalus, V-P shunt

OP-PED.03-07

Powder Topical Rifampicin on Reducing Infections After Neural Tube Defect (NTD) Surgery in Infants

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The correct timing and technique of neural tube defect (NTD) repairs significantly decreases the morbidity and mortality of NTD cases. However, infections related to the surgery are still common. We investigated the effects of topical rifampicin (RIF) combined with routine prophylaxis in newborns with open NTD. Eighty-six patients who had undergone NTD surgery were included in the retrospective study. Thirty patients who started on topical RIF before surgery made up the study group, and 56 cases that were not administered topical RIF made up the control group. Surgical site infections (SSIs) and meningitis/ ventriculoperitoneal (VP) shunt infections that developed within six months after the surgical intervention were evaluated. In the post-operative period, meningitis/ VP shunt infections were observed in 6.7% and SSI in 3.3% of the experimental group treated with topical RIF, while meningitis/ VP shunt infections were observed in 37.5% and SSIs in 21.4% of the control group. External ventricular drainage and not using topical RIF were identified as important risk factors for meningitis/ VP shunt infections [RR 19,28 (3,53-105,33), p=0.001; RR 18,10 (2,38-137,68), p=0.005, respectively]. A flap transposition, cerebrospinal fluid (CSF) leaks and not using a topical RIF were identified as relative risk factors for SSIs [RR 22,21 (4,81-102,47), p<0.001; RR 13,04 (1,22-139,33), p=0.034; RR 7,09 (1,12-53,99), p=0.042, respectively]. We did not observe any local or systemic side effects duo to the use of RIF. The use of topical RIF is an easy and effective method for reducing SSIs and meningitis/ VP shunt infections related to NTD surgery.
Keywords: Neural tube defect, Infants, Infection, Rifampisin

OP-PED.03-08

Outcomes of Neural Tube Defect Surgery in an Ethiopian Hospital

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Background: Ethiopia, being a developing country and the second largest population in Africa, neural tube defect (NTD) is among the common problem we face in our neurosurgical practice.
Method: The study was conducted in one of the teaching hospitals in the country. A hospital based prospective study was done. A standardized questionnaire was developed; (patient's demographic data, physical findings, maternal history and intraoperative findings) were documented. The patients were followed post-operatively in the ward, mainly to look for immediate post-operative complication and as an out-patient, on average 2-3 months postop, to assess their outcome.
Results: A total of 107 patients were included (63 male and 44 female) on the study. The most common site of the NTD was lumbar (69.4%). When we see the preoperative neurologic function of these patients, significant number of them (45.6%) had intact motor power. On the immediate postoperative period, 11 patients (10.2%) developed wound related complication and were managed in the hospital, 12 patients (11.1%) developed acute hydrocephalus. It was only possible to get 35 patients (32.4%) for follow-up, 7 patients (6.5%) died before the follow-up days. During the follow-up visit, 5 patients (4.6%) had acute hydrocephalus and there was no single patient presenting with wound related complication.
Conclusion: Most patients were born from a relatively younger mother with no previous history of pregnancy complicated by NTD. Most patients showed no change in there neurologic functions. There was high immediate postoperative wound related complication. The follow-up compliance was not good.
Keywords: Neural tube defect, Hydrocephalus, Wound related complication, Treatment outcome

OP-PED.03-09

Does the Antimigraine Drug Rizatriptan Effect Neural Tube Development in Early Chick Embryos?

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Background: Migraine headaches is still an important issue during pregnancy. Management of migraine with medications during pregnancy and in the postpartum period is challenging because of the potential risks to the fetus and infant. Data on the effects of triptans during pregnancy are scarce and for ethical reasons there are no controlled studies. We aimed to contribute to the literature regarding the effect of rizatriptan on neural tube development in early chick embryos.
Method: Thirty-six sterile pathogen free Leghorn chicken were

divided into sham, therapeutic and supra-therapeutic groups. After 24 hours the eggs were opened and sterile drug injections were done and closed again with plastic tape. After 72 hours the eggs were opened and the embryos were evaluated using the Hamburger-Hamilton chick embryology classification system. TUNEL staining was used to detect apoptosis. Hematoxylin-eosin stain was used for the evaluation of neural tube closure.
Results: Results showed that therapeutic rizatriptan slowed neural tube formation and the supra-therapeutic group resulted in neural tube closure defects.
Keywords: Neural tube defect, Rizatriptan, Migraine, Pregnancy, Chick embryo

OP-PED.04-01

Management of Pediatric Pseudotumor Cerebri Syndrome

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Background: Pseudotumor Cerebri Syndrome in childhood is rare comparing to adult, this condition is sight threatening. Management is usually medical but in some instances surgery is required. We report a retrospective series of children with pseudotumor cerebri syndrome and we focus on results of management to identify patients who should require early surgery.
Method: 24 patients were diagnosed with pseudotumor cerebri syndrome according to the modified Dandy criteria. Clinical and ophthalmological examinations were assessed. MRI of the brain and venography (MRV) were studied to identify known secondary causes. A lumbar puncture with measurement of the opening pressure of CSF was done without sedation.
Results: In our series, Age ranged from 7 to 16 years. Sex ratio M/F was 0.4:1. Headache and visual disturbances were most frequent symptoms. Papilledema was present in 22 cases and optic atrophy in 2 patients. Overweight was seen in one patient. Medical treatment was successful in 12 patients and the remaining required surgery. Among them, 11 had a lumbo-peritoneal shunt. Relapse was observed in 1 patient two years after a LP shunt, he had at that time a high cortisol level and the correction of the disturbance permitted to resolve the symptoms. All patients operated have improved visual function except two patients; both of them had optic atrophy at diagnosis.
Conclusion: Management of Pseudotumor Cerebri Syndrome must be tailored to children. In most cases medical treatment is successful with good outcome. Surgery must be required in patients with severe disturbances at diagnosis.
Keywords: Idiopathic intracranial hypertension, Papilledema, Opening pressure of CSF

OP-PED.04-02

Morbidity After Hemorrhage in Children with Untreated Brain Arteriovenous Malformation

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Background: Children with untreated brain arteriovenous malformations (bAVM) are at risk of life-threatening hemorrhage. A better understanding of the morbidity of bAVM hemorrhage might be helpful for weighing risk of untreated bAVM and invasive treatment. Our aim was to assess the clinical outcome after bAVM rupture and identify predictive features for severe hemorrhage.
Method: We identified all consecutive children admitted to our institution for bAVMs between July 2009 and December 2014. Clinical outcome after hemorrhage were evaluated with modified Rankin Scale (mRS) for children. Association of demographic characteristics and bAVM morphology with severe hemorrhage (mRS>3 or requiring emergency hematoma evacuation) was studied. A nomogram was formulated to predict severe hemorrhage risk.
Results: A total of 134 patients were identified with a mean treatment-free follow-up period of 2.1 years. bAVM ruptured in eighty-three (62%) children. Among them, 49% (41/83) had a severe hemorrhage; emergency hematoma evacuation was required in 28% of them (23/83), and 24% (20/83) remained as disabled (mRS $\geq$ 3) at last follow-up.The annual rate of severe subsequent hemorrhage was 1% in the overall cohort, and 3.3% in children with ruptured presentation. Periventricular location, non-temporal lobe location and long draining vein were predictors for severe hemorrhage in pediatric untreated bAVMs. A nomogram based on bAVM morphology was contracted to predict severe hemorrhage risk for individual patients, which was well calibrated and had a good discriminative ability (adjusted C-statistic, 0.72).
Conclusion: Evaluation of bAVM morbidity and morphology might be helpful for weighing risk of untreated bAVM in pediatric patients.
Keywords: Arteriovenous malformation, Child, Morbidity, Risk assessment

OP-PED.04-03

Polymorphisms in CD40 are Associated with Moyamoya Disease in Children

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Background: The etiology of Moyamoya (MMD) disease remains unknown. Immune and inflammation dysfunction may play an

important role in understanding the pathogenesis of this rare disease. We investigate single nucleotide polymorphisms (SNPs) found previously in Kawasaki disease (KD) and perform a genetic analysis among Chinese pediatric patients with MMD.
Method: We analyzed patients' DNA for SNPs in B lymphoid tyrosine kinase, CD40, and coatomer protein complex beta-2 subunit, which have been previously associated with KD. Genotyping was performed by sequencing the genetic regions containing the SNPs with custom-made primers. A total of 5 genotype polymorphisms were included among 48 cases and 50 controls.
Results: The mean age of MMD children was 6.72±3.63 years old. We found two SNPs polymorphisms were associated with MMD. Polymorphisms rs4813003 major allele CC and rs1535045 minor allele TT of CD40 were statistically associated.
Conclusion: Our findings provide evidence that there maybe a relationship between MMD and auto-immune dysfunction. Further analysis in the pathogenesis within the vascular wall may provide genotype specific personalized therapy target.
Keywords: Moyamoya disease, Single nucleotide polymorphism, CD40, Children

OP-PED.04-04

Effectiveness and Safety of Pediatric Epilepsy Surgery: A Retrospective Clinical Study of 50 Cases

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Background: Pediatric epilepsy surgery is an effective treatment for patients with intractable epilepsy. In this study, we have retrospectively evaluated clinical results of 50 intractable pediatric epilepsy patients who had undergone epilepsy surgery at Istanbul Faculty of Medicine, Istanbul University.
Method: In our study, 50 pediatric patients, below the age of 18, were evaluated according to patients' age of seizure-onset, preoperative neuroradiological and neurophysiological findings, along with the pathological findings, type of surgery and seizure-free outcome. The postoperative seizure-free outcome was evaluated according to the classification of Engel. Invasive monitoring and cortical mapping was performed in selected patients. Surgery was divided into two groups as resective and palliative.
Results: As a result, 40 patients (%80) had resective surgery, 10 patients (%20) had palliative surgery. Morbidity rate was %38 (n=19) and four patients passed away during the seven years of follow-up. These four cases were all below the age of two. Out of the 46 patients, 26 patients (%56,5) experienced a significant seizure control (Engel I and II). Seizure-free outcome rates were found to be %59,4 in patients aged between 2-18 (Engel I and II). In pediatric epilepsy patients, a more limited and safer resection is favored because of the better cognitive and neuropsychological outcome along with the seizure control.
Conclusion: Our study showed that epilepsy surgery is a favorable and safe procedure for pediatric epilepsy patients, especially for patients over two years. Below the two years of age, the surgery is debatable because of the mortality and morbidity risks of the procedure.
Keywords: Pediatric, Epilepsy, Surgery, Retrospective

OP-PED.04-05

Cerebrospinal Fluid Protein Analysis in Tuberculous Meningitis

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Background: The goal of the study is to ascertain whether there is a difference in cerebrospinal fluid (CSF) protein levels between cranial and lumbar CSF and to quantify what levels of protein will obstruct ventriculoperitoneal shunts in Tuberculous meningitis (TBM).
Method: A 30 year prospective analysis was performed. The protein levels in the CSF were analyzed to determine if there was a correlation between these levels and shunt obstruction. A secondary aim was to ascertain whether there was a difference in CSF obtained from lumbar puncture versus ventricular CSF. This would allow us to determine in advance which CSF diversion procedure could be utilized and whether elevated lumbar CSF protein would be a predictor of ventricular CSF protein and hence a predictor of shunt failure.
Results: In total, 214 children and 376 adults underwent VP shunting for TBM. 27.5% and 25.5% of children and adults sustained blocked shunts respectively. Mean protein levels in CSF gathered from the non-obstructed group was 1.76 g/l whereas levels of 2.94 g/l were present in the blocked shunt group. Mean CSF protein in ventricular samples gathered perioperatively in obstructed shunt patients was 2.471 g/l. Mean CSF protein obtained from lumbar puncture was 2.474 g/l.
Conclusion: Patients with elevated CSF protein are at a high risk of VP shunt blockage. In these patients, temporizing measures such as serial lumbar punctures, external ventricular drainage may be employed until CSF protein levels decrease. These procedures may even lead to shunt avoidance. Lumbar CSF protein levels are an accurate predictor of ventricular CSF protein.
Keywords: CSF, Tuberculous, Meningitis, Shunt, Obstruction, Protein

OP-PED.04-06

Television Tip-Over-Related Head Injuries: A Particular Type of Child Neglect

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Background: The purpose of this study is to identify, report, and raise awareness of the risk factors for TV tip-over.
Method: In total, 86 children who were hospitalized in the

Neurosurgery Clinic of the Health Sciences University Istanbul Bagcilar Training and Research Hospital between August 2011 and August 2016 because of TV tip-over-related head trauma were included in the study.
Results: Of these 86 patients, 47 were boys and 39 were girls. The mean age was 38.8 ± 19.5 (9–102) months. Low education level of the mother was a risk factor for this accident (p=0.009). In all the patients, injuries were caused by the tip-over of a cathode ray tube (CRT) TV. The TVs were not fixed to the stand or the wall in any of the patient's home. Average Glasgow Coma Scale (GCS) score at admission was 12.7±2.3(5–15). According to computerized tomography findings, 12 patients (13.9%) had intracranial hemorrhage and 19 patients (22%) had skull fractures. Six patients displayed otorrhea or rhinorrhea, and 17 patients (19.7%) had other injuries. The coexistence of intracranial hemorrhage and trauma to other systems was significantly higher ($p < 0.001$). Eighty-four patients (97.6%) were discharged as GCS**:** 15. One patient was discharged as GCS**:** 9/15 with tracheostomy and nasogatric tubes. One patient died.
Conclusion: The main problem is a lack of awareness by parents. As technological developments continue, CRT TV usage will reduce; therefore, we expect TV tip-over-related injury rates to accordingly reduce.
Keywords: Television trauma, Television tip-over, Pediatrics head injury, Traumatic brain injury, Head injury

OP-PED.04-08

Spontaneous Intracystic Hemorrhage of an Arachnoid Cyst Associated with Subacute Subdural Hematoma

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Arachnoid cysts (AC) are congenital malformations, which may develop anywhere in the subarachnoid space along the cerebrospinal axis, but mostly seen in the temporal fossa and sylvian fissure, predominantly at the left side and accounting for %1 of all intracranial space occupying lesions. AC are potential risk factor for the subdural hematoma especially in young population following a head trauma. Subdural hematoma accompanying with intracystic hemorrhage of an AC without evidence of head trauma is very rare. We report such a rare case and review the literature.
Keywords: Arachnoid cyst, Intracystic hemorrhage, Subdural hematoma

OP-PED.04-09

Cerebral Metastasis of Hepatoblastoma: Case Report and Review of Literature

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Introduction: Hepatoblastoma (HB) is the most frequent liver neoplasm in children. According to the literature review, 18% of patients presented metastasis at admission. Metastasis of HB to the brain are extremely rare.
Objective: To review the international literature to clarify the pathology, epidemiology, clinical presentation, lesion's topography, treatment, and literature review the children brain metastasis from hepatoblastoma, between 1984 and 2016.
Methods: A medical literature research was performed, using combinations of the following keywords: hepatoblastoma, metastasis, and children brain metastasis. In this research, we found 13 papers about this topic that reported 14 cases of brain metastasis by HB between 1984 and 2016. Our case is added to the body of literature in this review.
Results: Among the 15 patients, 9 were female and 6 male (1.5 female/1.0 male). The age ranged from 0 months (newborn) to 10 years old (mean 3.7 ± 3.2 years old). Among the patients, 11 (73.33%) presented other systemic metastasis and four patients did not present other metastasis. The treatment was conservative in 6 cases (40%), and surgical in 7 cases (46.66%). In two cases, form of treatment wasn´t reported. The analysis of the results presented a mortality of 11 cases (73.34%), two cases (13.34%) had poor results, and only 1 patient (6.67%) had good evolution (1 case the evolution no reported).
Conclusion: Hepatoblastoma (HB), when evolved with brain metastasis, has poor prognosis with high mortality. Despite advances in surgical techniques, combined with chemotherapy, the recurrence rate is high and implies a worse prognosis.
Keywords: Hepatoblastoma, Metastasis, Brain, Children

OP-PED.05-01

Atypical Teratoid Rhabdoid Tumors: Clinical Series of 28 Patients from a Single Center

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Background: Atypical teratoid rhabdoid tumor (ATRT) is a rare aggressive neoplasm of central nervous system occurring during infancy and childhood. Despite multimodality treatments, prognosis remains poor and the experience is limited to few clinical series. In this study, we aimed to describe clinical, radiological and surgical results of ATRT cases treated in a single institution.
Method: Demographic, clinical, radiological, histopathological and surgical features as well as treatment outcomes of all ATRT cases operated at our institution between 1995 and 2016 were retrospectively analyzed.
Results: A total of 28 patients (12 male, 16 female) were included in the study. Median age at diagnosis was 22 months (range 0.5-126 months). Tumors were supratentorial in 54% and infratentorial in 46% of the patients. MRI typically showed T1W hypointense, T2W hyperintense and heterogeneously enhancing mass lesion. Gross total resection (GTR) was achieved in 39% of the patients. All patients received various regimens of chemotherapy and those older than 3 years received radiation therapy as well. Median overall survival (OS) after diagnosis was 9 months (0.2-186 months). 1-year OS was 46%, 2-year OS was 29%, and 5-year OS was 18%. GTR and

older age (>3 years), but not location, were associated with more favorable prognosis.
Conclusion: ATRT is a highly malignant embryonal tumor of early childhood that leads to early disease progression and eventually death. Maximal safe resection should be attempted. Better treatment strategies are needed to combat this devastating childhood neoplasm.
Keywords: Atypical teratoid rhabdoid tumor, Children, Surgery, Outcome, Age, Gross total resection

OP-PED.05-02

Imaging of Leptomeningeal Dissemination in Pediatric Central Nervous System (CNS) Tumors: Accuracy of Balanced Fast Field Echo (BFFE) Sequence in Comparison with T1-Weighted Contrast Enhanced (t1w+c) Sequence and Correlation with CSF Examinations

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Background: The diagnosis of leptomeningeal dissemination (LMD) is crucial in the management of CNS tumors. Magnetic resonance imaging (MRI) of the whole neuroaxis and spinal CSF sampling are the main current diagnostic tools at the moment. Both modalities can produce false-positive and false-negative results, yet several studies described that MRI yielded greater diagnostic success in detecting LMD than CSF analysis did in the early detection. Our aim was to evaluate the role of BFFE sequence in the diagnosis of LMD, to compare with T1W+C, and retrospectively to correlate findings with spinal CSF examinations.
Method: Between 2011 and 2016, 56 pediatric cases (24F, 32M; mean age 80.8 months) were diagnosed with CNS tumor that spinal BFFE and T1W+C sequences were performed preoperatively. T1W+C and BFFE sequences of lumbosacral region were obtained in all cases whereas whole spine was examined with both sequences in 22. Lumbar puncture (LP) was performed in 41 cases. Time between preoperative MRI and CSF studies were less than 30 days in 32 cases. The tumors were in infratentorial area in 34 cases and in supratentorial area in 22.
Results: BFFE and T1+C demonstrated LMD in 7 cases. However, BFFE demonstrated LMD in 12 cases in which T1W+C failed to do so (table2) (figures 1,2). In only 1 case T1W+C was able to show LMD that BFFE was not. Spinal CSF examination showed LMD in only one case.
Conclusion: Spinal BFFE sequence demonstrates LMD very effectively in pediatric cases with common pediatric CNS tumors.
Keywords: Leptomeningeal dissemination, Balanced fast field echo sequence, MRI, Pediatric, Central nervous system, Tumor

OP-PED.05-03

Analysis of Results of Treatment of Medulloblastomas in Children

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Background: Medulloblastoma - one of the most frequent malignant brain tumors in children, affecting mainly the cerebellum and characterized by early dissemination of the tumor. Today, it is proven that age of child has a considerable influence on some clinical features of diseases and also results of treatment.
Method: The results of treatment were analyzed in 85 children with medulloblastoma. Peak incidence of disease was in children on the age of 4 and 7 with 12.94% (in 11 cases) and 10.58% (in 9) respectively. All patients were operated; the diagnosis of medulloblastoma was verified histologically.
Results: At 31.76% of patients was performed a total resection of tumor, where subtotal and partial resection was executed at 51.74% and 16.5% respectively. Cerebrospinal fluid shunting was needed in 16.47% of all patients. During 14 days after resection 8 (9.4%) patients died. A catamnesis was estimated in 72 (84.7%) children in terms from one month to 5 years. Median of survivability was 14 months. One-year survivability is established in 38.0%, two-year in 16.0%.
Conclusion: For the children of the early age the total resection of tumors was possible in 40.3% cases, subtotal — in 42.0%. Frequency of early dissemination of tumors in the different age-related groups of children statistically does not differ with small predominance in the children of early age. Influence of volume of combined therapy requires a study in the different age-related groups of children on survivability in postoperative period.
Keywords: Medulloblastoma, Children, Surgical treatment, Results

OP-PED.05-04

Paediatric Brain Tumours and Tumour-Like Lesions: A Single Center Experience

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Background: Brain tumours are an important cause of childhood solid tumours. They can be mimicked by other non-tumour brain lesions. We present our experience in paediatric age group.
Method: A retrospective review of 49 children (0-18 years) managed at Medica Superspecialty Hospital, Kolkata. Space occupying lesions from suppurative intra-cranial abscesses and traumatic lesions were excluded from the study. Data analysis was carried out using SPSS for Windows, version 21.
Results: The a mean age of patients was 11.2±4.3. Slight male preponderance was noticed (M:F of 1.3:1). Lesions were tumours in 81.6% and tumour-like lesions (TLL) in 18.4%. Location was Infratentorial in 34.7% of which 82.4% were tumours while 17.6% were TLL. Pilocytic astrocytoma (16.2%), Diffuse astrocytoma (13.1%),

and Ependymoma (13.1%) were the most common histological pattern for tumours. Tuberculoma and Cysticercosis accounted for 55.6% of TLL. Pilocytic astrocytoma and Tuberculoma were the most common infra-tentorial tumour and TLL respectively. Headache, Vomiting, and Imbalance/Gait abnormality were the most common presenting symptoms. Headache, Vomiting, and Seizure was found for both tumours and tumour-like lesions. A significant association exists between location of tumour and hydrocephalus (p = 0.000). Good early outcome (GOS 4 & 5) was achieved in 85.5% of patients with tumour, and 87.5% of patients with TLL. No mortality at discharge.

Conclusion: Despite being entirely of different pathologies from the more common brain tumours, tumour-like lesions share a lot in common and have similar good early outcome following appropriate surgical intervention. These lesions must be considered as possible differentials in developing countries.

Keywords: Tumours, Tumour-like lesions, Intra-cranial, Paediatric

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Meningiomas in Children (26 Cases)

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Meningioma represents 20-30% of intracranial tumors in adults. In children, this tumor is rare and has distiguished characteristics. We report a retrospective study of 26 cases of intracranial meningiomas of children, to study their diagnostic features, therapeutic and evolution. The average age of our patients was 10.58. and 53.84% of the children were male. Meningioma in children represents 2.71% of all cases of meningiomas and 4.15% of all intracranial tumors in children. The clinical expression was dominated by the intracranial raised pressure syndrome, motor deficit and epilepsy. Convexity was the main location in 9 cases, but specific locations were noted.
Total removal of the tumor was complete in 21 patients (80.76%). 8 patients were grade II or III. The outcome was favorable in 12 cases. 5 patients died, 4 patients presented recurrence in one case associated with metastasis through CSF.
Meningioma in children have several peculiarities**:** The male predominance, the imaging features with a high frequency of heterogeneous forms, cystic component and the large size; the high frequency of atypical grade II and malignant grade III; child feature with a small blood volume and consequent surgical difficulties and resuscitation and the important evolutionary potential with a high recurrence rate even in cases of low grade histology and complete resection.
The prognosis mainly depends on the quality of excision, histology and genetic and molecular factors that promote tumor progression and higlights the interest of the genetic and molecular evaluation of these tumors in children for better management.

Keywords: Meningioma, Pediatric brain tumor, Imagery

OP-PED.05-06

Posterior Fossa Tumour Surgery in Children: A Review of a Single Neurosurgeon Experience

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Background: Paediatrics Posterior fossa tumours are accounting for up to two-third of the children's brain tumours. Different approaches can be used for paediatrics posterior fossa tumour surgeries, such as sitting, lateral, and prone positions. A number of advantages and disadvantages can be encountered using these approaches.
Method: We retrospectively reviewed a single neurosurgeon experience in Paediatrics posterior fossa tumour surgeries in the National Children hospital, Temple street, in Dublin between 2010-2016. There was case mix of 40 patients, operated in different positions between sitting, lateral, and prone positions. We reviewed these patient's Medical notes, follow-up letters, operative and anaesthetic records.
Results: In this study, we assessed the surgeries performed by a single neurosurgeon to avoid surgical performance bias. we reported the neurosurgical outcome, and peri-operative morbidity attached with each approach. We also looked at the different anaesthetic parameters peri-operatively in different positions.

Keywords: Posterior fossa tumour, Sitting position, Neurooncology

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Outcome of Posterior Fossa Tumor in Children Between the Impact of Treatment and the Natural History of Disease

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Background: Most pediatric brain tumors (60%) are infratentorial. The objective is to assess the patients with posterior fossa tumor and its natural history.
Method: This is a retrospective study based on chart review of posterior fossa lesions in children operated at National Neuroscience Institute /King Fahad Medical City in time periods between April 2006 &April 2014.
Results: Age**:** 5 month to 18 year(7). Males 66 (64.0%), Females 37(35.9%). Presentation**:** high ICP 99 (96.1%), cerebellar signs 39 (37.8%), weakness 6 (5.8%), tortecolis 4 (3.8%), increase head size2 (1.9%), loss of mile stone 1 (0.97%), difficulty swallowing 2 (1.9%), hearing loss 2 (1.9%), seizures 2(1.9%), behavioral changes 1(0.97%), failure to thrive 1(0.97%). Underwent sub occipital craniotomy & excision of lesions. 52 (50.4%) complete excision & 51 (49.5%) residual, 63 (61.1%) in brain suite & 40 (38.8%) regular operative room, 63 (61.1%) shunted, 40 (38.8%) no shunt. Histopathology**:** Medulloblastoma**:** Survival 0-7 year (3). Pilocytic astrocytoma**:** Survival 0.58 - 7 years (3.5). Ependymoma**:** Survival 0-7 year (3). Atypical Rabdoid Teratoid Tumor**:** Survival 2-13 month (6). Ewings sarcoma**:** Survival 3.5 year. High grade glioma**:** Survival 0-6 year (2.3). Choroid plexus papilloma grade 1, 1/103 (0.97%). Survival

4yr. Heamangioblastoma**:** Survival 1yr. Low grade glioma**:** Survival 1-7yr (4).
Conclusion: Natural history of diseases has an impact on the outcome despites of aggressive treatment in highly malignant tumors.
Keywords: Posterior fossa tumor in children, Natural history, Aggressive treatment, Survival

OP-PED.05-08

Neuroblastoma in Childhood

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Background: We present epidemiologic, etiologic factors, treatment options and prognosis of primary central nervous system neuroblastoma.
Method: Our cases comprising of 6 primary CNS neuroblastoma, one of them was located in spinal cord, and others in brain. The ages of the cases ranged between 8-day and 13-year-old. All of them were male. 4 of cases was congenital, 2 of them were acquired. Postoperative radiotherapy and chemotherapy were applied to all of the cases.
Result: Neuroblastoma is the most common extracranial solid tumor, but rarely located in the CNS. Neuroblastoma is an embryonal tumor of the sympathetic nervous system derived from primordial neural crest which commonly occur in the young children and median age of about 17 months. It is usually located in the supratentorial region and, spinal cord is rarely affected primarily. It was suggest that some prenatal and antenatal factors could be associated with development of congenital neuroblastoma. Neuroblastoma has profound genetic heterogenity. Current treatment strategies for CNS embryonal tumors are based on risk stratification, by using patient age, primary tumor location, postoperative any residual volume, metastasis and leptomeningeal seeding. Primary treatment of the CNS neuroblastoma is surgery. After the surgery or biopsy, radiotherapy is standard treatment modality. Adjuvan chemotherapy is recomended for high risk group. Prognosis is generally poor and vary because of its complex biologic pattern.
Conclusion: Primary CNS neuroblastoma is rare and highly malignant tumor. There have been many studies make efforts to improving survival rate of this malignancy.
Keywords: Childhood, Neuroblastoma, Surgery, Treatment strategies

OP-PED.05-09

Brain Tumors in Peruvian Pediatric Population. Experience at the National Institute for Children-San Borja (Lima-Peru)

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Background: The National Institute for Children-San Borja is the most important pediatric hospital in Peru for its technology and modern facilitites. The Department of Neurosurgery has the most relevant experience for the surgical treatment of complex pediatric brain tumors of patients that come from all regions of Peru. The objective of this presentation is to show a representative case series of peruvian pediatric tumors.
Method: Revision of clinical charts and imaging studies from all patients operated in our department in the period 2015-2017. For this oral presentation, the presenting author selected his most relevant cases.
Results: From the period 2015-2017, 83 brain tumors was operated in our institution, 38 cases (45 %) was operated for the presenting author. No perioperative mortality, CSF leak in one case.
Conclusion: The National Institute for Children is the most important center for surgical treatment of pediatric brain tumors in Peru.
Keywords: Brain tumors, Pediatrics, Peru

OP-PED.06-01

Choroid Plexus Tumors in Infants and Young Children - Lessons Learnt from an Institutional Review

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Background: Choroid plexus tumors (CPT) are rare tumors characterized by papillary and intraventricular growth. The young age of presentation of such tumors as well as the lack of consensus on adjuvant therapy in cases of atypical choroid plexus papillomas (aCPP) and choroid plexus carcinomas (CPC) create a dilemma in their management.
Method: We retrospectively analyzed the case records of all patients in the age group 0 to 5 years with CPTs who were operated at our institute from January 2010 to July 2015. The variables analyzed included age, sex, presentation, location, surgical approach, extent of resection, intraoperative blood loss, blood transfused, histopathology, postoperative complications and outcome.
Results: 11 children were included in our study. 7 patients had choroid plexus papillomas (CPP), two patients had aCPP and two patients had CPC. The median age was 8 months (range 40 days - 4 years). The mean blood loss was 285.7 ml whereas the median blood loss was 130 ml. Out of 3 deaths, 2 deaths occurred on post operative day 1(POD1) (one patient with aCPP and one patient with CPC) whereas one patient(CPC) died four months after surgery.
Conclusion: CPT's are challenging tumors in infants and very young children because of potential for massive blood loss. CPP are associated with lesser blood loss and favorable outcome as compared to aCPP and CPC. CPC have a rapid proliferation potential as shown in one of our cases. Attempts at decreasing vascularisation of such tumors should be made by various methods which includes preoperative embolization and neo-adjuvant chemotherapy.
Keywords: Choroid plexus tumors, Tumors in infants, Choroid plexus carcinoma, Intraventricular tumors

OP-PED.06-02

Application of High Field Intraoperative Magnetic Resonance Imaging in Pediatric Low Grade Glial Tumors

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Background: Since mid 1990s there are reports on utilization of intraoperative magnetic resonance (IOMR) imaging in patients with intracranial pathologies. With the advent of technology, today 3-T ultrahigh-filed IOMR devices are in use with significant benefits in terms of increased tumor resection and surgical safety. This article aims to present our experience with a 3T IOMR device.
Method: 11 pediatric patients were operated with the help of IOMR between 01 2015 and 01-2016. Patients with at least 6 months of followup were included for this study.
Results: Mean age of the population was 7.73. Of the tumors 5 were frontal 3 were temporal 2 were thalamic and 1 were hippocampal. Mean tumor volume was 19.45 cm^3. All tumors were low grade gliomas of various kind. Mean hospital stay was 4.18 days. Mean total anesthesia time was 307 minutes (205-395). Mean time to IOMR request was 83 minutes and mean total IOMR duration was 28 minutes. Excluding IOMR duration (including time to and from the IOMR suite) mean active surgical time was 253 minutes. In two patients IOMR was used twice. There were 5 total and 6 near total (less than 10% residue) excisions. All of the residues was due to critical location. No postoperative neurological adverse events were experienced.
Conclusion: Although it is clear IOMR increases anesthesia duration, we did not experience any side effects realated to this. All patients were discharged in a reasonable time and did not experience any significant disabilities. IMR is safe for pediatric population.
Keywords: Intraoperative magnetic resonance, Pediatric neurooncology, Low grade glial

OP-PED.06-03

External Ventricular Drainage: An Operation Theatre or a Bedside Intervention?

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The insertion of external ventricular drainage (EVD) is an invasive intervention for treatment of hydrocephalus and elevated intracranial pressure. EVD is regarded as a bedside procedure, which may be done in the proper setting in intensive care units. One of the most problematic complications is ventriculitis. During EVD insertions in the intensive care unit and in the operation room, the bacteriological air samples were examined. The Petri dishes were exposed to air. Platecount agar was used and the dishes were exposed 30 cm from the surgical field during the surgical procedure, which in total lasted approximately 30 to 45 minutes. The dishes were incubated in aerobic and anaerobic conditions. Bacterial flora was diverse. The majority were aerobes. S. capitis, S. epidermidis and S. warneri were predominant in the intensive care. S. epidermidis, diphtheroids, S. haemolyticus, S. anginosus and Bacillus spp. were found in the operation theatre. The colony number was significantly higher in the intensive care unit in comparison to operation theatre (average 7 to 22 colonies and 0 to 4 colonies, respectively). The number of colonies was lower during the quiet times. Additionally, the infection rate of EVD was higher when the drainage was inserted in the intensive care. The EVD insertion is an operative procedure. Therefore it should be performed in the proper sterile conditions, not as a bedside intervention. There is a higher infection and complication risk in comparison to the operative intervention.
Keywords: External ventricular drainage, Bedside intervention, Microbiology, Infection

OP-PED.06-04

Disconnection vs Excision? A Ten Year Review of Hypothalamic Hamartomas

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Background: Hypothalamic hamartomas (HH) are rare tumors of childhood. They are usually associated with gelastic seizures. The optimal management of these tumors lacks a consensus. We present our experience with hypothalamic hamartomas over a ten year period.
Method: This study presents a retrospective review of 16 patients with HH's treated between 2002 and 2012 at the All India Institute of Medical Sciences (AIIMS), New Delhi, India, a tertiary care neurosurgical centre.
Results: There were 16 patients with an age ranging from 1.5 years to 20 years and included 9 males and 7 females. The most common symptom was seizures (81%; gelastic seizures-62.5%) followed by precocious puberty (56.2%). The median tumor volume was 5.9 cc (range 1.3 to 108 cc). Fourteen patients underwent surgery while two were managed conservatively. Three patients received secondary Gamma Knife therapy. A good seizure outcome (Engel class I and II) post surgery was seen in 8 (50%) patients. The median follow up period was 39 months (range 1 to 114 months). The odds ratio for a better seizure outcome was 2.5 times more in disconnection than for excision. The symptoms of precocious puberty had resolved in 7 of the 9 affected patients (78%). Transient diabetes insipidus was seen in one (6.2%) patient postoperatively while hyperphagia was noted in four (25%) patients. Hyperphagia persisted in all four patients until last follow-up.
Conclusion: HHs present with gelastic seizures or precocious puberty. Disconnection of the HH is more effective and a safer procedure vis-a-vis excision for controlling seizures.
Keywords: Hypothalamic hamartomas, Gelastic seizures, Precocious puberty, Disconnection, Surgical excision

OP-PED.06-05

Outcomes of Post-Neurosurgical Ventriculostomy Associated Infections

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Pakistan

Background: Ventriculostomy Associated Infection (VAI) is a major concern to physicians. Limited studies have looked at the outcomes of External Ventricular Drain (EVD) infection and predictors of unfavorable outcomes. In this study, we assessed the outcomes of EVD infection and predictors of unfavorable outcomes.
Method: This was a retrospective medical chart review, conducted at the Aga Khan University Hospital. All the patients irrespective of age and gender, fulfilling the diagnostic criteria of VAI were included. Patients with preexisting bacterial meningitis or ventriculitis were excluded from the study. Outcome assessment was based on Glasgow Outcome Scale (GOS) at one and three months after procedure. Other outcomes included 30-day mortality and total length of hospital stay.
Results: We included 256 patients in the study. 66 patients (25.8%) developed VAI. EVD was the primary procedure in 21 (31.8%) cases. Most patients, 24 (36.4%), had EVD as a secondary procedure for tumor surgery. Median interval between EVD placement and diagnosis of infection was 3 days. Mean length of stay in VAI patients was 31.85 ± 20.53 days. Seven patients required ICU care. Ten patients (15.2%) expired during hospital stay or within 30 days of discharge and further 4 had GOS of 2 or 3. A total of 52 patients had a favorable outcome after 6 months.
Conclusion: Rate of VAI in this cohort was high. VAI is associated with increased morbidity, mortality, and prolonged hospital stay.
Keywords: External ventricular drain, Ventriculostomy, Infection

OP-PED.06-06

Pediatric Central Nervous System Hemangioblastomas: Different from Adult Forms? A Retrospective Series of 25 Cases

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Background: Hemangioblastomas are uncommon central nervous system (CNS) tumors and more rarely encountered in the pediatric patients. The present study aimed to characterize the clinical course and identify predictive factors of clinical outcomes in pediatric hemangioblastomas, and further compare these results with adult cases.
Method: We performed a retrospective study of all patients with CNS hemangioblastomas who were treated at West China Hospital from January 2003 to March 2015. Patients under the age of 16 years were included in the study. The medical records of these patients were reviewed and statistically analyzed.
Results: Twenty-five children (15 females and 10 males,[mean age 12.6 ± 4.7 years]) presented with hemangioblastomas. Tumors were detected in the cerebellum, brainstem, and spinal cord in 40%, 28% and 32% of patients, respectively. Sixteen patients (64%) had VHL syndrome. The most frequent symptoms were those related to increased intracranial pressure. The mean duration of symptoms was 1.5±2.1 months. Preoperative hydrocephalus was noted in 11 children (44%). Gross total resection was achieved in all children. Clinical symptoms improved in 19 children (76%), unchanged in 4 children (16%) and aggravated in 2 children (8%), respectively. The mean follow-up was 44.5±32.3 months. Recurrence of hemangioblastoma developed in 5 of 25 cases (20%). Using univariate analysis, both tumor-associated cysts (p=0.027) and VHL disease (P=0.032) were significantly related to postoperative outcomes.
Conclusion: Surgical outcomes for pediatric hemangioblastomas are favorable. A high degree of suspicion for VHL disease should be raised in pediatric patients with hemangioblastomas. Furthermore, VHL disease is a risk factor for a worse long-term prognosis, and lifelong follow-up is mandatory to detect the tumor recurrence.
Keywords: Hemangioblastoma, Von Hippel-Lindau disease, Pediatric, Management, Outcome, Recurrence

OP-PED.06-07

Endoscopic Approach to Craniopharingioma: Retrospective Evaluation of 40 Cases

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Aim: To evaluate the clinical and endocrinological results of the endoscopic transnasal approach applied to the 40 craniopharyngiomas cases which diagnosed with radiological and pathologically and to present the surgical approaches applied to these cases.
Method: Between September 1997 and March 2017, 1887 cases who were operated on endoscopic transnasal route in Kocaeli University Medical Faculty Neurosurgery Clinic were retrospectively screened. 40 craniopharyngioma cases were included in the study. These 40 cases were divided into 4 groups according to infundibulum and third ventricle. Standard endoscopic surgery was performed in the cases, and in some cases an extended infrachiasmatic approach was performed. In 1 case, neuroendoscopic approach was applied.
Results: Standard techniques were performed in our cases with intrasellar spread craniopharyngioma, but our remaining cases were treated extended technique. Postoperatively cerebrospinal fluid (CSF) leakage developed in four cases included in the study. In three patients were transient, three had persistent diabetes insipidus, and three patients had postoperative hypophyseal insufficiency evolved. We performed total tumor resection in eighteen patients. We were able to perform cyst aspiration and resection in seven patients and subtotal resection in fifteen patients.
Conclusion: The extended approach that can be applied after obtaining a certain experience is the ideal method if the lateral expansions are not excessive in the lesions of preinfundibular, transinfundibular and retroinfundibular craniopharyngioma. Combined approaches should be preferred in patients with lateral expansion. The extended approach in the middle midline lesions is easier and safer.
Keywords: Craniopharingioma, Endoscopic, Extended

OP-PED.06-08

Management of Pediatric Brain Tumors, Strategies and Long Term Outcome

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Background: This study is aimed at shedding the lights on different patterns of presentation of Sudanese children with brain tumors and reflecting the experience of the national center for neurological sciences in setting strategies for management together with long-term follow up over 14 years period.
Method: Retrospective, observational study for all Sudanese children with brain tumors operated in the National Center for Neurological Sciences in the period between September 2000 to March 2015. Data were collected and patients were followed throughout the entire 14.5 years study period. All patients with deficient clinical pre and post-operative data, patients with missed operative details, patients with missed histopathology reports and adult patients were all excluded from study.
Results: During this 174 months period, 54 patients were operated aging between 1-17 years with average presentation at 9 years of age. M:F 2:1. The commonest presenting symptoms are headache (90.7%), back pain (81.3%), vomiting (59.3%) and unsteady gate (48.1%). T Average duration of symptoms was 1 year. Most patients were operated through posterior fossa craniectomy (n=30/54, 55.9%and histopathology reports were mainly medulloblastoma (n=15/54, 27.8%) and pilocytic astrocytoma (n=11/54, 20.4%). Most patients improved or cured post-operatively (n=43/54, 79.7%) 1 deteriorated and 9 died.
Conclusion: Pediatric brain tumors are among the most challenging neurosurgical problems that needs stepwise multidisciplinary team approach. Lesions tend to be infratentorial with obstructive hydrocephalus. We found that 2 steps surgery first with VP shunt followed by second stage tumor resection after few weeks is both effective and safe way with apparently good outcome.
Keywords: Pediatric brain tumors, Management, Long term outcome, Posterior fossa tumors, Medulloblastoma

OP-PED.07-01

Endoscopic Monro Foraminoplasty (EMF)

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Aim: To unveil the proper selection of suitable pathologies eligible for foraminoplasty, types per surgical target and avoidance of complications.
Method: Out of 2625 cranial endoscopic procedures performed through the past quarter of a century, in two Egyptian University Medical Centers, 80 cases subjected to "EMF" were reviewed. Preoperative MRI T2 including coronal sequence were obtained. Solid lesions up to 2 cm above the foramen of Monro, were considered for excision foraminoplasty. Dilatation and restoration foraminoplasty were performed using Fogarty balloon catheter. Combined EMF and pellucidotomy eliminated the need for bilateral Foraminoplasty. Patients' age ranged from 3 months to 36 years with a follow up period ranging from 2-12 years.
Results: Triventricular hydrocephalus with lateral ventricular asimilarity was detected in 60% while bilateral foraminal occlusion with equal sized lateral ventricles were detected in 20%. Unilateral hydrocephalus was reported in 20%. Congenital bilateral pinhole stenosis was dilated in two infants. Foraminoplasty can be sorted into three types**:** Dilatation Foraminoplasty used to treat congenital (2.5%), idiopathic (40%) or post hemorrhagic/ meningitic (10%), stenosis. Restoration Foraminoplasty was used to fenestrate a membrane (15%) or cyst wall nearby the foramen (10%). Excision Foraminoplasty for solid SOL (10%), partially cystic tumors (12.5.5%) may require combined aspiration and squeeze foraminoplasty especially in retro-foraminal colloid cysts with coapted foramen edges. The only reported complication was transient remediable memory disturbance.
Conclusion: Endoscopic Monro Foraminoplasty (EMF), is a definitive neuroendoscopic treatment procedure. It deserves abbreviation assignment (EMF).
Keywords: Neuroendoscopy, Foraminoplasty, Monro foramen

OP-PED.07-02

Neuroendoscopic Management of Intraventricular Cysts in Children: Technique and Evaluation of Cerebrospinal Fluid Dynamics

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Background: Intraventricular cysts are relatively common in children, and conventional treatment methods have been replaced by neuroendoscopy as the treatment of choice due to recent procedural improvements. The purpose of this study is to assess whether neuroendoscopic surgery in children is suitable for the treatment of intraventricular cysts, and if cerebrospinal fluid (CSF) dynamics should be analyzed by Cine MRI prior to surgery.
Method: Thirty-two children with symptomatic intracranial cysts underwent neuroendoscopic treatment at the Beijing Shijitan hospital between 2006 and 2013. Of these, fourteen had lateral ventricle cysts, three had third ventricle cysts, four had fourth ventricle cysts, nine had suprasellar arachnoid cysts and two had quadrigeminal cistern arachnoid cysts. CSF velocity and flow were analyzed by Cine MRI, and the optimal neuroendoscopic surgical method was selected for each cyst type.
Results: CSF dynamics improved in all patients after endoscopic surgery, and MRI revealed shrinkage of cysts in 26 cases, with a total success rate of 81.3% and no surgery-related serious complications or deaths. Furthermore, neuroendoscopic treatment prevented cyst enlargement without obstructing stomas.
Conclusion: Cine MRI aided in the evaluation of CSF dynamics for the determination of optimal surgical strategy and prognosis prediction. Neuroendoscopic surgery successfully alleviated the space-occupying effects of intraventricular cysts and improved CSF flow, and can therefore be considered as a suitable minimally invasive strategy for treatment of pediatric patients.
Keywords: Neuroendoscopy, Hydrocephalus, Intraventricular cyst, CSF dynamics

OP-PED.07-03

The Place of the Ventriculoatrial Shunt in the Management of Hydrocephalus: Indication, Possible Complications and Literature Review

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Background: There are limited options for continuous cerebrospinal fluid drainage. Ventriculoatrial (VA) shunts are provided to drain cerebrospinal fluid from the cerebral ventricle into the right atrium of the heart. The ventriculoperitoneal (VP) option is more popular than ventriculoatrial (VA) shunts. In some special events, VA shunts may be an appropriate option. In this presentation we will discuss of the importance of the VA shunt in the management of hydrocephalus, their indications and contre indication and the possible complications that we have encountered and how to deal with them.
Method: VA shunts were placed in 27 patients who had repeated previous shunt dysfunction or infection. The reasons, clinical findings, replacement methods, and postoperative clinical follow-ups and outcomes were recorded retrospectively. In 15 cases the shunt was placed for history of abdominal surgery, in 4 cases the indication was peritoneal infection and in the rest of cases the shunt was placed for repeted vp shunt dysfunction Preparation of the patients included**:** Negative CSF analysis Normal echocardiography.
Results: All patients were followed postoperatively. No early complications were noticed in our patients. Six long term complications were noted (a valve dysfunction in 4 cases; a case of endocarditis with pulmonary thrombus; and a fatal shunt nephritis).
Conclusion: VA shunts may be an option for cerebrospinal fluid drainage at necessary conditions. However, sterilization and general training on asepsis and antisepsy are the most important determinants affecting the clinical outcome due to the cardio systemic relationship.
Keywords: VA Shunt, Hydrocephalus, Endocarditis, Pulmonary thrombus

OP-PED.07-04

Infant Hydrocephalus in Sub-Saharan Africa: The Reality on the Tanzanian Side of the Lake

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Aim: To characterize the infant population affected by hydrocephalus who were presented to a government funded and patient cost-shared referral center of Tanzania and treated with a ventriculo-peritoneal shunt (VPS), to determine the early complication rate of this procedure and to assess its risk factors.
Method: Data was prospectively collected from every infant who were diagnosed with hydrocephalus and admitted to Bugando Medical Centre (BMC) for primary VPS, over a period of 7 months.
Results: 125 patients were included for analysis. 75% were younger than 6 months; 56% were males. Only 7% mothers had a gestational ultra-sound and 25% delivered at home. Congenital hydrocephalus accounted for the majority (56%) of the etiologies. The mean head circumference was 51.4 cm +/- 6.3 cm; 1/3 of patients were operated without a radiologic exam; 13 patients had had a previous intra-ventricular endoscopic procedure. Overall, at least one surgical complication was found in 33.6% of patients up to first follow-up assessment; VPS infection was the commonest one. The risk factors associated with early surgical complications were tumor-related etiology, larger head circumference and longer post-operative hospital stays.
Conclusion: This study shows that the good results previously reported by SSA hospitals sub-specialized in pediatric neurosurgery, are still not generalizable to every center in SSA. In order to improve neonatal care in the Lake Region of Tanzania, the development of a peri-operative protocol for VPS insertion and the increase in the number of endoscopic procedures are imperative at BMC.
Keywords: Infant hydrocephalus, Sub-Saharan Africa, Ventriculo-peritoneal shunt, Tanzania

OP-PED.07-05

Endoscopic Third Ventriculostomy in Children Below 2 Years

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Background: For years the VP shunt was the main treatment of hydrocephalus till the recent advances in the neuroendoscopic applications. Use of the endoscopic third ventriculostomy provides an ideal treatment without complications of the traditional shunts. However, it can be challenging in the age group below 2 years as the results are unexpected and differ from than the adult group. Our aim in this study to assess the results of the ETV in children below 2 years, we analyze the children data and its relation to the outcome.
Method: A retrospective and prospective study was carried out on twenty-one children who have hydrocephalus. An ETV was done for them between April 2012 and September 2014. All of them had an aqueductal stenosis. Follow- up CT was done fo all children one month and one year after the procedure.
Results: Their age ranges from 6 months and just below two years, with the mean age was 14.5 months. They were 15 males and six females. The overall success rate was 66.6% with the mean follow-up period of 13.7 months. VP shunt inserted in 5 babies after the ETV failure, one case of CSF leak and one case died due to intracranial hemorrhage.
Conclusion: Our study shows the effectiveness of ETV in children less than two years in general with reasonable complications. It is safe and effective method for treating hydrocephalus in this age group without confrontation of VP shunt
Keywords: ETV (endoscopic third ventriculostomy), VP (Ventriculoperitoneal) shunt, CSF (cerebrospinal fluid), IVH (intraventricular hemorrhage), HC (hydrocephalus), CNS (central nervous system)

OP-PED.07-06

Endoscopic Third Ventriculostomy in Infants. Is It Contraindicated?

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Background: Endoscopic third ventriculostomy (ETV) is a recent surgical option for hydrocephalus. There are multiple different opinions ranging from indication to contraindication depending on different results of managing hydrocephalus in infants through ETV. We are therefore presenting the results of ETV in 50 infants in a trial to delineate more favorable opinion.
Method: A prospective study which included 50 infants suffering from obstructive hydrocephalus (40 infants with congenital hydrocephalus due to aqueductal stenosis and 10 infants with post meningitic hydrocephalus).
Results: There was 56% (28 cases) clinical success rate in our study. Infection, persistent cerebrospinal fluid (CSF) leak and bleeding occurred in 4(8%) cases, while blockage of toma was observed in 8 (16%) patients. ETV stoma closure (4 out of total 8) occurred following infection (2) or bleeding during surgery (2). Overall failure rate in our study was 44% (8 stoma blocks and 1 procedure abandoned). Low birth weight premature infants had higher failure rate (4 out of 4 infants100%). Success rates were significantly different in patients with aqueductal stenosis and those post-meningitic hydrocephalus.
Conclusion: ETV can be the definitive treatment for obstructive hydrocephalus in infants less than one year of age. Many different etiologies of hydrocephalus may be treated; congenital aqueductal stenosis carries the best prognosis for success. Success rate of ETV depends not only on the age but mainly on the cause of hydrocephalus, maturity of the infant, preoperative MRI findings and surgeon endoscopic experience.
Keywords: ETV, Infant, Hydrocephalus

OP-PED.07-07

Ventriculoperitoneal Shunt Operation Complications in Pediatric Patients at Neurosurgery Department Hasan Sadikin Hospital Bandung

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Background: Ventriculoperitoneal (VP) shunt is used in the setting of hydrocephalus to divert CSF to the peritoneum and VP shunt operations are the most common surgical procedures performed by neurosurgeons for treating hydrocephalus. Despite the advances made in shunt devices such as a dramatic improvement in patient survival and neurological function, many complications have been attributed to the use of this devices.
Method: A retrospective study was performed on pediatric neurosurgery patients who had VP shunt complication such as infections, exposes, and malfunctions between January 2015 until December 2016 in our institution.
Results: There were 26 pediatric patients with VP shunt insertion complications which admit to our institution. There are 17 boys and 9 girls with mean age 31.84 months. 13 cases were performed operation in our institution and 13 cases from others. The shortest interval complication was 0.5 month and the longest was 24 months. 22 cases were proximal shunt and 4 distal shunt complication. 12 cases were causes by infection, 8 cases by shunt blockage due to debris materials, 4 cases by shunt malfunction due to under-drainage and 3 cases due to broken device. For the treatment, there are 9 cases were performing shunt repair, 3 cases performing shunt replacement, 12 cases performing shunt externalization, and 1 case were conservative.
Conclusion: Shunt malfunction and shunt infection is a common cause of complication especially in children. Many factors were involved. Although the benefits of VP shunt insertion are enormous but good consideration and decision still needed in order to prevent the complications.
Keywords: VP shunt, Hydrocephalus, Pediatric neurosurgery, Complications

OP-PED.07-08

Outcome of Endoscopic Third Ventriculostomy in Hydrocephalus. An Early Experience in 42 Patients At Liaquat University Hospital Jamshoro

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Background: Endoscopic third ventriculostomy is minimal invasive procedure for the treatment of Hydrocephalus. Aim of our study is to see outcome of endoscopic third ventriculostomy in terms of efficacy of procedure and post-operative complication.
Method: In this descriptive study 42 patients underwent Endoscopic third ventriculostomy from JAN 2015 to DEC 2015 in Neurosurgery ward Liaquat University Hospital Jamshoro. Success of procedure was defined as post operative clinical improvement along with radiological improvement in the appearanceCT scan or MRI brain on 30th day post-operatively.
Results: Out of 42 patients 24 (57.142%) were females and 18(42.857%) were males. Age range was between 3 months to 35 years. Most common etiology of Hydrocephalus was posterior fossa tumor (16 patients, 38.09%) followed by aqueductal stenosis (10 patients, 23.80%). Procedure remains successful in 32 patients (76.19%) and complication occurred in 6patients (14.28%), CSF leakage being the most common complication occurred in 4 patients (9.5%).
Conclusion: Endoscopic third ventriculostomy is an effective procedure for the treatment of hydrocephalus by diversion of CSF. This procedure provides shunt freedom and can be used alternative to shunts for the treatment of hydrocephalus.
Keywords: Endoscopic third ventriculostomy, Hydrocephalus, Neuroendoscopy

OP-PED.07-09

Endoscopic Third Ventriculostomy: A Resident's Experience in a Developing Country

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Aim: To evaluate the outcome of Endoscopic Third Ventriculostomy (ETV) in non-communicating hydrocephalus. The study was conducted at Department of Neurosurgery, Jinnah postgraduate medical center, Karachi form January 2016 to December 2016.
Method: Cross-sectional study. A total of 14 patients who fulfilled our inclusion and exclusion criteria were enrolled in the study after informed consent. MRI brain plain midsagittal sections were evaluated in all patients for pre-operative assessment of ETV. All patients were operated by the same surgical team. Post-operative clinical improvement was taken as an indicator of successful procedure. CT scan was performed after at least 2 weeks for radiological evaluation.
Results: Out of 14 patients 8 (57.14%) were males and 6 (42.8%) were females. They aged from 6 months to 7 years. The most common indication for ETV was aqueductal stenosis in 9 (64.3%) patients. Other indications for ETV included Posterior fossa space occupying lesion in 4 (28.57%) patients and pineal gland tumor in 1 (7.14%) patient. Overall success rate was 92.8%. One patient developed CSF leak which was managed conservatively.
Conclusion: ETV is safe and effective method for management of obstructive HCP. It is less invasive procedure and associated with minimal complications. The learning curve is short and can be safely performed by neurosurgeons in training.
Keywords: Neuroendoscopy, Third ventriculostomy, Aqueductal stenosis, Hydrocephalus

OP-PED.08-01

Simplest Radiological Measurement Related to Clinical Success in Endoscopic Third Ventriculostomy

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Background: Radiologic criteria for a successful endoscopic third ventriculostomy are not clearly defined and there is an ongoing need for determining simplest and strongest radiological criteria for this purpose. This paper aims to determine the easiest radiological parameter related to surgical outcome.
Method: Between January 2012 and December 2015 all patients receiving endoscopic third ventriculostomy were reviewed and 29 patients whose preoperative and early postoperative 3D-CISS images were available were studied. There were 13 males and 16 females, and there were 11 pediatric cases (mean age**:** 9.90 ± 5.2; range**:** 2-18). The mean age of the entire population was 26.58 ± 18.32 (range**:** 2-68 years). Measurements were performed using the ruler tool of a freely distributed medical imaging software. Simple ruler measurements of ventricular floor depression, lamina terminalis bowing, anterior commissure to tuber cinereum distance, mamillary body to lamina terminalis distance, third ventricular width, frontal horn width and occipital horn width were recorded and compared between successful and failed interventions.
Results: Of the ventriculostomies, 22 (75.9%) were considered successful and 7 (24.1%) as failed at the last follow-up visit. Of the measurements performed, only those related to the third ventricle itself were significantly higher in the failed group. There were no association with lateral ventricular measurements.
Conclusion: Simple ruler measurements of the suggested distances significantly correlate with clinical success. After validating our results with higher number of patients, complex measurements and calculations to determine the link between clinical success and radiological success of ventriculostomy procedures may not be needed.
Keywords: Endoscopic third ventriculostomy, ETV success, Hydrocephalus

OP-PED.08-02

Midline Intracranial Arachnoid Cysts in Children. What is the Best Treatment?

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Background: Midline intracranial arachnoid cysts are rare. While may be asymptomatic, some cause symptoms mostly related to hydrocephalus and warrant surgical treatment. In this retrospective review, the author aimed to study different methods of treatment of symptomatic cases and the outcome after surgical intervention in children with midline intracranial arachnoid cysts.
Method: Retrospective chart review of 25 prospective, consecutive cases presented with midline intracranial arachnoid cyst. Clinical presentation and radiological findings were analyzed, and methods of treatment of symptomatic cases and the outcome of surgical intervention were studied.
Results: Twenty-five children below 15 years of age, diagnosed with mid line intracranial arachnoid cyst. Hydrocephalus was present in (n. 16). Arachnoid cysts were discovered incidentally in 3 patients. Nine patients had large cyst extending between suprasellar, quadrigeminal regions and posterior fossa. Arachnoid cyst was retroclival prepontine in one patient. Fifteen patients underwent 20 endoscopic procedures. Complications of treatment included hemorrhage (n. 3), CSF leak (n.1), seizures (n.3), temporary respiratory failure (n.2), and shunt malfunction (n. 5). Outcome was considered good (n. 17), fair (n. 7), and one patient had disastrous hemorrhage during endoscopy and recovered vegetative.
Conclusion: There is no standard treatment of midline arachnoid cysts that agreed upon. There is no association between radiological size of the cyst, and clinical presentation/clinical improvement after treatment. Surgery for asymptomatic children is not justified although the vulnerability of arachnoid cysts in minor head trauma is well known. Shunt revision rate is higher among patients with midline arachnoid cysts.
Keywords: Midline / suprasellar, Quadrigeminal arachnoid cyst, Supraacerebellar, Retrocerebellar arachnoid cyst, Hydrocephalus, Neuroendoscopy

OP-PED.08-03

Smartphones Change the Opening Pressure of the Programmable Valves

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Aim: To find out whether smartphones have effect on programmable shunts or not.
Method: iPhone5S and Samsung GalaxyS5 smartphones chosen for study. For both phones, magnetic field mapping performed with three-dimensional magnetic scanning systems. The distance (h) between the distal outlet of the reservoir and the rugby ball of the Strata valve was measured with using highly sensitive microanalysis method. During microanalysis, while keeping the 3 cm distance between the valve and the magnetic generator, the h value (μm) was recorded for different magnetic flux densities (MFD). Then, the direct X-ray radiography was performed. For the analysis of the Codman Certas valve, the magnet orientation and the angle between the magnet with tantalum ball measured.
Results: Maximum MFD found 62 Gauss (G) for iPhone5S and 61 G for Samsung GalaxyS5. The magnetic generator formed a current at 0, 30, 60, 90 and 0 Gauss, the h values of the Strata valve adjusted to 100 mm H2O opening pressure were 320, 280, 190,175 and 320 μ, respectively. In direct graphs taken after each optical analysis at different G values, substitution was not observed. The angle in the Codman Certas valve was 123.9, 112.5 and 103.6 degrees at the magnetic flux densities 0, 60 and 90 Gauss, respectively. When the magnetic field was removed, the angle was still 103.6 degrees.
Conclusion: Smartphones exert reversible effects on Strata programmable valves and irreversible effects on Codman Certas valves.
Keywords: Hydrocephalus, Magnetic field, Programmable valve, Shunt, Smartphone

OP-PED.08-04

Outcome of Antibiotic-Impregnated Shunt (AIS) Catheters for Management of Hydrocephalus: A Retro-Prospective Study Versus Non-AIS Catheters

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Aim: To evaluate outcome of insertion of antibiotic impregnated shunt (AIS) catheter compared to non-AIS catheter for treatment hydrocephalus (HCP) in neonates.
Method: Prospective part of the study (Group A) included 50 patients fulfilling the diagnostic criteria for HCP and assigned to receive AIS catheter. The retrospective part included 50 age- and gender-matched patients underwent non-AIS catheter for treatment of HCP. Study outcomes included rates of catheter-related infection (CRI) and revision surgery (RS) for CRI.
Results: Sixteen patients required RS for CRI; 3 in group A and 13 in group B with significantly lower frequency in group A. Frequency of patients required early RS was significantly lower ($p<0.001$) and mean duration till development of the 1st CRI was significantly ($p=0.019$) longer in group A. Frequency of patients required frequent revision was significantly ($p=0.001$) lower in group A. Collectively, there were 25 episodes of CRI with significantly lower frequency in group A ($p=0.001$). Mean number of local CRI findings/patient was significantly ($p=0.019$) lower and duration of symptoms before diagnosis of CRI was significantly ($p=0.02$) longer in group A. Thirteen patients showed high leucocytic count, 12 patients had low CSF glucose/serum glucose. Bacteriological examination of replaced catheters showed significantly higher frequency of no bacterial growth in group A, the frequency of catheters positive culture for gram-positive cocci and gram-negative bacilli were significantly lower in group A.
Conclusion: AIS catheter allowed significant reduction of CRI and RS rates. CRI rate showed negative significant correlation with age at time of primary surgery.
Keywords: Hydrocephalus, Antibiotic impregnated shunt, Catheter-related infection, Revision surgery

OP-PED.08-05

The Indication of Drainage Procedure in Pediatric Hydrocephalus - The Role of Transcranial Doppler Sonography in Daily Clinical Praxis

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The indication of drainage procedure plays an important role in pediatric hydrocephalus and should be based on the recent knowledge of the pathophysiology of hydrocephalus. The authors present 15 years experiences of the use of transcranial Doppler sonography in the management of pediatric hydrocephalus in clinical praxis. The transcranial Doppler sonography allows the assessment of hemodynamic parameters of cerebral circulation. In general, the increased intracranial pressure leads to the increase of cerebrovascular resistance and alteration of Doppler parameters (decrease of end-diastolic blood flow velocity, increase of resistance index, increase of pulsatility index). However, the use of transcranial Doppler sonography in the management of pediatric hydrocephalus is still disputable. The relationship between the intracranial pressure and the alteration of cerebral circulation in pediatric hydrocephalus is complex and still unclear. The Doppler parameters are influenced by the number of intracranial (e.g. periventricular haemorrhagic lesions, asymmetry of dilatation of the cerebral ventricles) and extracranial factors. Therefore, the Doppler parameters of cerebral circulation not always reflect the value of intracranial pressure and the individual analysis of intracranial dynamics is always necessary. Based on our clinical experiences and the results of the scientific work, we can conclude that transcranial Doppler sonography plays an important role in the indication and timing of drainage procedure in pediatric hydrocephalus and is helpful as a noninvasive bedside and repeatable examination for the indirect assessment of intracranial hypertension. We also confirmed the

alteration of cerebral circulation before drainage procedure and the improvement after drainage operation (shunts, neuroendoscopic procedures).
Keywords: Pediatric hydrocephalus, Transcranial Doppler sonography, Drainage procedure

OP-PED.08-06

External Ventricular Drainage; Indications and Outcome among Sudanese Children

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Background: External ventricular drainage (EVD) in children has many uses in clinical practice. This includes perioperatively in posterior fossa tumors, infantile intraventricular hemorrhage (IVH), infected VP shunt and postinfectious hydrocephalus, traumatic brain injury for ICP monitoring and management of IVH and after surgical resection of an intraventricular tumor like choroid plexus papilloma.
Method: Prospective review of cases who have been operated at the National Center for Neurological Sciences during the period from February 2014 to February 2016. The data obtained from a computerized data record system in the center using a designed questionnaire and the data was then analyzed using SPSS version 20.
Results: Forty-one cases were operated during this 2 years period aging between 6 days to 7 years. The majority of the cases have posterior fossa tumor with obstructive hydrocephalus (n=19. 46.3%), followed with those with IVH (n=13, 31.7%). positive CT/MRI findings seen in 10 patients (24.4%). Most patients (n=28, 68.3%) respond to single injectable antibiotic therapy, two patients treated through systemic and intraventricular antibiotics while 11 patients treated through combined 2 and 3 injectable antibiotic. The duration for antibiotics use was ranging between 2 to 61 days.
Conclusion: EVD can be used for many indications including obstructive, post-infectious, post-meningitic hydrocephalus and IVH. Most patients may present with either deteriorated level of consciousness or symptoms and signs of raised ICP but few of them may have positive brain imaging findings. Single antibiotic therapy use which was found as effective as combined and intra-ventricular therapy.
Keywords: EVD, Children, Hydrocephalus

OP-PED.08-07

Outcomes in Pediatric Hydrocephalus in a West African Hospital

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Aim: To assess, in a cohort of children with treated hydrocephalus, the outcomes of hydrocephalus management in a west african hospital.
Method: A cross-sectional study of children with long-standing hydrocephalus, primary managed in the neurosurgery department of the teaching hospital of Yopougon between January 2006 and December 2010, was performed. Surgery outcome, sequellae, motor functioning and type of schooling were analysed. Data were obtained from patient medical records and parental interviews.
Results: A total of 129 patients was collected; 78 (60,46%) boys and 51 girls The mean age at hydrocephalus treatment was 1.07 year; the mean age at the time of assessment was 10,39 years. The mean delay before surgery was 8,73 months. An overall good long-term outcome was observed in 60% of cases. Forty-eight percent of the patients were able to attend a school for students with normal intelligence. Disabling motor functioning was found in 32%. Epilepsy was present in 30%. Thirty seven (28,68%) shunt revision procedures were performed. 17% shunt infections occurred. The majority of children graduated from a normal school, according to the grade level corresponding to their age (48%); or with a retard or a school for physically handicapped children (40%). Sixteen patients died (12.4%).
Conclusion: The results show relative good social and schooling outcomes despite the long delay before treatment and the high rate of post operative complications.
Keywords: Pediatric hydrocephalus, Neurosurgery, Prognosis, Outcome, Motor functioning, Schooling

OP-PED.08-08

Management of Infected Shut in Congenital Hydrocephalus

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Aim: To analyze etiology, clinical features, pathogens, mortality, morbidity and modalities of treatment of ventriculo-peritoneal (VP) shunt infections in congenital hydrocephalus.
Method: Prospective case series descriptive study was carried out in the department of Neurosurgery, mosul teaching hospital, from jan 2011 to Jan 2013, the patients with vp shunts infection was studied. Once infection was suspected, a cerebrospinal fluid (CSF) sample was taken and once infection confirmed, The management protocol consisted of**:** The removal of the infected shunt and EVD system putted and antibiotic. Or without removal of v-p system just antibiotic and tapping if needed. Use of IV antibiotic and wound debridement, re-stitching and dressing without shunt removal in patients presented with wound infection.
Results: The incidence of age**:** 69.44% below 1year and 30.6% were between the age of 1-2 years. Time between the surgery and the shunt infection**:** 61.11% were presented within 6 months of surgery and 38.88% presented between 6 months to 2 years. 13.8% of patients (n= 5) died.
Conclusion: The most common bacteria isolated were gram positive organisms (staph. aureus). In cases with VP shunt infection it is essential to remove VP shunt and start systemic antibiotics and put new VP shunt after 3 free samples of CSF. VP shunt should be inserted under strict aseptic techniques.
Keywords: Ventriculopertonial, Shunt, Infection, External ventricular drainage

OP-PED.08-09

Complication Rate of External Ventricular Drains in Peadiatric Complication

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Aim: To identify the indications and complications associated with the use of External ventricular drain (EVD) in the pediatric population in a developing country hospital.
Method: All pediatric patients who underwent EVD at out institute were included in this study. The inclusion criterion comprised of all pediatric patients who underwent insertion of EVD placement due to various underlying pathologies and had normal hematological parameters such as coagulation profile and platelet counts on admission. Variables such as age, gender, and days of admission, presenting GCS, primary pathology, and duration of EVD, level of trainee performing the procedure, Skewed continuous variables were reported with the median and interquartile range (IQ).p-value of less than 0.05 was taken as significant.
Results: One seventy one patients 171 were included in the study from the 199 records. 38 patients were excluded as their hospital records were incomplete. 65.5% males and 34.5% female patients were identified. Mean age at the time of EVD insertion was 5.3 years±5.18 [median 4, IQR 6] whereas the mean GCS before insertion of EVD was 11±4 [median 13, IQR 8]. Mean length of stay in the hospital was 7 days± 5 [median 6, IQR 6]. Infection was identified as the most common complication in patients with EVDs- 14 % (24 out of 171) followed by malfunction 6.4% (11 out of 171), hemorrhage, misplacement and EVD obstruction were also rarer complications identified.
Conclusion: One of the most common complications is infection.
Keywords: External ventricular drainage, Hydrocephalus, Infection

OP-SB.01-01

Correlation of Preoperative Diffusion Tensor Tractography for Cranial Nerves with Intraoperative Findings in Surgery of Cerebellopontine Angle Tumours: A Prospective Blind Study of 40 Patients

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Aim: To pre-operatively visualize the course of cranial nerves displaced by the cerebellopontine angle tumours using diffusion tensor tractography, and to evaluate this data with intra-operative findings.
Method: This was a prospective, non-randomized, blind study; consisting of 40 patients with cerebellopontine angle tumours operated by the senior author (BKM) at our centre. A 3-Tesla Philips IngeniaR MR scanner was used to obtain preoperative DTI sequences. The imaging data was stored in a digital imaging & communication in medicine (DICOM) file and transferred to 'Extended MR workspace (EWS)' for image processing. Image fusion and fiber tracking was carried out. The findings were correlated with intra-operative impression. The surgeon was blind to pre-operative DTI findings. Trigeminal, Facial and Vestibulocochlear nerves were studied. The tumours included vestibular schwannoma (31), meningioma (2), epidermoid (5), and trigeminal schwannoma (2).
Results: The trigeminal nerve, facial nerve and vestibulocochlear nerves were seen as distinct tracts in 39, 39 and 24 patients respectively. The concordance rate for trigeminal nerve was 85% (34/40); for facial nerve, 85% (34/40); and for vestibulocochlear nerve, 75% (12/16). In the 34 patients with concordance, the trigeminal nerve was anterosuperior (16), superomedial (9), medial (4), superior (3), and posterior (1) and lateral (1); facial nerve was anterior (12), anterosuperior (13), anteroinferior (5), or inferior (4).
Conclusion: Pre-operatively, the relation of the cranial nerves vis-a-vis CPA tumours can be predicted reliably by diffusion tensor tractography in the majority of the patients. It might result in better preservation leading to better post-operative nerve function.
Keywords: Cerebellopontine angle, Cranial nerves, Diffusion tensor tractography, Intra-operative impression, Concordance

OP-SB.01-02

Brainstem Cavernous Malformations Presentation of 20 Cases and Literature Review Recommendations

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Background: Bleeding from brainstem cavernomas may cause deficits due to the absence of non-eloquent nervous tissue and nerve nuclei. Surgical removal of these lesions presents a challenge to most surgeons. We present our experience with the surgical and clinical treatment of 20 patients with brainstem cavernomas. Important aspects of microsurgical anatomy are reviewed. The surgical management, with special focus on new intraoperative technologies as well as controversies on indications and timing of surgery are presented.
Method: The data were retrospectively reviewed to evaluate the outcome of 20 patients with brainstem cavernous Criteria used were**:** previous hemorrhages (one, two or more episodes), the possibility of total surgical removal at first glance, presence of previous our new transient postoperative déficits and the patient's choice of clinical support as unique treatment. It was also considereded the surgical techniques used and recomended by literature.
Results: Eleven were submited to surgical treatment. 9 patients did not accept the surgical option and kept clinical follow-up. The patients had an average age of 54 years, had cavernomas mostly at pons or at midbrain-pons or at the pons-medullary transition. The most part had partial clinical improvement and cranial nerve functions recovery.
Conclusion: According to our experience, surgical resection remains the treatment of choice of brainstem cavernomas especially if there was previous hemorrhage and the lesion reaches the pial surface of brainstem. An excellent outcome with very low morbidity and no mortality may be achieved if the surgery is performed by experienced neurosurgeons in selected referral centers.
Keywords: Brainstem, Cavernoma, Surgery, Treatment

OP-SB.01-03

Non Vestibular and Non Trigeminal Cranial Nerves Neurinomas; Microneurosurgical Management

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Background: Common cranial nerve neurinoma is vestibular nerve schwannoma and second common cranial nerve schwannoma is trigeminal nerve schwannoma. Other cranial nerve neurinoma is relatively less common. Complete removal of intracranial cranial nerve neurinomas without producing neurodeficit is one of the most challenging operations in neurosurgery even with modern microneurosurgical techniques. Aim of presentation is to share our experience of total or near total excision of nonvestibular and nontrigeminal cranial nerve neurinomas without further neurological deterioration or with acceptable morbidity.
Method: Cases that were operated from last April 2008 to December 2016 are studied. Tumor were removed totally or near totally by microneurosurgical techniques. 36 operated patients with intracranial cranial nerve neurinomas were prospectively studied.
Results: Total number of non vestibular and non trigeminal neurinomas-36 Oculomotor-03, Trochlear-00, Abducent neurinomas-03, Facial nerve & greater petrosal nerve schwannoma-07, Vagal/glossopharyngeal neurinoma- 13, Hypoglossal neurinoma 07, Spinal accessory neurinoma -03. Postoperatively severe cerebellar signs developed in 6 cases, swallowing difficulty in three cases that recovered totally; one patient expired immediate postoperative period. The glossopharyngeal/vagal neurinoma postoperatively developed hemiparesis, lower cranial nerve palsy. Outcome in the rest of the cases are very good with stable neurology or with some acceptable new neurodeficit. Postoperative neuroimaging showed total or near total removal of tumor.
Conclusion: Microneurosurgical removal of nonvestibular and non trigeminal tumors, totally or near totally without further neurodamage can bring cure to the patient with no neurodeficit or with acceptable neurodeficit.
Keywords: Non vestibular & non trigeminal cranial nerves, Neurinomas, Microneurosurgery

OP-SB.01-04

Microsurgical Management of Petroclival Meningiomas: A Challenging Frontier for Neurosurgeons

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Background: Petroclival meningiomas are the one of the most challenging skullbase meningiomas due to its relation to brainstem and cranial nerves as well as its strategic localization. Complete excision without morbidity and mortality is the goal but very difficult to achieve.
Method: Petroclival meningiomas that we operated from 2010 t0 2026 were studied for clinical profile, investigations, microneurosurgical management with surgical approaches, complications, follow up and outcomes.
Surgical approaches were used-
1. Infratentorial lateral supracerebellar approach-09 cases
2. Combined infratentorial lateral supracerebellar and retrosigmoid & retromastoid approach-10 cases
3. Retro-sigmoid-retromastoid approach in 11 cases
4. Subtemporal approach-05 cases
5. Subtemporal- anterior petrosectomy approach in 02 cases.

Results: Total number of cases 37. Average follow up was 20 months. Twenty nine patients developed cranial nerve palsy/paresis. Neurodeficit persisted in fifteen cases. One patient developed persistent hemiparesis. Two patient expired postoperatively. Due to simplicity and less cranial nerve manupulations infratentorial suracerebellar approach seems to be associated with less cranial nerve related complication. Moreover retrosigmoid-retromastoid route can be used as well.
Conclusion: We used various surgical approaches in removal of petroclival meningiomas and it is perceived that infratentorial lateral supracerebellar approach is relatively a safe trajectory and produce less cranial nerve palsy.
Keywords: Petroclival meningioma, Infratentorial lateral supracerebellar, Retrosigmoid retromastiod

OP-SB.01-05

The Influence of Iatrogenic Fifth Cranial Nerve Trauma on the Results of Surgical Treatment of Trigeminal Prosopalgias. Negative Outcome Predictors

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Aim: To analyze the iatrogenic predictors of negative outcome for the patients with trigeminal prosopalgias.
Method: Analysis is based upon 42 cases of surgical treatment of trigeminal prosopalgias. All occurred because of verified intracranial trigeminal root compression.
Results: Among all the patients 68% were female. 8 patients suffered symptomatic TN due to tumor compression, rest had classic TN. Average age was 51.9 y. Everybody had undergone trigeminal nerve decompression either via tumor removal or by means of Jannetta procedure. Decompression was primary in 15 (35%) cases – (Group I) or followed earlier destructive procedure elsewhere – 27(65%) – (Group II). 27(65%) patients showed positive blood PCR for one or several herpes viruses. Better results were obtained in 1st group. BNI pain score was lower both immediately after operation (1.2 vs 1.6; $p<0.0001$; 95% CI 1.1602 to 1.6398) and at 1 year follow-up (1.2 vs 2.9; $p<0.0001$; 95% CI 1.0658 to 2.3342). There were no difference according to this score between groups neither at the time of onset (4.23 vs 4.22; $p=0.9674$) nor preoperatively (4.44 vs 4.4; $p = 0.8339$). BNI numbness score and other neuropathy indicators were higher in Group II (3.8 vs.1.2; $p<0.0001$; 95% CI 1.9575 to 3.2425). Entire Group II had dysesthesias after 1 year. Positive HHV PCR was linked to worse outcome in both groups.
Conclusion: We could convincingly state that in cases of trigeminal pain of compressive origin destructive methods should be avoided as a first-line procedures.
Keywords: Trigeminal neuralgia, Microvascular decompression, Jannetta, Prosopalgia, Facial pain, Iatrogenic trauma

OP-SB.01-06

Individual Designed Approaches and Microsurgery for Huge Petrous Bone-Invasive Tumors: Report of 57 Cases

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Background: A lot of important structure located in or beside the petrous bone. The gross total resection of petrous bone-invasive tumor would be difficult and challenge to Neurosurgeon. For achieving the gross total resection of the huge petrous bone-invasive tumors and minimal damage to the important structures in the petrous bone, we combined several different approaches to every individual patient. We also aimed to describe the technical nuances and tips of the individual designed approaches and microsurgery.
Method: 57 patients, who have huge petrous bone-invasive tumors (average diameter is about 5 cm), were admitted to our department between 2014 and 2016. All of them underwent individualized microsurgery for resection the lesions. According to the relationship between the tumor and petrous bone, several different approaches were combined or improved. We designed different approach and microsurgery for every individual patient.
Result: The gross total resection was achieved in 52 cases. Subtotal in 3 cases, partial in 2 cases. 50 patients did not have new neurological dysfunction. In the other 7 patients who had new neurological dysfunction, 4 patients got better after 3-6 months. The preoperative neurological dysfunction in 29 patients were improved after the surgery. The most common complication was leakage of CSF. 5 patients had this complication. There were no deaths in this study.
Conclusion: The individual designed approaches and microsurgery can increase the gross total resection rate of the tumors and nerve protection rate. As the result, the outcome of the patients who have the huge petrous bone-invasive tumors were improved significantly.
Keywords: Petrous bone, Invasive, Huge

OP-SB.01-07

Keyhole Surgery for Skull Base Lesions Through Supracilliary Incision: Our Experience

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Background: Various surgical approaches can be used to operate frontal skull base lesions. The supraorbital keyhole approach popularized by Perneczky is also used to access skull base lesions such as tuberculum sellae and diaphragm sella meningiomas, craniopharyngioma and vascular lesions particularly anterior communicating, posterior communicating and proximal MCA aneurysms. The goal of this approach is to adequately access skull base lesions minimising trauma to the skin, bone, dura and brain.
Method: Using this principle, we operated 29 patients of vascular and neoplastic lesions over a period of 3 years. Among them 11 were ACOM aneurysms, 4 PCOM and 5 MCA bifurcation aneurysms. There were 6 cases of tuberculum sellae meningiomas and 3 craniopharyngiomas.
Results: There was no mortality, however few complications were encountered which were not life threatening. Among them frontalis branch of facial nerve palsy was the most common complication (9) followed by forehead hypoesthesia (3). There was opening of frontal sinus during craniotomy in four patients. Two patients had subgaleal collection of CSF without rhinorrhoea.
Conclusion: The supraorbital keyhole approach through eyebrow incision is suitable approach for selected anterior, middle and posterior cranial base lesions. Even though there are some technical limitations because of its narrow working angle, it offers fewer traumas to the tissue and better cosmetic results.
Keywords: Keyhole surgery, Eyebrow incision, Supraorbital craniotomy, Surgical technique, Surgical outcome

OP-SB.01-08

Microsurgery for Skull Base Tumors in Enugu Nigeria- A 7 Year Single Center Experience

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Background: The re-emergence of a vibrant neurosurgical unit in our center in Southeast Nigeria has allowed the performance of complex cranial and skullbase procedures using microsurgical and endoscopic approaches.
Method: We analyzed a prospective cohort of 157 adult patients(age range 18-77 years, mean 55.7±4.7 yrs 95%CI) who had microsurgery for skull base tumors from October 2009 to September 2016. Patients were followed up for 6 months to 6.5 years with a mean follow up of 3.9±0.7 years 95%CI. Patients with histologically verified anterior and middle skull base tumors were studied.
Results: Among 631 patients with cranial masses treated, 157 were anterior (n=67 and middle (n=90) skullbase tumors. All cases were performed via the transcranial route. Olfactory groove/planum sphenoidale meningiomas (n=31), esthesioneuroblastomas (11) and sinonasal carcinomas (17) were the most common tumors in the anterior skullbase, while craniopharyngiomas (33), pituitary adenomas (27) and sphenoid ridge meningioma (11) were the most common in the middle skullbase. Pituitary adenomas were more common in females, while Craniopharyngiomas were more common in male ($X2=5,77$, $P<0.05$,$df=1$. Meningiomas was also significantly more common in females in a ratio of, ($X2=4.99$,$P<0.05$). On Post operative CT / MRI images, 91% of anterior skullbase tumors were completely resected compared to 78% of middle skullbase tumors. The concordance between radiologist/ surgeons estimation of extent of resection was 64.3% (n=101). 15 (9.6%) cases recurred despite microsurgical total resection. Overall 1 and 5 year survival was 80.9 and 50.3% respectively.
Conclusion: Currently craniopharyngiomas are the most common middle skullbase tumors treated microsurgically in our subregion.
Keywords: Microsurgery, Skullbase, Tumors, Resection, Recurrence, Survival

OP-SB.01-09

Supraorbital Keyhole Craniotomy Approach to Anterior Skull Base Lesions

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Numerous neurosurgical approaches have been developed to operate on lesions of the anterior skull base. These approaches include frontal, bifrontal, frontotemporal, pterional, orbitozygomatic, and other variations. The goal of "keyhole" surgery was not to perform a small incision and craniotomy for the sake of a small opening. The goal of this approach was to permit adequate access to skull base lesions while limiting trauma to surrounding structures such as the skin, bone, dura, and, most importantly, the brain. We report our experience with a supraorbital eyebrow minicraniotomy. This technique is suitable to lesions situated in the region of the anterior fossa, suprasellar cisterns, parasellar region and Sylvian fissure. A supraorbital minicraniotomy via eyebrow incision is performed. Fourty patients harboring different lesions were operated on with good postoperative and cosmetic results. We conclude that this approach is safe and useful in selected cases.
Keywords: Tumor, Aneurysm, Skull base, Minimally invasive, Keyhole surgery

OP-SB.02-01

Facial Nerve Repair After Surgery of Vestibular Schwannomas: Long Term Outcomes

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Aim: To investigate the outcome of patients who have undergone surgical repair of sectioned facial nerves during surgery of vestibular schwannomas.
Method: The study is a retrospective analysis of eighteen patients that underwent surgery and per- or postoperative nerve transplantation and/or anastomosis compared with a control group of patients without repair (126 patients). Data were obtained from medical records, local databases, specific questionnaires and by re-assessing treated patients. The disease specific outcome scores House-Brackmann, Sunnybrook, May scales, a new visual analogue score for facial function (VASF) and a custom morbidity score (reported by both physician or patient) together with the patient reported generic scores EQ5D and Karnofsky were used as outcome measures.
Results: The disease specific scores showed a moderate facial dysfunction (HB=4, SB=34, MS=4) in the treated patients while the patient visual analogue score was surprisingly high for the treated group but only partially correlated to the other facial scores assessed by the physician. The generic outcome measurements for the treated group were comparable, or even better than for the control group. Although not statistically significant the patients treated with direct nerve anastomosis showed a trend towards better facial outcomes.
Conclusion: The direct anastomosis method is preferable when possible. The patient reported facial morbidity only partially correlates with the physician's assessment and should be included in outcome analysis of facial nerve injury.
Keywords: Vestibular schwannoma, Facial nerve repair, Outcome measurements

OP-SB.02-02

Effectiveness of Preoperative Facial Nerve Diffusion Tensor Imaging Tractography for Preservation of Facial Nerve Function in Surgery for Large Vestibular Schwannomas: Interim Results of a Prospective Randomized Study

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Background: Facial nerve preservation is a very important aspect of vestibular schwannoma surgery. Facial nerve paresis is a devastating complication and has an adverse psychosocial impact. In this prospective randomized study, the investigators attempts to know whether knowing facial nerve position preoperatively using DTI tractography could translate into better facial nerve preservation rates in surgery for large Vestibular schwannoma (>3cm).
Method: After obtaining Institute Ethics Committee approval and after obtaining a written informed consent from the patient and/or his relative,100 consecutive patients of either gender with large vestibular schwannomas (>3cm) undergoing surgery will be randomized into two groups using a computer generated randomization chart – group I (DTI tractography done) and group II (DTI tractography not done). The operating surgeon will be informed about the DTI tractography predicted facial nerve position before surgery. The facial nerve preservation rates between the two groups will be compared. Various subgroup analysis has been planned depending upon the position of the facial nerve in relation to the tumor, experience of surgeon etc.
Results: The interim analysis has been done for a total of 59 patients recruited till December 2016 in the study (30 in DTI tractography group, 29 in the control group). Facial nerve could be preserved in 28/30(93%) patients in the DTI group; and 22/29 (76%) in the control group.
Conclusion: The interim results point towards superiority of preoperative DTI tractography for facial nerve preservation in large Vestibular schwannoma. Conventional MRI should be integrated with DTI tractography in all such cases.
Keywords: Vestibular schwannoma, DTI tractography, Facial nerve preservation

OP-SB.02-03

Understanding of the Pathological Anatomy of Arachnoid in Large and Giant Vestibular Schwannoma and Its Relavance to Facial Nerve Preservation: A Personal Experience of 820 Cases

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Background: An understanding of the mechanism of formation of arachnoid fold around vestibular schwannoma is crucial in preserving the anatomical integrity of 7th nerve.
Method: The author, who has an operative experience of nearly 820 cases of vestibular schwannomas over a period of 19 years, describes the technical pearls for preservation of facial nerve. The essential initial step is peeling of the double layer of arachnoid from the posterior tumor surface. After reduction of the tumor volume, continued dissection of the arachnoid fold toward the brainstem can be achieved without opening the arachnoid over the fifth and lower cranial nerves, which are in separate cisterns.
Results: The key element in successful vestibular schwannoma is understanding that flattened facial and cochlear nerves do not have a arachnoid separating them from the tumor capsule which is essentially the compressed and attenuated perineurium of the vestibular nerve from which tumor has grown. If the tumor cannot be dissected from 7th nerve easily, a sub-perineural dissection is advised.
Conclusion: Acoustic neurinoma surgeons should strive to keep anatomical integrity of 7th nerve even in large acoustic tumors.
Keywords: Perineurium, Subperineural, Seventh nerve, Arachnoid

OP-SB.02-04

Microsurgical Transcanal Transpromontorial Approach for the Removal of Vestibular Schwannomas: A Minimally Invasive Alternative to the Classic Translabyrinthine Approach

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Background: Nowadays, the evolution of the surgical techniques and instrumentations has permitted a widespread diffusion of minimally invasive techniques, especially for skull base surgery. Herein we present the microsurgical transcanal transpromontorial approach (MTTA) in the management of vestibular schwannoma (VS) as an alternative to the classic translabyrinthine approach.
Methods: Between January 2015 and December 2016 at the Verona University Hospital 17 consecutive patients were submitted to MTTA for the removal of VS. The procedure starts with the enlargement of external acoustic meatus in order to reach the tympanic cavity; at this point the anatomical borders of the surgical corridor are represented by the jugular bulb (inferior), the carotid artery (anterior), the facial nerve (superior-posterior). The transpromontorial route finally provide the access to the internal acoustic canal (IAC) that can be circumferentially drilled to reach the CPA.
Results: There were not intraoperative complications. The MTTA provided a good visualization of the IAC and CPA and it provides an excellent corridor especially for VS located inside the IAC with a minimal cisternal component.
Conclusion: Transpromontorial techniques represent a valid option in patients with small VS without serviceable hearing. Compared to the translabyrinthine approach, the MTTA provides a less invasive surgical corridor but with an excellent visualization of the anatomical boundaries and a good maneuverability and dissection of the tumor from the cranial nerves.
Keywords: Vestibular schwannoma, Microsurgical transcanal transpromontorial approach, Translabyrinthine approach

OP-SB.02-05

Predictive Factors for Preservation of Facial Nerve Function in Vestibular Schwannoma Surgery

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Background: In vestibular schwannoma surgery, the preservation of facial nerve function may limit tumor resection despite use of intraoperative facial nerve monitoring. In Algeria, vestibular schwannoma makes p 05% of all intracranial tumors operated on, 85.5% of which are large and giant.
Method: From Jan 2010 to Dec 2016, 225 VS were operated in our department. The most common presenting symptom was hearing loss (41.66%), gait instability (48.6%) and tinnitus in (34.72%). Facial nerve signs were pathologic in 4.63%. At the time of diagnosis 50 patients had intracranial hypertension with hydrocephalus. All patients were operated in the semi sitting position with opening of the posterior wall of the internal auditory canal and under intraoperative facial nerve monitoring.
Results: Tumor resection was total in 185 patients. Anatomic preservation of facial nerve was the reason for non-total resection in 25 patients. The facial nerve was anatomically preserved in 220 patients. Two years after surgery, the facial nerve function was good in 188 patients. The status and improvements of post-operative facial nerve function depends on 04 factors**:** Anatomical preservation of the nerve, stimulation threshold, cystic form and the presence of train activity.
Conclusion: The systematic use of intra-operative facial nerve monitoring and retro sigmoid transmeatal approach have allowed us to move from the life preservation era to an era of preservation of function.
Keywords: Facial, Nerve, Function, Vestibular, Schwannoma

OP-SB.02-06

Modern Concepts of Microsurgical Treatment of Large and Giant Vestibular Schwannomas

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Aim: To improve the results of treating large and giant vestibular schwannomas.
Method: A prospective study of surgical treatment of 67 consecutive patients with vestibular schwannomas (VS) during the period from 2011 to 2016. All patients were operated on by the author of the study. The results of treatment were compared with the previous period (2006 - 2010). VSs were removed using the retrosigmoid approach. The function of the facial nerve was analyzed. In addition, English sources on the Internet were analyzed.

Results: Two (3%) patients with medium VS, 12 (17.9%) with moderately large VS, 31 (46.3%) with large VS and 22 (32.8%) with giant VS were operated on. Thus, large and giant schvannomas occurred in 79.1% of cases. Total removal of VS was performed in 59 (88.1%) cases, subtotal in 7 (10.4%, and partial in 1 (1.5%) case. In the study group 2 patients died. Postoperative mortality rate - 3%.
Conclusion: In the surgical series of studies patients with large and giant VSs, which were discovered in 79.1% of cases, predominate. The main objective of VS surgery is a maximum complete removal of the tumor while preserving function of the brain stem, blood vessels and cranial nerves. Application of modern technologies (ultrasound aspiration, trepanation of the internal auditory canal, neuromonitoring of the facial nerve function, preoperative surgery planning based on multimodal operation support) allows to increase radicality of surgeries and to improve functional outputs even for large and giant VSs.
Keywords: Vestibular schwannoma, Large schwannomas, Giant schwannomas, Microsurgical treatment, Results of surgery, Facial nerve function

OP-SB.02-07

Facial Nerve Outcomes in Surgically Treated Large Cystic Vestibular Schwannomas

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Background: There are conflicting data in the literature regarding facial nerve outcomes following resection of large cystic vestibular schwannomas (CVS), with most articles reporting worse facial nerve function with cystic tumors as compared to solid vestibular schwannomas (SVS). In this study, we compared facial nerve outcomes after excision of large cystic versus solid vestibular schwannomas.
Method: This was a retrospective case series at a single institution. Patients with large VS (>2.5 cm) resected between 2006 and 2016 were identified from archived surgical records. CVS consisted of >25% total hyperintense fluid on T2-weighted magnetic resonance imaging. Main outcome measure was facial nerve function measured on the House-Brackmann (HB) scale in the early and late (greater than 1-year) post-operative period.
Results: 36 patients were identified. Rates of gross total resection (GTR) were essentially equivalent for SVS and CVS. Regarding facial nerve outcomes, no significant difference was found in the immediate post-operative period or long term between CVS and SVS groups. Of those having poor function in the immediate post-operative period (≥ HB Grade IV), patients with SVS more often returned to a good outcome (≤ HB Grade III) after one year follow-up compared to those patients with CVS.
Conclusion: There is no difference in facial nerve outcome between cystic versus solid large vestibular schwannomas in the immediate postoperative period. Long-term facial nerve recovery may be worse for patients with CVS.
Keywords: Cystic, Vestibular, Schwannoma, Facial nerve

OP-SB.02-08

Improving Functional Preservation in Acoustic Neuroma Surgery

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Background: Restoration of cranial nerve functions during acoustic neuroma (AN) surgery is important for good outcome. The effects of minimizing the injury period and maximizing the recuperation period were investigated in 89 consecutive patients who underwent retrosigmoid unilateral AN surgery.
Method: Intraoperative cochlear nerve (CN) and facial nerve (FN) functions were evaluated using continuous auditory-evoked dorsal cochlear nucleus action potential (AEDNAP) monitoring and FN root exit zone-elicited compound muscle action potential (FREMAP) monitoring, respectively, and factors affecting same-grade functional preservation were analyzed.
Results: Twenty-three patients underwent standard treatment and investigated the monitoring threshold for functional preservation. Sixty-six patients underwent extended recuperation treatment to assess the effect on recovery of nerve function. Final AEDNAP response, final FREMAP response, and extended recuperation treatment were associated with same-grade functional preservation.
Conclusion: Patients with extended recuperation treatment had significantly better functional preservation.
Keywords: Acoustic neuroma surgery, Continuous direct brainstem auditory-evoked potential monitoring, Functional preservation, Intraoperative extended recuperation treatment

OP-SB.02-09

Excision of Cerebello-Pontine Angle Tumor (Acoustic Neuroma) via Trans-Labyrinthine Approach. A Case Series of First Four Cases in Pakistan

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Background: The article covers the first four cases of CP angle tumor in Pakistan via Trans-labyrinthine approach at Lahore General Hospital, Lahore in a period of 4 months.
Method: All these patients presented in Outdoor department with involvement of VIIIth nerve (Vestibulocochlear) of one side while the VIIth nerve (Facial) was preserved. There was no other deficit except for the involvement of Vth nerve (Trigeminal) in one patient. MRI revealed Grade IV to V lesions In the Cerebello-pontine angle.
Results: Trans-labyrinthine approach was performed in these patients using high speed drill. Facial nerve monitor was used to monitor facial nerve. In all four patients the facial nerve was preserved in the bony canal as well as in the Internal Auditory Canal. Tumor de-bulking was effectively done. Wound was closed after packing with fat and sealing with fibrin glue. Patients were fully alert after surgery with no or minimal deficit. One patient had CSF leak from wound and Lumbar drain had to be passed with complete resolution of leak. One patient had partial weakness of facial nerve which improved over time. None of the patients had basal cranial nerve involvement and were able to take oral feed from 1st post-op day.

Conclusion: Trans-labyrinthine approach for" CP angle tumor" appears to be a safer surgery than the Retro-Mastoid approach being used in Pakistan. Although it is more time consuming and expensive, yet the patient receives benefit of less morbidity. Surgical skill and time is improving with each case.
Keywords: Trans-Labyrinthine approach, Cerebello-pontine angle, Acoustic neuroma, Lahore Pakistan, Facial nerve, Vestibular schwanomma

OP-SP.01-01

Intramedullary Spinal Cord Tumors. Retrospective Study of 45 Patients

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Background: Intramedullary spinal cord tumors are rare neoplasms, (less than 5% of all CNS tumors) and can affect any age group or sex. Various management options and outcomes in patients with IMSCT exists. Advances in the operative management of such lesions have increased the success rate of tumor removal while minimizing iatrogenic-related trauma to the patient and, improved outcomes.
Method: We report a retrospective study of 45 patients managed over a 15 years period.
Results: There were 23 female and 22 male. The mean age of patients was 29 years (18 months–64 years). In 89 % patients, diagnosis was done by MR imaging. Tumor was in cervical position in 44 % of cases. 69 % patients had GTR, 14 % had subtotal removal, 11 % had partial resection and 6 % of patients had biopsy. Most common histological type was astrocytomas (44,4%) and ependymomas (28,8%). There was no mortality related to surgery. At a six months follow up period, 22.2% of our patients deteriorated, 47.3% were stable and 30.5% improved.
Conclusion: The gold-standard treatment of IMSCT remains maximal microsurgical resection without adjuvant therapy wish diminishes the risk of recurrence, and preserve neurologic function. For malignant or rapidly recurrent IMSCT, the optimum management is still controversial and operative management of IMSCT should be individualized and based on tumor type, location, and extensions. Factors of good outcome after surgery are histological type, total removal and a satisfactory neurological status before surgery.
Keywords: Spinal cord, Intramedullary tumor, Microsurgery

OP-SP.01-02

Unilateral Hemilaminectomy for the Removal of Intraspinal Extramedullary Tumors- Report of 1040 Cases

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Aim: To discuss the advantages and disadvantages of unilateral hemilaminectomy for the microsurgery of intraspinal extramedullary tumors.
Method: From January 2005 to July 2015, 1040 patients with intraspinal extramedullary tumors were treated via unilateral hemilaminectomy in our department. The number of laminal removal was 1 to 3 adjacent segments of vertebral plates, and made a bone window with a 3.7 cm mean length (range**:** 2.0–7.4 cm) and a 1.4 cm mean width (range**:**1–2 cm).
Results: The study group included spinal lesions in the cervical spinal cord in 532 (51.15%), the thoracic spinal cord was involved in 190 (18.26%), the lumbar region in 271 (26.05%), and multiple in 47 (4.51%) cases. The most common pathological types of the tumors were schwannomas and spinal meningiomas, and some other lesions such as neurofibromas, dermoid cysts, teratomas, arachnoid cysts, matastasis tumors and inflammatory granulomas. Gross total resection was achieved in 948 (91.15%) cases, and subtotal resection was performed in 92 (8.85%) patients. Patient symptoms recovered gradually in the postoperative period, and none of the patients necessary required a fusion procedure. At the median 43-month follow-up (12-108 momths) evaluation by MRI and CT, none of the subjects showed spinal deformity or instability. Tumor recurrence was found in 44 (4.23%) cases during the follow-up period.
Conclusion: Unilateral hemilaminectomy combined with microsurgical technique provide adequate space for the removal of diverse intraspinal extramedullary tumors, and guarantee fair neurological status and spinal stability.
Keywords: Spinal tumor, Unilateral hemilaminectomy, Surgery

OP-SP.01-03

Spinal Intradural Tumors and Tethered Cord Syndrome: Experience of Electrophysiological Outcomes

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Background: Electrophysiological evaluation of the outcomes of spinal procedures is important for neurosurgeons. Somotosensorial evoqued potentials (SSEPs) are used for electrophysiological evaluation of tethered cord syndrome (TCS) and spinal intradural tumors (SIT). The aim of this study is to document the electrophysiological outcomes of surgery for TCS and SIT and to compare the results based on the preoperative diagnosis.
Method: The data of 30 patients, who were operated for TCS and SIT between 2011 and 2013, were reviewed retrospectively. Surgical release of the spinal cord was performed for TCS and tumor removal was performed for SIT. Median and tibial nerve SSEPs at the left and right sides were measured at preoperative, early and late postoperative periods and compared statistically based on the diagnosis and the time of electrophysiological assessment.
Results: The diagnosis was TCS in 12 (40%) patients and SIT in 18 (60%) patients. There was a significant difference between preoperative, and early and late postoperative SSEPs values. Tibial nerve latencies were prolonged in the early postoperative, but shortened in the late postoperative period. Contrary, median nerve latencies were shortened in the early postoperative, but prolonged in the late postoperative period. There was no significant difference between the TCS and SIT groups based on the surgical intervention.
Conclusion: Tibial nerve latency may be prolonged in

early postoperative period of TCS and SIT patients. But electrophysiological changes were not predictive for these patients. Further studies with more patients are needed for other spinal lesions.
Keywords: Tethered cord, Spinal, Tumor, Electrophysiology

OP-SP.01-04

Intra-Spinal Schwannoma About 14 Cases

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Background: Intra-spinal schwannoma is a rare pathology and has a polymorphous semiology. Its diagnosis is made with the medullary MRI which remains the gold standard neuroradiological. The best treatment remains surgery, but has limitations in case of schwannoma infiltrating neighboring structures.
Method: We report a retrospective 13-year study, from January 2003 to December 31, 2016, of 14 patients treated at the department of Neurosurgery of the Hassan II Teaching Hospital in Fez.
Results: We noted an average age of 44.4 years with extremes of 21 and 60 years with an equitable distribution of sex ratio. The localization was thoracic in 7 cases, lumbar, 6 cases and cervical 1 case. The symptomatology was insidious in all cases with a clinical mutilated classic and extreme discretion of the symptoms despite the very large volume in two cases out of six of the thoracic localizations. It was mainly dominated by spinal syndrome and deficient spastic pyramidal syndrome. We performed an anterolateral approach for all intra-thoracic schwannoma, posterior for cervical and lumbar. The surgical excision was conducted by fragmentation in six cases and in block in eight cases.
Conclusion: The evolution was favorable in all cases marked by a total recovery of the neurological deficit after an average of two months.
Keywords: Spinal syndrome, Spastic pyramid syndrome, Intraspinal schwannoma, Anterolateral and posterior approach, Total recovery of neurological deficit

OP-SP.01-05

Cauda Equina Tumors in Adults: Analysis of Results

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Background: Retrospective analysis of a series of cases with Cauda Equina Tumors in adults, operated with similar surgical technique (FVB), describing their epidemiological characteristics and emphasizing the good functional results of the patients. It is a low frequency pathology that requires experience and a multidisciplinary approach in its management, to obtain good results.
Method: We analyzed a retrospective series between 1994 and 2016 (n**:** 43), registered in an Excel template, all made by the same surgeon (FVB), with similar technique, in two different institutions**:** Neurosurgery Institute A. Asenjo and German Clinic, with a mean age of 38 years The surgical technique considers the use of intraoperative Neurophysiological monitoring and use of Microsurgery. In all cases, pre and postoperative magnetic resonance imaging and adequate clinical follow-up are available.
Results: Of the 43 cases, 22 corresponded to Ependymoma Mixopapillary (56%), 12 Schwanoma (32.6%), and the rest several varieties, being rare the Meningioma and Para Ganglioma. The objective in all cases was resection Complete of the lesion which was obtained in about 90% of the cases, with good functional results, except for the cases that were operated with paraplegia. The most frequent local complication was CSF Fistula in 2 cases (4.8%).
Conclusion: In the surgical technique for Myxopapillary Ependymomas, it is important to take the precaution of avoiding their dissemination during surgery. Intraoperative neurophysiological monitoring in this type of surgery is very useful in identifying neural structures and avoiding their damage.
Keywords: Cauda equina tumors, Mixopapillar ependimoma, Spinal schwanoma

OP-SP.01-06

Surgical Treatment of Spinal Myxopapillary Ependymoma

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Background: Spinal intradural tumors are uncommon. Myxopapillary ependymoma are rare tumors. The surgical experience in managing a cohort group of patients with this type of tumors is presented.
Method: A consecutive cases of spinal myxopapillary ependymoma operated by the author between 2000 and 2016 is reviewed and presented. Demographic data, symptoms, signs, radiological studies, Intraoperative findings and postoperative complications and follow-up were collected prospectively and presented.
Results: In this series 174 cases of different intradural tumor pathologies were operated upon, 41of them were spinal ependymoma. A total of 17 patients with verified histological diagnosis of myxopapillary ependymoma subtype were identified. This cohort group consist of 12 males and 5 females with mean age of 22.5 years and range from 13-53 years at time of surgery. Majority of the cases occupied the thoraco-lumbar area depends on the size of the lesion. The cases were sub-classified to 3 different categories based on the location of the tumor mass as; conus medullaris, filum terminale or mixed. The surgical techniques and outcome of each category is presented.
Conclusion: Myxopapillary of spinal ependymoma are rare tumors. Surgical resection is challenging and technically demanding procedure. Total surgical excision remains the golden standard in the management of these tumors.
Keywords: Myxopapillary, Spinal, Ependymoma, Surgery

OP-SP.01-07

Surgical Outcome of Intradural Extramedullary Spinal Cord Tumors: Analysis of 51 Cases

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Background: Approximately two thirds of all intraspinal neoplasms are intradural extramedullary spinal cord tumors (IESCT). The purpose of analysis was to determine outcomes of surgical patients with IESCT.
Method: A retrospective study of 51 operative IESCT cases between 2009 and 2016 was performed. Outcomes were scored at one month and at mean follow-up of 3 months postoperatively. Patient demographics, tumor types and locations were also collected
Results: There were 25 men and 26 women (mean age 37 years, range 18-68 years). Men presented at a younger age than women. 65% patients presented with severe radiculopathy and/or myelopathy. The remaining 35% had symptoms typical of disc herniation. Mean duration of symptoms prior to diagnosis was 6 months. Schwannomas had the longest mean duration of symptoms, followed by meningiomas and ependymomas. 90% of patients demonstrated significant improvement at one-month and remaining patients observed improvement within mean follow-up as compared to the index exam. Only 18% patients had residual focal deficits on long term follow-up and one patient not improved.
Conclusion: Surgery for IESCT should be expected to produce significant and dramatic improvement in great majority of patients and improvement depends mostly on tumor locations and types of tumors.
Keywords: Spinal tumor, Intradural, Extramedullary

OP-SP.01-08

Filum Terminale and Conus Medullaris Ependymoma

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Background: Filum terminale and conus medullaris ependymoma are uncommon slow growing intradural spinal cord tumors with a high incidence in young adults. In this study we show the frequency and histopathologic characteristics of the analyzed tumors and the most usually used microsurgical approaches and operative techniques of their resection. The assessment of early postoperative results, usefulness of intraoperative neuromonitoring and the long-term outcome evaluation will be shown also.
Method: The study includes 102 consecutive patients with diagnosed and surgically treated one of the intradural spinal tumors. Twelve of them (7 males, 5 females) demonstrated as ependymoma in the lumbosacral region. This research is retrospective, descriptive study based on information obtained from pathohistological registry and patient histories and covers 11-years long period (Jan. 2006 - Dec. 2016).
Results: Laminectomy or laminotomy followed by microsurgical resection was performed in all 12 patients and total or gross total microsurgical resection was achieved in 11. There was only one recurrence during a 12 to 60 months follow-up period. Postoperative, 92% either improved or had no change from their preoperative neurological status. One patient experienced prolonged wound healing (diabetic patient).
Conclusion: Choosing an appropriate surgical approach and technique is an essential prerequisite for good results. The prognosis depends on the histological characteristics of the tumor and the severity of the disease. Total resection extends survival and recurrence-free period. Neuromonitoring should be standard procedure for every ependymoma surgery in this region.
Keywords: Spinal cord tumor, Ependymoma, Conus medullaris

OP-SP.01-09

Intraoperative Neurophysiological Monitoring for Intradural Spinal Tumors: Analysis of Predictive Value and Relevance on Surgical Outcome During a Ten-Year Experience

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Aim: To evaluate the accuracy and the impact of intraoperative neurophysiological monitoring (IOM) for surgical strategy and clinical outcome during surgery for both intramedullary (ISCT) and intradural extramedullary tumors (IDEM).
Method: From 2007 to 2016, 122 patients had microsurgery with IOM for ISCT (33) or IDEM (89) The IOM included somatosensory evoked potentials (SEPs), motor evoked potentials (MEPs), and D-waves.
Results: In ISCT 6 patients presented transitory alteration of IOM and total removal of tumor, after modification of surgical strategy, was carried out. In other 4 cases the permanent loss of evoked potentials led to incomplete resection. In this group only one patients presented a false positive, while the others developed in 7 case transient deficit and 2 case permanent deficit. 7 patients with IDEM presented transitory alteration of IOM while others 2 developed permanent deterioration of IOM with subsequent subtotal resection. In this group only one patients presented a false positive, while the others developed in 6 case transient deficit and 2 case permanent deficit.
Conclusion: In our series, significant IOM changes occurred in 30,3 % and 10,11 % of ISCT and IDEM respectively, and it is conceivable that the modification of the surgical strategy – induced by IOM – prevented or mitigated neurological injury in these cases. The accuracy was similar in two groups. On the basis of these results, the IOM should be considered accurate and useful not only for ISCT but also for IDEM.
Keywords: Intradural spinal tumors, Intraoperative neurophysiological monitoring, D-Wave

OP-SP.01-10

Surgical Management of Intramedullary Spinal Cord Cavernomas: Case Series and Outcomes

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Background: Intramedullary spinal cord cavernomas (ISCC) are rare lesions, representing 5-12% of the medullary pathology. ISCC tend to be clinically progressive associated with mass effect, myelopathy and hemorrhage. Surgical management is controversial. The objective in this study was to define the clinical characteristics of this disease, surgery approach and present the clinical outcome.
Method: We reviewed the records of patients with diagnosis of spinal intramedullary cavernoma confirmed by histopathology and were surgically treated at the INNN from January 2009 to December 2016. Demographic variables, preoperative and postoperative status, ASIA classification and imaging findings were evaluated. A descriptive analysis of the results was performed.
Results: Eight patients with a diagnosis of ISCC were identified, of whom 2 were excluded due to incomplete files or lack of histopathological correlation. A total of 6 patients were included: 2 (33.3%) male and 4 women (66.6%). The mean age was 42.0 ±14.6. The most frequent spinal level was thoracic in 4 cases and cervical in 2 cases. The surgery consisted of a posterior approach by hemilaminectomy and myelotomy. All surgeries were performed by a single neurosurgeon (AMN). In 4 cases, intraoperative electrophysiological monitoring was performed. Total resection was achieved in 5 (83%) cases. There were no associated surgical complications. Postoperative functional status showed improvement in 3 cases, in 2 cases it remained the same and in 1 case it worsened.
Conclusion: Intramedullary spinal cord cavernomas can be safely resected with good functional results. Although the presence of spinal cavernomas is rare, thoracic location was the most frequent in this series.
Keywords: Spinal cord cavernoma, Intramedullary cavernoma, Cavernous malformations, Cavernous hemangioma, Vascular malformation

OP-SP.02-01

Outcomes After Suboccipital Decompression without Dural Opening in Chiari Malformation Type I

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Background: Chiari malformation Type I (CM-I) is characterized by hindbrain deformity and obstruction of cerebrospinal fluid (CSF) flow. In order to restore the CSF flow at the craniocervical junction in Chiari I malformation (CM-I), most surgeons practice a suboccipital craniectomy with duraplasty. To reduce the risk of CSF leak and arachnoidal scarring, a dura splitting decompression is created by removing only the outer layer of dura.
Method: There were 33 patients with CM-I (15 males and 18 females) with ages ranging from 17 to 53 (mean 39.3) years old. 18 of them had syringomyelia. The medical records of these patients were reviewed respectively. All these patients underwent suboccipital decompression and C-1 laminectomy (when necessary partial C2, as well) with splitting of the dura. All the patients were followed-up clinically and radiologically.
Results: Headaches and cervicalgias disappeared in all the patients. Paresthesia in the upper limb remained unchanged in two patients. We observed no complications such as CSF leak, pseudomeningocele, or meningitis. Postoperative MRI scan showed a significant craniocervical decompression in 32 patients. Syringomyelias completely disappeared in ten patients, decreased in seven, and was stable in one.
Conclusion: The dural splitting cranio-cervical decompression is a safe and effective treatment for Chiari I malformation. Clinical results are similar to the other techniques with fewer complications. Radiological findings show satisfying posterior fossa decompression.
Keywords: Chiari type 1, Dural splitting, Complication, Surgery

OP-SP.02-02

Factors Affecting the Surgical Outcomes of Tethered Cord Syndrome in Adults: A Retrospective Study

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Aim: To find the factors that may affect the surgical outcomes of congenital tethered cord syndrome (TCS) in adults by evaluating the long-term surgical outcomes of 25 consecutive cases.
Methods: Medical records of 79 TCS cases which underwent surgery in BRSHH hospital, during an 11-year period from 2005 to 2015 were retrospectively reviewed. All adult cases (patient age >18 years) were selected as the core sample used for this study.
Results: Twenty-five cases of TCSs were surgically treated. The sample consists of sixteen female and nine male patients. The mean age of the sample is 30.1±10.3 years. Untethering was carried out in 88% of the patients. 64% of the patients had good clinical outcomes at their last follow-up (after 73.8 months on average). The mean length of hospital stay was 4.76±2.88 days. In a multivariate regression model, laminectomy, bladder dysfunction when associated to muscular weakness, and long-term (> 6 months) symptoms were selected as the independent risk factors associated with poor or minimally improved (almost unchanged) surgical outcomes. When the urodynamic test showed overactive destrusor muscle, no improvement was recorded in postoperative urodynamic test.
Conclusion: Laminoplasty (or hemilaminectomy), short-term (<6 months) symptoms, patients without lipomas and presentation with moderate or mild symptoms seem to be proper predictors for good surgical outcomes. Further prospective studies are necessary to investigate these findings systematically. Urodynamic study can be used as a predictive tool for close follow-up asymptomatic adult patients involved with TCS.
Keywords: Tethered cord syndrome, Untethering, Laminoplasty, Intraoperative Neurophysiological monitoring, Urodynamic test

OP-SP.02-03

The Role of Cine Flow Magnetic Resonance Imaging in Patients with Chiari 0 Malformation

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Background: Since the late 1990s, the "Chiari type 0 malformation" is defined as syringomyelia without tonsillar herniation that responds to posterior fossa decompression. The aim of this study is to define the role of phase-contrast cine magnetic resonance imaging (MRI) in deciding the therapeutic strategy and underlying pathophysiology resulting in syrinx formation in patients with Chiari type 0 malformation.
Method: Seven patients who were admitted to our clinic with the diagnosis of Chiari 0 malformation from January 2005 to July 2016 were enrolled in the study. All patients underwent a detailed preoperative neurological examination. Entire neuroaxis MRI and phase-contrast cine MRI were obtained preoperatively and postoperatively.
Results: Seven patients (5 female and 2 male) with Chiari type 0 malformation fulfilled the inclusion criteria. All of the patients had absent cine flow at the craniovertebral junction except two patients. These five patients underwent surgical interventions; suboccipital decompression and duraplasty. All of them showed both clinical and radiological improvement in the postoperative period.
Conclusion: Cine flow MRI appears to be a useful tool in the management of patients with Chiari 0 malformation. There was a good correlation between the clinical presentation and cine flow preoperatively, and between clinical improvement and cine flow in the postoperative period.
Keywords: Chiari 0 malformation, Cine flow magnetic resonance imaging, Decompression, Duraplasty

OP-SP.02-04

The Relationship Between Chiari Malformation Type 1 and Sleep Electrophysology

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Chiari Type 1 Malformation (CM1) is a craniovertebral junction pathology which is commonly observed in neurosurgical practice. CM 1's relation with sleep disorder have been shown in some cases. Furthermore in some surgically treated CM 1 cases, coexisting sleep apnea symptoms have been shown to be improved. The aim of this studys is to evaluate the neurophysiological changes of sleep activity, in CM 1 cases pre and postoperatively and consequently, the effect of treatment on the integrity of central nervous system. A group of voluntiers have been involved in this study (10 CM 1 cases, 8 women, 2 men, Ages 20-50, BMI**:**22.5-44). The two male voluntieers' had serious obstuctive sleep apnea syndrome. The volunteers sleep electrophysological studies have been performed preoperatively any 2nd month postoperatively. The operation procedures were similiar for all cases. Decompressive posterior craniectomy, C1 laminectomy and duraplasty. The volunteers' polisomnographıc recordings have been performed in Erzurum Regional Research and Training Hospital, Sleep and Electrophysiology Laboratory. The pre and postoperative recoringdgs have been evaluated statistically using Paired sample t test. The results revealed that, after surgical treatment sleep quantity, sleep efficinecy have been improved significantly.($p<0.05$). The durations of NREM stage 3 and REM periods have been significantly prolonged ($p<0.05$). The durations of NREM stage 2 have been shortened significantly ($p<0.05$). There were not any significant appearence between pre and postoperative NREM stage 1 durations. ($p>0.05$)
Keywords: Chiari type 1 malformation, Sleep electrophysology, Surgery

OP-SP.02-05

Management of Concomitant Scoliosis and Tethered Cord Syndrome in Non-Spina Bifida Pediatric Population

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Background: The management of concomitant scoliosis and tethered cord syndrome in the non-spina bifida pediatric population is challenging. In the present study, we evaluate the efficacy of different treatment modalities and propose an algorithmic approach to the management of affected patients.
Method: A systematic literature review was conducted by querying the MEDLINE, Pubmed, Cochrane, EMBASE, Scopus, and Web of Science databases for papers published between January 1996 and June 2016 and reporting on concomitant scoliosis and tethered cord. We excluded animal studies, non-English papers as well as papers reporting on patients with multiple concomitant intraspinal anomalies such as spina bifida.
Results: Out of 1993 articles only 13 met our inclusion criteria. These 13 articles described six main management approaches**:** Observation, cord untethering only, cord untethering followed by deformity correction, simultaneous cord untethering and deformity correction, and deformity correction without untethering.
Conclusion: We propose a stepwise algorithm for the management of patients with concomitant tethered cord syndrome and spinal deformity. Asymptomatic patients can be followed conservatively and managed as scoliosis patients with no need for untethering. Surgical management in a staged fashion seems appropriate in symptomatic patients with a cobb angle less than 35°. In these patients, deformity can improve following untethering thus sparing the patient the risks of surgical correction of scoliosis. Staged or non-staged cord untethering and curve correction seem to be adequate in symptomatic patients with cobb angle > 35° as these patients are likely to require both untethering and deformity correction.
Keywords: Tethered cord syndrome, Scoliosis, Deformity correction, Untethering

OP-SP.02-06

Diastematomyelia Surgical Treatment. Concerning 20 Cases

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Background: Diastematomyelia is a rare form of spinal dysraphism. This medullar duality syndrome is characterized by the division of two parts of the spinal cord**:** the hemi-medulla can be, each in a proper dural bag (type I Diastematomyelia) or in a unique bag (type II Diastematomyelia). It can be isolated or associated to abnormalities of the vertebral body segmentation. Usually it is associated to deformities (meningomyelocele, meningocele, dermoid cyst, lipoma, short filum).
Method: We report 20 cases, operated in our unit, carrier of Diastematomyelia with a bone spur and duality of the dura mater at a low fixed medulla with a dorsal lumbar scoliosis. 2 patients presented neurologic troubles. The others was asymptomatic. The intervention purpose was to prevent neurologic complications related to the growth and future correction of the scoliosis.
Results: The surgical intervention consisted in removing all the constraints suffered by the medulla by resecting the bone spur, liberating the low attached medulla. We have noticed no post-operative aggravation. Patient could be operated for scoliosis thereafter.
Keywords: Diastematomyelia, Spinal dysraphism, Resecting the bone spur, Deformities

OP-SP.02-07

Psychosocial Issues in Spina Bifida

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Spina bifida is the second most common congenital anomaly after Trisomy 21. The physical and mental problems experienced by the patient have negative effects on all the family members and on their social lives. These effects are often ignored and sufficient information and support is not given. The findings of one investigation showed that 26 out of 76 parents were unsatisfied by the given information about the disease. We examined the psychosocial effects of spina bifida with reference to researches and surveys on individuals with spina bifida and on their respective families. This disease brings issues such as abandoned children, lost jobs, divorces and the breakdown of family union. The psychosocial problems of spina bifida, a disease that requires a multi-disciplinary approach, need to be realised most especially by neurosurgeons.
Keywords: Spina, Bifida, Psychosocial

OP-SP.02-08

DCER as an Effective Technique in the Treatment of Basilar Invagination: 3 Years Outcomes of Three Cases

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Basillar invagination (BI) is a congenital pathology of the craniocervical junction charachterized by the protrusion of the odontoid process through foramen magnum into the skull base. Though transoral odontoid resection and posterior fusion being classical treatment modality of basilar invagination for the last 3 decades, intraoperative manupilations such as distraction have been shown to be effective in achieving reduction and decompression of the BI. Three cases of BI treated with a relatively new technique-DCER (Distraction-Compression-Extensive Reduction).
The first patient had severe myelopathy symptoms with a Nurick grade of 4. Other patients had non-spesific symptoms. C1-C2 distraction was performed with PEEK cages bilaterally and then compression and extension maneuvers were performed. Posterior fusion was performed with C1 lateral mass and C2 intralaminar screws in two patients and occipitocervical stabilization in the last patient. Correction was achieved in all patients. DCER technique described by Chandra and colleauges maintains reduction of the BI by distracting the C1-C2 joint with cages and uses these cages as fulcrum during the compression and extension maneuvers to get the odontoid process closer to the C1 arcus. DCER method has been reported to be effective 100% in BI and 95% in atlantoaxial disocation in the literature respectively. This technique can maintain the correction of the basilar invagination in one session with the posterior approach which is a more familiar method for the neurosurgeons. Especially when high morbidity of transoral approaches are taken into account, DCER seems to be a simple, fast and effective method in the treatment of BI.
Keywords: Basilar invagination, Craniocervical junction, Atlantoaxial dislocation

OP-SP.02-09

Foramen Magnum Decompresion (FMD) for Arnold Chiari Malformation (ACM)

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Background: Controversy exists over whether treatment of Arnold Chiari Malformation (ACM) esspesialy the Chiari I malformation and syringomyelia requires intra-arachnoidal dissection in addition to craniocervical decompression. The goal of treatment is to promote free flow of CSF by opening obstructed CSF pathways. Intra-arachnoidal dissection prolongs surgery, exposes neural structures to injury, and induces subarachnoid adhesions.
Method: To examine the effectiveness of extra-arachnoidal dissection in opening CSF pathways at the foramen magnum, we evaluated 11 patients who treated by extra-arachnoidal craniocervical decompression and duroplasty.
Results: In a prospective study of the patients with Chiari I and syringomyelia Clinical improvement or stabilization and reduction in syrinx size occurred in all 11 patients.
Conclusion: This study shows that extra-arachnoidal decompression of the foramen magnum consistently relieves CSF pathway stenosis in patients with syringomyelia associated with the Chiari I malformation
Keywords: ACM, Extra arachnodal, Decompression

OP-SP.03-01

Spinal Hydatid Cyst Disorder: Multiple Surgery and Long-Term Follow up Results

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Background: Hydatid Cyst (HC) is a zoonotic infection disease that affects the liver and lungs. Spinal involvement is quite rare. However, in case it extends to bones and paravertebrae, the recurrence rate is higher. We discuss the multiple surgical treatment, long-term results and reasons for recurrences for 8 spinal HC cases who were followed for 7-15 years.
Method: Eight patients who were treated in our hospital between 2000-2016 with a HC diagnosis, and followed up period for 7-15 years were evaluated along with their demographic information, symptoms, findings, spinal localization areas, recurrence rates, number of surgeries, medical treatments, causes of recurrence and long-term results.
Results: Four were male and 4 were female. The median age was 30.75 years (17-45).3 thoracic,1 lumbar,1 sacral,1 cervicothoracic,1 case had lumbosacral localization. Two patients had secondary cysts that developed from another organ (Lungs and Kidneys), no primary focus could be determined in 6 patients. The number of surgeries during the period varied between 2-5. The patients were followed for an average of 8.5 years (7-15) after their initial sugeries. The surgical treatments included an anterior corpectomy+anterior plaque for a patient with cervical localization, cystectomy for a patient with sacral localization, and the other patients underwent cystectomy+corpectomy+stabilization with an anterior approach and/or cysts excision+laminectomy with a posterior approach, or additional posterior transpedicular screw stabilization. They were prescribed with Albendazol.
Conclusion: Treatment is especially hard in vertebral and paraspinal localization, spinal instability, and recurrence cases. Long-term follow up is necessary. In addition to surgical treatment patients have to pay attention to their medical treatments, regularly come in for examination to undergo clinical, radiological and serological follow-up. Removal of the cysts without rupturing during surgery is important to reduce recurrence risks and rates.
Keywords: Hydatid cyst, Spinal, Recurrence, Surgery, Albendazol

OP-SP.03-02

Cervical Spine TB

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A retrospective study of 360 patients with spine tuberculosis, presented at Liaquat National Hospital from the year 2000 - 2015. On admission the patients were assessed neurologically and by Mehta's classification. Plain x-rays, magnetic resonance imaging and erythrocyte sedimentation rate were done for each patient. The patients were divided into two groups, surgical and conservatively managed patients. 60 patients had cervical spine TB. Indications for patients with cervical spine TB were neurological deficits, spinal instability, and failure of medical treatment. All patients went under anterior cervical approach. Postoperative improvement in symptoms and deformity was evaluated and compared with conservatively managed patients with a follow between 9 months to 15 years.
Keywords: Spine, Tuberculosis, Infection, Deformity

OP-SP.03-03

Dorso-Lumbar Tuberculous Spondylodiscities Experience in the Neurosurgery Department About 295 Cases

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Aim: To determine retrospectively, the various diagnostic methods and therapeutic modalities allowing spinal stabilization, neurological recovery and prevention of kyphosis in patients suffering from tuberculous disease of the spine.
Method: Our work focused on the epidemiological, clinical, radiological, histological, therapeutic and evolutionary data of 295 cases of dorsolumbar tuberculous spondylodiscities collected at the neurosurgery department of the IBN SINA hospital in Rabat from 1990 to 2016.
Results: The average age of our patients was 41 years. Neurological deficits are present in 83% of cases, spinal deformities in 22% of cases and paravertebral abscesses in 25% of cases. Localization was dorsal (37% of cases), lumbar (47%). The diagnosis was suspected on the basis of clinical, biological, bacteriological and radiological data and was confirmed in 75% of the cases by histological study. Remote postoperative progression in 84% of the cases showed a cure for tuberculous disease in all cases with an average follow-up of 18 months. On the neurological level, an improvement of the deficit in 88% of the cases carried out by an anterior procedure against 48% of the cases carried out by the posterior route. Orthopedically, an average of 3 ° improvement in the angle of kyphosis for patients with an anterior approach compared with 8 ° of worsening kyphosis angle for patients treated medically or posteriorly.
Conclusion: Through our study, we emphasize the value of early diagnosis of TS, and insist on the benefits of the anterior approach.
Keywords: Tuberculosis, Spondylodiscitis, Anterior approach

OP-SP.03-04

Surgical Correction of Severe Thoracic Kyphosis in Patients Spinal Tuberculosis with Posterior Decompression and Fixation

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Background: The spinal column is involved in less than 1% of all

cases of tuberculosis (TB). Spinal TB associated with neurologic deficit due to compression of adjacent neural structures and significant spinal deformity. Our aim is to evaluate the efficacy and safety of posterior decompression and fixation with kyphosis in patients spinal tuberculosis. We have 10 serial case to be reported with our experience and present our surgical technique to achieve correction.
Method: Between January 2014 and December 2016, 10 patients (6 men and 4 women) with thoracic myelopathy due to spinal tuberculosis underwent posterior decompression. Their mean age at time of surgery was 46.6 years (range 23–78 years). All patients suffered from back pain and were unable to stand upright. Posterior instrumentation was also performed for stabilization of the spine and reducing the thoracic kyphosis angle (kyphosis correction). The follow-up period below 1 year. The outcomes were evaluated using VAS, ASIA and ODI.
Result: Posterior decompression and fixation made it possible to correct the kyphosis. After surgery, the thoracic kyphosis in the stabilization area was reduced from 79,0° (range 50°–130°) before surgery to 35.6° (range -8° to 42°) on average, with a recovery rate of 74.0%. The results were good in 7 patients and fair in 3 patients. Postoperative imaging showed improvement in VAS, ASIA and ODI.
Conclusion: A considerable degree of neurological recovery was observed after kyphosis correction. The authors therefore suggest that the procedure is useful for patients whose spinal tuberculosis with thoracic kyphosis
Keywords: Spinal tuberculosis, Posterior decompression, Kyphosis, Deformity

OP-SP.03-05

Effects of Rifamycin Administration on Infection Rates in Patients Undergoing Posterior Stabilization

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Aim: To evaluate the efficacy of prophylactic antibiotherapy used in patients undergoing stabilization and decompression surgery for spinal pathologies.
Method: Between September 2011 and October 2015, a total of 264 patients underwent 282 posterior stabilization and/or decompression operations for the treatment of degenerative, traumatic, and malignant pathologies of the spine. Erythrocyte sedimentation rate (ESR) and C-reactive protein level were measured in patients with infectious symptoms and patients with clinically significant values underwent spinal magnetic resonance imaging (MRI) with contrast enhancement.
Results: Of these patients, 170 were females and 94 were males. All patients were followed for minimum 12 months. One patient developed spondylodiscitis as a complication and complication rate was 0.72%.
Conclusion: Our study results suggest that the use of dual or triple combination of broad-spectrum antibiotics in severe spinal infections is associated with a further increase in antibiotic resistance. Based on these results infection rates with intraoperative use of rifamycin are lower.
Keywords: Surgery infection, Prophylactic antibiotherapy, Posterior stabilization, Rifamycin

OP-SP.03-06

Neck Pain After Tonsillectomy: A Redflag for Cervical Spine Tuberculosis in Developing Countries

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Aim: To highlighten the importance of neck pain after tonsillectomy in developing countries where mycobacterium tuberculosis is endemic and cervical spine tuberculosis is not a remote possibility.
Method: Descriptive case series study was conducted from July 2011 to June 2016 (five year) in Department of Neurosurgery, Lady Reading Hospital, Peshawar. Patients who had persistant axial neck pain after tonsillectomy were included and patients with no history of tonsillectomy and patients with prolapse disc, cervical tumour, spondylosis were excluded. The diagnosis of cervical spine tuberculosis was made on history, exam, radiology, ESR and improvement with treatment.
Results: Out of total 18 patients, 8 were male and 10 female. Age range was from 22-38yrs. All patients were labelled as cervical spine tuberculosis and MRI cervical spine showed spondylodiscitis. Xray cervical spine was normal in 8 patients while disc space narrowing, end plate erosion, change of curve was noted in 3,partial collapse in 6 and subluxation in 1 patient. In all patients ESR was >60.2 months treatment with 4 and 7 months treatment with 2 antituberculous drugs showed clinical, radiological and biochemical improvement and all patients were cured.
Conclusion: Cervical spine tuberculosis should never be missed in patients who have undergone recent tonsillectomy and belong to developing countries. Whether its the provocative injury to the spine or change in biomechanics of spine after tonsillectomy or direct extension of bacteria or activation of dormant focus of bacteria in spine or lung leading to cervical spine tuberculosis is yet not clearly known but persistant neck pain after tonsillectomy should not go unnoticed.
Keywords: Neck pain, Cervical spine tuberculosis, Tonsillectomy, Developing countries

OP-SP.03-07

Clinical and Radiological Criteria for Diagnosis of Spinal Tuberculosis

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Tuberculosis is highly prevalent in developing countries. Within the diagnosed cases of extra pulmonary TB, spinal TB accounts for more than 50% of the cases. Early detection of disease can significantly improve patient outcome. However, this requires a set criterion based on clinical as well as radiological and laboratory parameters.
A retrospective study was done where the records of all patients diagnosed with spinal TB, spinal abscess (other than TB) and spinal tumors within the Aga Khan University Hospital, Karachi were reviewed. These patients had been admitted over a six-year period between 2011 to 2016. Clinical signs and symptoms, radiological and laboratory findings were then recorded and assessed.

The highest reported symptoms for both spinal infection and spinal tumors were pain and neurological deficits, however pain and fever was predominant presenting feature in spinal infection patients, where as neurological deficit was common presenting complaint in spinal malignancy cases. These analyses can be further used to develop a criterion to effectively differentiate and diagnose spinal pathologies, which can eventually be adopted in hospital settings within the developing countries.

Keywords: Spinal infection, Spinal tuberculosis, Spinal tumours

OP-SP.03-08

Indications of Surgical Interventions in Patients with Postoperative Spondyelodiscitis

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Background: Postoperative spondyelodiscitis remains uncommon but it is a serious complication of spine surgery. The prevalence of postoperative discitis is thought to be about 7% of all spinal procedures. Risk factors include extensive soft tissue dissection, prolonged operative duration, soft tissue devitalization, and use of surgical instrumentation. High level of suspicion is important in early diagnosis of post operative discitis. Pain is the most common presenting symptom. The aim of this study is to determine the efficacy of conservative treatment and to identify the indications for surgical intervention.

Method: Retrospective study includes 25 patients diagnosed with postoperative spondyelodiscitis during the period between january 2012 and october 2016 at neurosurgery department, cairo University hospitals.

Results: Conservative treatment only can be used in 14 patients(including bed rest, I.V antibiotics and brace. surgical intervention is needed in 11 cases (including debridement, open biopsy, removal of instruments and surgical stabilization and fusion.

Conclusion: Once the primary diagnosis is confirmed, early and adequately prolonged antibiotic therapy is recommended. Some of postoperative discitis cases can be successfully treated by conservative treatment. Surgery may be needed in other cases for different reasons such as**:** severe destruction of endplates, spinal abscess formation, chronic osteomyelitis, mechanical instability, neurologic deficit, severe pain and failure to respond to conservative treatment.

Keywords: Spine infection, Spondyelodiscitis, Surgery

OP-SP.03-09

Circumferential Fusion for Tuberculous Spine in Thoracic and Lumbar Levels Through Posterior Approach

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This is our experience of 72 cases of tuberculous spine operated through posterior approach for circumferential fusion in thoracic and lumbar levels. Rib resection and lateral approach through posterior for thoracic spine, and pedicle resection for lumbar levels was done as and when required. Follow up period from 14 months to 38 months. Rates of pain free survival, disease response, rate of pseudoarthrosis, implant failure, reinfection and resurgery were studied.

Keywords: Spine tuberculosis, Circumferential fusion, Tuberculosis

OP-SP.04-01

Survival and Fictional Outcomes After Surgical Treatment Intramedullary Spinal Cord Astrocytomas

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In Burdenko Neurosurgical Institute more than 385 patient underwented removal of intramedullary spinal tumors from 2002 to 2016. Tumor cervical location was in 27 cases (49%), cervicothoracic 7 (12%), thoracic 17 (30%), cauda equina 4 (9%). There were 24 male (43%) and 31 female (57%) patients. All patients undewented decompressive laminectomy and resection or biopsy of intramedullary tumors. During operation fluoroscopy, MEPP and ultrasound destruction were used. Median follow-up was 6 years.

Histological characteristics**:** 19 patients (35%) had Grade I astrocytomas, 19 patients (35%) had Grade II astrocytomas, 14 (25%) - Grade III astrocytomas, 3 (5%) - Grade IV. Sensitive disorder were in 48 cases (87%). Motor disorders**:** without paresis - 6 patients (11%), monoparesis – 7 patients (13%), hemiparesis – 4 patients (7%), paraparesis – 12 patients (22%) and tetraparesis – 19 patients (47%). 25 patients had bladder dysfunctions (45%). 3 patients (5%) died first year post-op (in one case – progression of tumor, in two cases – progression of general disease). 16 patient (30%) were better after tumor removal (transition from one McCormick grades up), 23 patients (45%) were worse (transition from one or two McCormick grades down) and 13 patients (20%) hadn't changes McCormick grade (this is patients with first or second McCormick grade).

Spinal cord astrocyromas are rare disease, which are requires multimodal view on treatment and recovery. Histological characteristics and total removal of tumors have a huge influence on the length of survival. Radiotherapy and chemotherapy allows preventing recurrence of disease.

Keywords: Intramedullary astrocytomas, Spinal cord tumors, Outcomes after surgical treatment

OP-SP.04-02

Lateral Approach for Management of Ventrally Located Upper Cervical Meningioma

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Background: Meningioma forms large portion of the tumor that occurs in upper cervical region, many of them locate anterior to spinal cord. Meningioma at this location forms a challenge for neurosurgeon due to close relationship to the spinal cord and complex anatomy of this region.

Method: Between year 2006 and 2014 thirteen patients with ventrally located upper cervical meningioma (C1-C3)were operated using lateral approach. They were 8 females and 5 males, the age ranged from 42 to 73. The fellow up period was 2-12 years. Neck pain and occipital headache together with motor and sensory disturbances were the most frequent presenting symptoms.
Results: Total excision was achieved in all 13 patients. All patients who had preoperative motor deficits. They improved significantly postoperatively, who presented with sensory disturbance had partial recovery. No patient got worse neurologically compering to preoperative condition. No mortality. All meningiomas were grade I;
Conclusion: Lesions ventral to the spinal cord in the upper cervical region could be managed safely using the lateral approach in comparison with other approaches. It offers enough exposure for safe dissection and removal of the tumours. No need for retraction or rotation of the spinal cord. It is technically relatively simple, with low incidence of complications e.g. instability, infection, injury of neural or vascular structures comparing with other approaches.
Keywords: Meningioma, Tumor, Cervical spine

OP-SP.04-03

Unilateral Approach (Hemilaminectomy/Facetectomy/ Costotransversectomy) Is a Less Invasive and Effective Approach for Removing of Extramedullary Tumors

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Background: Spinal tumors may be resected via unilateral approach (Hemilaminectomy/Facetectomy/Costotransversectomy-UA) when the latest improvements in developing technology and clinical practice are concerned.
Method: In our clinic, 133 spinal canal tumors were operated on between May 2009 and December 2016 (primary and metastatic bone tumors were exluded). Seventy-four cases were operated via unilateral hemilaminectomy, 26 with total laminectomy, 22 with laminoplasty and 1 with corpectomy. Among 74 UA cases, 35(48.5%) were female and 39 were male (51.5%) with a median age of 42.9(12-66 years).Complaints on presentation were pain and sensory symptoms in 39, disturbance of motor functions in 32 and sphincter malfunction in 9 cases. Neurologically were normal 13 cases. Localization of lesions was cervical in 31, 17 in lumbar and 26 in thoracic vertebrae. 27 lesions were extradural, 3 were intramedullary and 44 were intradural and extramedullary. UA was preferred on the lesion where sited extramedullary localization. The lesions were reported as schwannoma (24), meningioma (19), metastasis (19), epenymoma (2), multiple myeloma (2), epidermoid tumor (4), astrocytoma (1), cavernoma (2) and endodermal cyst (1) on histopathology.
Results: Thirty-three cases were better or neurologically intact. Thirty-seven cases were not changed neurologically and 4 were worsened. Mean follow-up was 30.7 months (3-76 months). Cases with neurological worsening were determined to improve at the follow-up. All remaining cases with stable postoperative picture were also improved on follow-up. Prolo economical score was 3.14 and social score was 3.98.
Conclusion: UA provides a surgical corridor for removing of tumors efficiently. This approach also obtains to protection of contralateral bony and muscular preservation as well as preservation of midline ligamentous elements.
Keywords: Spine, Spinal cord, tumor, Unilateral approach

OP-SP.04-04

Spinal Meningiomas. Retrospective Multicentric Study of 80 Patients

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Background: Spinal meningiomas are benign, slow growing tumors intra dural extra medullary tumors, representing 12 % of all meningiomas.
Method: We report a retrospective series of 80 patients managed during 20 years and reviewed influencing factors of post operative outcome of these tumors. 84 % of our patient were female. Mean age was 56 years. Mean symptom duration before surgery was 1 year. Pain and walk disturbancies were very common at the time of diagnosis. Motor and sensory troubles were found respectively in 72 % and 55 % of patients, sphincter disturbancies in 9 % of patients, Brown Sequard syndrome in 6 % and cauda equina syndrom in 5 %. 65 % of our patients had pre operative MRI that showed tumor in dorsal position in 69 % of cases. All patients were operated by posterior approach. GTR was achieved in 90 %. 3 patients had adjuvant treatment**:** radiotherapy and chemotherapy.
Results: We had a 8.75 % post op complications rate. Mortality rate was of 3.75%. 98 % of patients had grade I WHO classification. Mean follow period was of 2 years. Patient condition improved in 87 %. We had a 10 % recurrence rate, wich was influenced by the tumor resection extent and histopathological type. Sex, age, initial presentation, topography, histopathological type and extent of meningioma resection were not influenced factors for neurological condition recovery.
Conclusion: Regarding our results and literature reports, surgical management for all patients must be done, unless there is a major anesthesiology contraindication.
Keywords: Spine, Meningioma, Microneurosurgery, Prognosis

OP-SP.04-05

Factors Affecting the Surgical Outcomes of Primary Spinal Ependymomas: A Retrospective Study

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Background: Primary spinal ependymomas (PSEs) are almost benign tumors. They vary greatly in size and typically have a long

prodrome as well as frequently cause nonspecific symptoms. To find the factors that may affect the surgical outcomes of PSE by evaluating the long-term surgical outcomes of 46 consecutive cases.
Method: Medical records of 46PSE cases which underwent surgery in BRSHH hospital, during a 12-year period (2004-2015) were retrospectively reviewed.
Results: 46 cases of PSEs were surgically treated. The sample consists of twenty-one female and twenty-five male patients. The most common symptom was radicular pain (80.4%). The mean age of the sample is 36.7±10.1 years. GTR was carried out in 65.2% of the patients. 67.4% of the patients had good clinical outcomes at their last follow-up (after 92.2±50.9 (16-158) months on average). The mean length of hospital stay was 7.9±9.4(2-64) days. 8-Year recurrence rate**:** 8.7%. 2 patients had abscess and 2 had epidural hematoma, all were reoperated. One of epidural hematoma died after 64 days. According to WHO grading; 22**:** Grade I, 23**:** Grade II and 1**:** Grade III. In a multivariate regression model, long tract finding/neurological deficit on presentation, intramedullary tumors, syrinx coexistence, cervical location, STR, Grade II-III, and developing of postoperative complication were selected as risk factors associated with poor outcomes.
Conclusions: Short symptoms less than 3months, GTR, WHO-gradeI, extramedullary and lumbar location were independent factors associated with good outcomes. We recommend performing MRI in suspecision of PSEs, using intraoperative neurophysiological monitoring and giving attention to resect tumors without inviolation of their capsules may reduce recurrence and result with good outcomes.
Keywords: Primary spinal ependymoma, Surgical outcome, Intraoperative neurophysiological monitoring, Syrinx cavity

OP-SP.04-06

Intramedullary Spinal Cord Tumors Surgical Management

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Background: Majority of intramedullary spinal cord tumors (IMSCT) are benign and microsurgical resection can often provide longterm improvement.
Method: 21 consecutive patients (age 14-67 years, M/F 12/9) with IMSCT operated on in our facility were analized. Median myelotomy was applied in 19 and DREZ meylotomy in 2 surgeries. GII astrocytomas were in 8 cases (38%), ependymomas in 5 (24%), subependymomas in 3 (14%), myxopapillary ependymoma in 1 (5%), hemangioblastomas in 3 (14%), dermoid in 1 (5%), ganglioglioma with anaplastic transformation of astrocytic component in 1 (5%) and metastatic medulloblastoma in 1 (5%) case.
Results: Subtotal or partial resection was done in all cases of infiltrative tumors, in all other 10 cases resection was total. Only in patients with anaplastic ganglioglioma and metastatic medulloblastoma we considered stable neurological symptoms and worthening respectively; neurological improvement was found in all other cases.
Conclusions: Radical resection via midline and DREZ access provided good outcomes for patients with non-infiltrating IMSCT. Histological nature of the tumor was the main factor that predefined extent of resection. Microsurgical resection of IMSCT can be recommended as a method of choice and first step in treatment of IMSCTs.
Keywords: Intramedullary tumor, DREZ approach, Spinal cord tumor

OP-SP.04-07

Results of Surgical Treatment of Hemangioblastomas of the Spinal Cord

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Background: Vascular tumors of spinal cord is a rare pathology which by histological nature is most often presented by hemangioblastomas of different localization. Hemangioblastomas arise sporadically, however may be associated with the von Hippel-Lindau disease. Hemangioblastoma symptoms vary from asymptomatic carriage to severe neurological impairment causing permanent disability or death for the patient.
Method: From 2013 to 2016 Burdenko Neurosurgery Institute operated 385 adult patients with intramedullary tumors of different histological nature. Among them there were 38 of intramedullary hemangioblastomas. Of these, three patients had diagnoses of von Hippel-Lindau disease. The diagnosis is based on MRI data and neurological examination. The patients were assessed on a McCormick classification part of preoperative and postoperative treatment.
Results: Patients with hemangioblastomas mean follow up was 50 months (36-144 months). The average time of pathogenic pathway was 36 months (12-300 months). MRI examinations of 25 patients showed syringomyelia. Postoperatively only two patients had deterioration of neurological condition, with the rest of the patients showing preoperative state.
Conclusion: Surgery of vascular tumors of the spinal cord is a complex and multicomponent task that requires a search for the correct patient approach, a decision whether there is need for embolization of vascular tumor, as well as microsurgical treatment when needed.
Keywords: Vascular tumors of spinal cord, Intramedullary hemangioblastomas, Spinal hemangioblastoma surgery

OP-SP.04-08

Preoperative, Peroperative and Postoperative Electrophysiological Evaluations of Spinal Tumors: A Retrospective Clinical Study

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Background: Although recent radiological tools are very effective on the diagnosis of these tumors, electrophysiological assessment is crucial for the determination of neurological condition of

the patient. The aim of this study is to show the importance of electrophysiology on the diagnosis, surgery and follow-up of patients with spinal tumor.
Method: The data of 65 patients who underwent surgical treatment for spinal tumor is reviewed retrospectively and 49 patients who had full electrophysiological recordings are included this study. Pre-, intra-, and postoperative somatosensorial and motor evoqued potential responses of the patients were also collected. The results are compared using statistical methods.
Results: 29 (59.2%) patients were male and 20 were female with a mean age of 39.22 years. Nine patients had extradural tumor, 31 (63.3%) patients had intradural-extramedullary and 9 patients had intradural-intramedullary tumors. Neurological improvement was observed in 8 (16.3%) patients, while neurological condition was unchanged in 34 patients and worsened in 7. Intraoperative and postoperative right tibial nerve latency was longer than the preoperative latency in 15 patients and this was statistically significant ($p<0.05$). This changes was especially correlated with age. In addition, this change was not correlated with postoperative neurological condition of the patients. But, othe other comparisons (left tibial nerve, left and right median nerves) were not statistically significant ($p>0.05$).
Conclusion: Intraoperative neuromonitoring is important during the surgery for spinal tumors. However, the chnages in electrophysiological parameters are not predictive for the neurological outcome of the patients. More detailed studies with larger patient population is needed for accurate clinical outcomes.
Keywords: Electrophysiology, Spinal tumor, Outcome, Surgery

OP-SP.04-09

Minimally Invasive Surgery of Spine Tumors

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The incidence of intraspinal tumors is 10 per 100,000 population. The most common primary tumors of the spinal cord are nerve sheath tumors, meningiomas, and astrocytomas. A significant number include metastasis to the spine and bony involvement of extraspinal tumors. Minimal access technologies such as hemilaminectomy, use of tubular retractors and endoscopic approaches are newer approaches which provide a safe and minimally-invasive operation. Some problems addressed by minimal access spine surgeries include (1) issues with time-consuming operations, (2) significant morbidities, (3) prolonged disability and hospital stay, (4), negative psychological sequealae, (5) risks associated with muscle stripping and denervation, (6) regional ischemia contributing to potentially prolonged recovery periods, (7) associations with chronic persistent back-pain, and (8) issues with instability. With proper patient selection, preoperative evaluation and availability of adequate instrument systems, there are no reported increased complications arising from minimal access technologies. The relatively steep learning curve of dissection in a smaller field and suturing of the dura using finer needles and needle holders is easily overcome after approximately six to eight cases. The operating time is actually shorter for minimal access procedures than standard cases.
Minimal access spine surgery of intraspinal tumors can be a safe and effective approach with proper patient selection, preoperative evaluation, and adequate instrument systems. Minimal access surgery of intraspinal tumors via the unilateral muscle-splitting technique is an innovative alternative to laminectomies and bilateral paraspinal muscle dissection surgeries. There is a statistically significant decrease in VAS scores, blood loss, and hospital stay.
Keywords: Minimally invasive spine tumor surgery, Minimal access spine tumor surgery, Minimal access spine surgery

OP-SP.05-01

Assessment of Efficiency of the Easy Go Spinal Endoscopic Spine System. Is This Easy Go or not so Easy Go System

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Background: With the advent of technology, the endoscopic discectomy is becoming popular. We assess the efficiency of new Easy-go endoscopic discectomy system by storz. We want to assess the Clinical outcome, quality of life, neurological function and complications.
Method: We have 25 patients who have lumbar disc prolapse at various level. They were treated conservative for 3 to 6 months. Twenty of these Patient had neurology and reaming of had Sciatic. All of these patient had endoscopic discectomy by using Easy Go system. Two patient we have to condemn the procedure and do open discectomy.
Results: These patients were follow up for one year. The technique problem and other clinical assessment was done. The duration of operation was 2 to 3 hours. The author has difficulty in initial case. The difficulties and complication were following**:**

1. Difficult to work through the tube
2. Prolong operation time
3. Frequent fog and blood on the camera which require frequent cleaning
4. Two patient had Dural tear, and nerve damage.
5. One patient developed recurrence of disc prolapse in 6 months' time.

Conclusion: Lumbar endoscopic discectomy with Easy Go system is not easy system. First of all, it's work through a small size tubular retractor is difficult. In two patients we have nerve root damage and Dural tear. In two patients we have to condemn the procedure. There is steep learning curve. Over all 72% of over patient were satisfied with the produce. The complication are more than benefits.
Keywords: Easy go system, Endoscopic discectomy, Complication

OP-SP.05-02

Urodynamic Study in Idiopathic Scoliosis: An Obscure Entity

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Background: Congenital scoliosis is a known entity with odd urinary abnormalities, detectable in urodynamic studies (UDS).

However, it is believed that UDS problems have a very low prevalence in idiopathic scoliosis. This is a relatively obscure entity and thorough review of the literature does not reveal, reliable information in this regard.
Method: In our experience, 286 patient candidates for surgical correction of scoliosis were assessed with whole CNS MRI and UDS in a single center and by single blinded radiologists and urologists. All of the urodynamic parameters were then assessed and analyzed.
Results: Among these cases, 189 were idiopathic and surprisingly, a mild, moderate or severe abnormality in UDS was found in 76 patients (40.2%). Although this is less than what we found in congenital cases (53.6%), but is high prevalence rate and alarming for the attending physician.
Conclusion: UDS abnormalities are not uncommon in idiopathic cases. Although many of them are not indicative of tethered cord syndrome but in some cases this may reflect some subclinical urinary problem. The importance of performing MRI and UDS in idiopathic scoliosis is a topic which is worthy for further evaluation and research.
Keywords: Idiopathic scoliosis, Urodynamic study, Tethered cord

OP-SP.05-03

Surgical Treatment of Sacral Tarlov Cysts: Report of 20 Cases

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Tarlov cyst or perineural cyst is a local expansion of the subarachnoid space forming in contact with a nerve root and is filled with cerebrospinal fluid. There is no consensus on the optimal treatment of symptomatic sacral perineural cysts. Many methods have been used to treat these symptomatic lesions, with varying results.
We report a series of 20 patients operated for a sacral Tarlov cyst. Our results were satisfactory with 80% improvement and without neurological deterioration postoperatively. Our surgical technique [sacral laminectomy+punction cyst+sleeve of the synthetic dura], described for the first time in this work, appears to be effective in 20 reported cases in our series.
Keywords: Tarlov cyst, Cyst punction, Surgery, Dura sleeve

OP-SP.05-04

Spine Surgery Done in the Land of Borneo Sarawak; An Audit

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Background: Spine surgery is one of the major chunk of surgeries done by neurosurgeon worldwide. The variety and number of cases done by neurosurgeon varies from centre to centre. Even though a majority of spine cases done by Orthopaedic Spine team in our centre but the idea of presenting this audit is to show the variety and the outcome of spine cases done under Neurosurgical team in the land of Borneo, Sarawak.
Method: This is a comprehensive retrospective review on spine surgery cases done by Neurosurgical Department, Sarawak General Hospital, Kuching, Malaysia. Data collection done mainly from the online data system and the logbook entered. There are about 50 spine surgeries done in our centre since 2015 until 2016 which is about 16% from the total cases done by our centre per year. The cases mainly divided into traumatic and non traumatic cases such as tumours and infections.
Results: In general, there is increase in the total number of spine cases that were done in our centre this year. Majority of cases done under IGS guidance especially after the introduction of brain suite in our centre. the major issue encountered by us are due to the logistic issue as most of the patient arrive late to our centre and lead to poorer outcome.
Conclusion: In the nutshell, it is fulfilling to see that the neurology for most of the patients that have spine pathology improve despite the logistic limitation. Furthermore, it shows that early rehabilitations play a great role in post operative care.
Keywords: Spine, Borneo, Sarawak, Neurosurgery

OP-SP.05-05

Predisposing Factors for Dural Tear During Lumbar Spine Surgery

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Background: Dural tear is a well-known risk of lumbar spine surgery. The aim of these prospective study was to identify risk factors for dural tear in lumbar spine surgery.
Method: We prospectively evaluated 523 patients who underwent lumbar spine surgery from 2013 to 2016 in faculty of medicine cairo University. we compared data on patients in whom a dural tear occurred (group A) and those in whom a dural tear did not occur (group B) basic demographic information, intraoperative data(surgeon experience, type and time of surgery), and clinical information from a medical record review were compared between the two groups.
Results: 311 patients underwent discectomy, 151 patients underwent laminectomy. and 61 patients underwent lumbar fixation. Among the 311 patients who underwent discectomy 13 patients had a dural tear. Among the 151 patients who underwent laminectomy 8 patients had dural tear. Amongthe 61 patient underwent lumbar fixation 5 patients had dural tear. Patients with incidental durotomy were older (mean 65 ± 13 vs 60 ± 14 years), and had longer surgery (146 ± 59 vs 110 ± 54 minutes), compared with the patients without dural tear. the incidence was significantly higher with lumbar fixation (prolonged surgery) When physician training was examined, residents were responsible for 49% of all dural tear,
Conclusion: Predisposing factors for dural tear were, older age, prolonged surgery, and The years of physician training or resident experience appear to be a major risk
Keywords: Dural tear, Spine, Surgery

OP-SP.05-06

Epidural Catheter Breakage: Systematic Review and Recommendations

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Epidural catheter is one of the most important components in the armamentarium of anesthesiologist for safe anesthesia. The primary use of epidural catheter is administration of anesthesia or pain control. While being overall a safe procedure, the common complications reported are dural punctures, spinal hematomas and later on epidural abscesses. These complications at times may cause major neurological sequelae. Catheter breakage is a rare but often reported complication of this procedure. Here we have described two cases of epidural catheter breakage that happened in our hospital and performed a systematic review of the literature of breakage of the epidural catheter. An attempt to identify the predisposing factors for breakage was made and guidelines was derived based on recommendations in the studies.
Keywords: Epidural catheter breakage, Review, Recommendations

OP-SP.05-07

Electronic Record Keeping of Intraoperative X-Ray and Avoidance of Wrong Level Spinal Surgery: 2 Year Series

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Background: Perhaps the single greatest error that a surgeon hopes to avoid is operating at the wrong spinal level. Intra-operative fluoroscopic radiograph is commonly used to identify and confirm the correct level. Electronic storage of radiographic records serves as evidence that the correct level was performed. Generally, radiography with an instrument in the disc space intraoperatively is the only unequivocal proof of correct level surgery. Anything less is subjective to argument. We investigated the usage of spinal disc space as the landmark to confirm the correct level surgery as identified in preoperative documentation and/or consent form. The compliance of the surgical and radiological staff was reviewed with regard to maintaining the radiographic records.
Method: 186 consecutive spinal cases from 01-12-2014 to 30-11-2016 under the care of a single consultant neurosurgeon. All patients had intraoperative fluoroscopic radiography and requested to be stored electronically. An initial X-ray with spinal needle before incision, middle X-ray with Lamina exposed and final X-ray with spinal disc space identified were taken in the same order.
Results: Electronic record keeping for the initial X-ray, Middle X-ray and final X-ray were 166 cases (89%), 174 cases (93%) and 178 cases (95%) respectively. There were no saved electronic X-ray records in 9 cases (5%).
Conclusion: Wrong level spinal surgery remains unresolved. Intraoperative fluoroscopy and electronic record saving are vital. Compliance remains poor. Consideration of including fluoroscopic electronic record saving in Timeout check list may increase compliance.
Keywords: Spine, Surgery, Wrong, Level

OP-SP.05-08

Efficiency of the Blood Patch (BP) in Repairs of the Dural Tear Post Spine Surgery: Proposal A Protocol Therapeutic

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Dural tear (DT) is frequent complication in a neurogisurgical practice. It usually result in many clinical signs due to spinal CSF leakage. Its severity is linked to the risk of infection. The surgical treatment may be not effective if not association with biological glue. The purpose of this article is to provide an economical treatment protocol, well codified, based an epidural injection of autologous blood.
A retrospective study of 92 cases of dural tear, over 2108 lumbar spine procedures, archieved by different surgeons and conducted over a period of 7 years from may 2008 to may 2015. In 36/92 patients the following treatment procol was applied**:** Dural suture if possible, complemented by fat or muscle patch overlaid with surgical. A clamped non-suction redon is set-up, followed by a tight closure. The day after, the redon drain is opened. In case of CSF leakage autologous blood is taken from peripheral vein and injected with a volume depending on each case. The procedure is repeated up to three times. All patients are left in bed for 48 hours and receive intravenous antibiotics for 48 hours then orally for 8 days. Among the 92 cases,48 were successfully treated by dural suture. Eight cases were reopeated for excessive CSF leakage. The remaining 36 (39%) benefitted from BP; among them, in 28 cases the first injection of BP was efficient, but the 8 others required a second or third injection. No complications were noted during and after the blood-patch procedure.
Once the DT is diagnosed, the cure by the BP, which is always efficient, is now systematically recommended after surgery, when biological glue is lacking.
Keywords: Dural tear, Blood-patch, Biological glue, CSF leakage

OP-SP.05-09

Non-Traumatic Spinal Cord Compression of the Child

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Background: No-traumatic spinal cord compressions aren't often described in children population. This study will discuss, the etiology, the therapeutic and evolutionary aspects in Senegal.
Method: 113 children aged between 15 months and 18 years were managed in a 10 years period (from January 2005 to July 2015) for a no-traumatic spinal cord compression (average 8.3 years).
Results: There was 66 males (58%) and 47 females (42%) with sex ratio of 1.40. 21 patients was performed The CT scan and 4 performed myelography. 22 patients was performed MRI. Dorsal lesions were majority (46%) followed by the lumbar spine (27%). Pott's disease

(80%) followed by tumors (17%) and spondylodiscitis to banal germs (2%) and parasitic spinal cord compression (1%). Histology of 06 patients revealed neurofibroma Type II, extramedullary intradermal arachnoid cyst, intramedullary arachnoid cyst, Anaplastic pilocytic astrocytoma, ganglioneurinoma I terminal cone meningothelial meningioma; 1 Histiocytic granuloma with caseous necrosis. Pott's disease be cured by TB chemotherapy. 68% had a favorable recovery, and 20% had completely recovered after an average of 7 months of treatment with 3 death. Bilharzias was be cured by Myelotomy and praziquantel with a favorable result. We have decompressive laminectomy or laminotomy with tumor resection on 18 patients, with 58% good recovery and 1 death.
Conclusion: In Africa, particularly in the tropics, Pott's disease remains the first etiology followed by vertebra-medullary tumors
Keywords: Spinal compression, Child, Pott's disease, Tumors, Spondylitis, Bilharzia

OP-SP.06-01

The Role of Pain Distribution in Surgical Decompression of Painful Diabetic Peripheral Neuropathy

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Aim: To investigate the effect of surgical decompression on painful diabetic peripheral neuropathy (DPN) patients and discuss the role which pain distribution and characterization play in the management of painful DPN as well as the underlying mechanism involved.
Method: A total of 306 patients with painful diabetic lower-extremity neuropathy were treated with Dellon surgical nerve decompression in our department. Clinical evaluation including Visual analogue scale (VAS), Brief Pain Inventory Short Form for diabetic peripheral neuropathy (BPI-DPN) questionnaire, two-point discrimination (2-PD), nerve conduction velocity (NCV) and high-resolution ultrasonography (cross-sectional area, CSA) were performed in all cases preoperatively, and at 6 month intervals for 2 years post-decompression. The patients who underwent surgery were retrospectively assigned into two subgroups (focal and diffuse pain) according to the distribution of the diabetic neuropathic pain. The control group included 92 painful DPN patients without surgery.
Results: The levels of VAS, scores in BPI-DPN, 2-PD, NCV results and CSA were all improved in surgical group when compared to the control group ($P<0.05$). More improvement of VAS, scores in BPI-DPN and CSA was observed in focal pain group than that in diffuse group ($P<0.05$).
Conclusion: Efficacy of decompression of multiple lower-extremity peripheral nerves in patients with painful diabetic neuropathy was confirmed in this study. While both focal and diffuse group could benefit from surgical decompression, pain relief and morphological restoration could be better achieved in focal group.
Keywords: Diabetic peripheral neuropathy, Surgical decompression, Pain, Visual analogue scale, Two-point discrimination, Nerve conduction velocity

OP-SP.06-02

Creation of Conduits for Peripheral Nerve Defect Restoration Based on Adult Neural Crest-Derived Multipotent Stem Cells, Chitosan-PVA and Fibrin Gel: In-vitro Biocompatibility Study

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Background: Treatment of critical peripheral nerve defects (>30 mm) requires the autologous nerve grafting, which have a number of drawbacks. The aim of a study was to assess the biocompatibility in vitro of tissue-engineered nerve conduits based on chitosan-PVA tubes, fibrin gel and adult neural crest-derived multipotent stem cells (NC-MSCs).
Method: NC-MSCs were isolated by explant method from the bulge region of the whisker follicle of adult rat. The purity/identity of cell cultures was examined using immunocytochemical analysis, flow cytometry and RT-PCR. Chitosan-PVA tubes were constructed as follows**:** a glass rod with a circular cross-section (2 mm diam.) was vertically immersed into mix of 10% polyvinyl alcohol and 5% chitosan solution (500 kDa, 1**:**1), polymerized tube was removed from rod and washed. Fibrin gel was polymerized in insulin syringe or in chitosan-PVA tube. NC-MSCs were seeded within and over chitosan-PVA tube and in fibrin gel. Biomaterial toxicity and cell viability were evaluated by FDA/PI staining. The proliferation and metabolic activity of NC-MSCs were evaluated using Alamar Blue assay.
Results: Adult NC-MSCs have phenotype Sox10+p75+ nestin+cytokeratin- and demonstrate self-renewal capacity and ability to directed multilineage differentiation. FDA/PI staining showed NC-MSCs viability in fibrin gel and on surface of chitosan-PVA tube. Alamar Blue assay showed NC-MSCs proliferation in fibrin gel and on chitosan-PVA surface. The growth rate of NC-MSCs was higher in the fibrin gel.
Conclusion: Hybrid tissue-engineered conduit based on NC-MSCs, fibrin gel and chitosan-PVA tube seems to be perspective for further evaluation in animal models of peripheral nerve defects.
Keywords: Neural crest-derived multipotent stem cells, Peripheral nerve, Conduit, Chitosan, Fibrin

OP-SP.06-03

Effects of Topically Administered Decorin on Epidural Fibrosis and Axonal Regeneration in Damaged Rat Sciatic Nerve

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Background: The primary anastomosis after peripheric nerve injury has not reached the desired levels in terms of functional recovery, despite all surgical techniques and technological advances. Decorin (Dc) is a proteoglycan located in the extracellular matrix of almost all body tissues. In this study, we wanted to investigate the effects of the topical application of Dc on epineural fibrosis (EF) and axonal regeneration (AR) in rat sciatic nerve model (RSNM).
Method: Twenty-four Sprague-Dawley rats were used in the study, incision was made in the right sciatic nerves, followed by primary epineural anastomosis. Scar formation index (ScFI), sciatic function index (SFI), electrophysiological imaging (EMG), axon number (AN), axonal area (AA), score of 5 (5S), myelin thickness (MT), wound healing and nerve adhesion (NAD) parameters were measured at 4th and 12th weeks.
Results: 4th week**:** ScFI**:** Control Group (CG)**:** 2.17±0.753; Topical Decorin Group (DG)**:** 2,83±0,983; SFI**:**CG**:** %-78,731±2,133; DG**:** %-72,735±4,043. EMG**:** distal latency; CG**:** 0,233±0,753; DG**:** 0,200±0,447; amplitude; CG**:** 338,33±22,286; DG**:** 386,67±51,153. AN**:** CG**:**5260,6682±1460; DG**:** 8423,3017±2341. AA**:** CG**:**8,628±0,975; DG**:** 12,626±2,178. 5S**:** CG**:**2,17±0,753; DG**:** 2,83±0,983. MT**:** CG**:**0,775±0,524; DG**:** 0,880±0,816. NAD**:** CG**:**2,50±0,548; DG**:** 1,50±0,548.12th week**:** SFI**:**CG**:**-64,570±1,644; DG**:** -55,308±2,282. EMG**:** distal latency; CG**:** 0,200±0,044; DG**:** 0,135±0,037; amplitude**:** CG**:** 410,00±26,833; DG**:** 510,00±34,059. AN**:**CG**:** 8353,535±2697,089; DG**:** 12533,20±1797,319. AA**:**CG**:** 13,346±0,949; DG**:** 16,0216±1,707. 5S**:**CG**:** 2,33±0,816; DG**:** 3,50±1,049. MT**:**CG**:** 0,953±0,630; DG**:** 1,236±0,226. NAD**:** CG**:** 2,33±0,816; DG**:** 1,50±0,548.
Conclusion: Our results show that, in RSNM, topical Dc administration has positive effects on EF and AR. TGF-β and TNF-α are important mediators in fibrosis tissue organization. In the literature, the effect of Dc on TGF-β and TNF-α; have been reported to have antifibrotic, antioxidant and antiapoptotic properties on post traumatic neural tissue. However, there are no studies investigating effects on peripheral nerve injury. We believe that topically administrated Dc improves EF, AR and axonal maturation in RSNM through TGF-β and TNF-α inhibition in accordance with the literature, and ultimately enhances functional recovery.
Keywords: Rat, Sciatic nerve incision, Anastomosis, Fibrosis, Decorin, Regeneration

OP-SP.06-04

The Role of Percutaneous Radiofrequency Thermocoagulation for Persistent or Recurrent Trigeminal Neuralgia After Surgery

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Therapeutic strategy is controversial and not yet uniform for patients with trigeminal neuralgia (TN) and persistent or recurrent facial pain after microvascular decompression, percutaneous radiofrequency thermocoagulation (PRT),or Gamma Knife surgery. The outcomes and risks of PRT for these patients are not clearly understood. The authors performed a retrospective study of 84 patients with persistent or recurrent TN after surgery who then underwent PRT between 2007 and 2013. Data were obtained with chart review and telephone interviews. The mean follow-up duration was 44.2 months. The immediate pain relief after PRT was 98%. The survival rates of pain free without medications at 1, 2 and 3 years after PRT were 85%, 68 % and 54%, respectively, with a nearly 80% rate for effective pain control (pain free, or pain controlled with medications) during the study period. Previous surgical method for TN did not have a significant effect on pain-free rates ($p>0.05$). 95% of patients benefited from multiple PRT procedure and were satisfied with their pain relief. 14 of 17 patients who required retreatment selected additional PRT, resuting in 8 patients (57%) in excellent outcome and 12 (86%) in effective pain control. Two patients had failed all conventional invasive treatments. All patients experienced numbness of varying degrees, with 2 reporting severe and bothersome numbness. The complication rate was 15%, including 6 patients with masseter weakness, 2 patients with impaired taste acuity, 4 patients with absent or decreased corneal reflex, 1 patient with oculomotor paralysis. PRT can serve as an alternative treatment option for patients with persistent or recurrent TN after surgery,
Keywords: Trigeminal neuralgia, Pain, Radiofrequency thermocoagulation, Microvascular decompression

OP-SP.06-05

Surgical Management of Brachial Plexus Injuries. Our Experience Over Past 3 Years

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Background: Brachial plexus injuries represent the most devastating injuries of the upper limb and various techniques have been used in management like neurolysis, nerve grafting and nerve transfer. The aim of this study is to demonstrate management of brachial plexus injuries at our centre.
Method: This is a retrospective descriptive clinical case study. Between January 2013 and April 2016, the team operated sixteen patients have brachial plexus injuries and were followed up each three months up till now. Recovery of the motor power is evaluated using the MRC scale.

Results: 16 patients (13 males, 3 females) diagnosed as Upper brachial plexus injuries (9 cases), lower brachial plexus injuries (4 cases) and panplexus injuries (3 cases) were surgically managed. Donors that used in nerve transfer were radial N. (4 times), SAN (3 times), ICN (2 times), contralateral C7 root, thoracodorsal N, MPN, median N and ulnar N (1 time), while recipients were axillary N. (5 times), MCN (4 times), SSN (3 times), median N. and ulnar N. (1 time). The average time of the surgical operation was 7 hours. The mean of recovery period is 10 months in neurolysis, 19 months in nerve grafting and 8 months in nerve transfer.
Conclusion: The study gives an insight into brachial plexus injuries that managed in our unit and reflects the situation in Egypt and will give an idea as to the work load to a new centre being specialized in the management of brachial plexus injuries.
Keywords: Traumatic brachial plexus, Nerve transfer, Nerve grafting, Centre experience

OP-SP.06-06

Cortical Bone Trajectory Screw for Lumbar Fixation: A Quantitative Anatomical and Morphometric Evaluation

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Background: Lumbar cortical bone trajectory (CBT) screw constructs are reported as an alternative method to pedicle screw fixation for minimally invasive spine surgery. The current study explores the CBT technique in further anatomic detail. The primary aims are to evaluate variations in anatomy relevant to CBT screw placement and to determine optimal screw location, trajectory, and length utilizing measures obtained from CT scans.
Method: One-hundred CT scans of the lumbar spine were evaluated, and 14 total measurements were determined for screw entry points, trajectories, and lengths for placement of CBT screws.
Results: Across all lumbar levels, the mean right pedicle-pars interarticularis junction length ranged from 7.58-8.37 mm (SD = ±1.18-1.42 mm). The mean left pedicle-pars interarticularis junction length was 7.95-8.6 mm (SD = ±1.42-1.74 mm). The pedicle-pars interarticularis junction from L1 to L5 was deemed too small for a 5 mm diameter CBT screw on the right in 35, 24, 17, 17, and 19%, respectively, and on the left in 30, 17, 17, 17, and 20%, respectively. The average length of a screw placed along the cranial cortical bone of the pedicle measured 27-30.5 mm (± 2.5-3.4 mm) and the angle of the screw with respect to the vertebral body endplate measured 44-48° (± 4.1-6.2°).
Conclusion: Improved anatomic knowledge relevant to CBT screw placement for lumbar fixation offers the potential to improve outcomes and reduce complications. Further, detailed analysis of the anatomy of the pedicle-pars interarticularis junction via preoperative CT can assist in choosing the ideal fixation method.
Keywords: Cortical, Trajectory, Bone, Screw, Pedicle, Pars interarticularis

OP-SP.06-07

Peripheral Nerve Tumors: It's Profile and Surgical Outcome in 58 Cases

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Background: Peripheral nerve tumors are rare soft tissue tumors. The nerve tumor originating from just outside of intervertebral foramen (in case of spinal nerves) or just outside the bony foramen (in case of cranial nerves) to the cutaneous branch were regarded as peripheral nerve tumor. In this presentation anatomical distribution, clinical presentation, histopathplogical types, surgical options and results of surgical treatment of the peripheral nerve tumors have been presented. At the same time we want to give emphasis that proper operative planning and utilization of microsurgical technique can avoid operation induced morbidity of postoperative neurodeficit.
Method: Clinical material consisted of 58 patients. The following surgical procedures were performed**:** excision of the tumor without damaging the structure of fascicles -10 cases; with transsection of 1–3 fascicles - 5 cases; with transection of many fascicles -2 case; excision of the tumor with microsurgical reconstruction of part of the nerve - 10 cases; excision of the tumor without reconstruction of any part of the nerve - 2 cases; amputation of limb - 3 cases; and evacuation of the intraneural ganglion - 2 case. 24 nerve tumor originating from cutaneous twigs were simply excised.
Results: Peripheral nerve tumors were mainly benign and malignant neoplasm was only found in 4 cases. There were very few new neurological deficits after surgical treatment.
Conclusion: The result of surgery of peripheral nerve tumors depends on the histopathological type, size and localization of tumors and the choice of the optimal operative procedure and microsurgical technique.
Keywords: Peripheral nerve tumor, Microsurgical reconstruction, Neurodeficit

OP-SP.06-08

Protective Effects of Resveratrol in a Rat Model of Ischemia-Reperfusion Injury of Sciatic Nerve

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The aim of this study was to determine the effects of resveratrol on ischemia- reperfusion (I/R) injury in the rats sciatic nerve. We used

18 Wistar rats anesthetized with ketamine (50 mg/kg-im). In the sham group, we only performed the surgery and not administer any medication. In the ischemia group, we generated I/R injury in 5 minute intervals with medical treatment of saline only. In the resveratrol group, we brought about the same I/R injury but gave resveratrol before the surgery by per oral. After sacrifice, we studied blood and nerve tissue samples. We evaluated the damage with malondialdehyde (MDA), nitric oxide (NO), and total antioxidant capacity (TAC), both in tissue and blood. Evaluation of serum levels of antioxidant markers and tissue samples demonstrated statistically significant effects of resveratrol in ischemia-reperfusion injury.This study revealed the antioxidant effect of resveratrol as an inhibitor of lipid peroxidation.

Keywords: Sciatic nerve, Ischemia-reperfusion injury, Resveratrol

OP-SP.06-09

Simple in Situ Decompression for Idiopathic Cubital Tunnel Syndrome Using a Microscopic Mini-Invasive Approach: Case Series of 36 Patients

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The treatment of ulnar nerve compression at the elbow remains controversial. None of the surgical techniques has yet proven its superiority. We describe a technique of simple in situ decompressıon for idiopathic cubıtal tunnel syndrome using a microscopic mini-invasive approach We present the results of 36 patients with one year follow-up. We defined the stages with modified Mc Gowan scores preoperatively. Post op clinical classification was done according to wilson & krout. Results will be discussed by recent publications

Keywords: Ulnar nerve decompresion, Cubital tunnel sendrom, Minimal invazive

OP-SP.06-10

Fabrication and *in vitro* Testing of Hybrid Construct Based on Adult Neural Crest-Derived Multipotent Stem Cells, Fibrin Gel and NeuraGen™ Implant for Restoration of Peripheral Nerve Defects

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Background: The development of tissue-engineered constructs for the restoration of critical size peripheral nerve defects is an actual task of modern neurosurgery and regenerative medicine. In this work, we investigated the possibility of modifying the commercial resorbable collagen implant NeuraGen™ (Integra LifeSciene) by its seeding with adult cultured neural crest-derived multipotent stem cells (NC-MSCs) from hair follicle.

Method: NC-MSCs were isolated by explant method from the bulge region of the whisker follicle of adult rat and from human hair follicle (scalp region). The purity/identity of cell cultures was examined using immunocytochemical analysis, flow cytometry and RT-PCR. For seeding NeuraGen™ implant the following approach was used: 1) direct seeding of NC-MSCs on inner surface of implant; 2) combination of direct cell seeding with the filling of the implant cavity with polymerizable blood plasma-derived fibrin gel with NC-MSCs. NC-MSCs viability was evaluated by FDA/PI staining on 2, 24 and 72 h. The proliferation and metabolic activity of NC-MSCs were evaluated using Alamar Blue assay during 7d culturing. The ability of NC-MSCs to directed differentiation toward Schwann cells during 7d culturing in NeuraGen™ was assessed by immunocytochemical analysis. NC-MSCs were treated by neuregulin (20 ng/ml), a synthetic analog of retinoic acid e32 (1 μM) and forskolin (10 μM) for directed differentiation in Schwann cells.

Results: Adult NC-MSCs have phenotype $Sox10^+p75^+nestin^+$ $cytokeratin^-$ and demonstrate self-renewal capacity and ability to directed multilineage differentiation into Schwann cells, neurons, adipocytes, osteoblasts and chondrocytes at clonal level. FDA/PI staining showed NC-MSCs viability when cultured in NeuraGen™ and combination of NeuraGen™ with fibrin gel. Alamar Blue assay showed proliferation of NC-MSCs during culturing in NeuraGen™ with cell growth rate comparable with standard *in vitro* conditions. Proliferation rate of NC-MSCs in hybrid construct NeuraGen™+ fibrin gel was three times faster. Adult NC-MSCs were successfully differentiated into S100β-positive Schwann cells after seeding in NeuraGen™ and NeuraGen™+ fibrin gel.

Conclusion: The resorbable collagen implant NeuraGen™ alone and in combination with fibrin gel is a promising carrier for the fabrication of tissue engineered nerve conduit based on NC-MSCs or Schwann cells. Further evaluation of the effectiveness of this approach should be performed on *in vivo* animal models of peripheral nerve defect.

Keywords: Resorbable collagen implant, Peripheral nerve defect

OP-SP.07-01

Evaluation of Spinopelvic Parameters in Patients with Recurrent Lumbar Disc Herniation

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Aim: To evaluate spinopelvic parameters in operated lumbar disc herniations recurrence versus non-recurrence group.

Method: We retrospectively identified 107 patients. Of these 77 patients were operated for recurrence lumbar disc herniation, and the other 30 patients operated for lumbar disc herniation. Lateral lumbosacral graph including the femoral head was performed and the sacral slope (SS), pelvic tilt (PT), pelvic incidence (PI) and lumbar lordosis were measured and recorded. We compared with these parameters between two groups.

Results: In this study, there was a positive correlation (pearson correlation coefficient**:** 0.527 and 0.505 respectively, p<0.0001) between the lumbar lordosis angle, the angles of SS and PI but a negative correlation between the lumbar lordosis angle and recurrence (pearson correlation coefficient**:** -0.265, p=0.005). The mean lumbar lordosis angle was 34.86±9.83 in non-recurrent patients and that of recurrent patients was 28.78±10.35, which indicates a significant difference between these two groups (p=0.005). In addition, a positive correlation was found between the pelvic tilt and recurrence in the whole cohort (pearson correlation coefficient**:** 0.198, p=0.041). The mean PT was 12.06±9.50 in the non-recurrent group whereas the mean PT was 16.49±10.08 in the recurrent group. There was a significant difference between the mean values of these two groups (p=0.038).
Conclusion: In this study, there was a strong correlation between PT and LL angles and recurrent lumbar disc herniation. This should be taken into consideration in making a choice between lumbar micro discectomy or lumbar fusion.
Keywords: Spinopelvic parameters, Recurrence lumbar disc herniation, Microdiscectomy

OP-SP.07-02

Microsurgical Transfacet Approach to L1-L2 Disc Herniation, a Biomechanical and Neurological Specific Region

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Background: In comparison to lower lumbar disc herniation, L1-L2 disc herniation has unique characteristics which cause controversy in selection of surgical approach. The goal of this study was to present a novel surgical technique and evaluate the clinical outcomes and complications for treatment of L1-L2 disc herniation.
Method: Between 2010 and 2015, 29 symptomatic patients of L1-L2 disc herniation were treated by microsurgical transfacet approach. Operation time, intraoperative blood loss, and the post-operative time to return to routine work and daily life were documented. Clinical and radiological assessment were performed post-operatively and patients were followed-up for at least 12 months. Clinical outcomes were collected and assessed using the Visual Analogue Scale (VAS) and Oswestry Disability Index (ODI).
Results: 29 patients (15 Males) with a mean age 48.3±13.9 years were followed-up, the average follow-up period was 18.6 months (range 12-26). The mean operation time and intraoperative blood loss volume were 114 minutes (range 100-145 minutes) and 371 ml (range 300-480 ml), respectively. The mean VAS for back and leg pain and ODI were recorded pre-operatively 6.9±1.1, 7.7±1.0 and 68.1±6.1% and post-operatively in last follow-up time 1.8±0.6, 1.7±0.5 and 20.6±3.1%, respectively. Statistical analysis showed significant clinical improvement after surgery (P-value <0.001). Also, bony union was seen in 26 of 29 patients (89.6%).
Conclusion: Results show that the Microsurgical transfacet approach is an effective, reproducible and safe technique for surgical treatment of L1-L2 disc herniation. To our knowledge, this is the largest series of surgical treatment of L1-L2 disc herniation
Keywords: Lumbar, Disc, Transfacet approach

OP-SP.07-03

Clinical and Radiological Evaluation of Patients After Endoscopic Lumbar Surgery

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Background: Lumbar disc herniation is a clinical condition developing in the Background of degenerative spine disease, resulting in herniaton of nucleus pulposus. Less invasive surgical procedures are still being investigated. Endoscopic lumbar discectomy has been concluded in favorable outcomes and is now used widely. In this study, a total of 65 patients, operated endoscopically between 2009-2012 at Istanbul School of Medicine Neurosurgery Department, were enrolled.
Method: A total of 65 patients operated between 2009-2012 in our clinic were evaluated clinically and radiologically in the postoperative 1st day, 3rd and 6th months. The results were analysed by Friedman test and post-hoc analyses.
Results: Study group consisted of 65 patients with a mean age of 46,7 and the male/female ratio was 1,3. 26 patients were operated by transforaminal procedure and 37 were operated by interlaminar procedure and for two patients both techniques were used. Three patients were reoperated due to relapsed herniation. Oswestry Lom Back Pain Quastionnaire and Visual Analogue Scale were evaluated by patients in the early and late postoperative periods. Patients made profit of endoscopic lumbar surgery, with statistical significance
Conclusion: Achievement of microsurgical techniques in lumbar surgery can also be obtained with endoscopic procedures. When the appropriate patient is selected, less invasive procedure, less intervention to the stability of the spine and earlier mobilization can be provided.
Keywords: Endoscopic lumbar surgery, Lumbar disc herniation, Degenerative spine disease

OP-SP.07-04

The Clinical Comparison Between the Patients Operated for Unilateral Radiculopathy via Contralateral (Facet-Sparing) and Ipsilateral Side Approach

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Aim: To compare clinical outcomes of the patients operated contralateral or ipsilateral hemilaminectomy for unilateral radiculopathy in spinal stenosis.
Method: 20 patients were listed as Group 1 (Contralateral) whom had unilateral radiculopathy with spinal stenosis with/without lateral recess syndrome or foraminal stenosis. Decompression from the radiculopathy side was performed to the patients in Group 2.(Ipsilateral) back pain VAS and leg pain VAS were assessed at pre operative(preop),postoperative(postop) 1st month and postop 12th month. The results were assessed in statistically.
Results: 2 patients were excluded because of reoperation at 2nd

month from the group 2 to assessment 12th month VAS. There was no significant difference between two groups at 1st month back pain VAS and leg pain VAS. There was no significant difference between two groups at 12th month back pain VAS and leg pain VAS too. Dynamic stabilization was performed at 2nd month to two patients after first operations for instability. So, there was no difference of clinical outcomes between the patients threated by contrlaterral approach and ipsilateral approach if instability didn't occur. But there is a risk of instability of the same side approach and surgery owing to shaving of facet joint.
Conclusion: At this contrlateral approach, the recess of the contrlateral side and foramen can be seen better from the ipsilateral approach. So this is a facet-sparing approach to spinal stenosis with/without lateral recess syndrome or foraminal stenosis with unilateral radiculopathy. Contralateral approach to the unilateral radicular complaints is quite effective. With this approach, facet joints are preserved from possible instability.
Keywords: Contralateral approach, Ipsilateral approach, Facet-sparing

OP-SP.07-05

Outcome of Endoscopic Micro-Discectomy for Lumbar Disc Prolapse

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Background: Multiple modalities were used to relieve pain and decompress neural tissue, Endoscopic Micro-discectomy one of them is used to minimizing muscle damage by stripping paraspinal muscles. Aim of this study was to evaluate the outcome in patients with lumbar disc prolapse treated with endoscopic micro-discectomy.
Method: Twenty consecutive cases aged from 26-52 years were operated. All patients had a Single lateral projecting disc, only sciatica and (BMI) <40. Patients with Recurrent lumbar disc prolapse, (BMI) > 40 or indicated for spinal fixation were excluded. All patients had preoperative MRI. All patients were operated with the METRx system (Medtronics). Postoperatively, all patients were discharged within 24 h postoperatively. Patients were evaluated radiologically and by modified Macnab's criteria. Patients were followed up at 7th day, 1 and 3 months postoperative.
Results: Open surgical conversion was required in one patient with large dural tear before discectomy. Minor dural puncture occurred in another case in early practicing time. The average surgical time was 90 min (range 60-120 min). The mean hospital stay in this series was 15 hours (range 8 hours- 24 hours). 95% of patients had good-to-excellent results. One patient had postoperative discitis and were managed-conservatively. Three cases with severe back spasm required analgesics and muscle-relaxants.
Conclusion: Microendoscopic discectomy is minimally invasive procedure which is effective and safe. This system offers many advantages it reduces tissue trauma, allows direct visualization of the nerve root and disc diseases, and enables bony decompression, shorter hospital stay, early return to work.
Keywords: Disc prolapse, Sciatica, Endoscopic micro-discectomy

OP-SP.07-06

Safety and Efficacy of the Lateral Interpedicular Approach for Far Lateral Lumbar Disc Herniation

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Aim: To retrospectively evaluate 28 patients undergoing a lateral interpedicular surgical approach, and discuss the results in light of the current literature.
Method: This study included extruded or sequestered lumbar disc herniations extending to the far lateral space and intervertebral foramen, resulting in radiculopathy. A midline skin incision was made, the thoracolumbar fascia was opened at the midline, and a subperiosteal paravertebral muscle dissection was performed. The exiting nerve root in the lateral aspect of the pars interarticularis was exposed, and the sequestered or extruded disc fragment in the far lateral compartment was removed.
Results: This study evaluated 28 patients undergoing a lateral interpedicular surgical approach between 2013 and 2015. There were 15 males and 13 females, with a mean age of 50.5±9.65 years old. Two of the patients had disc pathologies at the L2-3 level, 11 at L3-4, and 15 at L4-5. The mean duration of the operation was 48.8±8.7 minutes, and the visual analog scale scores decreased from 9.32±0.61 preoperatively to 0.78±0.57 postoperatively. According to the MacNab classification, the postoperative 6thmonth results were excellent in 78.5% of the patients, good in 14.2%, and fair in 7.1%. None of the patients had complications, including nerve root injuries, CSF fistulas, or hematomas in at the surgical field.
Conclusion: The lateral interpedicular approach is a safe and easy-to-perform method with a short surgical duration, short hospital stay, and low complication rate for the surgical treatment of far lateral disc herniations.
Keywords: Far lateral, Lateral interpedicular, Lumbar disc herniation

OP-SP.07-07

Minimally Invasive Surgery of Spinal Column Through Neuroendoscopic Techniques

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We retrospectively studied 198 patients who underwent minimally invasive lumbar spinal column surgery**:** 130 spinal stenosis and 68 herniated discs, with a good response evaluated using the modified criteria of Macnab as excellent in 91% of males and 95% of females. women. The complication was CSF fistula in 6% of males and 4% of females. The hospital stay was on average 3 days and a cost reduction of 42% compared to surgery with spinal instrumentation. In conclusion, minimally invasive surgery using neuroendoscopic techniques is an excellent alternative for the spinal column degenerative pathology solution.
Keywords: Minimally invasive surgery, Spinal column, Narrow canal, Neuroendoscopy, Disc herniation

OP-SP.07-08

Relationship Between Bone Mineral Density and Lumbar Disc Herniation: Friend or Foe?

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Background: Several published studies have investigated the effect of bone mineral density (BMD) on lumbar disc disease; however, most studies that have been made on the elderly and osteoporotic patients. We aimed to investigate the effect of bone mineral density (BMD) in the etiopathogenesis of lumbar disc herniation (LDH) among premenopausal women and men younger than 60 years.
Method: A total of 100 patients(50 males, 50 females) who hospitalized in the Physical Medicine and Rehabilitation Clinic evaluated retrospectively. In the study group (G-I) included 50 patients (27 males, 23 females; mean age 39,81±8,96) with LDH, the control group (G-II) included 50 patients (23 males, 27 females; mean age 36,62±8,46) with lower back pain but with no finding of LDH detected on magnetic resonance imagings. Both the groups were subjected to BMD analysis by Dual Energy X -ray Absorptiometry. Biochemical parameters such as 25(OH) Vitamin D3, parathormone, calcium, phosphorus, alkaline phosphatase levels evaluated. IBM SPSS Statistics 22 (Turkey) program used for the statistical analysis.
Results: We did not determine any statistically significant relationship between LDH and non-osteoporotic BMD in this age group.
Conclusion: LDH is a multifactorial disease, and etiopathogenesis may be different in each age group and gender. Especially the cases in this age group should be educated on the numerous avoidable risk factors to prevent its development.
Keywords: Bone mineral density, Dual-energy X-ray absorptiometry, Lumbago, Lumbar disc herniation, Osteoporosis, Premenopausal women

OP-SP.07-09

The Role of Percutaneous Discectomy in Lumbar Disc Herniations

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Background: The primary goal of the surgical treatment of nerve root compression from a disc protrusion continues to be the relief of compression through the removal of the herniated nuclear material with open discectomy. In recent years, a number of minimally invasive nuclear decompression techniques for lumbar disc prolapse, protrusion, and/or herniation have been described. These methods, by sparing the paravertebral musculature, do notrequire general anesthesia; the early mobilization of patients and short hospitalization timesmake these methods very attractive. The efficacy of several alternative techniques has been described, but the results are not convincing.
Method: We present our study of 33 non-selected, consecutive patients with various degrees of disc compression in thelumbar spine, treated in our hospital over the last year with percutaneous discectomy. Pain relief was the primary outcome measure (VAS scale). Other outcome measures were functional improvement, improvement of psychological status, analgesic intake, return to work (Denis scale), and overall satisfaction from the procedure.
Results: In our study thepercutaneous discectomy was effective in 61% of patients. These patients showed statistic significant improvement in VAS and Denis scales, returned earlier to their work and daily activities, reduced their analgesic intake and remained satisfied with the procedure. We didn't have any infection-related complications.
Conclusion: Performing percutaneous discectomy may provide appropriate relief in properly selected patients with lumbar disc herniation. This is a safe and effective method with acceptable rates of accuracy. Percutaneous discectomy is not replacing microsurgery. It's just another useful technique available to us to offer satisfaction to our patients.
Keywords: Disc protrusion, Percutaneous discectomy, Lumbar spine

OP-SP.08-01

Management of Hangman`s Fracture

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Background: Traumatic spondylolisthesis of C2(Axis) which is also known as hangman fracture was initially noted in 1965 by Schneider et al. There are two kinds of it, i.e. (i) one of a hyperextensive-distractive mechanism with the very severe neurological lesion leading to the classical injury due to hanging and (ii) one of a hyperextensive-compressive mechanism without neurological lesion of current traffic injuries or with slight neurological symptoms. Management of hangman's fracture is still controversial. Indications for surgery depend on the type of hangman's fracture and/or additional injuries ofl disc or ligaments.
Method: 27 patients with hangman's fraeture were treated between 2005 and January 2017. All patients presented with neck pain and 7 with neurological deficit.3 patients with stable fracture were treated by rigid collar. Of the 17 surgically treated patients 16 were managed with screws, placed on the C2 pedicles. Of them 7 required additional fixation with rod & screw on the lateral masses of C3 and another with C4 pedicle screw as he had associated C3 body fracture. 1 patient underwent anterior discectomy and fusion with internal fixation.
Results: All the patients had good post surgical outcome with satisfactory fusion of the fractures.
Conclusion: Compared to conservative treatment, surgery offer significant benefits**:** 1) immediate, better and stable reposition; 2) high fusion rate; 3) shortening of the treatment period with better quality of life. Though technically difficult, transpedicular screw

fixation is the best option as it preserves the motion more than other techniques.
Keywords: Hangman fracture, C2 pedicle, Pedicle screw

OP-SP.08-02

Nerve Transfer for Reconstruction of Hand in Tetraplegia After Cervical Cord Injury

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OP-SP.08-03

Treatment of Vertebral Traumatic Fractures with Cranio-Caudal Expandable, Intravertebral Implant (SpineJack) in Combination with a High Viscosity PMMA Cement

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Background: Clinical and radiological evaluation of the use of a cranio-caudal expandable, intravertebral implant (SpineJack) in combination with a high viscosity PMMA cement for the treatment of vertebral traumatic fractures.
Method: From May 2014 to June 2016 consecutive 30 patients (21 males and 9 females) with traumatic vertebral body fractures from Th8 to L4 were operated on. Fractures were classified according to AO**:** A1 (17), A2 (2), A3 (10), B2 (1), In case of B2 fracture transpedicular stabilization was also performed This technique was facilitated by use of intraoperative CT O-arm scan and StealthStation S7 Surgical Navigation System.
Results: Reduction in VAS from 7.87 to 2.73. Increase in ODI scale from 77.33 preoperatively to 25.33 postoperatively. Mean height restoration 25.33 % (Min 4.09 % Max 42.35 %) of fractured vertebral body.
Conclusion: The use of a cranio-caudal expandable, intravertebral implant (SpineJack) in combination with a high viscosity PMMA cement is safe and effective technic, significant height restoration is combined with good clinical outcome.
Keywords: SpineJack, PMMA, Height restoration

OP-SP.08-05

Outcome of Early Surgical Decompression in Traumatic Central Cord Syndrome; A Controlled Clinical Study

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Background: Since the description of traumatic Central Cord Syndrome its treatment has been a subject of discussion. A debate between surgical decompression and conservative treatment has been raised. Even if surgical treatment is chosen, the timing of the procedure is also debated. Our aim is to evaluated the clinical outcome of early surgical decompression in traumatic Central Cord Syndrome.
Method: Thirty patients with traumatic Central Cord Syndrome admitted to the Neurosurgical Department of Cairo University were divided into two groups, a conservative group (n=15) and a surgical group (15). The surgical group patients were treated by cervical laminectomy and duroplasty within 24 hours from the onset of trauma. Assessment was done and recorded at admission, hospital discharge, 1 and 3 months interval. American Spinal Injury Association (ASIA) impairment scale, spasticity, bladder function and neuropathic pain scores were recorded.
Results: Clinical improvement was observed in 8 patients (53.3%) in the surgical group compared to 4 patients (26.7%) in the conservative group.
Conclusion: Superior results of our study favor early surgical decompression for the management of traumatic Central Cord Syndrome.
Keywords: Central cord syndrome, Early, Surgical decompression

OP-SP.08-06

Vertebral Artery Injuries

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Vertebral arteries injuries may be**:** 1- traumatic, 2- iatrogenic, caused by various interventions, 3- spontaneous injury- dissection, with or without trivial trauma. Most often, injuries remain asymptomatic due to adequate collateral circulation; however, at times it may lead to significant morbidity and occasional mortality. Over 34 years of neurosurgical practice, we have encountered half dozen cases of vertebral artery injury. Few cases of post-traumatic vertebral artery injuries due to blunt trauma to head and neck are presented. We present two additional cases of iatrogenic vertebral artery injury (one with perioperative bleeding, another with vertebral artery dissection). Diagnostic modalities, therapeutic challenges and outcome is presented. Etiological classification of vertebral artery injury is variable (post traumatic, iatrogenic, and spontaneous). We will discuss normal anatomy of vertebral arteries and abnormal anatomic variations. Majority of vertebral artery injury may remain silent or asymptomatic, when occlusion is complete; however, few could be symptomatic (vertebral artery dissections with ischemic manifestations, or pseudo aneurysms with risk of bleedings), which may lead to significant morbidity and even mortality. Diagnostic modalities to detect these injuries are discussed, along with various radiological classifications. Treatment strategies and outcome, as well as literature review is presented. There are various etiological factors causing vertebral artery injuries. Majority of injuries may remain asymptomatic (due to adequate collateral circulation), therefore may remain undetected. Once suspected and/ or diagnosed, appropriate treatment strategies should be instituted, to avoid significant risk of morbidity, and mortality, even though the latter is uncommon.
Keywords: Vertebral artery, Injury, Dissection

OP-SP.08-07

Traumatic Injuries of the Spine

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Background: Traumatic injuries are most common cause of spinal cord injuries and disability trauma-related injury contributes significantly to morbidity&mortality. The aim of this work is to study the causes&most effective factors (medical&surgicall) which leads to the best prognosis of this devastating injuries.
Method: During the interval between 1997-2016, 947 with spinal trauma have been managed by us at hospitals in Sana'a & reviewed retrospectively. 402 are excluded from this study due to presence of penetrating injuries. The remaining (545) were included in this study. 410 of them due to car accidents, 108 due to fall down & 27 due to assults, 320 male & 225 female, 72 of fall down female & 45 under 10 years old. MIN age was 18 months old, MAX age was 75 years old, the average age was 35. 365 with acute or subacute trauma & 180 with old trauma, 64 patients of them have been operated before.
Results: CT scan was done for all the patients along with plain x-rays&mri was done for 268 of them, 432patients went under surgery (group II) 123 conservative treatment (group I), 214 out of 432 patients went to surgery during 72 hours post injury, 218 patient operated after the 72 hours period, 228 decompression with fixation, 30 correction of fixation and decompresion, 34 removal of fixation with decompression, 28 removal of fixation & 112 decompression without fixation. They were managed according to ATLS& after that they were evaluated according to ASIA scores group (I) 1-39 grade A 2-24 gradeB 3-23 gradeC 4-37gradeD group (II) 1-•75patients (considered) grade A, 2-52 patient grade B, 3-170 patients grade C,4-135grade D. with follow up period from 6m to11 yrs, average 2.5ys. 34 died (11groupI) (23 Group II) 40 cannot be followed up (12GroupI)(28 group II) 248improved in group II, 48 in group I,19 deteriorate 12 in goup II, 7 in group.
Conclusion: Good early Intensive medical care&accurate surgical intervention considering the type & time of the surgery play important role in prevention of secondary injuries & improving the clinical outcome of patients with traumatic spinal injuries.
Keywords: Spine, Trauma, Surgery, Surgical, Conservative, Trauma

OP-SP.08-08

Cervical Spine Trauma: Management at Cotonou, Benin Republic

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Aim: To establish an epidemiological and clinical data and also therapeutic management of cervical spine.
Method: Prospective study of 51 cases treated in our department from 2010 to 2016.
Results: Mean age 34.74 y ranged from 3.5 to 80 y. Male predominance ratio 6/1. Traffic accidents make up majority of aetiologies 54.49% followed by falls. Admission within 24 hours. The neurological status according to Frankel scale showed grade A in 32.56%. The neuroradiological data showed upper cervical spine injury in 13 cases and lower cervical spine in trauma in 38 cases. Spinal cord lesions without bone involvement were diagnosed in 6 cases. Cervical traction were carried out in 83.72%. Surgical treatment in 67.44%. Anterior approach were performed 69% of cases (dissectomy + bone graft, or corporectomy and bone graft with cervical anterior plate). The posterior approach was performed in 28.5%. Patients improved in 44 cases. 9 patients have stationary status for 9 nine patients.
Conclusion: Cervical spine trauma is frequent with a high rate of mortality. The most important factors are the prevention of traffic accidents, the efficient management of the cervical spine trauma. From the accident site to the hospital and rehabilitation by a multidisciplinary team after surgical treatment which allowed for decompression, stabilisation and outcome improvement.
Keywords: Cervical spine, Surgical, Anterior approach, Upper cervical

OP-SP.08-09

Cervical Spine Facet Dislocations: About 36 Cases

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It refers to anterior displacement of one vertebral body on another. Without a fracture, it can be an unilateral or bilateral facet dislocation. These are serious lesions, can be life threatening. They need an surgical management. Our study is retrospective on 36 cases of low cervical facet dislocation, collected in the Department of Neurosurgery of the CHU Ibn Rochd of Casablanca, over a period of six years, between 2011 and 2016. We have a male domination with 33 men for three women, the male to female incidence ratio was estimated to 11/1. The average age was 47.5 years, with extremes ranging from 17 to 78 years. Road traffic accidents were the most frequent cause. The symptoms were dominated by neck pain; A sensory and motor deficit was noted according to the Frankel grade classification. Symptoms of severity were present in 10 patients. The couple cervical x ray and cervical CT scan, performed in all our patients, made the diagnosis with a predominance on stage C5-C6 (33%) and rarely C7-D1 (2 cases). MRI was performed in 30 patients. Treatment requires medical management, axial cranial traction followed by per operative reduction with osteosynthesis using the anterior approach (31 patients); In 5 of our patients, reduction was not possible until we used the posterior approach. The short-term outcome was marked by clinical improvement in 33 patients, so 91%. Unfortunately We had one death. Cervical dislocations are serious lesions that can be life-threatening. They need a surgical management.
Keywords: Facet dislocation, Bilateral facet dislocation, Frankel grade classification, Osteosynthesis, Anterior approach

OP-SP.09-01

Expanded Indications of Endoscopy to Treat Anterior Cranio-Vertebral Junction Lesions

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Background: Extended endoscopic endonasal approaches (EEA) are increasingly being used to address lesions of the anterior craniovertebral junction (CVJ). The variations of EEA and how these may expand the indications in the surgical approaches to CVJ are illustrated and discussed.
Method: From 2009 to 2015, 41 consecutive patients presenting anterior CVJ disorders underwent EEA alone or combined with open approaches at our institution. Twenty-two tumors including**:** 5 ventral foramen magnum/clivus meningiomas, 8 chordomas and 9 metastases. Six patients underwent a combined anterior transcervical - endoscopic endonasal screw fixation approach for non union of odontoid fractures. During the same period, the EEA was used in other 12 patients with irreducible compression of the brainstem by the odontoid process. An endoscopic endonasal odontoidectomy was carried out with preservation of anterior arch of C1 in all patients. Lastly we report a resection of a ventral pontine cavernous malformation operated via an EEA.
Results: Gross total removal was achieved in 4 meningiomas, in 6 chordomas and in 5 patients with metastases. The most frequent complication was cerebrospinal fluid leakage in 2 patients with meningiomas. The radiological follow-up revealed a regular ossification in cases of C2 fractures. Adequate bulbar-medullary decompressions were achieved in all patients with preservation of anterior arch of C1, in absence of post-operative instability and posterior fixation.
Conclusion: The transnasal fully endoscopic technique may represent an alternative approach for the resection of ventral CVJ tumours also allowing the preservation of the integrity of the anterior arch of C1.
Keywords: Cranio-vertebral junction, Preservation anterior column, Extended endoscopic approach

OP-SP.09-02

3-D Printed Models- an Emerging Investigational Revolution for Craniovertebral Junction Surgery

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Background: Complex craniovertebral junctional anomalies can be daunting to treat surgically. Pre-operative information regarding the osseous abnormalities, course of the vertebral arteries, and size of the pedicles and location of the foramen tranversarium is invaluable to surgeons operating on these challenging cases. The authors present their experience with the emerging technology of 3-D model acquisition for surgery for complex craniovertebral junction region anomalies.
Methods: Fifteen patients with complex craniovertebral junction abnormalities had 3D printed model made from thin CT scans using a 64 slice CT scanner. The inclination of the joints, the presence of false articulations, and size of the pedicles and the course of the vertebral artery was studied pre-operatively on the acquired 3D models. The model was scaled to actual size and was kept beside the operating surgeon in its anatomical position during surgery. The potential advantages of the model over conventional radiological investigations are discussed.
Results: Fourteen patients had basilar invagination. Ten patients had partial or complete occipitalization of the atlas and one patient had a bifid arch of atlas. The vertebral artery had an abnormal course in 6 patients. Vertebral artery injury was avoided in all the patients. All patients improved in their neurological deficits post-operatively.
Conclusion: 3D models can be an invaluable aid during surgery for complex craniovertebral junction anomalies. The information available from a real life size model supersedes the information available from 3D reconstructed CT scan imaging. It is both cost effective and easy to build.
Keywords: Complex craniovertebral anomalies, 3D models, 3D printing, Simulation, Atlantoaxial fixation

OP-SP.09-03

Computed Tomographic Morphometric Study of the Occipital Bone Thickness in 100 Adults Moroccan Patients. Application to Occipito-Cervical Fixation

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Background: Occipital cervical fixation is an important technic with certain risks due to adjacent anatomic features. The aim was to evaluate occipital bony thickness in Moroccan population in order to determine the variability of thickness and to assess the feasibility and safety of screw placement in these patients.
Method: We evaluated occipital bony thickness using computed tomography imaging in 100 patients (30 females and 70 males; age range, 18–70; mean, 36.2 ± 11.9 years). Axial CT cutting was made at 1.25-mm intervals. CT measurements were performed on the bone windows at two levels starting at 1cm under the external occipital protuberance (EOP) and 1cm inferior to this level. Three measurements were performed both sides at 1cm interval. We acquired 14 values.
Results: The mean thickness of occipital bones varied between 10.003 to 13.964mm in the left and 10.747 to 13.715mm in the right (±2.8) and between 9.845 to 11.478 mm in th left and 9.903 to 11.371 in the right (±2.5) at 1 cm and 2 cm above EOP respectively. The thickest point was in the midline with 17.366 mm and 12.579 mm at 1cm and 2cm above EOP respectively, Intra-individual and inter-individual discrepancies are found between left and right sides ($p<0.05$) but not between age and sex at two levels.
Conclusion: This study findings suggest that there were significant differences between individuals and ethnics. The preoperative CT scans of occipital bony thickness should be thoroughly analyzed of patients undergoing occipital cervical fixation. These for successful intraoperative fusion and to ovoide complication.
Keywords: Anatomy, Occiput, Computed tomography, Screw fixation

OP-SP.09-04

High Cervical Antero Lateral Retropharyngeal Approach is This the Twilight Zone?

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The first High Cervical Antero Lateral Retropharyngeal (HCALR) approach was reported by Steven GC for a clivus chordoma in 1966. Anterior approaches to the spine were often developed in response to problems presented by tuberculous spondylitis. This approach is indicated in anterior high cervical spine cases such as tumor resection, abscess drainage, atlantoaxial subluxation; decompression and stabilization. Up to our knowledge, only 21 papers in the literature mentioned this approach. It's main advantage over posterior approaches is easy positioning and minimal soft tissue dissection. HCALR approach provides a wide exposure (of anterior upper cervical spine, lower clivus and brain stem region) and feasibility for instrumentation. The limited space in which important neurovascular and visceral structures course and overlap contributes to the Complexity of its anatomy. Navigating this intricate anatomy is essential for safety of this approach and has been a drawback for utilizing the retropharyngeal corridor. This approach is one of the safest and most effective methods available to access the CCJ. The benefits are clearly out weighing the risk and complications.

Keywords: Craniocervical junction, Anterior approach, Anatomical corridors, Minimally invasive

OP-SP.09-05

Additional Surgical Method Aimed to Increase Distractive Force During Occipitocervical Stabilization: Technical Note

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Craniovertebral junctional anomalies constitute a technical challenge. Surgical opening of atlantoaxial joint region is a complex procedure especially in patients with nuchal deformity like basilar invagination. Stabilization surgery regarding this region should consider the fact that the area exposes excessive and life-long stress due to complex movements and human posture. Therefore, all options should be considered for surgical stabilization, and they could be interchanged during the surgery, if required. A 53-year-old male patient applied to outpatients' clinic with complaints of head and neck pain persisting for a long time. Physical examination was normal except increased deep tendon reflexes. The patient was on long-term corticosteroid due to an allergic disease. MRI and CT findings indicated basilar invagination and atlantoaxial dislocation. The patient underwent C0-C3-C4 (lateral mass) and additional C0-C2 (translaminar) stabilization surgery. The technique can be described as the binding to the occipital plate by extra rod without a need for additional kit between C2 translaminar and C0, that was performed as adjuvant to C0-C4 lateral mass and pedicle screw stabilization surgery. This method may be added to the occipitocervical stabilization by 2 extra rods without a need for any additional material. Moreover, rod may be connected to the desired site of the occipital plate, and difficulties regarding rod connection could be overcome. We believe that this technique, which could be easily performed as adjuvant to classical stabilization surgery with no need for special screw and rod, may improve distraction force in patients with low bone density

Keywords: Occipitocervical stabilization, Basilar invagination

OP-SP.09-06

Anterior Screw Fixation in Type II Odontoid Fractures: Keys for Better Outcome in Early Experience

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Background: Representing up to 15 % of cervical injures, odontoid type II fractures may cause spinal cord compression through atlanto-axial instability. Anterior odontoid screw fixation provide direct fracture site stability, high fusion rate and most importantly keeping cervical spine move free. We will highlight success keys in early experience for better outcome.
Method: We operated eight cases with traumatic type II odontoid fractures in Neurotraumatology unit, Cairo University hospitals from march 2015 till December 2016.five males and three females were included. Preoperative MRI and dynamic CT were among assessment criteria. Uni-planner fluoroscope was used.
Results: No post operative deficit appeared. one screw was inserted in all cases. post-operative and 6 weeks later CT cervical spine showed stable reduced fracture site.
Conclusion: Anterior odontoid screw fixation done with prior good selection of the patient and fracture shape is an effective motion-preserving surgical option for type II odontoid fractures. Limited resources shouldn't prevent starting experience especially in developing countries. But larger studies are needed.

Keywords: Odontoid, Screw, Atlanto-axial

OP-SP.09-07

Surgical Experience with Posterior Atlantoaxial Segmental Fixation

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Background: The atlantoaxial instability is a serious problem that can be solved in most recent studies posterior reduction and fixation surgery. There are many described techniques for C1-C2 fixation. In this work C1-C2 segmental screws was used aiming to study its efficency and safety.
Method: Between jan 2011 and September 2016, 22 patients underwent posterior fixation using C1 lateral mass and C2 screw (pars in 4 cases and pedicle in 7 cases, translaminar screw in 11 case) with rod fixation. It should be mentioned that before screw placement, reduction was achieved by both traction and opening of C1-C2 joint and insertion of bone either from iliac crest or spinous process of cervical vertebrae that help in distraction of the joint and fusion Transoral reduction and decompression was done first in two

cases. Occipital condyle fixation (C Zero) was adone in addition in a single case.
Results: Reduction +/- decompression and C1 lateral mass and C2 pars, pedicle or translaminar screw were used to achieve C1-C2 stabilization in all patients. Optimum insertion was achieved in all screws. There was single case with dural tear and another case with wound infection but there were no permanent complications. Myelopathic manifestation show improvement to varying degree in all cases. Rigid fixation and sabilization was confirmed on postoperative radiographs and maintained on follow-up radiograph.
Conclusion: Posterior reduction and fixation using C1 lateral mass and C2 screws is an effective and safe method of stabilizing the atlantoaxial spine.
Keywords: Craniocervical junction, C2 screws, Atlas lateral mass screw

OP-SP.09-08

Posterior Approaches to Cervical Spine

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Background: Stabilization and fusion of unstable spine from cranio-cervical junction to cervico-thoracic junction can be achieved through various posterior approaches. Different techniques and fixation devices have evolved over the years that have progressively produced more rigid, physiological fixations and minimal complications.
Method: This is a retrospective study from 2004 to 2016 where cervical spines were operated and stabilized through posterior approaches. There were 336 patients of 9 to 78 years age and male**:** female ratio of 2.5**:**1. The instability was by road traffic accident in 212 patients, postoperatively after decompression in degenerative canal stenosis in 114, post-infective in 4 and tumor in 6. The CV junction and upper cervical spine was involved in 156 patients, sub-axial spine in 172 and cervico-thoracic junction in 8.
Results: All these patients underwent posterior fixation under general anesthesia in prone position. Sublaminar wiring was done in 32 (10%) patients, cranio-vertbral fixation by Hartshill rectangle in 58 and trans-articular fixation in 86, lateral mass fixation in 43, transpedicular fixation in 106 and combined lateral mass and transpedicular fixation in 11. Reduction and fusion was achieved in all at the end of three months. There was no neurovascular injury or neurological deterioration. Of 68 malpositioned screws out of 1192, only 15 needed to be either readusted. Mortality was 12% due to respiratory infection.
Conclusion: Posterior approach can be applied to most pathologies of cervical spine where better stability can be achieved. The newer fixations methods provide a very strong stability, requiring minimal external immobilization and allow early return to work.
Keywords: Cervical spine, Stabilization, Fusion, Posterior approaches

OP-SP.09-09

Pure Endoscopic Transnasal Approaches to the Craniovertebral Junction Pathologies

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Background: The craniocervical junction is a remarkable anatomical area with unique anatomical and functional relationships. Multiple etiologies and surgical approaches were defined for cranicervical junction pathologies. Recently, endoscopical approaches are more common performed all over the world. Craniocervical junction surgery is an important challenge for surgeons and microscopic transoral resection with posterior fixation is a traditional procedure traditionally. Endoscopic endonasal clivus and odontoid surgeries are alternative approachs to the microscopic transoral method.
Method: The authors reviewed 26 patients that endoscopically operated for cranicervical junction pathologies between 2008-2016 years.
Results: We identified 26 cases involving involving endoscopic endonasal approaches for surgical management of a variety of pathologies located within the craniovertebral junction in Ankara University Medical School between 2011-2016 years. Male female ratio was 15/11.We detected 11 clivus chordomas, 5 basilar invagination, 6 odontoid lesions (1 hydatid cyst and 5 rheumatoid arthritis pannus), 1 clivus chondrosarcoma, 1 clivus meningioma, 1 clivus cholesterol granuloma and 1 clivus angiomyoma. 6 patients underwent an additional posterior decompression or fusion either before or after the endonasal procedure. Patient's mean modified rankin scale and visual analog scale scores were 3 and 4 respectively. The follow up time ranged from 12 to 50 months.
Conclusion: Despite gold standart craniocervical junction surgical management was introduced as microscopic transoral approach, endoscopic approaches are highly safe and effective method in this region pathologies with developing technique and experience.
Keywords: Endoscopy, Craniocervical junction, Clivus, Odontoid

OP-SP.10-01

The Microendoscopic Approach for Far Lateral Lumbar Disc Herniation: A Preliminary Series of 33 Patients

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Background: In far lateral lumbar disc herniation the laterally herniated fragment typically could not be exposed by the standard posterior hemilaminectomy technique. The author presents his initial 4 years experience and surgical outcome using a posterior endoscopic enlarged trans-pars approach.
Method: The study was carried out in the period between February, 2011 and January, 2015; 33 consecutive patients with symptomatic far lateral lumbar disc herniations were operated upon using the reported technique. The mean age was 39.3 years, range**:** 26-59 years. Patients were followed-up for 4 years (mean follow-up was 19.9 months, range**:** 3 – 47 months). Patients had their clinical

outcomes reviewed and evaluated in terms of pain Visual Analogue Scale (VAS) and Modified Macnab criteria (MMC).
Results: Mean operative time was 91 minutes (range**:** 55–166 min.). At initial follow-up, according to MMC (3months postoperative) 86% of patients were pain free (28/33) and considered their postoperative status as excellent, 14% as good (5/33), no patients reported a fair or poor outcome. There were no new postoperative neurological deficits or major complications. There were three cases of accidental medial facetectomy due to excess bony work, a single case of dural tear and a single case that had a transient postoperative neuralgia that persisted for 2 weeks.
Conclusion: Far lateral lumbar disc herniation can be treated adequately with the reported microendoscopic modified posterior trans-pars approach. The technique is associated with marked improvement in back pain and lower limb symptoms, as well as a short length of hospitalization.
Keywords: Endosopic, Minimally invasive, Foraminal disc, Far lateral herniation

OP-SP.10-02

Efficacy of Endoscopically Assisted and Pure Endoscopic Lumbar Disc Surgery. 10 Years Experience

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Background: Efficiency of endoscopy assisted pure endoscopic (transforaminal and posterolateral) lumbar disc surgery is still point of discussions. The aim of this retrospective cohort study was to evaluate the biggest series of patients endoscopically operated on lumbar bulged disc the efficacy and benefits differentiated approaches for treatment of lumbar discs herniation.
Method: Patients with lumbar pain or/and unilateral lower extremity radiculopathy, with diagnosed by MRI lumbar disc herniation from L3 to S1 (one or two levels) were endoscopically operated through tubular retractors (Endoscopically Assisted Discectomy) or by mean of Percutaneous Endoscopic Lumbar Discectomy (PELD). Oswestry Disability Index (ODI) and the Visual Analogue Scale (VAS) for back, and leg pain were evaluated pre-operatively, post-operatively, and at the latest follow-up. Functional outcome was evaluated using MacNab`s criteria.
Results: 1750 patients were included to this study. Post-operatively significant improvement in the ODI (p=0.006), VAS back pain (p<0.0001), and VAS leg pain on the pathology and the approach side (p = 0.004, p = 0.021, respectively). At average follow-up of 31.3 ± 20.7 months, there was also significant improvement in the ODI (p<0.0001), VAS back pain (p=0.001), and VAS leg pain on the side of pathology (p<0.0001, p = 0.001, respectively). The functional outcome was excellent and good in 95.2%. The complication rate was 1,25%. 52 (2,9%) patients have the repeated surgery due to herniation recurrence or instability.
Conclusion: Differentiated endoscopically assisted and percutaneous endoscopic lumbar disc surgery is an effective technique for treatment of all types of bulged lumbar discs.
Keywords: Transforaminal endoscopic discectomy, Endoscopic approach, Portal discectomy

OP-SP.10-03

Oblique Lateral Lumbar Interbody Fusion (OLLIF): A Comparative Study of Perioperative and Clinical Outcomes

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Background: Minimally Invasive (MI) fusions of the lumbar spine are associated with lower complication rates and improved outcomes relative to their open equivalents, but have not gained widespread acceptance in part because they are technically challenging procedures. Oblique Lateral Lumbar Interbody Fusion (OLLIF) is a new MI fusion of the lumbar spine that is technically straightforward, because it does not require direct visualization. In OLLIF the disk space is approached through Kambin's triangle guided by electrophysiological monitoring and biplanar fluoroscopic imaging. Unlike other MI fusions, OLLIF does not require facetectomy or laminectomy.
Method: This is a retrospective review of perioperative outcomes and technical notes from 292-OLLIF surgeries on 538-levels with a control group of 58 open Transforaminal Lumbar Interbody Fusions (TLIFs) on 153-levels, all performed by the same surgeon. We also collected fusion rates and patient reported outcomes on the oswestry disability index (ODI) one year post surgery for the OLLIF group.
Results: OLLIF cuts surgery times and hospital stay in half relative to TLIF (59/132-min, 4.7/2.3-days respectively) and reduces blood loss by over 87% (355/44ml). OLLIF patients report significant improvements on the ODI. OLLIF is a straightforward procedure with a steep learning curve for the surgeon. OLLIF can be adapted to correct spinal deformities like scoliosis and for fusions of the thoracic spine.
Conclusion: OLLIF is a MI fusion of the lumbar spine that is safe, effective and technically less demanding than comparable procedures. OLLIF has the potential to improve clinical outcomes relative to the current standard of care.
Keywords: Spinal fusion, Lumbar spine, Minimally-invasive surgery

OP-SP.10-04

Investigation of the Factors Affecting Reherniation of LDHs according to Their MRI and Radiographs' Findings: A Prospective Study

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Background: Lumbar disc herniation(LDH) causing low back pain and radiculopathy exacts serious losses on economies worldwide. Reherniation is the experience of another LDH at the same level and same side after a pain-free period. Causes for a recurrent disc can be multifactorial. In this study, the factors affecting reherniation after discectomy prospectively have been investigated.

Method: 816 patients were underwent discectomy surgery at Neurosurgery department of BRSHH between the years 2014 and 2015, the patients who followed up at least 12-month after first surgery were included. The patients' demographic characteristics such as age, gender, job, BMI as well as lumbar MRI parameters such as disc type, degeneration grade, disc space height index and pre- and postoperative clinical status had been evaluated. The patients were divided into who had recurrent LDH and others (control group) and the comparison had been performed between both groups using all above parameters prospectively.
Results: 816 (430 women, 386 men) patients were underwent discectomy for 842LDH levels. The mean age**:**46,9(17-82). The mean follow-up period**:**23,8(12-37) months. The most common symptom was leg pain(100%). Gender, age, symptom's duration, surgery condition and period, trauma, comorbidities, smoking, lordosis angle, ROM, Modic changes, postoperative hospital stay, postoperative mobilization and early returning to duties are not effect our patients' recurrence of LDH.
Conclusion: Deficits on presentation, high socioeconomic status, conform duties, minimal annular fissure, extruded LDH with fragment, advanced degeneration grade(IV), and IDH≤0,40 may reduce recurrence risks of LDH. IDH≥0,58 and preserving ligamentum flavum discectomy technique may increase recurrence risks of LDH.
Keywords: Lumbar disc herniation, Recurrent lumbar disc herniation, Risk factors, Disc type in MRI, Intraoperative disc type

OP-SP.10-05

10 Year Analysis of Usage of Endoscopic Portal Discectomy in Patients with Lumbar Disc Herniations

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Background: Technological progress during past 15 years made us possible to use really minimally invasive techniques in treatment of lumbar disc herniations. But minimizing operative trauma has it's downfalls. Portal endoscopic methods are well-known for more than 10 years, but it's really difficult to compare them and measure their effectiveness. During past 10 years we thoroughly accumulated experience in this technology and have compared different endoscopic methods and microsurgical ones.
Method: During past 10 years we operatied 2273 patients. 1510 of them were operated using endoscopic portal discectomy. Comparing group that was treated using microsurgical discectomy consisted of 763 patients. We measured 3 main aspects of endoscopic methods**:** 1) clinical effectiveness (using MacNab, VAS and EuroQual-5D scales before, after and 6 months after operation), 2) reoccurrence rate and 3) technical usability and capabilities of methods.
Results: According to our data after the operation patients patients had statistically significant difference in quality of life in favor for endoscopic methods. But 6 months this difference is becoming insignificant. Thus we assumed that this technologies don't have a long-term difference. Reoccurrence was also insignificant. The most interesting fact was that technical capabilities of methods really differ.
Conclusion: Endoscopic and microsurgical methods are almost the same in regard of clinical recovery of patients, but technical differences make this methods more preferable in some cases. Thus we made a clinical algorithm for decision making in choosing the best method.
Keywords: Portal endoscopic discectomy, Lumbar disc herniation, Minimally invasive spine

OP-SP.10-06

Foraminoplastic Extra-Kambin's Triangle Approach in Percutaneous Endoscopic Lumbar Discectomy and Foraminotomy

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Percutaneous endoscopic lumbar discectomy(PELD), have been one of the most less invasive techniques in treating herniated nucleous pulposus (HNP) patients. However, there are potentials for exiting root injury and for the treatment failure in highly migrated HNP cases. Foraminoplastic PELD (FPELD), especially when the working sleeve is mostly outside of the Kambin's triangle, avoids these two circumstances with high satisfaction. FPELD starts with placing the working sleeve just lateral to the corresponding superior articular process (SAP) and drilling of the SAP. Pedicles, either upper or lower, or lateral portion of isthmus are partially drilled whenever needed for better visualization of the pathology. During the whole procedure, exiting root is under full endoscopic visual control and is minimally irritated by not passing the working sleeve through the neural foramen. Foraminotomy in foraminal stenosis cases follows the same process. From April 2016 to February 2017, 31 patients underwent FPELD at Cheonan Woori Hospital, Cheonan, South Korea. Male to female ratio is 13 to 18. Mean age is 52.5. The disc levels were 23 at L4-5, 5 at L3-4 and 3 at L5-S1. HNP patients were 27 and foraminal stenosis patients were 4. Mean VAS score decreased from 8.2 to 2.6 immediately. According to modified Macnab criteria, excellents were 22 (80.64%), goods were 6 (22.6%) and fairs were 3 (9.7%). No patient suffered from neurologic deterioration. There were 2 cases with recurrent HNP. FPELD under full endoscopic visualization of the exiting root is a relatively safe and satisfactory surgical technique.
Keywords: Stenoscope, Foraminoplastic, Endoscopic discectomy, Foraminal stenosis

OP-SP.10-07

Minimally Invasive Spine Surgery Concept in Recurrent Lumbar Spine Radiculopathy

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Aim: To evaluate the use of endoscopy as a minimally invasive spine surgery, in patients with recurrent lumbosacral radiculopathy.
Method: From 2005 to 2016, out of 1000 of patients with lumbar spine radiculopathy, 200 patients with recurrent lumbar spine radiculopathy underwent spinal endoscopy procedures, recurrent disc (n=180), and recurrent foraminal compression (n=20), included 120 males and 80 females with age ranged between 25-74 years. All patients underwent preoperative plain films (A-P,lateral and dynamic views), MRI and CT scan. Follow up period ranged between 6 – 132 months.

Results: 2 patients (1%) showed motor deficit,170 patients (85%) reported sciatica free,120 patients (85%) showed excellent outcome. Small dural tears occurred in 10 patients(5%) with no postop CSF leak. Two patients (1%) recorded superficial wound infection.
Conclusion: Spinal endoscopy is an effective minimally invasive spine surgery. It is a real practice rather than imagination. It could be a good alternative to standard open surgery in recurrent lumbar spine radiculopathy. It offers less tissue destruction, It obviates the need of implants, less hospital stay, and early return to work. Complications are comparable for those occurred in standard surgery.
Keywords: Recurrent disc, Spine, Endoscopy, Minimal invasive

OP-SP.10-08

Lumbar Herniated Disc: Recurrence and Post Operative Fibrosis

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Background: Surgery of lumbar disc herniation is not always successful. One of the main worries of the neurosurgeon is to be confronted to recurrence or failed back surgery syndrome (FBSS).
Method: Of 819 patients who underwent surgery for a lumbar herniated disc, during a period of 10 years (2005-2014), sixty one (7,1%) with recurrences benefited from a new surgery. There were 39 male (64%) and 22 female. Mean age was 43,7 years (range**:** 19-65 years). On the other hand, 15 patients suffered from FBSS due to epidural fibrosis.
Results: Fifty two recurrences were located at the same level (ipsilateral in 38 cases, contralateral in 14 cases), above or below the first operated level in 9 cases. In 13 patients this second surgery was realized before 6 months, between 6 to 12 months in 7 cases, from one to 2 years in 13 cases, after 2 years in 28 patients. Two patients presented a second recurrence which needed a third surgery. Poor results were observed in 4 patients. For FBSS, spinal cord stimulation was realized in 5 patients with a pain relief comprised between 70 to 90 %. In the remaining 10 cases, this was achieved with medical treatment.
Conclusion: Rigorous selection of patients, minimally invasive surgery and post operative health practices are the pre requisite conditions for a good outcome in herniated disc surgery.
Keywords: Herniated disc, Recurrence, Failed back surgery

OP-SP.11-01

Percutaneous Spine Fixation Versus Open Traditional Spine Fixation in Cases of Traumatic Thoracolumbar Fractures

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Minimally invasive spine surgeries a new invention that has grown widely in the last decade of the spine era. Percutaneously insertion of transpedicular screws through small skin incision sparing the wide dissection, blood loss and loss of muscular innervation that used to be done in traditional spine fixations. this new technique used in cases of traumatic thoracolumbar fractures and it's impact on the patients selected for the study compared with open traditional method. the benefits and the drawbacks have been studied and recommendations were made for the selection of best technique. blood loss, hospitalization, instrumentation, operative time and post operative complications, analgesia use and finally discharge from hospital duration. This study is conducted in Suez Canal University hospital where Thoraco-lumbar trauma patients according to the criteria of this study to be allowed in this study where percutaneous spine fixation was done and results were collected and studied thoroughly and results were gathered.
Keywords: Spine, Percutaneous fixation, Fractures, Thoracolumbar, Minimal invasive

OP-SP.11-02

Short Segment Posterior Fixation with Index Level Screws Versus Long Segment Posterior Fixation for Thoracolumbar Spine Fracture: Angle of Correction and Pain

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Aim: To assess and compare between short segment fixation with screws into index level (fractured level) versus long segment posterior fixation in maintaining angle of correction and post-operative pain.
Method: A prospective study of 61 patients, have single level thoracolumbar spine fracture with Cobb's angle ≤ 25^0, underwent posterior fixation. Of them, Thirty three patients underwent short segment fixation one level above and one level below with screws into the index level, and twenty eight patients underwent long segment fixation. All patients were followed up for about 1 year until the fusion achieved.
Results: T In short segment group the pre-operative mean Cobb's angle was $19.3^0 \pm 3.7^0$,whereas, in long segment group the pre-operative mean Cobb's angle was $18.6^0 \pm 3.8^0$. the post –operative mean angle of correction were $6.8^0 \pm 2.6^0$ and $5.8^0 \pm 1.6^0$ respectively. After 1 year follow up, the angle of correction have become $7.8^0 \pm 1.6^0$ and $7.9^0 \pm 1.8^0$ respectively. The pain was assessed by VAS on regular base follow up. In short segment group the pre-operative VAS was 5.6 ± 2.1 whereas the long segment group VAS was 5.1 ± 2.1. On one year follow up the VAS were 1.4 ± 0.5 and 1.8 ± 0.4 respectively.
Conclusion: The short segment fixation with screws into index level can maintain the angle of correction till the fusion achieved as long segment fixation
Keywords: Thoracolumbar fracture, Short segment fixation, Long segment fixation, Index level, Cobb's angle, Visual analogue scale (VAS)

OP-SP.11-03

The Effects of Steroids in Traumatic Thoracolumbar Junction Patients on Neurological Outcome

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Aim: To evaluate the effects of methylprednisolone on neurological outcome of spinal cord injury (SCI) patients with thoracolumbar junction (T10-L1) spine fractures.
Method: The data from 182 SCI patients who sustained a thoracolumbar junction spine fracture were operated by us between September 2008 to January 2015 was analysed retrospectively. The patients were divided into two groups**:** Group 1 underwent methylprednisolone treatment in conjunction with early surgical intervention while group 2 underwent only early surgical intervention without methylprednisolone treatment. American Spinal Injury Association (ASIA) motor index scores of the patients were evaluated and compared with statistical methods at admission and at the first year follow-up.
Results: The main follow up period was 14.4±1.4 months in group 1 and 13.6±1.7 months in group 2. Initial and last follow up ASIA scores of the patients was similar between groups ($p>0.05$), but the complication rate was significantly high in group 1 ($p<0.05$).
Conclusion: According to our results steroids have no significant beneficial effects on the neurological outcome but have significant side effects and leads to increased complication rate in SCI patients.
Keywords: Spinal cord injury, Thoracolumbar junction, Methylprednisolone, Treatment

OP-SP.11-04

Percutaneous Unilateral Vertebral Body Augmentation Using Mesh-contained Bone Graft with Percutaneous Bilateral Pedicle Screw-Rod Fixation: A Novel Treatment in a Patient with a Thoracolumbar Burst Fracture

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A number of different approaches, techniques, and instrumentation have been used for the operative treatment of thoracolumbar injury, each with their own inherent limitations. To our knowledge, there is no documented use of mesh-contained bone graft for vertebral body augmentation with non-fusion short-segment fixation for management of burst fractures. A 55-year old male presents following a fall while on a ladder. He landed on his buttocks and complained of nonradicular back pain and tenderness. He denied bowel/bladder incontinence, paresis, and saddle anesthesia. The x-ray demonstrated anterior wedging of L1. CT scan was conducted which demonstrated a burst fracture with 25% height loss. MRI showed no posterior ligamentous injury. He was taken to the operative suite where we placed percutaneous screws at T12 and L2 before performing percutaneous vertebral body augmentation utilizing mesh-contained bone graft. 12cc of bone graft was tamped into the mesh bag at L1 through a unilateral extrapedicular method. Pedicle screws were used bilaterally at T12 and L2 with rods. The patient was given a TLSO brace and was weight-bearing the night of surgery; his pain was significantly reduced. The patient was discharged home the following day. 2-months post op our patient endorsed improved back pain and was back to work pouring concrete. He was given a 60-pound weight restriction but later requested to increase the weight restriction to 75 pounds. Post-operative imaging showed deformity correction. Stabilizing a thoracolumbar burst fracture is feasible using completely minimally invasive non-fusion techniques.
Keywords: Spine, Trauma, Burst fracture

OP-SP.11-05

Feasibility of Expandable Cage for Vertebral Body Reconstruction in Unstable Thoracolumbar Spine Fractures via Single-Stage Posterior Approach

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Background: Patients with unstable thoracolumbar spine fractures require surgical treatment to relieve pain, address paralysis, and stabilize the spine to prevent further segmental deformity. The purpose of this study is to examine the efficacy and safety of vertebrectomy and reconstruction of vertebral body using an expandable cage via a single-stage posterior approach for trauma-related unstable thoracolumbar spine fractures.
Method: Thirty patients underwent single-stage posterior-only vertebral column resection and vertebral body reconstruction using an expandable cage. Neurologic status was classified using the ASIA Impairment Scale, while functional outcome was analyzed using a VAS for back pain. Segmental Cobb angles were measured preoperatively, immediate postoperatively, and at the last follow-up.
Results: The preoperative neurologic status was ASIA grade E in 6 patients, grade D in 13, grade C in 5, and grade B in 6. Postoperatively, neurologic stability was demonstrated in 8 patients (26.7%), and 22 (73.3%) showed improvement in the ASIA grade. The mean preoperative VAS score was 8.6, which decreased to 4.3 postoperatively, and to 1.7 at the final follow-up. The mean preoperative segmental lordotic angle was 8.9°, which increased to 17.4° postoperatively, and decreased to 16.1° at the last follow-up. Regarding surgical complications, an intraoperative dural tear occurred in two patients and cage subsidence in three osteoporotic patients.
Conclusion: The results of our series suggest the feasibility, efficacy, and safety of this surgical option for unstable thoracolumbar spine fractures. This technique from a single posterior approach offers several advantages over traditional anterior or anterior-posterior combined approaches using strut graft or nonexpandable implants.
Keywords: Expandable cage, Unstable thoracolumbar spine fracture, Transpedicular vertebrectomy, Posterior approach

OP-SP.11-06

Percutaneous Vertebroplasty for Osteoporotic Vertebral Compression Fracture

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Aim: To assess the safety and efficacy of percutaneous vertebroplasty in the treatment of single level Osteoporotic Vertebral Compression Fractures.
Method: The place and duration of study are Lahore General Hospital, Lahore from January 2012 to January 2014. Patients fulfilling the inclusion criteria were given time for vertebroplasty. Those patients were excluded from my study if they had a neoplastic. Patient's level of pain was recorded by using the visual analogue scale**:** a scale of 0–10, with 10 indicating the most pain. After vertebroplasty, patients were asked whether their pain was completely relieved, partially relieved, unchanged, or worse. The post vertebroplasty visual analogue scale score were recorded on the day of vertebroplasty immediately after the end of the procedure and at 24 hours then at follow up on 2 weeks, 1 month, 3 months, 6 months, 1 year.
Results: In this study there were 20 (35.1%) male and 37(64.9%) female patients. The mean age of patients was 59.12 ± 12.40 years with minimum and maximum age 39-88 years respectively. On pre-assessment L1, L2, L3 was seen in 10 (17.5%), 6(10.5%) and 5(8.8%) respectively while T11 and T12 was seen in 6(10.5%) and 16(28.15%) respectively. Mean pre and postoperative pain on VAS was 7.91 ± 1.17 and 1.17 ± 1.45. After surgery mean difference in pain score was 6.73 ± 1.90 with fulfillment of normality assumptions (Kolmogorov-Smirnov Z = 1.18, p-value = 0.123). On applying paired sample t-test found significant improvement in Pain after surgery, t=26.71, p-value < 0.001.
Conclusion: Pain is significantly improved after percutaneous vertebroplasty in patients with osteoporotic vertebral compression fracture.
Keywords: Osteoporosis, Spine fractures, Vertebroplasty, Pain relief

OP-SP.11-07

Traumatic Thoracolumbar Fractures: Clinical Serial Analysis

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Background: The most common site of spinal fractures is the thoracolumbar region because it is the transition level between the rigid thoracic kyphosis and the lumbar lordosis. Our aim is to analyse our traumatic thoracolumbar fracture cases.
Method: Patients who admitted to the emergency department for thoracolumbar trauma were inspected. Forty-four patients who underwent surgery for thoracolumbar fractures were collected and files and radiological data were reviewed retrospectively.
Results: Eleven women (25%) and 33 men (75%) were included in the study. The age ranges were 15-80 for women and 14-80 for men. The mean values of history of the patients were 77.30% fall-down, 13.60% traffic accidents, 4.5% firearm injuries and the remaining ones were rare traumas. Diagnosis rates were 63.70% compression fractures, 20.50% explosive fractures, 6.80% explosion + compression fractures and the remaining were other types of fractures. Spinal fracture areas were found to be 15.90% thoracal, 45.50% thoracolumbar and 38.60% lumbar region. Surgical rates were 63.70% stabilization and fusion, 31.80% kyphoplasty and 4.50% laminectomy.
Conclusion: We found that falling down is the most common history for thoracolumbar fractures. The diagnoses is compression fractures mostly and the operation type choosen for these patients is stabilization and fusion.
Keywords: Thoracolumbar fractures, Stabilization, Fusion, Kyphoplasty, Laminectomy

OP-SP.11-08

Posterior Corpectomy Instead of Anterior Corpectomy in Traumatic Fracture-Dislocation Lumbar Spine with Complete Neurological Deficit (Few Case Series)

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Anterior corpectomy carries higher morbidity and mortality rates more than posterior corpectomy in cases of fracture - dislocation dorsolumbar spine with complete transection of the cord. In the literature few cases are reported of posterior corpectomy instead of anterior corpectomy. And we are presenting few case series of young patients who had crush accidents; on assessment there was a history almost similar for all of severe back pain + lower limbs weakness + sphincteric disturbances; on examination they shared back tenderness and paraplegia. MRIs and CTs dorsolumbar documented dislocation fracture vertebra with complete cord transection. They have been treated all with posterior approach corpectomy, relocation and vertebral column alignment together with fixation with peek cage in one of the cases. This approach was chosen because of that; already the patients were having neurological deficits and the dislocated vertebra was easily accessible though the posterior approach. And the aim of the surgery is pain relief, better nursing care and rehabilitation care.
Keywords: Corpectomy, Fracture dislocation, Neurological deficit

OP-SP.12-01

The Role of Minimally Invasive Spine Surgery for Thoraco-Lumbar Fractures in Patients with Ankylosing Spondylitis and Diffuse Idiopathic Skeletal Hyperostosis (DISH)

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Background: Patients with Ankylosing Spondylitis & DISH may experience spinal fractures even after minor injuries. The diagnosis of non-dislocated spinal fracture is based on clinical symptoms and radiological findings. Difficulties in interpreting the imaging studies can result in considerable diagnostic delays.

Method: This is a retrospective review of patients with acute traumatic thoraco-lumbar fractures. 16 patients underwent minimally invasive percutaneous short segment posterior fixation of Thoraco-lumbar fractures. 2 patient required anterior instrumentation. Diagnosis was suspected on CT scan of Spine and confirmed with Magnetic resonance imaging (MRI) T2 STIR sequences allowed determining the location and showed signs of a recent fracture. Then, MRI T1 images and computed tomography provided a detailed evaluation of the fracture line.
Results: All patients were post-operatively either neurologically the same or improved. The mean follow-up was 20 months (3-28 months). The mean operative time was 80 minutes (range 35-105 minutes) and the mean blood loss was <100 mL from the minimally invasive percutaneous short segment posterior fixation of Thoraco-lumbar fractures. VAS was significantly improved from 7.5 to 2.1 at last follow-up. One patient developed incisional hernia which was managed conservatively.
Conclusion: In patients with Ankylosing Spondyltis and DISH, fracture instability is common, making surgical treatment mandatory. Open surgery is associated with substantial rates of infection and delayed recovery. This minimally invasive surgical technique enables multilevel internal fixation and may constitute an alternative to open surgery for unstable fractures in patients with Ankylosing Spondyltis and DISH
Keywords: Ankylosing spondylitis, DISH, MISS

OP-SP.12-02

Craniocervical Junction Fractures Treatment with Minimally Invasive Percutaneous Screws Fixation

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Background: Despite most cases of craniocervical junction fractures can be treated nonoperatively with reduction and subsequent immobilization in a rigid cervical collar or halo, in some instances, operative management is necessary and can be accomplished by using either anterior or posterior fusion techniques. Open posterior procedures can result in significant blood loss, pain, and limited cervical range of motion, also variability of C2 anatomy can make instrumentation challenging and prone to potentially severe complications. We want to show a minimally invasive, navigation-guided technique for surgical treatment of Levine-Edwards (L-E) Type I, Type II hangman's fractures and C1 Type II (Jefferson`s) fractures.
Method: For 6 patients**:** 2 with L-E Type I, 2 with L-E Type II hangman's fracture and 2 with Jefferson fracture percutaneous screw fixation was performed**:** 4 directly through the fracture site and 2 C1- C2 transarticular fixation. This technique was facilitated by use of intraoperative CT O-arm scan and StealthStation S7 Surgical Navigation System.
Results: Of the 6 patients, 2 were women, 4 were men, age range was 33–69 years. No intraoperative or postoperative complications occurred. All patients were obtained flexion-extension radiographs the day after surgery nd at 6 weeks. For all patients, dynamic imaging demonstrated a stable construct.
Conclusion: Craniocervical junction fractures can be safely repaired by using percutaneous minimally invasive surgical technique. This technique may be appropriate, depending on circumstances, for L-E Type I, L-E Type II hangman's and Jefferson fractures; however, the degree of associated ligament injury and disc disruption must be checked.
Keywords: Craniocervical junction fractures, Surgical navigation system, Minimally invasive, Percutaneous screws fixation

OP-SP.12-03

Posterior Transpedicular Screw Fixation of Subaxial Vertebrae: Accuracy Rates of Mini-Laminoforaminotomy Technique

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Posterior cervical transpedicular screw fixation has the strongest resistance to pull-out forces when compared with other posterior systems. We retrospectively analyzed 36 patients operated this technique combined with mini-laminoforaminotomy technique which serves as a guide for accurate screw insertion using posterior cervical transpedicular screws in our clinic between January 2014-November 2016 (24 male 66.6%, 12 female 33.3%) aged 15-80 years (median age 52.2 years). The etiology was trauma in 17 (47.2%), degenerative in 16 (44.4%), spinal infection in 2 (5.55%) patients and basilar invagination due to systemic rheumatoid disease in 1 (2.77%) patient. Among 17 trauma patients, 13 short-segment (1-2 levels), and 4 long-segment (3 or more levels) posterior cervical instrumentation and fusion were performed. Mini-laminotomy technique was used in each patient to insert, direct and penetrate screw at exact localization of the pedicles. Grading of the medial, lateral breach and perforation were also noted. Among 206 cervical pedicle fixation; at C3 level 46, at C4 level 44 and at C5 level 52, C6 level 48 and at C7 level 16 pedicular screws were used. 189 of these screws were accurately placed according to CT measurements of axial scans (91.7% Grade 0 and Grade1). Seventeen screws (8.25%) were malpositioned (Grade 2 and 3). In our malpositioned patients no additional neurological injury was observed. Two patients had cerebrospinal fluid fistulae which resulted with complete recovery by external lumbar drainage. Mini-laminoforaminotomy technique is considerable in posterior transpedicular screw placement in subaxial vertebrae for single-staged fusion in experienced hands with neglectable complications.
Keywords: Mini-laminoforaminotomy technique, Posterior cervical transpedicular screw fixation, Subaxial vertebrae

OP-SP.12-04

Management of Craniovertebral Junction Anomalies-Experience of 223 Cases

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Aim: To study the effectiveness of different methods of methods of management of CV-Junction problems.
Method: Total 223 patients, age ranging from 2.5 years to 70 years were included in this study. Study period is 2000 AD to date. Types of surgery include occipito-cervical & posterior interspinous fusion, trans oral decompression, C1-C2 laleral mass fixation with or without joint jamming & C1-C2 transarticular fixation. X-ray, MRI was in all cases and CT scan was done in selective cases.
Results: There were 3 deaths in the series and all other patients showed various degrees of neurological improvements. There was dural tear in 8 cases and vertbral artery injury in 2 cases. Wound infection was in 3 cases. Instability of the cranio-vertebral junction (C V junction) and upper cervical spine is a serious condition requiring urgent management. Common cause of CV junction instability is atlanto axial dislocation (AAD) due to trauma, congenital cause or infection. In the past, there were very few options for instrumentation of the CV junction. But, during the last three decades different types of devices & technique are being introduced for stabilization of the CV junction. Among the different methods of surgery trans-articular screw fixation gives the strongest construct. C1-C2 lateral mass fixation also gives very good results.
Conclusion: Atlantoaxial dislocation is the difficult most part of spinal surgery requiring urgent management. Each and every patient should be properly evaluated before taking decision of surgery. Some of the patients may require more than one procedure.
Keywords: Atlanto-axial dislocation, Lateral mass, Lateral mass screw, Joint jamming, Trans articular screw

OP-SP.12-05

Surgical Management of the Type II Odontoid Fractures

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Background: Odontoid fractures comprise 9-15% of cervical spine fractures. Type II fractures are the most common odontoid fracture, occurring in 65%–74% of the cases and the most prevalent cervical fracture in patients over 70 years of age. In this study, we evaluated our surgically treated type II odontoid fractures cases retrospectively.
Method: The studied parameters were age, gender, characteristics of the fracture such as degree of odontoid displacement, displacement of the odontoid relative to the C2 body, anatomy of the fracture line, and the distance between fragments.
Results: We evaluated 17 patients with type 2 odontoid fracture. Mean age was 54.2 ranged between 19 and 91 years; female/male**:** 6/11. Anterior odontoid screw fixation was performed in 4 cases (23.5%); posterior cervical atlantoaxial instrumented fusion was performed in 9 cases (52.9%); occiputocervical fusion was performed in 4 cases (23.5%), Fracture line in 9 (52%9) patients was posterior oblique, in 4 (23.5%) patients was anterior oblique, in 4 (23.5%) patients was horizontal. Displacement of the odontoid in 12 (70.6%) patients was anterior, in 5 (29.4%) patient was posterior.
Conclusion: In the literature was not defined the certain surgical approach, anterior or posterior, is better in odontoid fractures. Anterior can preserve atlantoaxial motion. Posterior approach risks are vertebral artery lesions, damage or dysfunction of the root of C2, inadequate placement of the screws, and excessive bleeding during dissection We discuss surgical approach of the cases with odontoid fractures.
Keywords: Anterior odontoid fixation, Type II odontoid fractures, Type II odontoid fractures surgical approach

OP-SP.12-06

Usefulness of Navigated O-Arm Spinal Fixation for Spinal Trauma in a Level 1 Poly-Trauma Centre

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Background: There is a relatively high incidence of screw misplacement during spinal instrumentation due to distortion of normal anatomy following spinal trauma. Our aim is to evaluate and to share the initial experience with the use of neuro-navigated 3D O-arm (®) (Medtronic, USA) in a level 1 poly-trauma trauma center.
Method: In this study, consecutive patients of spinal injury who underwent screw fixation under O-arm guidance over 10 month period (April 2016 - Feburary2017) were evaluated for accuracy of screw placement. Patient demographics and radiology were reviewed and spinal injury was assessed using the ASIA grading. Screw placement was assessed by intraoperative scans of the relevant spine and accuracy of screw placement and breach of the medial or lateral cortex of the pedicle were recorded for each case.
Results: In the O-arm group, there were 58 patients in whom 210 screws were inserted. 3 patients had screw mal-placement and required positioning of the screws.
Conclusion: In a level 1 poly-trauma center the intra-operative O-arm (®) imaging ensures accurate placement of screws with the possibility of reposition of mal-placement screws without added neurological deficits.
Keywords: 3D intraoperative imaging, O-arm, Complication

OP-SP.12-07

C1 Lateral Mass Screw Insertion from the Caudal-Dorsal to the Cranial-Ventral Direction as an Alternate Method for C1 Fixation: An Anatomical and Morphometric Evaluation

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Aim: To conduct a detailed morphometric measurement of an alternative approach for C1 LMS insertion, which involves screw insertion caudally from the C2 root.
Method: We measured locations on three-dimensional CT scans to assess optimal parameters for placing a C1 LMS by this alternate approach and evaluated the reliability of the dorsal surface of the C1 lateral mass as a landmark for determining the optimal site of screw entry. Three-dimensional CT scans obtained in 100 adults were evaluated, and measurements were determined for screw entry points, trajectories, and screw lengths for placement of a C1 LMS. Additional measures were included to account for relevant anatomic variation, including the size of the dangerous lateral zone of the C1 entry point and depth of the atlantooccipital joint surface. Twenty dried atlantal specimens were evaluated to determine corresponding ex vivo measurements.
Results: The mean maximum angle of medialization was 20.8º on the right and 21.1º on the left. The mean maximum superior angulation was 24.7º on the right and 24º on the left. The mean screw length within the lateral mass was 21.2 mm on the right and 21.3 mm on the left. Given an additional 10-15 mm needed for rod adaptation, an ideal screw length of 30-35 mm was determined.
Conclusion: The C1 LMS insertion caudally from the C2 nerve root may become an alternate method for insertion of C1 screws. Preoperative consideration of the ideal screw insertion point, trajectory, and length are vital for safe and effective surgical intervention.
Keywords: C1, Trajectory, Lateral mass, Screw, Fixation, Alternate

OP-SP.13-01

Neuroprotective Effects of Calcitriol on Ischemia/Reperfusion Injury of the Rabbit Spinal Cord

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Recent studies demonstrated the neuroprotective and immunomodulatory effects of calcitriol (1,25-dihydroxyvitamin D3; 1,25-D), but no previous study has examined these effects of calcitriol on spinal cord ischemia/reperfusion (I/R) injury. The purpose of this study was to evaluate whether calcitriol could protect the spinal cord from I/R injury. Rabbits were randomized into four groups of eight animals as follows**:** group 1 (control), group 2 (ischemia), group 3 (30 mg/kg methylprednisolone, intraperitoneal) and group 4 (0,5 µg/kg, 1,25-D, intraperitoneal). Premedication was performed for 7 days before I/R injury. In the control group only a laparotomy was performed. In all other groups, the spinal cord ischemia model was created by a 20-min occlusion of the aorta just caudal to renal artery. Levels of malondialdehyde and catalase were analyzed, as were the activities of caspase-3, myeloperoxidase, and xanthine oxidase. Histopathological, ultrastructural and neurological evaluations were performed. After I/R injury, increases were found in caspase-3 activity, myeloperoxidase activity, malondialdehyde levels, and xanthine oxidase activity ($p<0.001$). In contrast, decreases in catalase levels were observed ($p<0.001$). In calcitriol pretreatment group, decreases were observed in caspase-3 activity ($p<0.001$), myeloperoxidase activity ($p=0.018$ serum myeloperoxidase; $p<0.001$ tissue myeloperoxidase), malondialdehyde levels ($p<0.001$), and xanthine oxidase activity ($p<0.001$), whereas catalase levels increased ($p<0.001$). Furthermore, calcitriol pretreatment showed improved results concerning histopathological scores, ultrastructural score and neurological scores. Our results revealed that calcitriol exhibits significant anti-inflammatory and neuroprotective activity following I/R injury of the spinal cord. Further studies are needed to reveal the role of calcitriol in spinal cord I/R injury model.
Keywords: Ischemia/reperfusion, Methylprednisolone, Neuroprotection, Vitamin D, Spinal cord

OP-SP.13-02

The Effects of Thymoquinone via High Mobility Group Box-1 Protein on Apoptosis and Oxidative Stress in Experimental Spinal Cord Injury

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Background: Spinal cord injury is an important result of traumatic injuries which cause morbidity and mortality. Inflammation cause secondary injury and HMGB-1 is an important mediator of inflammation. In our study we investigate the effects of Thymoquinone on HMGB-1, Nrf2, apoptosis and oxidative stress in experimental spinal cord injury model.
Method: Weighing 250-300 g, 8-10 weeks, total of 18 adult female Sprague-Dawley rats were used for the experiment. T9-T10 laminectomy were made in laminectomy group, after T9-T10 laminectomy 30 second extradural compression with aneurysm clip were made in trauma group, after extradural compression 20 mg/kg Thymoquinone 0., 24., 48., 72. hour of trauma were done intraperitoneally in Thymoquinone group. 96 hour after procedure rats were sacrified. Serum and spinal cord samples HMGB-1, TLR-4, RAGE, Nrf2, NF-κß expression levels analysed by western blot and immunohistochemistry examinations. Apoptosis was evaluated with TUNEL method and Bax, Bcl-2, p53, Aktive Caspase-3 levels analysed by western blot.

Results: Thymoquinone group HMGB-1 (P<0.001), TLR4 (P<0.001), RAGE (P<0.001) levels decreased significantly according to trauma group. Nrf2 is an important part of antioxidant mechanisms and Thymoquinone group Nrf2 levels also increased according to trauma group (P<0.001). Apoptotic cell number which evaluated with TUNEL method decreased significantly in Thymoquinone group according to trauma group (P<0.001).
Conclusion: With the investigation of spinal cord and serum samples we have shown Thymoquinone has anti-inflammatory effect via HMGB-1 and antioxidant effect via Nrf2 and these result decrease in apoptosis and secondary injury. These results throw light on to clinical studies.
Keywords: SCI, Thymoquinone, HMGB-1, Nrf2, Apoptosis

OP-SP.13-03

p53 Inhibition Provides a Pivotal Protective Effect Against Spine Cord Ischemia-Reperfusion Injury in vitro via mTOR Signaling

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Background: Tumor suppressor p53 has recently been reported to have numerous functions independent of tumorigenesis, including neuronal survival during ischemia. The mammalian target of rapamycin (mTOR) signaling pathway plays a central role in the regulation of metabolism, cell growth, development, and cell survival. p53 inhibition provides a pivotal protective effect against spine cord ischemia-reperfusion injury *in vitro* via mTOR signaling The aim of our research is to further clarify the role of p53 and the mTOR signaling pathway in neuronal ischemic-reperfusion injury in vitro.
Method: Mouse primary mixed cultured spine cord neurons with an oxygen glucose deprivation (OGD) model was used to mimic an ischemic-reperfusion injury in vitro. A lentiviral system was also used to inhibit or overexpress p53 to determine whether p53 alteration affects OGD and reperfusion injury.
Results: Our results show that activated p53 was induced and it suppressed mTOR expression in primary mixed cultured neurons after OGD and reperfusion. Inhibiting p53, using either a chemical inhibitor or lentiviral-mediated shRNA, exhibited neuroprotective effects in primary cultured neurons against OGD and reperfusion injury through the upregulation of mTOR activity. Such protective effects could be reversed by rapamycin, an mTOR inhibitor. Conversely, p53 overexpression tended to exacerbate the detrimental effects of OGD injury by downregulating mTOR activity.
Conclusion: p53 inhibition has a pivotal protective effect against an in vitro ischemia-reperfusion injury via mTOR signaling and provides a potential and promising therapeutic target for spine cord ischemia treatment.
Keywords: Ischemic reperfusion injury, OGD, mTOR, p53

OP-SP.13-04

Effect of Adalimumab on Spinal Cord Ischemia-Reperfusion Injury

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Background: Adalimumab is an antiinflammatory agent developed for treating rheumatological diseases. In animal models, beneficial neuroprotective effects of adalimumab has been reported. In this study, we examine the effects of adalimumab on spinal cord ischemia reperfusion injury, in a rabbit model for the first time.
Method: Twenty four rabbits were randomized into three groups of eight animals each**:**group1(sham),group2(ischemia-reperfusion), group 3 (50 mg/kg adalimumab). Only laparotomy was performed in the sham group. Spinal cord ischemia was created by a 30-min occlusion of the aorta, just caudal to renal artery with an aneurysm clip. Spinal cord segments were harvested for analysis. Neurological evaluation was performed by using the Tarlov scoring system. Tissue and plasma TNF alpha, TAS, TOS, TBARS levels were analyzed as a marker of inflammation and oxidation. Histopathological evaluation of the tissues was performed and apopitosis was evaluated by TUNNEL method.
Results: Both plasma and tissue TNF alpha, TOS and TBARS levels were significantly decreased in adalimumab group when compared with ischemia reperfusıon injury group. Also plasma and tissue TAS levels were significantly increased after adalimumab treatment. Histopathological evaluation of the spinal cord tissues demonstrated significant decrease in neuronal damage score after adalimumab treatment. Also neurological examination scores were significantly better when compared with the ischemia-reperfusion group.
Conclusion: This study showed the neuroproctive properties of adalimumab on spinal cord ischemia-reperfusion injury in an experimental rabbit model.
Keywords: Adalimumab, Inflammation, Ischemia-reperfusion, Neuroprotection, Spinal cord

OP-SP.13-05

The Effect of l-Arginine on Dural Healing After Experimentally Induced Dural Defect in a Rat Model

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Background: Incomplete repair of the dura mater may result in numerous complications such as cerebrospinal fluid leakage and meningitis. For this reason, accurate repair of the dura mater is essential. In this study, the effect of systemic and local supplementation of l-arginine on dural healing was evaluated.
Method: Thirty male Wistar rats were used and divided into control, local, and systemic l-arginine groups, with 10 rats in each. In each group, a 5-mm experimental incision was made at the lumbar segment of the dura mater and cerebrospinal fluid leakage was induced. Each group was divided into 2 subgroups and at the end of the first and sixth weeks, the rats were killed and the damaged segments of the dura were separated, histologically evaluated and the dural healing indicators including cell types, granulation tissue formation, collagen deposit, and vascularization were compared between groups.
Results: The systematic supplementation of l-arginine showed a significant effect in dural healing compared with the control group. After the first week, granulation formation increased considerably ($P < 0.031$), and after 6 weeks, collagen deposition and neovascularization were significantly different compared with the control group ($P < 0.030$; $P < 0.009$). In comparison between different groups at the end of the first and sixth weeks, maximum changes in healing indicators were observed in the systemic group and the least variations were related to the control group.
Conclusion: The systemic supplementation of l-arginine may accelerate dural healing by increasing the level of granulation tissue formation, collagen deposition, and vascularization.
Keywords: Arginine, CSF leakage, Dura mater

OP-SP.13-06

Histopathological Investigation of Spinal Epidural Fibrosis in Experimental Animal Models Following Hemostatic Agent Employment

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Background: Epidural fibrosis is a common reason of failed back surgery syndrome. Many agents have been tested for effectiveness, but only one has been proven to reduce epidural fibrosis; ADCON-L but has limited practical use. However, many hemostatic agents are readily availabl, easy to reach and are frequently used for hemostasis. For these reasons, hemostatic agents Pahacel®, Sealfoam®, Surgiflo® and Celox ™ were used in this experiment to determine their effects on epidural fibrosis on rats after laminectomy.
Method: 40 Sprague Dawley rats were used in this experiment and divided into 5 equal groups including the control group where only laminectomy was performed. The other 4 groups received hemostatic agents after laminectomy. The rats were sacrificed 45 days later and were assessed by a blinded observer to grade the fibrosis level.
Results: The study revealed that Pahacel®, Sealfoam® and especially Surgiflo® lowered the epidural fibrosis grade which was stastically significant. Although Celox ™ created fibrosis similar to the control group it was not proven to be statistically significant. However when compared with other hemostatic agents it resulted in a higher fibrosis grade which was statistically significant. Celox ™ also caused an abscess formation in two subjects. Succinctly, oxidized regenerated cellulose, polysaccharide hemostat and thrombin hemostatic gelatin matrix are frequently used in spinal surgery under different brands.
Conclusion: Surgiflo®, Pahacel® andSealfoam® are effective in reducing epidural fibrosis. But the amount and duration of the hemostatic agents needs to be studied further to come up with a clear advice.
Keywords: Pahacel®, Sealfoam®, Surgiflo®, Celox ™, Hemostasis, Epidural fibrosis

OP-SP.13-07

The Histological Effects of Ozone Therapy on Sciatic Nerve Crush Injury in Rats

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Background: Peripheral nerve injury is a common and important problem of modern area that lacks of definitive and effective treatment. The aim of this study is to evaluate the effect of ozone therapy on sciatic nerve crush injury in rats.
Method: A total of 24 male rats were divided into three groups**:** a control sham surgery group (n=8), a sciatic nerve injury group (n=8), and a sciatic nerve injury with ozone group (n=8). Medical air in the sciatic nerve injury group and 0.7 mg/kg ozone in the sciatic nerve injury with ozone group was given. Vascular congestion, vacuolization, edema formation and expression of S 100, and the thicknesses of perineurium and endoneurium and diameter of injured sciatic nerves investigated.
Results: The diameter of sciatic nerve and the thickness of the perineurium and epineurium and were significantly greater in the sciatic nerve injury group than in the sham surgery group ($p< 0.05$). High S100 immunoreactivity was shown in sciatic nerve injury group compared with the sham surgery and sciatic nerve injury with ozone group ($p < 0.05$). Distributions of vascular congestion and vacuolization were found statistically significant differences less in the sciatic nerve injury with ozone group ($p<0.05$).
Conclusion: Ozone therapy improved sciatic nerve injury recovery without causing an increase in fibrotic tissue. We found that ozon reduce the fibrosis, vascular congestion, vacuolization, and edema in rodents. Ozone treatment may be used as an agent to assist in the sciatic nerve injury.
Keywords: Fibrosis, Injury, Ozone, S100, Sciatic nerve

OP-SP.13-09

Time-Dependent Effects of Dantrolene Upon the Motor Evoked Potentials in Experimental Spinal Cord Injury

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Background: Spinal cord injury (SCI) continues to be a serious medical and social problem that results in major losses in neuromotor functions. The aim of the current study is researching the Dantrolene's effect on the time-related motor evoked potential responses in the spinal cord injury (SCI).
Method: The experimental study was performed on the 5 main groups of totally 38 rabbits. These was respectively; Group 1 (Sham)**:** only laminectomy (n = 6), Group 2 (SCI)**:** Laminectomy + Traumatic SCI (n = 8), Group 3 (Dnt 0h)**:** Just after the SCI + Dantrolene 10 mg/kg I.P (n=8), Group 4 (Dnt 1h)**:** 1 hour after the SCI + Dantrolene 10 mg/kg I.P (n=8), Group 5 (Dnt 4h)**:**4 hours after the SCI + Dantrolene 10 mg/kg I.P (n=8). Dantrolene given for the treatment had a therapeutic effect on motor function, and this was observed by recording the neural transmission that is created via Tarlov test and Transcranial Magnetic Stimulator by using the values of the MEP.
Results: It was seen histopathologically a significant reduction in the number of apoptotic cells.
Conclusion: Dantrolene had a time-related effect of improvement on the MEP responses in the experimental spinal cord injury.
Keywords: Spinal cord injury, Dantrolene, Motor evoked potentials, Apoptosis

OP-SP.14-01

3D Thoracoscopic Surgery for Spinal Neurogenic Tumors as the Fast Track Technology in Spinal Care

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Aim: To define advantages of 3 D thoracoscopy approaches in surgical treatment of thoracic spine primary and metastatic tumors, neurogenic extravertebral and "dumbbell" tumors. The ventral approach for thoracic spine using 3 D endoscope minimize the additional bone resection, provide the exact deepness and axial positioning inside the disc space, facilitate the quality of hemostasis, tumor removing in full and avoiding the spinal cord compression.
Method: 36 patients with spine tumors (metastasis 15; primary 21) and 30 with paraspinal neurogenic schwannomas were operated thoracoscopically with 3 D technology. For the primary tumors SEER grading scale used to define the surgical strategy – the mean cumulative score was 3.45 (3 – 5) The Tokuhashi score for metastases before operation was 3-6 (average 4.7). 3 D thoracoscopic surgery for spine tumors included solitary vertebrectomy at Th3-Th11 levels with titanium mesh spondilodesis and lateral plate fixation. For benign extravertebral tumors or "dumbbell" – total resection were performed via thoracoscopic approach (2a, 2b McCormick).
Results: 3 D thoracoscopic approach in comparison with posterolateral approach and conventional thoracoscopy significantly reduce the complication rate from 47.2% and 21.3% to 11.4 ($p<0.05$), increases Quality of Life 0.96 ± 0.014 (in comparison with posterolateral approach 0.83 ± 0.04, $p=0.001$). The activization day for the 3 D thoracocsopic group was 3.36 ± 1.34
Conclusion: The 3 D thoracoscopy provide the shortest recovery rate for benign, metastatic and paraspinal tumors
Keywords: Thoracoscopic spinal approach, Dumbbell tumors, Spinal metastases

OP-SP.14-02

Pure Spinal Epidural Cavernous Haemangioma: A Case Series & Systematic Review

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Background: Pure spinal epidural cavernous hemangiomas (PSECHs) are rare vascular lesions. Till date about 100 cases have been reported. Herein, we present a case series on seven cases discussing the clinical presentation, radiological characteristics, surgical technique and intra-operative findings, pathological features and functional outcome. An updated literature review of all publsihed is also presented.
Method: We retrieved from the retrolective databases of the senior authors, patients with pathologically confirmed PSECH operated between January 2002 to November 2015. From their medical records, the patients' sociodemographic, clinical, radiological, surgical and histopathological data were retrieved and analyzed.
Results: The mean age of the 7 cases was 50.3 years. Four were females. All the 5 cases (71.4%) in the thoracic spine had myelopathy and the 2 (28.6%) lumbar cases had sciatica. All the lesions were isointense on T1W1, hyperintense on T2W1 and in 5 cases showed strong homogenous enhancement. In 6 cases (85.7%), classical laminectomy was done, lesions resected in one piece in 5 cases. Total excision was achieved in all the cases. Lesions were thin walled dilated blood vessels, lined with endothelium and engorged with blood and with scanty loose fibrous stroma. The median Follow-up was 12 months (range**:** 1-144 months). All patients improved neurologically and achieved a good outcome with no recurrence at the last follow-up.
Conclusion: PSECH although rare is increasing reported and ought to be considered in the differential diagnosis of spinal epidural lesions. Early surgical treatment with total resection is recommended as would result in a good prognosis.
Keywords: Cavernous hemangioma, Epidural, Functional outcome, Pathology, Surgical findings, Spine

OP-SP.14-03

Efficacy of Endoscopic Surgery for Spinal Intradural Lesions

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Background: Endoscopy is gaining popularity for various surgical procedures in view of minimal invasiveness and panoramic visualization. However, its efficacy for spinal intradural lesions has not been evaluated.
Method: Patients who underwent endoscopic surgery using various minimal access systems for spinal intradural lesions were studied with respect to clinical features, radiology, operative techniques, peri-operative complications, post-operative course, histopathology, clinical and radiological outcome at 3 months. Stand-alone use of endoscope was considered under 'true-endoscopic' surgery, predominant use of microscope considered 'micro-endoscopic' surgery, and equivalent use of both under 'mixed' category.
Results: Among the total 26 patients studied, the initial 9 had 'micro-endoscopic' surgery, the last 14 had 'true-endoscopic' surgery, while 3 were in 'mixed' category. There was no difference in the distribution of patients in these groups. The size of tumors ranged from 1 to 6 cm. Most underwent postero-lateral intermuscular access, while posterior thoracic spinal lesions had paramedian surgical access. Small bony fenestration and/or interlaminar-space were utilized for access. There were 12 nerve sheath tumors, 6 meningiomas, 3 ependymomas, and 5 arachnoid cysts. While visualization of sides and angles was better with endoscope, haemostasis and dural closure had steep learning curve, necessitating use of microscope in the initial cases. Clinical improvement and radiological cure could be achieved in all, with only 1 patient in 'true-endoscopic' group developing transient pseudomeningocele.
Conclusion: Endoscopic surgery is effective and safe for most of the intradural spinal lesions with better visualization of sides and angles, albeit with haemostasis and dural closure having initial learning curve.
Keywords: Endoscopy, Spinal intradural tumors, Minimally invasive, Efficacy, Safety

OP-SP.14-04

Combined Endovascular and Surgical Treatment of Spinal Dural Arteriovenous Fistulas

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Aim: To present our experiences and results in combined endovascular and surgical treatment of type I spinal dural arteriovenous fistulas (SDAVFs). SDAVFs are rare but most common form of spinal vascular malformations. They are low-flow vascular shunts fed by radicular arteries in patients who most often present with myelopathy.
Method: We conducted a retrospective review of 27 adult patients with diagnosis of SDAVF who underwent treatment at UHC Rebro Zagreb between January 2013 and January 2017. We compared complication rates, recurrence rates and data on clinical and imaging follow up.
Results: Out of 27 patients in the study, 18 patients underwent endovascular embolization (Onyx was used in 1 patients and NBCA in 17 patients) as first line therapy. 9 patients underwent surgical ligation as initial therapeutic modality. 6 patients in embolization group had recurrence of fistula during follow up requiring surgical ligation. Patients in both groups showed significant improvement in clinical status after treatment. One patient in endovascular group developed spinal infarction due to accidental embolization of posterior spinal artery. Two patients in surgical group had recurrence of fistula during the course of follow up and were successfully reoperated. There was one epidural hematoma as a complication in surgical group of patients which had to be surgically removed.
Conclusion: Although most of the fistulas are amenable to endovascular embolization, microsurgical obliteration is first option in specific anatomic situations and usually only solution in recurrent cases. Combined approach offers best results after careful selection of patients based on DSA imaging.
Keywords: Spinal dural arteriovenous fistulas, Ligation, Endovascular embolisation

OP-SP.14-05

Intramedullary Spinal Cord Tumors, Surgical Outcomes of Early Presentation

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Aim: To evaluate early presentation of the patient with other factors affecting surgical outcome of intramedullary spinal cord tumors (IMSCT) in our hospitals.
Method: Between June 2013 and June 2016, a retrospective study was conducted on 16 cases of intramedullary spinal cord tumors. The cases were surgically treated and evaluated pre and post operatively by MMS score. Appropriate statistical analysis was carried out.
Results: There were sixteen patients. Mean age was 50.4 years. Median follow up was 15 months. The most common histological origins was ependymoma (n=9, 56.25%). A cervical tumor was detected in eight cases, dorsal tumors in seven cases. Postoperatively the score was improved clinically but not statistically in seven cases cervical (87.5%) and four cases dorsal (57.1%), p value**:** 0.334. Ten cases were subjected to total resection. Postoperatively MMS showed improvement in all cases of total resection group (n=10, 100%), this was clinically and statistically significant on last follow up MMS, p value**:** 0.008. Less than four segments were involved in 9 cases, and 7 cases more than four segments. Postoperatively, 9 cases (100%) of less segments involved improved, while three patients (42.9 %)of more than 4 segments were good, p value**:** 0.019.low grade tumors as ependymoma was related to good surgical outcome while high grade tumors like astrocytoma was related to bad surgical outcome p value**:**0.022.
Conclusion: Total tumor resection with good preoperative clinical condition and early presentation with tumor localization in cervical or conus region considered predictable for good neurological outcome.
Keywords: Spinal cord tumors, Intramedullary, Surgical outcome, Early presentation

OP-SP.14-06

CyberKnife Stereotactic Radiosurgery for Intraspinal Intramedullary Tumors and Spinal Arterio-Venous Malformation

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Background: Intraspinal intramedullary lesions, including astrocytomas, ependymomas, spinal arterio-venous malformations (AVM) and other pathogens are always challenges for neurosurgeons to achieve completely surgical resections for the high morbidity and mortality. CyberKnife (CK) stereotactic radiosurgery (SRS) is one of treating modalities for these kinds of lesions. We conducted this prospective study to exam the effect and safety of this modality for these lesions.
Method: Between Sep. 1st, 2005 and Dec. 31st, 2016, we totally performed CK radiosurgery for 1300 cases with intracranial or extracranial lesions. Of them, 14 cases with intramedullary spinal cord tumor (IMSCT) while 6 cases were spinal AVM. The pre-CK and post-CK neurological status were examined and graded by McCormick scale (grade 1 to 4, higher grades mean worse status).
Results: Of them, six were ependymoma, eight were astrocytomas and six were spinal AVM. The mean irradiation dose was 24.7 Gy, 5 fractions with 81% isodose. The clinical outcomes demonstrated improved in 25% (5/20), maintained in 60% (12/20) and worse in 15% (3/15). The images outcomes revealed 95% (19/20) lesion control rate except one case with extended spinal AVM from medullary to thorax.
Conclusion: In our study, we approved that CK was effective for residual/recurrent IMSCT and spinal AVM, not only in clinical outcomes but also in images outcomes.
Keywords: Arterio-venous malformation, CyberKnife, Intraspinal tumor, Stereotactic radiosurgery, Outcome

OP-SP.14-07

Our Experience in Sacrococygeal Chordoma Surgery

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Background: Chordoma is a rare malignant tumor that typically originates from notochordal residual cells, grows slowly but locally aggressive. It occurs in the skeletal system, especially in sacrum (50%), base of skull (35%) and mobile vertebrae segments (15%). In this study, we present our experience with a literature review in patients who were operated for sacrococygeal chordoma in last 5 years in our clinic.
Method: Six patients were operated due to sacrococcygeal cordoma between May 2011 and January 2016. Five patients underwent radical resection, including lower sacral region and coccyx. One patient underwent open biopsy and decompression at S1 level. All patients were followed up for clinical and radiological findings, postop neurological deficit and local recurrence.
Results: This study included 4 male, 2 female patients, ranging in age34-78 years (mean:57.5 years). Two patients had preop neurological deficit. None of the patients demonstrated new neurological deficitis. One patient developed pseudomeningocele 8 months after operation, and was re-operated. All patients were guided for postoperative adjuvant radiation therapy. Mean follow-up was 6 months ± 4 years. No local recurrence during follow up was reported.
Discussion: A multidisciplinary approach is important in sacrococcygeal chordoma surgery and follow-up. Local recurrence is the most important predictor of mortality for patients with cordoma. Therefore, performing the excision as wide as possible for surgical margin is very important in survival. However, major sacral excisions are associated with higher morbidity rates. We believe that protective but radical excision and subsequent adjuvant radiotherapy is the most effective method in the treatment of sacrococcygeal chordoma
Keywords: Chordoma, Sacrum, Coccyx

OP-SP.14-08

Intramedullary Tumors Main Characteristics, Advances of the Surgical Approach and a Series of 44 Cases

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Intramedullary tumors are rare and ccorrespond to 2-4% of tumors of the nervous system. Clinical condition**:** sensory alterations, torticollis, motor deficit, urinary dysfunction, scoliosis, myoclonus, subarachnoid hemorrhage and hydrocephalus. The goal of the neurosurgeon is to resect the entire tumor without damaging the spinal cord. It is also important to locate the lesion within the medulla as to its depth and laterality. The first step is to expose the tumor for biopsy. Hemostasis should be careful. Tumor volume should be reduced by ultrasonic aspiration prior to identification of the cleavage plane. If the cleavage plane is not found or if it is lost during resection, it is important not to proceed to avoid worsening of the neurological deficit. In our series of 44 patients there was no per operative mortality. In large series, with more than 200 patients, this index reaches 3%. The main causes are pulmonary embolism, tumor edema with severe respiratory distress and brain stem dysfunction. Currently most of these tumors are curable and patients maintain a good quality of life as long as the treatment strategy is correctly applied in the first surgical procedure. In order to perform tumor resection, we used the posterior medial groove, except for cases of vegetative and asymmetric lesions. These procedures are associated with low morbidity, mortality and relapse. There is no indication for radiotherapy in benign tumors and even in relapses, it may compromise a reoperation.
Keywords: Neurosurgery, Operative techniques, Intramedullary tumors, Surgical advancements

OP-SP.14-09

Neuroangiographic Study of Spinal Vascular Malformation and Endovascular Treatment: Our Experience

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Our knowledge of spinal vascular malformations has advanced significantly in the last century specially spinal arteriography pioneered in the 1960s first allowed the detailed classification of these lesions based on their angiographic characteristics. Spinal vascular malformation (SVM) may be either fistulous type or malformation. Anatomically the lesion may be in the dura (dural fistula), in the pia, in the spinal cord or even in paraspinal region. SVM may produce neurologic manifestations due to mass effect, arterial/venous steal. The understanding of the anatomy of these lesions led to multidisciplinary treatment modalities like microsurgery, radiosurgery in addition to endovascular approach. The last 2 decades have seen a gradual increase in the use of endovascular techniques as a primary treatment modality. We have treated 15 cases of spinal vascular malformation out of those some were dural AVF, few were perimedulary AVF and other were intramedulary AVM. In most of the cases embolization done through transfemoral route by glue. Few treated by microsurgery where embolization failed or was incomplete. In postoperative follow up for variable time most of the patient shows very good outcome in respect to their neurology without any mortality or procedure related morbidity. Understanding and planning of the malformation is important and only difficult part. Once plan, the rest of the treatment is very simple. Though neurology at presentation is disappointing post operative outcome is very encouraging.

Keywords: Spinal vascular malformation, Spinal angiography, Embolization

OP-SP.15-01

The Effectivenes of Percutaneous Intradiscal Oxygen-Ozone Therapy in Lumbar Disc Hernia

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Background: Percutaneous intradiscal ozone therapy, called also as "nucleolysis" or "chemical discectomy", is a minimally invasive treatment procedure used in patients with low back pain due to prolapsed lumbar intervertebral disc, in which property of oxygen-ozone mixture is used. The aim of this prospective study is to assess the effectiveness of this procedure in the treatment of lumbar disc diseases.
Method: In 2016, 72 patients who suffered back pain and/or leg pain because of lumbar disc prolapsed were treated with intradiscal ozone injection. Of all 39 patients were females and 33 were males, ages ranging 19 to 61 years. All patients underwent follow up examination at 1 month and 3 months postoperatively. Visual Analog Scale (VAS) was used to assess pain intensity, and functional outcome was analyzed by Oswestry Disability Scale.
Results: Pain intensity was found to be decreased in 60 patients, and not changed in 12 patients at three months. The mean Oswestry disability score decreased from 38.9 ±9.14 to 20.25±7.19. Younger patients (ages 25 to 35 years old) were seemed to get more benefit from the treatment. Also the patients with disease at L4-L5 level demonstrated the higher percentage of amelioration.
Conclusion: Ozone therapy is a technique with high successful rate and has low side effects in the treatment of low back pain and leg pain due to prolapsed intervertebral disc without free disc fragment. The results of our study suggest intradiscal ozone therapy is a reliable and safe procedure for the treatment of lumbar intervertebral disc prolapse.

Keywords: Lumbar disc herniation, Nucleolysis, Oxygen ozone therapy

OP-SP.15-02

The Role of Epidural Steroids in the Outcome of Postoperative Lumbar Discectomy

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Background: Intraoperative epidural corticosteroids have been used by some surgeons to decrease pain following surgery for a herniated lumbar disc. The objective of this study was to determine if epidural steroid have significant roll in improves the outcome in lumbar disc surgery.
Method: We prospectively evaluated 321 patients who underwent unilateral lumbar discetomy from 2013 to 2016 in faculty of medicine cairo University 321 patients divided into two group group (A) 157 patient with epidural steroid postoperative (40 mg methylprednisolone) group (B) 164 patient without use steroid the two groups was evaluated and compare by pain relief as measured by consumption of postoperative pain medications; the length of hospital stay; postoperative functional status; and the time interval from surgery until return to work.
Results: The mean postoperative analgesic medications consumed was 12.2 ± 1.9 mg of morphine equivalents in the group(A) versus 12.2 ± 1.8 mg of morphine equivalents in the group (B). The mean hospital stay was less than 2 days in each group, and the mean interval until return to work was 21 ± 3 days in the group (A) versus 25 ± 3 days in the group (B). Moreover, no statistically significant difference was measured between both group The mean outcome scores, which are derived from a postoperative assessment of pain relief resulting from surgery, functional status, and interval until return to work, were identical between both group.
Conclusion: The use of epidural steroid does not affect the outcome of unilateral lumbar discectomy

Keywords: Steroid, Epidural, Disc

OP-SP.15-03

The Efficacy of Epiduroscopic Adhesiolysis and Analgesic/Steroid Injection in Patients with Low Back, Leg Pain and Failed Back Surgery Syndrome

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Aim: To describe the possible role and clinical efficacy of epiduroscopy procedure on diagnosis and treatment of spinal pain syndromes.
Method: 102 patients, diagnosed with lumbar dyscopathy and treated via epiduroscopy in Ege University Faculty of Medicine, Neurosurgery Department between February 2013 and July 2016, were retrospectively analysed. Epiduroscopy was performed in patients who did not respond to conservative treatment for 6 months and refused lumbar surgery. Preoperative overall VAS score was 6.4 (between 7-10) and patients with severe pain (VAS≥7) were included. Postoperatively, a decrease in VAS score (VAS<5) was considered as favourable result. All patients were evaluated on week 1, month 1 and yearly follow-ups; of 102 patients, 40 had a 1-year, 24 had a 2-year follow-up, and 17 patients had a 3-year follow-up.
Results: Short-term follow-up results were favourable in 95% of the cases (97 patients), who got significant pain relief. The favourable results were recorded as follows**:** On month 1 follow-up, in 89% of the cases (91 patients); on year 1 follow-up, in 65% (26 patients); on year 2 follow-up, in 62.5% (15 patients); on year 3 follow-up, in 58.8% (10 patients).
Conclusion: Based on this prospective study, epiduroscopy by mechanical adhesiolysis and targeted administration of steroid, analgesics and hyaluronidase appears to be an effective minimal invasive technique in providing long-term pain relief in properly selected patients with chronic low back and leg pain and in Failed Back Surgery Syndrome.
Keywords: Epiduroscopy, Mechanical adhesiolysis, Laser adhesiolysis, Spinal pain syndrome, Failed back surgery syndrome

OP-SP.15-04

Perioperative Steroids for Lumbar Disc Surgery: A Meta-Analysis of Randomized Controlled Trials

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Background: Our review question was "Does perioperative steroids administration, in comparison with other treatments or placebo, improve either postoperative pain control, length of hospital stay, or return to work in patients undergoing lumbar disc surgery?"
Method: We searched PubMed, CINAHL PLUS, and Cochrane databases for randomized control trials (RCTs) studying the role of steroids for lumbar disc surgery. Studies that compared perioperative steroids with other treatments or placebo were included. Study outcomes included postoperative back pain, leg pain, length of hospital stay, and return to work. Data was extracted through a proforma. Means and mean differences were calculated for continuous data, whereas odds ratios were calculated for dichotomous data. Data were analyzed with the help of Rev Man 5.
Results: Twenty RCTs were included in the review. Quantitative analysis could be performed on 19 RCTs. Intraoperative steroids improve control of back pain at 24–48 hours. Although there was some benefit of steroid administration in controlling postoperative leg pain, it disappeared at 1 year and in the overall pooled analysis. The length of hospital stay was much shorter in the steroid group. The frequency of adverse events and complications also favored steroid administration.
Conclusion: Intraoperative epidural steroid administration offers some benefit in pain control with a significant reduction in the length of hospital stay. However, there is insufficient evidence to support the routine use of oral and intravenous steroids in the perioperative period.
Keywords: Lumbar surgery, Lumbar surgery outcomes, Microdiscectomy, Perioperative steroids, Randomized control trials

OP-SP.15-05

Wasting of Extensor Digitorum Brevis as a Decisive Preoperative Clinical Indicator of Lumbar Canal Stenosis- A Single Center Prospective Cohort Study

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Background: The dilemma in managing patients with low back ache lies in differentiating radiculopathy from lumbar canal stenosis. This has a huge bearing in patients being planned for surgical intervention as under performing leads to failed back syndrome whereas overdoing leads to instability. There still remains a loophole in clinically diagnosing lumbar canal stenosis. We opt to utilize a simple bed side clinical examination in routinely assessing patients presenting with low back ache in ruling out underlying canal stenosis.
Method: We performed a prospective study on 120 consecutive patients presenting with low back ache in the spine clinic. Each of them were neurologically examined and thoroughly assessed for wasting of extensor digitorum brevis (EDB) muscles. These were then correlated with the radio-imaging and the intra-operative findings.
Results: Lumbar canal stenosis was mostly observed in the age group of 50-60 years. Diagnosis for L3/4 canal stenosis was made in 44/120 (36.6%), L5-S1 in 52/120 (43.3%) and L3/L4/L5 level in 48/120 (40%) of patients. EDB wasting was seen unilaterally in 72/120 (60%) and bilaterally in 36/120 (30%) of the study group.
Conclusion: This study appraises the clinical implication of observing for the wasting of Extensor Digitorum Brevis muscle so as to aid in the diagnosis of lumbar canal stenosis. This simple bedside clinical pearl can help us in predicting the need of further imaging studies and also in taking right therapeutic decision.
Keywords: Lumbar canal, Stenosis, Wasting, Indicator

OP-SP.15-06

Sacroiliac Joint Pain After Non Instrumented Lumbar Surgery

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Background: Lumbar decompressive surgery without instrumentation (laminectomy and/or discectomy) is an effective treatment for degenerative canal stenosis and disc prolapsed. Postoperative correction of posture and gait may lead to redistribution of forces to the sacroiliac joints (SIJ); this study analyzes the post operative SIJ pain.
Method: Of 92 consecutive patients operated by posterior decompressive surgery without instrumentations by the author, 26

patients showed SIJ pain, within less than 1 month after surgery, that respond to SIJ local anesthetic injections were included in the study (Group A). Other cases without SIJ pain (Group B). All patients are assessed clinically, laboratory and radiologically.
Results: Patients with SIJ pain, group A (n=26),had significantly higher female distribution longer duration of preoperative symptoms than non SIJ pain (group B n=66) (P=0.039 and P=0.042 respectively), there was no significant difference between the 2 groups as regard other parameters include age, type of surgery, and number of operated levels.
Conclusion: The rapid correction of posture and gait after good lumbar decompressive surgery can lead to more stress over the SIJ and surrounding ligaments causing SIJ pain. SIJ pain is a common cause of failed back surgery that can easily diagnosed and treated
Keywords: Sacroiliac joint pain, Lumbar decompressive surgery, Degenerative lumbar canal stenosis, Lumbar disc prolapse

OP-SP.15-07

Trigger Point Injections in Patients with Low Back Pain

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Aim: To know about the efficacy of trigger point injections(TPI) in patients with low back pain.
Method: This was a prospective study conducted between March 2016 till January 2017 in the out patient clinic of Naseer Teaching Hospital and the private clinical set up. All patients complaining of low back pain were included in the study. Name, age, symptomatology, duration of pain, physical and radiological findings, previous history of surgery and other related examination findings were sought on a proforma. Patients with non radiating unilateral symptoms for more than 3 months with acceptable radiology were included, and those with less than three months and radiating symptoms were excluded from the study. Patients were pre-counseled about the injection of steroids with local anaesthetic on 24G needle into the area of intense pain. The data was put forth in SPSS 19 and is presented in the form of tables and charts.
Results: Total 112 patients had a TPI, including 54 males and 58 females. The age range was from 18 to 48 years and the median age was 32 years. Duration of pain was from 3 months to 4 years, morning exacerbation was noted in 43(38.38%), unilaterality and point sign was present in 58(51.78%). Radiology was acceptable in 67%. Side effects like dizziness and pain at injection site was reported in 12(10.71%), 102(91.07%) were followed after one month and of them 83(81.37%) had improvement in symptoms.
Conclusion: TPI is an effective means of alleviating low back pain in selected patient population.
Keywords: Trigger point injections, Low back pain, Steroids

OP-SP.15-08

Comparison of Microscopic Excision of Granulation Tissue with Epiduroscopy-Assisted Adhesiolysis Treatment in the Treatment of Epidural Adhesions

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Background: Today, spinal surgery is the most preferred treatment method in back and leg pain. Therefore, epidural adhesion tissue that occurs in postoperative period is encountered more freguently. Today, treatment of epidural adhesions that occur after spinal surgery is still not fully clear. In our study, we aimed to compare the activities of microscopic and endoscopic treatment methods and their activity time in the treatment of epidural adhesions that occur after microscopic lumbar discectomy.
Method: Our study was designed as a retrospective. Due to the epidural adhesion that occur after lumbar disc herniation surgery, data of 42 patients taken under hospitalization were examined in our department between January 2011 and May 2015.
Results: Microscopic excision of granulation tissue and decompression of neural tissue were performed to 27 patients. 15 patients were underwent adhesiolysis with epiduroscopy. The pain of patients were assessed by Visual Analog Scale (VAS) in postoperative period, in first hour, first week, first month, sixth month and in first year.
Conclusion: It was determined that after making treatments in both patients groups have statistically and clinically benefit in fisrt year. Based on this results; ıt was determined that in patients with microscopic excision of granulation tissue and patients underwent adhesiolysis with epiduroscopy, both treatments are benefical clinically and statistically in the fisrt year. However, in patients underwent adhesiolysis with epiduroscopy, after postoperative first month, it was determined that patients have less benefit from the treatment.
Keywords: Epidural adhesion, microsurgery, epiduroscopy

OP-SP.15-09

Effect of Age on Space Available for Cervical Spinal Cord (SAC) of Asymptomatic Adult Nigerians: The Case for MRI-Based Cervical Spine Screening

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Background: Space available for cord (SAC) is an indicator of cushion available for spinal cord at each level. The aim of this study is to determine age-adjusted SAC values of asymptomatic adult Nigerians. This will serve as screening tool to predict risk of trauma or degenerative disease induced cervical spinal cord injury from compromised CSF cushion.

Method: T1Wi MRI-based prospective, cross-sectional study involving 100 randomly selected asymptomatic adults 21-50 years. SAC was calculated by subtracting disc level mid-sagittal spinal cord dimension (X) from corresponding level spinal canal dimension (Y).
Results: SAC value was 5.40±0.38mm (20-25 years), 5.12±0.51mm (26-30 years), 5.32±0.47mm (31-35 years), 5.16±0.39mm (36-40 years), 4.61±0.77mm (41-45 years), 3.49±0.39mm (46-50 years). At C3/4 SAC was 5.54mm (21-25years), 5.28mm (26-30years), 5.54mm (31-35years), 5.16mm (36-40years), 4.14 (41-45years), 3.42mm (46-50years). (P=0.0001). At C4/5 SAC was 4.89mm (21-25years), 4.95mm (26-30years), 4.76mm (31-35years), 4.52mm (36-40years), 4.31mm (41-45years) and 3.42mm (46-50years). (P=0.015). At C5/6 SAC was 4.98mm (21-25years), 4.84mm (26-30years), 4.96mm (31-35years), 4.86mm (36-40years), 4.30mm (41-45years) and 2.97mm (46-50years). (P=0.0001). At C6/7 SAC was 5.42mm (21-25years), 4.86mm (26-30years), 5.28mm (31-35years), 5.33mm (36-40years), 4.89mm (41-45years) and 3.67mm (46-50years). (P=0.001). Correlation between age and SAC was -0.446 at C3/4 (P=0.0001), -0.266 at C4/5 (P=0.008), -0.272 at C5/6 (P=0.006), -0.197 at C6/7 (P=0.049). Pairwise comparison analysis revealed very significant drop in SAC values obtained in the 41-50 years group across all disc levels when compared with value of SAC obtained from 20-40 years groups (P=0.0001).
Conclusion: There is negative correlation between age and SAC especially at C3/4 level. Effect of age is mostly at C3/4, C5/6 levels. Age group 41-50 years had significant drop in values of SAC and may benefit from prophylactic MRI-based cervical spine screening to predict risk of cord injury.
Keywords: Age, SAC, MRI-based screening

OP-SP.16-01

Clinical Results After Surgical Treatment in Young Male Patients with Low Grade Isthmic Spondylolisthesis

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Aim: To evaluate the long term results of surgical treatment in young patients with low grade isthmic spondylolisthesis (IS).
Method: Postoperative clinical results of 42 patients ageing between 20-29 were retrospectively analized in this study. Oswestry Disability Index (ODI) and Visual Analog Scales (VAS) scores were used to compare patients' preoperative and postoperative pain levels.
Results: All patients were male and the mean age of patients was 23.4 (between 20-29). Mean duration of symphtoms was 1.8 years (between 1-4 years). All patients had physical therapy before surgery and 24 patients (%57,1) used lumbosacral brace. Isthmic spndylolisthesis was present in L5-S1 level in 78.5% (n=33) and in L4-5 level in 21.4% (n=9) of the patients. Mean preoperative ODI and VAS scores were 76.68 (between 43-100) and 5.98 (between 3-10), respectively (p<0,05). Mean postoperative ODI and VAS scores were 26.65 (between 0-66) and 2.49 (between 0-5), respectively (p<0,05).
Conclusion: Posterolateral in stu fusion and transpedicular instrumentation in young well-selected patients with low grade IS reduce pain, improve function and result good clinical outcome. Prospective and multicenter studies with 10-20 years follow-up are needed for further data.
Keywords: Isthmic spondylolisthesis, Young, Posterior stabilisation, Transpedicular fixation

OP-SP.16-02

Maximizing Safety in Spine Surgery: O-Arm Based Navigation Combined to Pedicle Screws Stimulation

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Background: It is well demonstrated in the literature that 3D based spinal navigation techniques improve the accuracy of pedicle screws placement and increase safety due to reduction of malposition complications. Much less are published the papers exposing the problems of radiation exposure during spine surgery and the benefits of associating 3D based navigation to intra operative monitoring.
Method: In this presentation we will show our experience in 70 patients operated for Thoraco-lumbar (from T10 as higher level) and lumbar spine with pedicel screws fixation, based on O-arm 3D navigation and verification of pedicle screws correct positioning by pedicle screws triggered EMG stimulation, followed by 3D scan (O-Arm or Body tom) intraoperative confirmation of the accuracy of screw position. Inclusion and exclusion criteria, the technique and results will be demonstrated in this presentation.
Results: Our results showed high accuracy of 3D based navigation, verified by triggered EMG stimulation and comparing-stimulation to final results with O-arm or bodytom scanning. If stimulation test of pedicel screws is normal (upto 10 mA). So we can avoid additional radiation to the patient and possibly to the OR staff. We do not perform anymore x-rays or 3D scan intraoperative.
Conclusion: Our study shows that using a protocol of routinely combining PS triggered EMG with O-arm based spinal navigation may avoid a redo 3D scan or fluoroscopy in the majority of the patients without compromising the safety Since 2 years all our surgeries with pedicle screw insertion are done under this protocol. No major complications happened or any significant screws malposition
Keywords: Safety in spine surgery, Navigation, O-Arm

OP-SP.16-03

Accuracy of Consecutive Series of 1273 Pedicle Screws Placement in Thoracolumbar Spine with IONM and CT-Guided Navigation (O-Arm) in 230 Patients

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Background: A number of imaging techniques have been introduced to minimize the risk of pedicle screw placement. Either intraoperative neurophysiological monitoring (IONM) or intraoperative CT has been introduced to assist in spinal instrumentation. The aim of this study was to evaluate effectiveness of both: IONM and intraoperative CT-guided navigation in enhancing the safety and accuracy of pedicle screw placement.
Method: The authors included all cases from July 2013 through June 2015 in which IONM and/or intraoperative CT scanning was used to confirm pedicle screw placement.
Results: A total of 230 patients were included. Whole patients were operated with CT-guided navigation system and at 46 cases (20%) IONM was also performed. Of 1273 screws, 53 screws (4,13%) were revised intraoperatively: 45 (4,55 %) with CT- guided navigation and 8 (2,82 %) with IONM. Only 4 (0,32 %) screws in 3 cases was revised in delayed surgery.
Conclusion: Image-guided spinal surgery can be a great option in the operating room and provides high pedicle screw accuracy rates that also increases while IONM is used.
Keywords: IONM, CT-guided, Accuracy

OP-SP.16-04

Interbody Fusion: Is It Has a Rule in Broken Screws in Surgical Management of Lumbar Spondylolisthesis?

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Background: For many years, posterolateral fixation for lumbar spondylolisthesis by using pedicle screw has been the standard procedure for lumbar spondylolisthesis. For increasing fusion and anterior support, the interbody fusion, either with cage or bone, were used by many surgeons, one of the most disappointing complications of pedicle screw fixation is broken screw.
Method: This is retrospective cohort study in six years comparing the number of cases with broken screw between two groups: Group I posterolateral fixation (PLF),Group II posterolateral interbody fusion (PLIF). Analysis of 26 cases of broken screw occurred in six years from 2010 to 2016 which were done in Nasser Institute by the same surgeon and same system.
Results: 26 cases were reviewed, the mean age was 44.6 years, female: 6/26 (23%), male: 20/26 (77%),mean weight: 74.8 kg, site for broken screw: (L1: 4 patients – L2: 2 patients – L3: 2 patients – L4: 4 patients – L5: 6 patients – S1: 8 patients),6 patients had broken screws following trauma, while 20 patients were found spontaneous, all patients was found intraoperatively to have posterolateral fixation, they underwent redo screw fixation,18 patients underwent redo screw fixation with posterolateral interbody fusion (PLIF) while the other 8 patients underwent redo screws fixation with posterolateral fixation. All patients with PLIF didn't come back with broken screws, while 2 patients with posterolateral fixation came back with broken screws.
Conclusion: Posterolateral interbody fusion (PLIF) may have a rule in preventing broken screw in management of lumbar spondylolithesis
Keywords: Spondylolisthesis, Posterolateral fixation (PLF), Posterior lumbar interbody fusion (PLIF), Broken screw, Nasser institute

OP-SP.16-05

Foraminal, Disc Height and Lumbar Lordosis Changes: Comparison Study Following Stand Alone Anterior- Versus Instrumented Posterior Interbody Fusion for L5-S1 Degenerative Disc Disease

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Background: Stand alone anterior lumbar interbody fusion (ALIF) and instrumented posterior interbody fusion has been widely used as a surgical approach for lumbar degenerative disc disease. Still much controversy exists regarding the factors radiologically and biomechanically. This is a retrospective study and the aim is to Compare of stand alone anterior- versus instrumented posterior interbofy fusion for treatment of L5-S1 degenerative disc disease.
Method: Patients underwent instrumented fusion L5-S1 treated with stand-alone ALIF (21 cases) and instrumented posterior fusion (53 cases). The biomechanical sagittal change on the radiographs were assessed.
Results: The pelvic tilt, sacral slope, whole lumbar lordosis and pelvic incidence for stand alone ALIF versus instrumented posterior fusion were 11.1±11.4° vs 15.8±10.06 (P=0.06), 47.3±11.7° vs 35.1±8.57°(P<0.01), 44.7±7.6°vs39.3±11.79°(P=0.03) and 58.4±13° vs 50.9±12°(P=0.01) respectively. Foraminal Height was significantly different between stand alone ALIF versus instrumented posterior fusion 20.9 ± 3° vs 18.5 ± 3.42° at final follow up ($p < 0.01$.) Foraminal Height changes was significantly different between stand alone ALIF versus instrumented posterior fusion 0.8 ± 2.8° vs -2.68 ± 4.57° at final follow up ($p < 0.01$). Posterior disc height changes was significantly different between stand alone ALIF versus instrumented posterior fusion 0.1± 1.2° vs -1.05 ± 1.72° at final follow up ($p < 0.01$.). With regards of ASD stand alone ALIF better than posterior instrumented fusion (7.4% and 11.3%) respectively.
Conclusion: Boths are effective treatment for L5-S1 degenerative disc disease but stand alone ALIF was better in terms of restoration of lumbar spinal imbalance and lower incidence of adjacent segment degeneration.
Keywords: Anterior lumbar interbody fusion, Adjacent segment disease, Spondilolisthesis

OP-SP.16-06

Evaluation of Clinical Outcomes of Sacral Double Screw Technique on Lumbosacral Posterior Fixation

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Background: The sacral double screw system (SDSS) is a novel implant which is designed to resolve the infamous S1 screw loosening problem. The system includes two interlocked screw on

one side of the sacrum, one purchases sacral body and other sacral ala in a novel way. The aim of this study is to evaluate clinical results of SDSS and to compare it with the standard single screw technique on patients who underwent lumbosacral posterior fixation.
Method: For this, 13 patients who underwent surgery using the SDSS and 13 patients (nearly identical for 12 parameters which may potentially affect the outcome) who received standard single S1 screws were reviewed. The follow-up duration was 12 months. Clinical outcomes of both groups were statistically analyzed and compared. There was no implant-related intra-operative complication in both groups. Halo around S1 screws was detected in one case in study group and in 3 cases in control group, one of which was leading to pseudoarthosis.
Results: SDSS group had higher patient satisfaction (85,8 vs 54,2 points, p=0,001) and higher improvement levels (77,2 vs 55,9 points, p=0,03) in pain scores. On the other hand, the SDSS had longer average operation duration (336,9 vs. 259,2 minutes, p= 0,03) and intraoperative blood loss (1021,1 vs 634,6 ml, p=0,06). The reason may be the fact that double screw group had received a higher rate of interbody fusion.
Conclusion: Our results suggest that utilization of SDSS for lumbosacral fixation is a promising technique. Its use may be recommended especially for high-risk patients for implant failure.
Keywords: Pedicle screws, Prosthesis failure, Sacrum

OP-SP.16-07

Early Clinical Results with the Midline Lumbar Interbody Fusion Using Cortical Bone Trajectory Pedicle Screws

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Background: The Midline lumbar interbody fusion (MIDLIF) using the cortical bone trajectory (CBT) pedicle screws was recently proposed as an alternative method to the traditional fusion techniques. The CBT screw follows a mediolateral path in the transverse plane and caudocephalad path in the sagittal plane. The entry point is located closer to midline, on the pars interarticularis. This technique is less invasive, improves screw–bone purchase and reduces approach-related morbidity.
Method: Between January 2016 and January 2017, 36 patients (14 men and 22 women) underwent midline lumbar interbody fusion for degenerative disorders of the lumbar spine. The procedure included bilateral total facetectomy, bilateral intervertebral cage insertion and CBT pedicle screw fixation of the spine. The L3 to S1 levels were instrumented, the L4-L5 being the most frequently fused level. For S1 screws, we used the penetrating S1 endplate technique.
Results: We obtained good postoperative results in all cases. Considerable improvement in both back and leg pain was achieved. The most frequently encountered complication was the pedicle fracture at the screw insertion site (6 cases). The mean operation time, blood loss was and postoperative morbidity were significantly lower than in the traditional lumbar fusion surgery. We observed considerable improvement in VAS, SF-12 and ODI scores comparing to traditional techniques. We present early clinical results of a new technique that appeared to have a better fixation profile in laboratory testing.
Conclusion: The MIDLIF represents a good alternative option to obtain decompression and a solid fixation of the spine through a single minimally invasive procedure.
Keywords: Cortical bone trajectory, MIDLIF, Degenerative spondylolisthesis

OP-SP.16-08

Interbody Fusion. Is It has a Rule in Broken Screws in Surgical Management of Lumbar Spondylolisthesis?

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Background: For many years, posterolateral fixation for lumbar spondylolisthesis by using pedicle screw has been the standard procedure for lumbar spondylolisthesis. For increasing fusion and anterior support. The interbody fusion, either with cage or bone, were used by many surgeons, one of the most disappointing complications of pedicle screw fixation is broken screw. This is retrospective cohort study in six years comparing the number of cases with broken screw between two groups**:** Group I**:** posterolateral fixation (PLF), Group II**:** posterolateral interbody fusion (PLIF).
Method: Analysis of 26 cases of broken screw occurred in six years from 2010 to 2016 which were done in Nasser Institute by the same surgeon and same system.
Results: 26 cases were reviewed, the mean age was 44.6 years, female**:** 6/26 (23%), male**:** 20/26 (77%),mean weight**:** 74.8 kg, site for broken screw**:** (L1**:** 4 patients – L2**:** 2 patients – L3**:** 2 patients – L4**:** 4 patients – L5**:** 6 patients – S1**:** 8 patients),6 patients had broken screws following trauma, while 20 patients were found spontaneous, all patients were found intraoperatively to have posterolateral fixation, they underwent redo screw fixation,18 patients underwent redo screw fixation with posterolateral interbody fusion (PLIF) while the other 8 patients underwent redo screws fixation with posterolateral fixation. All patients with PLIF didn't come back with broken screws, while 2 patients with posterolateral fixation came back with broken screws again.
Conclusion: Posterolateral interbody fusion (PLIF) may have a rule in preventing broken screw in management of lumbar spondylolisthesis.
Keywords: Spondylolisthesis, Posterolateral fixation (PLF), Posterior lumbar interbody fusion (PLIF), Broken screw, Nasser institute

OP-SP.16-09

Clinical and Radiological Results of Dynamic Instrumentation in Lumbar Degenerative Scoliosis and Degenerative Listhesis Surgery

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Background: Posterolateral fusion with transpedicular screwing is one of the common and effective methods used in the treatment of lumbar degenerative scoliosis and degenerative listhesis surgery.

The complication rate of the fusion surgery is high especially in the elderly group. The aim of this article is to investigate clinical and radiological results before and after surgery with dynamic stabilization (peek rod) in patients with lumbar degenerative scoliosis and degenerative listhesis.
Method: 146 patients were included in the study. Patients had lumbar degenerative scoliosis or degenerative listhesis. All patients had either coronal or sagittal alignment. Clinical evaluation of the patients (Visual analog scale, Oswestry Disability Index) was performed. Radiological examinations of the patients were performed with anterior-posterior and lateral scoliosis graphs. All of the 146 patients were stabilized with peek rod together with posterior transpedicular instrumentation. The amount of bleeding and the duration of surgery were determined during surgery of the patients. The anterior-posterior and lateral graphs of the patients were analyzed before and after surgery in the standing scoliosis graphy.
Results: The clinical results of the patients were the same as those patients who underwent fusion surgery. Patients with dynamic instrumentation had shorter duration of surgery and less bleeding.
Conclusion: Transpedicular instrumentation and fusion were found to be more effective in providing scoliosis curvature and lumbar lordosis. However, it was determined that there was no clinical difference. Moreover, complication and revision rates of dynamic instrumentation were found to be much lower.
Keywords: Degenerative scoliosis, Dynamic instrumentation, Peek rod

OP-SP.17-01

Guiding the Course of Spinal Metastases, Patient Factors or Disease Factors?

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Background: The outcome for patients with spinal metastases is difficult to predict, hence multiple scoring systems have been devised. The aim of this study was to determine the effectiveness of various scoring systems for predicting prognosis, as they invariably highlight the significant disease factors.
Method: A retrospective analysis of surgically treated, spinal metastases patients was performed between 2005 and 2016. Data was collected prospectively. Records and follow-ups of 63 patients were reviewed. Treatment and prognosis was analyzed on the basis of SINS, Tomita, modified Tokouhashi and Bauer scores.
Results: Records of 63 patients averaging 54 years were analyzed. The Tomita scale was applicable on 44 patients and modified Bauer on 49, whereas SINS and modified Tokouhashi scores were calculated for all 63 patients. For our series, Tomita Score provided the highest statistical significance (p=0.000) followed by Bauer (p=0.002) and Tokuhashi (p=0.003). Notably, SINS showed no significant correlation in predicting patient survival. Preoperative variables like, gender, region of the spine, symptom duration and surgical approach had no correlation with survival. Age (p= 0.008) and functional status of the patient (p=0.016), however depicted a statistically significant relation.
Conclusion: Our study showed that, of the four widely used prognostic criteria; Tomita, modified Tokouhashi and Bauer showed statistically significant results. Malignancy runs a different course, disease factors were found to correlate well with overall survival compared to patient individual factors. It is well reflected by the effective usage of these prognostic scores.
Keywords: Metastases of spine, Prognosis, Scoring system, Tomita, Bauer, Tokouhashi

OP-SP.17-02

Spine Metastatic of the Prostate's Cancer

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This is a retrospective study covering 3 years (2012-2014) involving 17 patients with vertebral metastases on prostate cancer in the neurosurgery and urology departments of the General Hospital of Grand Yoff.
Our study showed**:**

- The frequency of spinal metastases in our study is 21.26%.
- The average age of our population is 65.82 years.
- 41.18% of our patients first came to the metastatic stade and 35.29% had spinal metastases in the first year, resulting in a total of 76.47% of metastasis cases after one year of diagnosis.
- Prostatism is the most commonly encountered call symptom.
- Almost half of our patients have a poor karnosky index.
- With regard to spinal metastases, the pain is virtually permanent in our study with 82.35% of the cases.
- Spinal cord compression is present in 9 patients.
- About 50% of our patients are of Frankel stage A or B.
- Spinal metastases were diagnosed by standard radiography (29.41%), CT (64.70%). MRI was performed in 47.06% of our patients. The vertebral lesions that we have identified in our patients are osteolysis or mixed in 2/3 of the cases. Epiduritis is associated in half the cases.
- 6 patients (35.29%) received decompressive laminectomy for medullary compression with partial removal of epiduritis.
- Chemotherapy was indicated in a single patient and no radiotherapy was performed.
- Our death rate is high and 82%. Our median survival is encouraging as it shows a median 1-year survival of 82% and a 2-year survival of 29%.

Keywords: Spine, Metastatic, Prostate

OP-SP.17-03

Spine Stereotactic Radiosurgery

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Stereotactic radiosurgery has been offered as a good option for treatment of brain tumors, both of metastatic and extrinsic benign pathologies, reaching tumor control rate of as high as 90%. Similarly, it may be an option for treatment of patients with tumors of the spine not eligible for surgery, which may affect at least 100,000

patients a year and a significant number of which develop spinal cord compression.
The technique of spine radiosurgery in our institution was described. With regards to tumor histology, our patients include metastatic histologies that range from prostatic cancer, osteosarcoma, breast cancer, lung cancer, and rectal adenocarcinoma, and benign tumors like schwannoma and meningioma. The age range was from 30 to 83 years where majority were males. The most common site that was treated was the thoracic spine. Treatment targets per patients ranged from one to three. The average dose of treatment was 15.3 Gy. Our patient population responded well in terms of pain relief (VAS score), clinical improvement of motor strength and local tumor control.
Based on our experience, spine stereotactic radiosurgery is an effective alternative treatment option for spine tumors.
Keywords: Spine tumors, Stereotactic radiosurgery, Minimally invasive treatment of metastatic spine tumors

OP-SP.17-05

Spinal Metastasis: Diagnosis to Management; Study of 42 Cases and Literature Review

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Background: Spinal metastasis is common complication of malignant tumor. The diagnosis is easy with the development of new neuroimaging modalities but their management is subject of controversy. We report 42 cases of spinal metastasis managed in our department to discuss indication of treatment and outcome in spinal metastasis.
Method: This is a study of 42 patients**:** from January 2009 to December 2016. It included 36 men and 16 women with a mean age of 49,3 years. Lung tumor was the main origin. Back pain is the most frequent sign present in 100% of cases; motor dysfunction 89, 1%. Thoracic spine is frequently affected. 75% were operated.
Results: Spine is the most common site of metastasis and can occur in 40% tumor evolution. Men were more affected and the average is 40-65 years. Lungs, breast and prostate cancers are the most incriminated. Thoracic spine is often affected. Back pain is the most common sign. If the problem with their prognosis has been solved since years through studies TOKUHASHI and TOMITA, the challenge related to the appropriate support benefited from SINS stability study. It is a multidisciplinary support which must made on individual basis with a principal objective of offering a proper life ending to the patient by combining surgery and cancer treatments. Our sample results then confirms what has been discussed in the literature.
Conclusion: Spinal metastases occur frequently in the development of cancers. Their number has increased in recent years. We need multidisciplinary approach.
Keywords: Spine, Metastasis, Surgery, Oncologic treatment

OP-SP.17-06

Management of Rare and Complicated Spinal Tumors in a Peripheral Hospital

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Tumors in the spinal column are a group of diseases wherein not many institutions have vast experience due to their relative rarity in occurrence compared to other pathology. We would like to present a case series of 15 spinal column tumors in a district hospital for their various pathology at various levels. The tumors involved sacral chordoma, Meningiomas, Secondaries, Astrocytomas, Ependymomas, Schwannomas etc.
Surgical treatment involving total sacrectomy, varying degrees of decompression, excision and stabilisation were done with good results, no mortality, two cases of temporary disability which improved over time and no permanent disability.
Keywords: Neoplasm, Spine, Surgery

OP-SP.17-07

Intraoperative Neurophysiology Monitoring for Intradural - Extramedullry Spinal Tumours – Is It Really Helpful?

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Aim: To evaluate the outcome of the intradural spinal tumours operated on using intraoperative neurophysiology monitoring in select cases. Retrospective review of all the patients (40 in total) operated on for intradural spinal tumours between April 2008 and April 2016 by a single surgeon were included in the study. Total of 40 patients were operated upon by the author for intradural spinal tumours using intraoperative neurophysiology monitoring when appropriate/ available.
Method: All the patients having intradural spinal tumour were operated upon by the presenting author. The possibility for intraoperative neurophysiology monitoring was discussed pre-operatively with the neurophysiology team when indicated and appropriate monitoring techniques were employed during surgery**:** motor evoked potentials (MEPs), somatosensory evoked potentials (SEPs), free running and stimulated EMG.
Results: The outcome of surgical excision of intradural spinal tumours was enhanced using intraoperative neurophysiological monitoring, most effectively with MEPs, though EMG was often most effective to identify structures – particularly in the conus region.
Conclusion: The use of appropriate intraoperative neurophysiology technique in selected cases of intradural spinal tumours increases safety of surgical excision and surgeons' confidence/ comfort during the operative procedure. Monitoring and mapping are often separate**:** the motor evoked potentials in general are considered most sensitive and robust for monitoring, giving immediate feedback, while free running and stimulated EMG aid in identifying nerve roots.
Keywords: Spinal tumours, Neurophysiology monitoring, Intra-operative

OP-SP.18-01

Anterior Lumbar Approach: Experience with "Access Surgeon" 2002-2006 and without 2006-2016: Analysis of Complications and Morbidity. Retrospective Review

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Aim: To analyze the incidence of complications related with exposure of anterior lumbar spine in two diferents periods, between 2002 to 2006 when the approach was done by "access surgeon" and since 2007 to 2016, when the approach was done by "spine surgeon"
Method: A retrospective review of the medical records for 330 patients who underwent anterior lumbar spine surgery in two institutions since 2002 to 2016. Each record was analysed for diagnosis, levels, procedure, implant, trans and postoperative complications, and if the approach was conducted by "acces surgeon" (2002-2006) or by "spine surgeon" to compare incidence of complications.
Results: The percentage of complications in access surgeon was 32% compared with spine surgeon 11.6%. Venous rupture was experienced in 11.2% and 8.4% for the access surgeon and spine surgeon respectively. Severe bleeding more than 1000 ml was present in three patiens in accesss surgeon and no patients in spine surgeon. Two cases with venous thrombosis in access surgeon and no patients in spine surgeon. The incidence of other kind of complications were similar in both groups.
Conclusion: Our results based in our experience after 14 years support the concept that the anterior lumbar approach can be done by spine surgeon without of "access surgeon". The rate of complications related with the exposure of the anterior lumbar spine was higher in "access surgeon" group. However we must emphasize that is necessary adecuate training and judgment before the spine surgeon perform this kind of approach without "access surgeon".
Keywords: Access surgeon, Lumbar spine, Anterior approach, Complications, Review

OP-SP.18-02

Efficacy of Intraoperative Computed Tomography Navigation in Spine Surgery: Preliminary Evaluation

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Background: Imaging-guided surgery, providing intraoperative real-time navigation, allows greater accuracy, a lower rate of screw misplacement, and reduced surgical time for spinal surgery. We present our preliminary study utilizing intraoperative computed guided (IOCT) for spine surgery.
Method: A preliminary evaluation of 14 consecutive cases operated at King Abdulaziz University Hospital in Jeddah during the period from March 2016 – February 2017 with different spinal pathology. We utilized IOCT (Airo, Brainlab AG Germany). The time of the procedure, radiation exposure, and screws placement was evaluated.
Results: A total of 14 patients underwent spine fixation with IOCT. 57% of them were males and 53% females. The mean age of the patients was 53.78 years. A total of 100 screws were placed (4 Cervical pedicle screws, 2 Cervical lateral mass screws, 26 Thoracic pedicle screws, 60 Lumbar pedicle screws and 8 Sacral pedicle screws), the accuracy rate was 98%, and only two screws were revised intraoperatively (Thoracic screws).
Conclusion: Intraoperative CT neuronavigation achieves a relatively high accuracy of screws implantation. It is a very useful tool especially in a complex spine pathology and spine trauma cases, as a misplaced screw can be revised during real-time confirmation of the screw position, and no subsequent operation will be required for revision.
Keywords: Spine fixation, Navigation, CT scan, Intraoperative

OP-SP.18-03

Anterior Approach to the Thoracolumbar Junction: Our Experience About 55 Cases

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Background: We wish to report our experience in this kind of surgery and also to compare our results to the literature. This work describes the surgical technique to approach the thoracolumbar hinge of the spine and reports the clinical and radiological characteristics of patients as well as their outcome.
Method: A retrospective analysis of 55 medical files of patients who have been hospitalized at our department between January 2003 and December 2016. All patients have been operated by thoracophrenotomy.
Results: The mean age of our patients was 32.8 years, with a clear male predominance. All patients were initially admitted with motor disability that was classed using the Frankel grading**:** 07 cases of grade B (13%), 36 cases of grade C (65%), and 12 cases of grade D (22%). Plain X-rays of the spine were performed in all cases. 19 patients underwent CT scan (35.5%), and 43 patients were explored by MRI (78%). The mean time of hospitalization was 12 days. In all cases, the goal of the intervention was to achieve a satisfactory decompression of the spinal cord and a good stabilisation and alignment of the spine. Tuberculosis was the cause in the majority of cases (30 cases) followed by traumatism (14 cases). At follow up, all patients won at least 1 grade according to the Frankel classification.
Conclusion: The anterior approach of the thoracolumbar hinge of the spine seems to be an effective method in the surgical management of spinal diseases with good neurologic results.
Keywords: Anterior approach, Thoracophrenotomy, Tuberculous spondylodiscitis, Spinal cord compression

OP-SP.18-04

Assessment of Spinal Cord Motion Using MRI CINE-FIESTA Protocol

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Background: The assessment of SCM has several clinical implications. A detailed knowledge on SCM motion is necessary in the assessment of accurate radiation therapy to the spinal cord. However, characterization of SCM in healthy individuals is not clear. The aim of the current study is to investigate SCM in healthy volunteers.
Method: SCM was examined in 23 healthy volunteers. An MRI (Cine-FIESTA sequence) of the spine was performed. SCM was examined at three levels (upper-mid-lower) of the cervical and thoracic region. The SCM was assessed at different directions including anteroposterior (AP), transverse (TR), and superior-inferior (SI). Quantitative assessment of SCM was done using an image processing software (Fiji).
Results: The mean magnitude for SCM in AP direction was less in the cervical region compared to the thoracic area(0.25 0.23 mm vs. 0.30 0.18 mm respectively, P=0.241, no statistical significant). SCM in SI direction for thoracic area was found significantly higher than the cervical spine(0.42 0.23 mm vs. 0.23 0.21 mm, respectively, P< 0.0001). Interestingly, patient's age was found to have a negative correlation with AP cervical SCM, (P= 0.043). In addition, with increasing patient weight, cervical SCM has increased in all the directions, AP (P= 0.017), TR (P=0.003), and SI (P=0.002). With increasing patient height, cervical SCM has increased in all the directions, AP (P=0.002), TR (P=0.003), and SI (P=0.010).
Conclusion: SCM was found to be variable from one patient to another and from one level to another. Studying the normal SCM may advance our understanding of spinal cord physiology and aid in applied therapies and/or prognosis of different spinal cord illnesses.
Keywords: Spinal cord motion, Spinal cord pulsation, Spinal cord radiation

OP-SP.18-05

Segmental Surface Referencing During Intraoperative Three-dimensional Image-Guided Spine Navigation: An Early Validation with Comparison to Automated Referencing

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Background: Intraoperative three-dimensional (3D)-guided navigation improves spine instrumentation accuracy. However, image acquisition may need to be repeated with segment hypermobility or distant target from reference frame (RF). The current study is an interventional human cadaver study and evaluates the usefulness of internal metal fiducials (IMFs) as surface references in enhancing registration accuracy and avoiding repeating imaging.
Method: Six fresh-frozen cadaveric human torsos were utilized. Posterior C1–T2 exposure was done, and three IMFs were inserted per level; intraoperative 3D images were then acquired. Two registration methods were utilized**:** autoregistration (AR, group 1) and point registration using IMF (IMFR, group 2). Registration accuracy was checked by identifying IMFs in both groups. Pedicle screws inserted into C2, C4, C5, and C7 based on the two registration methods (three cadavers each) with RF on C7 and then on C2.
Results: The mean registration error was lower with IMFR compared with AR (0.35±0.5 mm versus 2.02±0.85 mm, p=0.0001). Overall, 34 pedicle screws were inserted (AR, 18; IMFR, 16). Final screw placement was comparable using both techniques (p=0.58). Lateral screws violations were observed in four IMFR screws (1 to 2 mm) as compared with five in AR group (2 to 3mm). Reregistration after moving RF to C2 was possible using surface screws in IMFR group, thus avoiding new 3D image acquisition.
Conclusion: During intraoperative 3D navigation in spine procedures, surface fiducial registration using IMF provided superior accuracy over automated registration. It allowed repeat registration without repeating radiation during long spine segment instrumentations. More studies are needed to clarify both practical and clinical application of this method.
Keywords: Spine instrumentation, Pedicle screws, Spine navigation, Cervical spine, Fiducial markers, O-arm

OP-SP.18-06

Hirayama Disease - A Review of 10 Years Experience of a Corporate Hospital in India

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Background: Hirayama disease is rare form of dynamic cervical myelopathy. Surprisingly the incidence is more in Asian Countries-Japan, India etc. & more in younger age & male sex. The pathogenesis is constantly debated which has initial insidious onset, then gradual progressive, then a period of deterioration followed by a stable phase. Early diagnosis and treatment are the mainstay for the prognosis of this disease.
Method: Based on clinical presentation and radioimaging, we had 14 patients who were diagnosed to have Hirayama Disease. EMG & NCS were done in all the patients. All these patients underwent surgery-10 patients underwent Anterior cervical stabilization, 3 underwent Anterior cervical stabilization & fusion with PEEK cage and 1 underwent Anterior & posterior stabilization. All patients were assessed postoperatively and followed up for period of 2 years. Odom's Outcome Criteria was used to assess the improvement in the preoperative features.
Results: 8 out of 10 patients who underwent Anterior cervical stabilization had good outcome and 2 had fair outcome, 1 of the 3 patients who underwent Anterior cervical stabilization and fusion with PEEK cage had good outcome and other 2 had fair outcome, and 1 patient who underwent Anterior & posterior stabilization had fair outcome.
Conclusion: Suspicion of Hirayama Disease in Adolescent male patients with atrophy of hand & forearm muscles and early diagnosis & treatment followed by regular physiotherapy is the mainstay for better outcome. Anterior cervical stabilization with or without decompression can be considered as a treatment of choice and recommended by us.
Keywords: Hirayama disease, Dynamic compressive cervical myelopathy, Juvenile muscular atrophy of upper extremity, Monomelic amyotrophy

OP-SP.18-07

The Adversity of Managing the Spinal Pathologies in a Single Centre in Bandung, Indonesia: Is It a Well-Developing Health System in a Developing Country?

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Background: The lack of knowledge about health problem is one of the major problem in developing countries. This condition leads to poor judgement of symptoms and delayed of diagnosis. The needs of advanced diagnostic tools, surgery and medical treatments in spinal pathologies compound those difficulties in achieving the optimal outcome. But all the problems were not well-documented as an objective data to evaluate the adequacy of the health system. The aim of this study is to overview the pre-hospitalization, hospitalization, surgery and post-hospitalization problems in a single centre study.
Method: This is the retrospective study with statistical analysis. We reviewed the records of patients who presented to Neurospine unit of Neurospine Perihperal Nerve and Pain Division, Neurosurgery Departments Hasan Sadikin General Teaching Hospital, Bandung from 2010 through 2016.
Results: There were 590 consecutive patients included in the study who met the inclusion criteria. The data was recorded for the demographics, time of the initial symptoms to diagnosis, surgical procedure, pathology entities, and 12-months follow-up obedience. We described the complicating factors from patient's history taking and literature review.
Conclusion: The good collaboration of the surgeons, medical caregivers, peers and relatives support plays important role to establish the proper data registry that can enhance the development of health system in our centre.
Keywords: Spinal pathologies, Developing country, Health system

OP-SP.18-08

Lumbar Facet Joint Angles: Morphometric Study

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Background: Our aim in our study is to understand the mean and standard values by forming a nominative database from the sides of the lumbar facet joints and to predict the values in the lumbar facet joint pathologies.
Method: Two hundred and two adult lumbar spinal Magnetic Resonance Imaging (MRI) images of patients from emergency department and outpatient clinic were reviewed retrospectively. Facet joint angles were measured by Grobler method using lumbar MRI axial views.
Results: 202 patients (102 females, 50.49% and 100 males, 49.51%) participated in the study. The mean age of women was 37,03 ± 11,52 and the mean age of men was 37,55 ± 11,53 respectively. There was no significant difference between sexes in terms of measured values ($p > 0.05$).
Conclusion: We tried to find the average values of the Lumbar facet joint angles in order to make a comparison with pathologies such as facet joints degeneration and other spinal diseases by creating a nominative database.
Keywords: Facet joint angles, Grobler method, Morphometric study

OP-SP.19-01

Microendoscopic Decompression in Single and Multiple Level Lumbar Canal Stenosis: A Series of 583 Cases

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Background: The current study focuses on the clinical outcome and utility of minimally invasive microendoscopic decompression via a unilateral approach in surgical management of patients with single and multiple level lumbar canal stenosis.
Method: From May 2008 to January 2016, 583 consecutive patients were treated for lumbar canal stenosis at our institution. Single level decompression was performed in 468 (80%) cases and multiple level decompression in 115 (20%) cases. Magnetic resonance imaging (MRI), computed tomography (CT) scan and plain X-rays were performed for all patients and then repeated postoperatively. All patients were followed up for at least 3 months and their data collected. Clinical and functional outcomes were assessed using Visual Analogue Scale (VAS) and the Japanese Orthopedic Association (JOA) score for lumbar disease.
Results: Compared to preoperative complaint, there was an improvement of back pain in 62% of patients and in radiating leg pain in 86%. With regards to functional outcomes, median preoperative JOA score was 14.93± 0.48 and improved postoperatively to 27.17 ± 1.45 ($p < 0.001$). The mean operating time per level was 78 minutes, and the mean intraoperative blood loss per level was 18 ml. Complications mainly included dural tears in 27 (4.6%) cases, transient postoperative dysesthesia in 46/583 (7.9%) cases and excess bony work in the form of unintended medial facetectomy in 38/583 (6.5%) cases and fracture of the spinous process in 3 (0.5%) cases.
Conclusion: The microendoscopic decompression technique via a unilateral approach is safe and effective in treatment of single or multiple level lumbar spinal stenosis.
Keywords: Endoscopic, Minimally invasive, Canal stenosis

OP-SP.19-02

Bilateral Decompression Using Unilateral Approach on Stable Degenerative Lombar Stenosis: Analysis of 48 Cases

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Background: Degenerative lombar stenosis is a common disease. Several surgical techniques are available. In our study unilaterally approached bilaterally decompressed patients were studied retrospectively.

Method: 48 patients who operated for lumbar stenosis disease between 2012 and 2015 were included. Under microscopic visualization, bilateral decompression was performed by unilateral approach from the most affected side. Patients were followed up with preoperative and postoperative radiological findings and VAS scores.
Results: Male/Female ratio was 20/28. Mean age of the patients was 59.8(26-79). Most common sypmtom was back pain and radiculopathy and the second was the shortening of the walking distance. 22 patients were decompressed for one level; it was 20 for two and 6 for three levels. The total sum of 80 decompression was performed for 48 patients. L4-5 was the most stenotic segment. A simultaneous decompression and microdiscectomy was performed in 18 patients. The mean spinal canal diameter shown in MRI was 69.9 preoperatively while it was 142.8mm postoperatively. Dural tear was present in 4patients; primary suturation and tissue adhesives were used to close the tear. One patients was reopereated due to the CSF leakage. Postoperative pain was regressed for average of 5 levels according to VAS. On long term followup 5 patients were reoperated for instability.
Conclusion: Bilaterally neural decompression by unilateral approach under microscope is a technique that allows adequate decompression with the results of lower operation time and blood loss and minimal disturbance to the anatomical integrity. This less invasive technique may be preferred for elderly patients with comorbidity.
Keywords: Bilaterally neural decompression, Lombar stenosis, Unilateral approach

OP-SP.19-03

Decompressive Surgery via the Unilateral Paramedian Muscle Splitting Technique for Lumbar Spinal Stenosis

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Background: Conventional surgical treatment of lumbar spinal stenosis involves decompression via laminectomy or bilateral laminotomy procedures with exposure of bilateral paraspinal musculature. However, this may increase the risk of postoperative pain syndromes secondary to muscular atrophy and fibrosis. The technique of decompression in lumbar spinal stenosis via the unilateral paramedian muscle splitting approach with minimal tissue dissection was described.
Method: Patients who underwent decompressive surgery for lumbar spinal stenosis were divided into the conventional group, laminotomy procedure with bilateral dissection of paraspinal muscles (Group A) and the minimal access group, laminotomy with paramedic muscle splitting technique (Group B).
Results: Our results showed that there is no significant difference in the operative times, blood loss and postoperative improvement, with a trend towards less pain scores and less hospital stay for the minimal access group.
Conclusion: Decompressive surgery using the unilateral paramedian muscle splitting approach is effective in the treatment of lumbar spinal stenosis.
Keywords: Lumbar stenosis, Minimal access surgery, Minimally invasive spine surgery

OP-SP.19-04

Minimal Invasive Interlaminar Fusion in Lumbar Spinal Stenosis, Comparison W/O Additional Interbody Fusion

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Aim: To retrospectively evaluate pain resolution and function scores through 3 years following lumbar decompression and interlaminar spacer implantation. With regard to the preservation of the special conditiones of the moveability of lumbar spine segments the surgical therapy including movement preservation procedures was discussed frequently.
Method: This retrospective case-series included 150 patients presenting with chronic lumbar back pain caused by lumbar spinal stenosis. The follow up time was 5 to 7 years. 90 Patients underwent decompression combination with implantation of an interlaminar Peek Cage in combination of processus spinosus fixation by screw and clamp (ILIF). Group "DA". In 60 cases, in addition to the aforementioned procedure was the implantation of one TLIF Cages in the intervertebral space performed. Group "DAC". Clinical outcomes measures were collected pre-operatively, and continuing stepwise up to 7 years. Outcomes measures included standardized common measurement scoring systems (VAS, Oswestry, SF 36).
Results: Drop out rate**:** 2%. Patient's age in years was distributed. Significant improvement of the walking distance. No further improvement after 3 month. Significant reduction of medication in the follow up in all cases. In the oswestry disability scores singnificant improvement relations. No intraoperative complications are reported. Post OP complication are in report**:** 2 spinosus fracture, 6 seromas, Operative revision in 3 cases. No infection.
Conclusion: The interlaminar Spacer implantation and the additional interlaminar fusion has a significant positive effect on the development of complaint and stability.
Keywords: Spinal stenosis, Interlaminar fusion, Interbody fusion

OP-SP.19-05

Unilateral Instrumentation-Fusion and Bilateral Decompressive Surgery in Degenerative Lumbar Spinal Stenosis via Unilateral Approach; Advantages and Comparison to Different Approaches

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Background: Lumbar stenosis is a common spinal pathology needing treatment because of associated back and leg pain, neurogenic claudication, and disability. Efficient surgery method is still an open laminectomy, which involves wide muscle retraction and extensive removal of the posterior spinal structures. However, this can lead to instability and the need for additional spinal fusion. Therefore, instrumented correction would be required for the restoration of sagittal balance with the following operations. The purpose of the present study was to evaluate the effectiveness of unilateral instrumentation, unilateral arthrodesis, and bilateral decompression via unilateral approach in both one-level and two-level lumbar spinal stenosis.

Method: 18 patients were enrolled in the study. Oswestry Disability Index (ODI) and Visual Analogue Scale (VAS) were applied to the patients in the preoperative and post operative period. Radiologic assessments of the stenosis were analyzed by means of using BAB Image System software. Operating-time, blood-loss, hospital-stay, and complications were also evaluated and compared.
Results: Of the 18 patients, 6 were male and the median age of the whole group was 65.7±9.1 years. Duration of operation was 105 min (90-120), loss of blood was 75 (30-110) ml, and hospitalization was 3 (2-4) days. On comparing the ODI, VAS, and the canal width, there was significant difference between pre- and post-operation.
Conclusion: Bilateral decompression with unilateral instrumentation and arthrodesis via unilateral approach preserves spinous process, supraspinous and interspinous ligament, and paravertebral muscles of the opposite side and cause less epidural fibrosis, blood loss, hospital stay as well as providing satisfactory clinical results in lumbar spinal stenosis.
Keywords: Lumbar spinal stenosis, Unilateral instrumentation, Unilateral approach, Bilateral decompressive surgery

OP-SP.19-06

Comparison of Unilateral Versus Bilateral Pedicle Screw Fixation in Transforaminal Lumbar Interbody Fusion for Single Level Lumbar Degenerative Diseases and Review of Literature

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Background: There are some recognized treatment modalities in the literature for the treatment of lumbar degenerative diseases, which cause pain and avoidance of daily life activities for the patients. The most widely accepted algorithm in the literature is medical treatment, physical therapy and minimally invasive pain-relieving therapies, if necessary, followed by surgical interventions. The common procedure used in neurosurgery practice is the decompression of neural elements followed by fusion. It is reported in the literature that unilateral pedicle fixation and Transforaminal Lumbar Interbody Fusion (TLIF) procedure have many advantages compared to bilateral pedicle screw implementation (PSF). We examined the clinical and radiological follow-up and results of our patients undergoing fusion procedure by unilateral versus bilateral pedicle screw fixation along with TLIF.
Method: 54 patients were included in the study. 33 patients were operated with bilateral PSF and TLIF and 21 had unilateral PSF and TLIF. The patients were evaluated preoperatively, on the postoperative 15th day, 6th and 12th month, and at the time of last examination (38 months in average for all patients) using Visual Analogue Scale (VAS) and Oswestry Disability Index (ODI). Fusion rates were examined with direct X-ray films with flexion-extension dynamic views and 3D CT scan.
Results: Operation times are shorter and blood loss is less in the unilateral PSF group. Fusion rates are similar in both groups with no statistical significance. For both groups significant clinical improvement was observed in the preoperative and postoperative scores.
Conclusion: Unilateral PSF along with TLIF procedure is an effective option in selected patients. We need prospective randomized studies with higher number of patients and longer follow-up periods for more reliable results.
Keywords: Lumbar degenerative disease, Interbody fusion, Bilateral fixation, Unilateral fixation

OP-SP.19-07

Surgical Outcome of Unilateral Approach in Lumbar Spinal Stenosis; Report of 42 Cases

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Background: Degenerative stenosis in lumbar spine is the most frequently observed type of spinal stenosis and is common among the elderely who present as low back pain and sciatica. Age associated degeneration involves disc hieght reduction, bulging of disc, osteophyte formation, facet hypertrophy and sometimes listhesis. Various procedures are described in the literature to relieve the symptoms. Aim of this study is to asses whether microscopic or endoscopic decompression of both sides from one side is helpful or not.
Method: A prospecpective study of 42 cases were observed of whom 28 were male and 14 were female. A single surgical procedure of unilateral approach to decompress the both sides in lumbar spinal stenosis was studied. Patients having cauda equina syndrome or spinal instability were excluded from the study.
Results: Out of 42 patients 4 were not improved, 1 had CSF leak and 1 had discitis. 36 patients were pain free.
Conclusion: The unilateral approach from one side for lumbar spinal stenosis is safe and efective. Correct level diagnosis prior to surgery is essential. There should be no instability. It should be done under microscope/endoscope. There is risk of injury to neuronal stuctures which can be eliminated by skillness and prior pathological concept.
Keywords: Lumbar spine, Stenosis, Unilateral

OP-SP.19-08

Effects of Non-Instrumental Microdecompression on Quality of Life in Patients with Lumbar Spinal Stenosis

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Background: In this study, preoperative and postoperative pain, walking distance levels (neurogenic claudication; NC), and daily activity levels were studied in patients with a lumbar spinal stenosis (LSS).
Method: Twenty-two (male = 13, female = 9) patients who had LSS without spinal instability were included in this study. Microdecompression surgery was performed with unilateral hemilaminectomy and bilateral flavectomy. Visiual Analog Scale

(VAS), Oswestry Lumbar Disability Questionnaire (OSW) were administered preoperatively and six months postoperatively, and spinal instability was investigated by radiological examinations.
Results: VAS, OSW, NC values were not different between the male and female patients before and after surgery. Except OSW values, postoperative VAS and NC values of women and men reached close to those of healthy people levels. Postoperative dynamic lumbosacral X-rays showed no new listesis and/or spinal instability. In literature, conservative treatment, surgical decompression, medial facetectomy, microdecompression has been suggested in treatment of LSS. In surgery, laminectomy and fusion with instrumentation has been recommended in order to reduce the postoperative spinal instability. However, there have been many reports suggesting that fusion of these patients is not necessary. In present study, spinal decompression with hemilaminectomy and bilateral flavectomy could decrease long-term axial lumbar pain in patients; whereas in these patients no fusion with instrumentation was needed. Furthermore, it could improve long-distance walking in long-term follow-up.
Conclusion: It could be suggested that surgical microdecompression without instrumentation should be kept in mind as an option in LSS patients who have no spinal instability.
Keywords: Lumbar spinal stenosis, Microdecompression, Oswestry

OP-SP.19-09

Minimally Invasive Techniques in the Treatment of Degenerative Spine Diseases

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Background: Patients with chronic back pain with ineffective conservative treatment and open surgery is not indicated, but which have a local persistent pain, there is a need for minimally invasive procedures in order to relieve pain. The aim of the study was to examine the results of radiofrequency ablation of facet nerves and percutaneous nucleotomy used to eliminate irritative-radicular and reflex pain syndromes.
Method: We studied the results of radiofrequency ablation (RFA) in 22 and percutaneous nucleotomy in 14 patients with degenerative processes of intervertebral discs and spondylarthritis. All patients underwent a complete clinical and radiological examination, including**:** laboratory studies, MSCT, MRI, EMG.
Results: According to MRI and MSCT revealed degeneration of the 1-3 vertebral segments with disc protrusion into the spinal canal to 4 mm without compression syndromes from the spinal cord and nerve roots. RFA and percutaneous nucleotomy performed in the operating room under fluoroscopic guidance with "C" arm. Depending on the severity of the reflexive and irritative-radicular pain syndrome, disc degeneration degree patients underwent radiofrequency ablation or percutaneous nucleotomy, or a combination of these two methods. Short-term results were studied on the basis of clinical data - on a scale Nurick (NS).
In 90% of patients reached the level of 1, 10% the level 2 of the scale. The negative results were not observed.
Conclusion: The use of minimally invasive techniques in the treatment of degenerative spine diseases gives positive results for pain regression and improve the quality of life of patients.
Keywords: Back pain, Minimally invasive, Nucleotomy, RFA

OP-SP.20-01

Proximal Junction Kyphosis After Long Thoracolumbar Fusions for Adult Spinal Deformity: Do Radiographic Mechanical Failures Correlate with Revision Surgery?

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Background: PJK after surgery for ASD is caused by a gradual degenerative process or acute mechanical failures. We evaluate relationship between types of PJF and revision surgery rates after ASD surgery.
Method: Consecutive adults who underwent thoracolumbar fusions for ASD (2003-2011) were reviewed. Inclusion criteria**:** instrumentation from pelvis to L1 or above and minimum 2 years follow-up. Peri-op spinal deformity parameters and presence of vertebral body fracture, screw pullout, or spondylolisthesis at the proximal junction were analyzed. Associations between PJF and the development of radiographic PJK and need for revision surgery for PJF were assessed.
Results: Of 340 patients (M**:** 86; F**:** 254; avg age 63±10yrs), 176 (51.8%) developed PJK and 48 (27.2% of those with PJK / 14.1% of the whole cohort) underwent revision for PJK. Fractures of the upper-instrumented vertebrae (36.8%) occurred more commonly than screw pullout (14.4%) and listhesis (5.2%)($p<0.01$). Mechanical failures occurred together in 50 patients**:** screw pullout/fractures (n=32; 12 revised), fractures/listhesis (n=14; 10 revised), screw pullout/listhesis (n=4; 2 revised), and all three (n=4; 3 revised). Radiographic PJK developed**:** in 83.2% with fractures, 79.6% with screw pullout, and 100% with listhesis. Odds ratio of PJK development was 8.07($p=0.000$) for fracture and 2.93($p=0.01$) for screw-pullout. Revision for PJK was not required for some fractures (64.5%), screw-pullouts (61.6%), and listhesis (38.9%).
Conclusion: After long fusions for ASD surgery, PJK occurred in more than 50% of patients, of whom 27.2% were revised. Junctional mechanical failures (fracture, screw pullout, spondylolisthesis) often do not undergo revision surgery.
Keywords: Adult spine deformity, Proximal junctional kyphosis, Proximal junctional failure, Screw-pullout, Fracture, Listhesis

OP-SP.20-02

Microsurgical Approach to the Lateral Disc Herniation in the Lumbar Spine Using Metri'x System

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Background: Lateral lumbar disc herniation is frequent clinical entity in neurosurgical practice, though-evolving imaging

techniques becaume better know than before. !!there has been discussion as to the most suitable surgical approach to a lateral disc lesion. The purpose of this study was to describe and to determine the feasibility of performing lateral lumbar discectomy by using Metri'x System by a microsurgical approach.
Method: This reptrospective observational study was undertaken for the analysis of 120 patients with lateral lumbar disc herniation who underwent microsurgical approach using Metri'x System betwen 2012 and 2017. Clinical outcomes were assessed with Oswerstry Disability Index (ODI) and Short Form-36 Health Survey (SF-36).
Results: 110 of these patients were avaible for evaluation at a minimum 1 year after surgery. The ODI scores decreased significantly in both first month and first year follow-up evaluations and the SF-36 scores demonstarted significant improvement in late follw-up results in our series. Failure to diagnose and precisely localize these herniations can lead to unsuccessful surgical exploration or exploration of the incorrect interspace. Although various techniques exist for the treatement of lateral disc herniation, microsurgical approch using Metri'x System (That we were detaiiling) is unique in lateral pathological entities can be directly visualized and removed via a 1.5 cm paramedian incision.
Conclusion: For Lateral Lumbar Disc Herniation, microsurgical approach allowed sufficient and safe decompression of the neural structures and adequate preservation of vertebral stability, resulted in a highly significant reduction of symptoms ans disability, and improved health-related quality of life.
Keywords: Microsurgical, Approach, Metri'x, System

OP-SP.20-03

Minimally Invasive Direct Lateral Interbody Fusion (MIS-DLIF): Proof of Concept and Perioperative Results

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Background: Minimally invasive direct lateral interbody fusion (MIS-DLIF) is a novel approach for fusions of the lumbar spine. In this proof of concept study, we describe the surgical technique and report our experience and perioperative outcomes of the first nine patients who underwent this procedure. In this study we establish the safety and efficacy of this approach. MIS-DLIF was performed on 15 spinal levels in nine patients who failed to respond to conservative therapy for the treatment of re-herniated disk, spondylolisthesis, or other severe disk disease. We recorded surgery time, blood loss, fluoroscopy time, patient-reported pain, and complications.
Method: Throughout the MIS-DLIF procedure, biplanar fluoroscopic imaging is utilized to place an interbody graft or cage into the disc space through the interpleural space. A discectomy is performed in the same MIS fashion, completed with posterior pedicle screw fixation.
Results: MIS-DLIF took 44/85-minutes, for 1/2-levels, with 54/112-mls of blood loss, and 0.3/1.7-days of hospital stay. Four patients did not require overnight hospitalization and were discharged 2-4 hours after surgery. No clinically significant complications were encountered. Ninety-days post surgery, patients reported significant reduction of 4.5 points on a 10-point pain scale.
Conclusion: MIS-DLIF with pedicle screw fixation is a safe and clinically effective procedure for lumbar spine Fusions. The procedure overcomes many limitations of current MIS approaches to the lumbar spine and is technically straightforward. MIS-DLIF has potential to improve patient outcomes and reduce costs relative to the current standard of care, warranting further investigation. We are currently expanding study size and documenting long-term outcome data.
Keywords: MIS-DLIF, Lumbar, Fusion, Minimally invasive

OP-SP.20-04

Midline Lumbar Fusion (MIDLF) Alternative Method of Transpedicular Spinal Fusion

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Background: Midline lumbar fusion (MIDLF) using cortical bone trajectory is an alternative method of transpedicular spinal fusion for degenerative disease. The new entry points location and screwdriving direction allow to reduce the approach-related morbidity. We present our experience with the MIDLF technique on the series of the first 32 consecutive patients with lumbar degenerative disease and with average follow-up of 11,6 month (range**:**3-24 months).
Method: Retrospective analysis was performed on 32 patients with foraminal (32) and central (20) stenosis. After adequate decompression, the patients were fused at L3-L4-L5 (4), L4-L5 (15), L4-L5-S1 (7), L5-S1 levels (6) under fluoroscopic guidance, with additional interbody device placement at all fused levels.
Results: An improvement regarding the leading symptom in the early postoperative period (sciatica 30/30, claudication 19/19) was achieved in all patients. The intra- or postostoperative complications included**:** incorrect screw placement (1; 0,6% of all scews) and screw loosening with interbody device dislocation (1). The both patients required revision surgery (6%). The mean improvements in Visual Analogue Scale for low back and leg pain were 3.6 and 3.9 respectively. The mean Oswestry Disability Index scores were 53.1% (range**:**16%-82%) before surgery and 36.8% (range**:**0%-82%) at the last follow-up. The 1 year follow-up dynamic X-rays and CT showed no instability at the fused levels, satisfactory screws placement and bony union in all 13 patients with follow-up >1year.
Conclusion: In our experience, the MIDLF technique seems to be effective alternative to traditional transpedicular trajectory screws when short level lumbar fusion is needed.
Keywords: Cortical bone trajectory, Lumbar degenerative disease, Midline lumbar fusion, Minimally invasive spine surgery, Pedicle screw

OP-SP.20-06

An Alternative Fusion Technic for L5-S Stabilization: Preliminary Results of Finite Element Study

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Background: In this study, we used the finite element (FE) model to compare the "inferior oblique transdiscal fixation (IOTF)" technique with the classic posterior transpedicular stabilization technique (PTS).
Method: Computed tomography (CT) scan data from a healthy male 35 year-old male was used to construct a three-dimensional FE model of the full lumbar spine from L1 to S1. The lower surface of S1 was fixed and a bending force of 10 Nm was applied to the upper surface of the L1 vertebrae in the intact spine and segmental and general motion fields were obtained in flexion, extension, lateral bending and axial rotation. FE analysis was performed in the following order**:** 1) intact lumbar spine, 2) intact lumbar spine + IOTF with cage for L5-S1 level, 3) intact lumbar spine + L5-S1 posterior transpedicular stabilization system (PTS).
Results: The FE analysis showed that IOTF had similar effects on extension, lateral bending, and axial rotation except for flexion on the range of motion at L5-S1 level when compared to PTS. In flexion, the IOTF combined with the cage allowed 10% more movement than the PTS, compared to the intact spine.
Conclusion: IOTF has the potential to be an effective system that can be used as an alternative to PTS for L5-S1 fusion surgery in certain cases (especially in revision cases).
Keywords: Finite, Lumbar, Stabilization

OP-SP.20-07

A New Elastic - Rigid Adjustable Rod System for Transpedicular Screw Systems

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Background: Transpedicular screw-rod systems have been used for a long time and have unique advantages like segmental stabilization and fusion capabilities. But these systems have major problems. First of all; rigidity of system and the consequence may be; pullout of the screw, adjacent segment degenerative changes or early metallic failure. In this study we are presenting a unique rod system that was designed and tested mechanically by our laboratory. The aim of this study was to design and test the mechanical properties of an adjustable elastic rod.
Method: Rods (n**:**10) were produced by standard titanium-aluminium-vanadium alloy and dimensions were 5.5x50 milimeters. They contain spiral shaped cutting edges longitudially and have cable system in the centrally located holes. These titanium cable systems allows to adjust the elastisicity of the rods. To compare mechanical properties, standart rods with same dimensions were tested also at the same mechanical testing procedure (n=10). All rods were tested with an axial loading machine(10.000 N/mm^2 Shimadzu Autograph AG-1S). All the rods were tested for rotatory-axial failure with a specially designed machine for this purpose (Mechanical engineering faculty). Also mechanical loading and failure properties were tested with a computer based finite elements analysis (Komsol Inc.).
Results: Results of finite elements analysis and loading and failure machine tests were similar. Adjustable rods have mechanical resistance levels as 92% of rigid rods. On the other hand, failure test results were 20% longer at adjustable rods group.
Conclusion: It is our opinion that; this new rod system may be a solution for dynamic spine stabilization, diminishing the rate of adjacent segments disease. And for the first time; elastisicity of the rod can be adjustable for every patient individually.
Keywords: Elastic - rigid adjustable rod system, Elastic rods, Dynamic spine stabilization

OP-SP.20-08

Posterior Enstrumentation Types of Single Vertebral Fracture

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Aim: To compare the surgical results of patients with one vertebral segment fracture due to trauma.
Method: 71 patients, with one vertebral segment compression (more than 30% height loss of vertebral body) fracture, are retrospectively studied in our clinic between 2012-2015 years. Postoperatively these patients are followed 1 to 4 years with imaging studies that give chance for angle measurement.
Results: Of these 71 patients; 48 is men, 23 is women. Average age is 46.2 years. In first group 24 patients have a fixation of 2 above and 2 below vertebbral segments of fractured vertebra. 23 patients in second group have a fixation of 1 above and 1 below segments. In third group 24 patients have a fixation of the fractured vertebral segment with 1 above and 1 below vertebral fixation. 1 patient in first group had re-operation for screw revision; and 1 patient had revision for infection. Comparing angle measurement of imaging studies in the early and late (1-4 years) postoperative follow-up**:** Increase of angulation in first group is 1.7 degree; in second group 6.41 degree; in third group 0.65 degree.
Conclusion: With our study, we can say that group 3 (fixation of the fractured vertebral segment with 1 above and 1 below vertebral fixation) have better outcome comparing to other groups.
Keywords: Trauma, Vertebra, Posterior, Compression, Fracture

OP-SP.21-01

Comparative Analysis of Prolo and Watkins Scales Evaluating Economic and Functional Status

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Background: The Prolo Scale (PS) is a widely used assessment instrument to evaluate economic and functional outcome after lumbar spine surgery. Watkins scale (WS) is not widely used although it has a similar design. The goal si to compare validity of Prolo and Watkins scales.
Method: Retrospective study. Outcomes in 472 patients underwent microdiscectomy was studied by administrating Prolo and Watkins scales, Oswestry Disability Index, Quinquefarious Visual Analogue Pain Scale, four-part scale to evaluate ability to perform normal daily

activities and work, satisfaction with results of surgery, frequency of pain-killers intake and ambulation. Internal consistency was evaluated by Cronbach α, validity by ρ Spearman.
Results: Internal consistency of WS was good (Cronbach α = 0,85). Two domains in PS are not enough to evaluate internal consistency. Concurrent validity of PS and WS was strong (ρ = - 0,87). Concurrent validity of WS with all assessment tools was more strong comparing with PS. Pain level as for back and for leg at different interval scores of WS has significant difference (p<0,001). In contrast to this there was not significant difference (p>0,05) in pain level as for back and leg at poor and fair final scores of PS.
Conclusion: Watkins Scale is more valid comparing with PS.
Keywords: Outcome assessment, Questionnaires, Spine surgery

OP-SP.21-02

Oblique Lateral Interbody Fusion (OLIF) for Lumbar Degenerative Disease: Surgical Techniques and Complications

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Aim: To clarify the technical details, indications, clinical outcome and complications of OLIF combined with different fixation strategies for degenerative lumbar diseases.
Method: Thirty seven patients with lumbar degenerated disease underwent OLIF in the department of neurosurgery of Sichuan Provincial Hospital from May 2013 to February 2015. Posterior percutaneous pedicle screws was applied for fixation in 12 cases and anterior screw rod in 16 patients, while 9 patients received stand alone OLIF. Duration of operation, total blood loss, surgical complications, were carefully recorded and evaluated. Visual analog scale (VAS) score, Oswestry Disability Index (ODI) and radiological image were evaluated.
Results: Among the 37 patients, degenerative lumbar spondylolisthesis were diagnosed in 6 cases, degenerative disk disease in 19, kyphoscoliosis in 5 and discogenic pain in 7 cases. Fifty three spinal segments were fused totally. Average follow-up of 12±2.45 months. The clinical symptoms improved significantly after the operation. VAS and ODI scores significantly decreased (p< 0.05). The average operation time 100.5±18.5 min, blood loss 90.5 ml± 32.5 ml, length of hospital stay 6.5±2.6 d. Postoperative radiographic examination demonstrated increased disc height and foramen area (p<0.05). There was no major complications. Two patients underwent revision surgeries because of the improper location of the cage placement, which caused neurological symptoms.
Conclusion: OLIF is a safe and effective minimally invasive surgical approach for the treatment of lumbar degenerative diseases with less iatrogenic injuries and quick recovery. Its short term clinical outcome is reliable, however longer follow-up is needed to determine its long-term effects.
Keywords: Oblique lateral interbody fusion, Lumbar degenerative disease, Indications, Complication

OP-SP.21-03

Combined Percutaneous Pedicle Screw Fixation and Minimal Access Open Posterior Decompression for Treatment of Unstable Thoracolumbar Fractures

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Background: Percutaneous fixation of unstable thoracolumbar fractures is increasingly used as alternative to open surgery. The complexity of the fracture pathology and spine dynamics affects the indications of percutaneous treatment. Our aim is to evaluate the percutaneous pedicle screw fixation combined with posterior minimal access decompression of neural canal in unstable thoracolumbar fractures.
Method: Ten patients with unstable thoracolumbar fractures with significant neural compression who are indicated for both fixation and neural canal decompression were treated with this technique. Patient both neurologically intact or with deficit with only single vertebral fractures are included. All patients underwent percutaneous fixation and decompression. The procedure is assessed for the effectiveness of the decompression and surgical events.
Results: Effective percutaneous fixation can be done in all patients. Effective dural and root decompression can be achieved. No infection or hardware related problems encountered. No deterioration of preoperative neurologic status. No blood transfusion given
Conclusion: Percutaneous fixation of unstable fractures with minimal access decompression of neural canal is an effective and safe technique for treatment of single level unstable thoracolumbar fractures.
Keywords: Thoracolumbar, Fracture, Percutaneous

OP-SP.21-04

Comparison of Bupivacaine Plus Magnesium Sulphate and Ropivacaine Plus Magnesium Sulphate Infiltration for Postoperative Analgesia in Patients Undergoing Lumbar Laminectomy: A Randomized Double Blinded Study

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Background: Lumbar spine procedures are associated with intense perioperative pain so multimodal analgesia is usually the preferred mode in these patients. The objective of this study was to assess/ compare the analgesic duration of local infiltration of bupivacaine plus magnesium sulphate and ropivacaine plus magnesium sulphate for postoperative analgesia in patients undergoing lumbar laminectomy.
Method: Sixty one adult patients of ASA class 1 and 2 were randomly allocated into two groups RM and BM, comprising 30 and 31 patients. Post operatively, the study drug was locally infiltrated into the paravertebral muscles on either side before skin closure. Group bupivacaine with magnesium (BM) was given 20 ml of 0.25% Bupivacaine with 500 mg of Magnesium Sulphate and group Ropivacaine with Magnesium Sulphate (RM) was given

20 ml of 0.25% Ropivacaine with 500 mg of Magnesium Sulphate. Postoperative VAS pain score was assessed every hourly for the first 24 hours, duration of postoperative analgesia, rescue analgesia consumption, degree of overall patient satisfaction and side effects were also recorded. Comparison of data between the groups was done using independent T-test, Chi-square test, Mann-Whitney test accordingly. A P value less than 0.05 was considered significant.
Results: Time to first analgesic consumption was significantly longer in BM group compared to RM group. The consumption of Nalbuphine rescue analgesic was significantly higher in RM group compared to BM group.
Conclusion: Wound infiltration with BM compared to RM provided longer post operative analgesia and significantly reduced postoperative opioid consumption following lumbar laminectomy.
Keywords: Bupivacaine, Lumbar laminectomy, Magnesium sulphate, Ropivacaine

OP-SP.21-05

Lumbar Disc Herniation: A Review of Patients Seen in Government and Private Hospitals in Harare

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Background: Lumbar disc herniation remains not well documented in Zimbabwe. The only study done dates from 1967 (Levy Let al,1967). The specific objectives of this study are to determine the prevalence and risk factors in patients consulting for low back pain.
Method: This was a prospective cross sectional study from January 2015 to December 2015 done on 242 patients with backache suggestive of sciatica. All had neurological examination and imaging plus a three months follow-up.
Results: From the above patients,140 (57,9%) cases were female and 102 (42,1%) cases were male. The median age was 48 years with a range of 38-62 years. Most cases were of African descent accounting for 225 (93%) cases and 17 cases (7%) Caucasians. Independent risk factors for Sciatica were**:** age between 40-49 years (AOR=8.88, 95% CI; 1.76-44.77), being employed as an office worker (AOR=5.62, 95% CI; 2.16-14.56), manual worker (AOR=6.55, 95% CI; 1.13-37.88) and nurse (AOR=14.41, 95% CI; 2.70-77.04). These factors remained significantly and independently associated with an increased odd of lumbar disc herniation. Concerning treatment, the majority of cases (73,5%) responded well to conservative management and most of them (84,2%) were free of pain after three months of follow up.
Conclusion: The hospital prevalence of lumbar disc herniation was 43.9%, that of sciatica was 32.2% and 13.2% for degenerative lumbar canal stenosis. It was located at L5-LS1, affecting mainly the age group between 40-49 years. This group represented the most economically active group. Conservative management had good results.
Keywords: Lumbar disc herniation, Surgery, Zimbabwe

OP-SP.21-06

Prevalence of Erectile Dysfunction in Patients with Lumbar Herniated Disc

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Background: Erectile dysfunction (ED), is defined as a man's inability to achieve or maintain a sufficient level of penile erection for sexual intercourse. It is reported that ED's prevalence is between 30-52% in patients aged 40-70. There are many studies examining the effects of chronic pain, diabetes, rheumatoid diseases and knee arthroplasty studies about ED. Beside it patients who suffer from lumbar herniated disc aren't found in pubmed. Study design**:** The experimental group includes male patients, who have been admitted to the neurosurgery clinics, diagnosed with lumbar disc herniation clinically and radiological. Patients with a history of other risc factors to ED excluded from the study. Furthermore, patients diagnosed with conus medullaris or cauda equina syndrome were also excluded.
Method: Patients' VAS scores, whether any motor losses in clinical findings, or any sense or reflex losses were noted. Radiological findings were recorded and classified. FSH, LH, and testosterone levels were noted. IIEF (International Index of Erectile Function), Beck Depression Inventory, and Beck Anxiety Inventory tests were performed. Obtained data was analysed statistically.
Results: No statistically significant ED prevalence differences were found between the patients who have been diagnosed with lumbar herniated disc and the control group.
Conclusion: It has been found out that disc location affects ED prevalence and severity and there are statistically significant differences in terms of IIEF-5 scores between the cases of laterally herniated disc and centrally herniated discs. Contrary to other studies in the literature, no significant relationship between VAS and ED was found out.
Keywords: Erectile dysfunction, Lumbar herniated disc, Depression

OP-SP.21-07

Percutaneous Endoscopy Assisted Interlaminar Lumbar Discectomy for Extruded /Migrated Lumbar Disc Herniations

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Background: Microdiscectomy is a gold standard technique for treatment of lumbar disc herniation, but there is a trend with endoscopic lumbar disc surgery for preserving lumbar paravertebral muscles. However, extruded and/or migrated disc herniations have a challenge because of removing difficulty. The purpose of this study was to evaluate the feasibility and clinical outcome of percutaneous endoscopic assisted interlaminar lumbar discectomy (PEAILD) for extruded/migrated lumbar disc herniations (LDH).

Method: We retrospectively reviewed the clinical outcomes of 69 patients who were operated on PEAILD method between May 2013 and January 2017.
Results: There were 32 women (%46,4) and 37 men (%53,6) with mean age 43,7 years (21-67). The patients had single level LDH that follows 35 (%50,7) of them at L4-5 and 34 (%49,2) L5-S1 level. Patients were grouped according to radiological imaging as follows; 27 (% 39,1) cases extruded and 42 (%60,8) extruded/migrated LDH. They operated with PEAILD on the side of radiculopathy by Easy-Go System (Karl-Storz, Germany). Mean follow-up was 21,7 months (3-32). The preoperative mean VAS was 8,8 (5-10) and improved to 2,2 point (1-5). the preoperative mean PROLO economic scala was 1.85 (1-3)and improved to 4.3.
Conclusion: Early endoscopic techniques only used for protruded or far-lateral LDH. Endoscopic disc surgery has been gradually widened throughout development of technique and increased experience. Recently, sequestered and migrated LDH's have been removed by endoscopic techniques. Extruded/migrated LDH's was removed with excellent outcomes. PEAILD is an effective and an alternative method for extruded/migrated LDH's as well as microdiscectomy
Keywords: Lumbar, Endoscopic, Discectomy

OP-SP.21-08

Can Using Similar Implant Design for Fusion and Motion Preservation, Associated with Customization, Result in Cost Savings When Treating Degenerative Disease of the Spine?

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Spinal fusions are amongst the most costly surgeries in the United States. The average cost for a lumbar fusion was approximately $ 81.960 in 2011 with some cases reported at over $ 120.000 per procedure. Partial recent data suggest that 650.000 spinal surgeries are now performed yearly at a cost exceeding 20 billion per year. A new paradigm is needed to reduce cost without compromising quality. A modular implant to better reproduce the natural lumbar disc is proposed. It can be tailored to fit the individual patient. Because it is modular and the components are inserted individually, this product can be used to preserve motion, obtain a lumbar fusion or utilized as spacers. The properties of the components can be modified to achieve the desired goal while the general design remains the same. Printing the modules for a particular patient results in a better fit with a reduced migration a faster integration. Disruptive innovations can bring significant benefits. Combining the concept of modular design and customization results in standardization of surgical techniques and instrumentation. This should reduce the learning curves for surgeons and provide significant cost savings.
Keywords: Degenerative spine disease, Lumbar fusion, Disc arthroplasty, Motion preservation, Cost controle

OP-SP.21-09

Correct Placement of Operating Sheath & Epidural Block is the Key Success to the Painless Approach of all Types of Transforaminal Percutaneous Endoscopic Lumbar Procedures Under Local Anaesthesia for a Successful & Excellent Post-Surgical Outcome –

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Background: Percutaneous Transforaminal endoscopic lumbar procedure (PTELP) under local anesthesia sometimes become very troublesome and to be postponded due to pain. Proper image guided placement of working sheath almost at the epicenter through the mid-circumference of the disc might be the painless entry particularly avoiding the upper & lower end plates is the key point of painless discectomy under local anesthesia along with instillation of local anesthetic agents at the epidural space. The purpose of this study was to describe in detail the painless PTELP under local anesthesia for disc herniation and to demonstrate the good clinical results.
Method: Entry angulation was 25 degree till the facet joint then forty five degree directly into the disc space was maintained in every patient. before piercing the annulus epiduroscopy was done in all twenty two patients for epidural block along with other pain relieving agents. The surgical outcomes were assessed using the visual analogue pain score.
Results: The operated levels were L3-4 in 5 (15.4%) patients, L4-5 in 13 (76.9%), and L5-S1 in 4 (7.7%). The mean visual analogue score VAS for leg pain improved from 8.30 ± 1 preoperatively to 2 ± 1.20 per operatively and 1.25±.80 at immediate postoperatively ($P < 0.01$).
Conclusion: Excellent surgical outcome in PTELP under local anesthesia can be achieved very easily only with a painless, non apprehended, co-operative patients.
Keywords: Epiduroscopy, Endoscope, VAS

OP-SP.22-01

Posterior Cervical Foraminotomy for Recurrent Cervical Radiculopathy After Prior Anterior Cervical Discectomy and Fusion

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Background: Cervical radiculopathy after prior anterior cervical discectomy may result from residual compression after the first surgery or development of new compression at the same level or an adjacent level. We evaluated posterior approach after different anterior approaches and describe the surgical outcome of posterior cervical foraminotomy with or without discectomy.
Method: We retrospectively analyzed a prospectively collected database of a consecutive series of patients who had undergone microscopic posterior cervical foraminotomy with or without discectomy surgeries for residual or recurrent cervical radiculopathy after prior anterior cervical discectomy and fusion. Cases with

central canal compression were excluded from our series. The site of recurrence and outcome after surgery was noted and correlated with the procedure performed.
Results: We identified Twenty-one patients with 24 posterior cervical foraminotomies after prior anterior cervical discectomy and fusion from 2013 to 2016. 18 (85.7%) patients had excellent or good outcome. 2 cases had wound infection and one case had wound hematoma, all treated conservatively. No neurologic deficit has resulted from the PCF. No postoperative mortality. No recurrence of symptoms in the period of follow-up.
Conclusion: Microscopic posterior cervical foraminotomy with or without discectomy is extremely effective in treatment of recurrent cervical radiculopathy from recurrent or residual cervical disc that remain after prior surgery and may be preferable to anterior cervical discectomy in such cases.
Keywords: Posterior cervical foraminotomy, Recurrent cervical radiculopathy, Anterior cervical discectomy and fusion

OP-SP.22-02

The Comparison of Angle of Lordosis and Intervertebral Disc Height of Patients with Cervical Disc Herniation after Disc Prosthesis and Cage Implantation

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Background: We evaluated and compared the influence of cage and prostethic material implantation on the cervical lordosis, disc height and visual analog scores (VAS) of patients that has undergone single level (C5-6) cervical discectomy.
Method: 80 patients who underwent C5-6 anterior discectomy surgery between 2014 and 2017 were included. Forty cervical disc prosthesis implanted patients (Group A) and forty cervical peek cage implanted patients (Group B) were selected. C1-7 Cobb angle and anterior-medial-posterior intervertebral disc heights were calculated preoperatively and postoperatively. Preoperative and postoperative VAS studies were performed.
Results: Female to Male ratio were 25/15 in both groups. Mean age of patients were 43.02(23-59) in group A and 53.2 (33-67) in group B. Mean preoperative angle of lordosis were 29.2 degrees in group A and 36.8 degrees in group B; mean postoperative angle of lordosis were 34.3 degrees in group A and 34.5 degrees in group B. The anterior-medial-posterior intervertebral disc heights were increased 1.8/1.3/1.7 mm in group A and 2.9/2.1/2.7 mm in group B. While the average VAS scores were decreased from 8.6 to 2.9 postoperatively in group A, it was 8.2 to 2.6 in group B.
Conclusion: The increase in the angle of lordosis was higher in the prosthetic implanted group, but the increase in the intervertebral disc height was higher in the cage implanted group. However, the older age and degenerative disc disease in cage group may have led us to this result. Both VAS scores were similarly improved in both groups. Studies with larger patient groups are advised.
Keywords: Cervical disc prosthesis, Cervical lordosis, Peek cage

OP-SP.22-03

Long Term Functional Outcomes in Total Disc Arthroplasty (TDA) and Anterior Cervical Disc Fusion (ACDF) Cohorts - Single Centre Prospective Observational Study

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Background: Total disc arthroplasty (TDA) is a motion-preserving procedure developed as an alternative to anterior fusion. Whether this method is superior over fusion remains still unclear.
Method: This prospective cohort study consists of two series of patients with single or two level cervical degenerative disc disease who underwent surgery in one institution treated either with TDA (88) or ACDF (90). Both cohorts were clinically followed and compared up to 8yrs. Functional evaluation included the NDI, VAS scores for neck and arm pain and EuroQol.
Results: Follow-ups data significantly improved from baseline in both cohorts. The only noteworthy difference in functional outcome is EQ-5D index at midterm what correlates with the difference in VAS neck pain at 6 months. During the longterm follow-up we report 13 surgeries for ASD in ACDF group and only 4 in TDA group. The risk of symptomatic ASD requiring additional surgery was calculated to be as high as 1.9% /level/yr in ACDF compared to 0.6% in TDA.
Conclusion: TDA is a safe and effective surgical procedure but this study doesn't reveal sufficient evidence that it is superior over ACDF for the treatment of symptomatic cervical disc disease in terms of either early or long term functional outcomes. In midterm evaluation we even observed interestingly slightly worse functional results in TDA cohort probably due to the presence of increased axial pain probably related to neck hypermobility. However, in our study TDA provides the decrease of the incidence of adjacent segment degeneration requiring further surgery compared to ACDF, what remain still unclear in other literature reports.
Keywords: Total disc arthroplasty, Anterior cervical discectomy and fusion, Adjacent segment disease

OP-SP.22-04

Segmental Range of Motion Preservation After Cervical Total Disc Arthroplasty in Military Patients: Analysis with Flexion-Extension CT

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Cervical total disc arthroplasty is a well-stablished technique for motion preservation in treating degenerative cervical spinal disease. Young patients with one or multi-segmental degenerative disease of the cervical spine are not uncommon in the military, where high biomechanical and physical requirements are routine. Military activities, including parashooting, use of ballistic helmets and special force operations require cervical movement preservation.

We describe the experience of the Neurosurgery Department of Sao Paulo Military Area Hospital, Brazilian Army, in the surgical management of cervical spine disorders with arthroplasty and analysis of range of motion preservation with volumetric neutral-flexion-extension cervical spine CT imaging. Retrospective data of all patients who underwent operation by this technique at this hospital in the last two years was collected. Characteristics as age, gender, etiology, time to return to unrestricted military activities were raised. Three CT volumes of the cervical spine, 1 in neutral position, 1 in flexion and 1 in extension, were obtained in each patient and then analysed with a specific imaging tool. Motion between the plates of the artificial disc, as well as motion between these plates and adjacent vertebrae, were measured. Cervical ahtroplasty is an extremely important tool in the treatment of military personnel, specially in those highly specialized, who should have motion preserved whenever possible.
Keywords: Cervical arthroplasty, Dynamic computed tomography, Military

OP-SP.22-05

3D CT Guided Cervical Spine Injection for Neck Pain and Brachialgia Secondary to Cervical Disc Disease

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Aim: To evaluate the efficacy of 3D CT guided Cervical lateral facet/ Periradicular injections as an alternative to surgery, in patients with neck and radicular pain secondary to Cervical disc prolapses.
Methods: A prospective evaluation of 12 consecutive patients with cervical disc prolapses causing pain not relieved by maximal medical treatment or physiotherapy were treated with 3D CT guided Cervical facet/ periradicular injections. A total of 10 females and 2 males were followed up for a minimum of 2 years. Visual analogue scores (VAS) for pain and numbness were charted for minimum 2 years after the procedure.
Results: Pre-procedural pain scores varied from between VAS of 7-10/10. At 6 months after injection, 11 patients (91.6%) had complete pain relief. After this 3 patients had gradual recurrence of pain. At 12 months, 5 patients (41.6%) had complete relief. At 2 years only 2 patients (16.6%) continued to have complete pain relief. There was slow recurrence of pain in 10 patients. At the final follow-up visit after 3 years, only 1 patient remained totally pain free. Surgery was required for 1 and another went for Ayurveda. 9 patients had mild to moderate symptoms that were controlled with conservative pain medications. No complications were recorded.
Conclusion: CT guided Cervical Spine facet/ peri-radicular injections are very safe in expert hands with excellent pain relief up to 6 months and continued partial pain relief up to 3 years. It is therefore an excellent alternative to surgery in these patients.
Keywords: CT guided, Cervical, Spinal injection, Corticosteroids, Local aesthetics, Radiculopathy

OP-SP.22-06

Cervical Arthroplasty Using Globus Secure-C Artificial Disc: A Case Series Review and Long-Term Outcome

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Aim: To review all patients undergoing cervical disc replacements using Globus Secure-C artificial discs under a single surgeon.
Method: 39 patients underwent cervical disc replacement between May 2011 and December 2016. This included 23 females and 16 males. The mean age at surgery was 42.1 years with the age for males 41.6 years and 44.9 years for females. 33 patients underwent single level cervical disc replacement, 5 patients had 2 level disc replacements and 1 patient underwent 3 level disc replacements.
Results: 26 patients reported complete resolution of all their symptoms and discharged from clinic after one review. 7 patients required MRI cervical spine in long-term follow up. 5 patients reported post-operative neck pain with 2 requiring an MRI. Imaging was satisfactory and all 5 patients improved and discharged. 5 patients reported persistent neuropathic pain and all 5 underwent MRI imaging finding no post-operative compression. 4 patients improved and 1 persisted with chronic pain requiring medical input. No patients developed post-operative infection, haematoma requiring surgery, dysphasia or dysphagia. No patient has so far re-presented with adjacent level disease. All MRI's were of satisfactory quality to assess for nerve root and cord compression in the presence of the implant with no significant prosthesis related artefacts.
Conclusion: Cervical disc replacement using Globus Secure-C can be used to treat degenerative cervical disease. Post-operative MRI provides a radiological assessment without significant prosthetic artefacts. Long-term follow up revealed favourable outcomes with no adjacent disc disease progression, no prosthesis related complication and no need for further surgery.
Keywords: Cervical, Disc, Replacement, Arthroplasty, Myelopathy, ACDF

OP-SP.22-07

Evaluation of Patients with Cervical Disc Hernia in Terms of Preoperative and Postoperative Restless Leg Syndrome

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Background: Cervical disc hernias cause spinal cord and root pressure, resulting in pain, motor and / or sensory deficits in the neck and upper limbs. One of the mechanisms suggested in the pathogenesis of Restless Legs Syndrome (RBS) is a defect related to spinal inhibitory pathways. There are no publications describing the preoperative and postoperative HBS frequency in cases of spinal cord compression such as cervical disc herniation. In this study, we investigated the presence of HBS in patients with cervical disc herniation and whether or not their symptoms improved postoperatively.
Method: From April 2016 to January 2017, 23 patients with a history

of anamnesis, examination, imaging and cervical disc herniation and normal ferritin levels were included in the study. Patients were asked preoperatively by a one-way interview according to the criteria of HBS diagnosed in Classification of International Sleep Disorders-3. All the patients were asked and recorded again at the first postoperative month.
Results: 15 of the patients were female (65.2%) and the average age was 47.4. Preoperative HRV symptoms were present in 8 of the patients (34.7%). In 4 of these 8 patients (50%) postoperative HBsAg symptoms were reduced or disappeared.
Conclusion: Decreased symptoms of HBS in 50% of patients with symptoms of preoperative HBS after opine with cervical disc herniation suggest that spinal cord compression may be effective in the development of HBS symptoms.
Keywords: Restless legs sendrome, Cervical disc herniation, Ferritin

OP-SP.22-08

Anterior Cervical Discectomy with Fusion- Evolution and Results in a Tertiary Care Centre. A Series of 242 Cases

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Background: Anterior cervical disectomy and fusion is one of the commonest anterior cervical spine procedure usually done for cervical radiculopathy and myelopathy. Single or Two level surgery is routinely done.
Method: In 1200 bedded tertiary care hospital, from January 2006 to December 2014, 242 anterior cervical disectomy and fusion procedures done. Of which, in 34 cases cervical interbody device with screws, in 134 cases interbody cage was used. In remaining 74 cases iliac crest graft was used for fusion.
Results: Postoperative clinical improvement was nearly similar in all the three procedures, with best improvement in cervical interbody device and screws. Recurrence of neck and arm pain incidence was less with Cervical interbody device and screws. Attempt towards restoration of cervical lordosis immediately after surgery was possible with cervical interbody device and screws ($p< 0.005$).
Conclusion: Cervical interbody device and screws used for anterior cervical disectomy and fusion gives better clinical results than cervical interbody cage and iliac crest grafting
Keywords: Fusion, Discectomy, Cervical interbody device

OP-SP.22-09

Anterior Cervical Discectomy with Bone Cement Fixation: Our Experiences

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Background: Anterior cervical discectomy (ACD) is a surgical procedure to remove a herniated or degenerated disc in the cervical spine through anterior approach. This is followed by fusion either by autograft, or bone graft substitutes. We used polymethylmethacrylate (PMMA) the bone cement as the bone graft substitute.
Method: A retrospective study has been conducted. After the routine procedure of cervical discectomy, we prepare the PMMA cement along with omnipaque (non-ionic contrast) Gentamycin in it. Then we take the liquid paste of PMMA in a 5 cc syringe and put it in the disc space under microscopic guidence. Thorough irrigation is done with normal saline to prevent the thermal injury till it becomes hard and set.
Results: Out of 255 cases, 165 are male and 90 are female. The commonest presentation is cervical radiculopathy, followed by myelopathy. There are 222 cases of single level discectomy and 33 cases of multiple level discectomy. Out of single level discectomy, C5-C6 is the commonest (137), then C6-C7 (63), C4-C5 (16), C3-C4 (5) and C7-D1 (1).35% of patient had hard disc and 65% had soft disc. Patients do not require collar and can mobilize neck immediate postoperatively. The mean hospital duration of stay is 4-5 days. There was one mortality due to mediastinitis, quadriparesis in one cases,4.5% had transient hoarseness and 6 cases had graft dislocation. Symptoms improvement was seen in almost all cases of radiculopathy and guarded prognosis in myelopathy.
Conclusion: ACD with bone cement fixation is a cheaper, safe and less time consuming procedure with excellent result in our series.
Keywords: Anterior cervical disectomy, Polymethylmethacrylate, Fixation

OP-SP.23-01

Oblique Lumbar Interbody Fusion (OLIF), It's Versatility in Adjacent Segmental Diseases

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Background: Lumbar interbody fusion (LIF) is currently an indispensable surgical procedure in dealing with degenerative lumbar diseases. Traditionally, anterior lumbar interbody fusion (ALIF) has been performed but recently oblique lumbar interbody fusion (OLIF) has been introduced and is emerging as an alternative. The purpose is to discuss the value of OLIF procedure in dealing with adjacent segmental diseases (ASDs).
Method: From January of 2015 to May of 2016, 11 patients underwent OLIF at Cheonan Woori Hospital. Male to female ratio was 2 to 9. The procedure was performed for single level in 9 patients and multi-level in 2 patients. Except for one patient, all of them had previous LIF surgeries either anteriorly or posteriorly.
Results: Mean operation time was 67 minutes which was comparatively shorter with that of ALIF. Operative corridor to reach for the disc was in between the great vessels and psoas muscle, thereby avoiding splitting of the psoas. No peritoneal membrane tear occurred even with those who underwent ALIF previously. There were no vascular injuries. Transient symptom from sympathetic injury occurred in one patient but there were no post-operative cruralgia. No abdominal muscular fascial disruption occurred.
Conclusion: LIF surgeries, as its frequency increases, ASD inevitably increases. Adhesion is inevitable for both anterior and posterior approaches and dealing with the adhesion is always painstaking. OLIF on the other hand avoids manipulating the adhesions coming from both anterior and posterior approaches. Apparently, OLIF is not the ultimate alternative to other LIF techniques but could be a useful approach in selected patients.
Keywords: OLIF, ASD, ALIF

OP-SP.23-02

Surgical Treatment of Postoperative High Degree of Spondilolistesis (Spondiloptosis)

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Work is based on analysing results of examinations and surgical treatment of 32 patients with postoperative spondilolistesis. Women were - 20, men - 12. All patients passed the clinic-neurological, rentgenologic and MRI examination. Spondilolistesis of the I degree is diagnosed among 17 patients, II degree among 8, III degree among 4 sick people, IV degree among 2 patients and V degree among 1 patient. Herewith spondilolistesis VL3 was revealled in 4 events, VL4 in 12, VL5 was also revealed among 14 patients and the two levels of spondilolistesis were noted among 2 patients. Monoradicular syndrome is revealed among 11 patients, biradicular among 15 and polyradicular among 6 patients.

All patients were made an operative treatment. Decompressive laminotomy with the interbody spondilodesis cage was made among 4 patients, decompressive laminotomy with transpedicular fixation was made among 8 patients, decomopressive laminoectomy with transpedicular fixation and spondilodesis of outbone was made among 12 patients, decomopressive laminectomy with transpedicular fixation and interbody spondilodesis cage was made among 6 sick men. 2 patients with a high degree of spondilolistesis for the first time were made unusual operation of decompressive laminoectomy with transpedicular-transcorporal fixation.

The surgical treatment were characterized by following**:** good results were reached among 25 (78.1%) patients, satisfactory among 6 (18.7%) and non satisfactory among 1 (3.2%).

Wide decompression of contain formations of vertebral canal with interbody stabilized cage and/or reliable transpedicular fixation are methods of choice of the surgical treatment of postoperative spondilolistesis.

Keywords: Postoperative spondilolistesis, Fixation, Lumbar division

OP-SP.23-03

Diagnostic Accuracy of Standardized Qualitative Sensory Tests and Straight Leg Raising Test to Assess Lumbar Lateral Stenosis Involving the L5 Nerve Root

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Background: Lateral stenosis (LS) is easily overlooked, especially when there is coexisting central stenosis, and misdiagnosis of LS may result in an unfavorable prognosis after surgical treatment. This study is to access the diagnostic accuracy of the standardized qualitative sensory test (SQST) and straight leg raising test (SLRT) for the presence of LS.

Method: 95 adult patients with degenerative spinal disorders at the L4/5 or L5/S1 level and disabling back pain or leg pain or both of more than 3 months were included. Lateral recess stenosis at the L5 level or foraminal stenosis at the L5/S1 level on MRI was independently identified by two neurosurgeons blinded to any clinical information. Cutaneous sensory functions of the L5 dermatome on the symptomatic side were evaluated by the SQST. The SLRT was performed as well. Patients' characteristics were recorded by reviewing charts.

Results: Each item of the SQST or SLRT had a modest performance for diagnosing LS which was confirmed using MRI (sensitivity=0.375~0.708, specificity=0.830~0.936). All eight items of the SQST and SLRT were then chosen for a stepwise selection procedure. The final model identified low-strength von-Frey, brush, cold, and the SLRT to be the best predictors of LS with an area under the receiver operating characteristics curve of 0.9198 (95% confidence interval=0.8602~0.9793).

Conclusion: Each item of the SQST or SLRT in isolation had significant diagnostic value for LS on MRI at the L4/5 or L5/S1 level, and the diagnostic accuracy of a model with low-strength von-Frey, brush, cold, and the SLRT was excellent.

Keywords: Lumbar spinal stenosis, Lateral stenosis, Lumbar radiculopathy, Central stenosis, Neuropathic pain, Sensory test

OP-SP.23-04

Funnel Technique of Pedicle Screw Insertion in Dorso-Lumbar and Sacral Spine - Our Experience

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Background: Fluoroscopic guidance to put pedicle screws helps to confirm the accuracy of the screw in place; however, it is always not mandatory.

Method: In 119 patients, 964 pedicle screws were inserted during a period between July 20013 and November 2016. There were 528 pedicle screws in trauma, 268 in TB spine, 126 in Spondylolysis/ spondylolisthesis and 42 in tumors. In lumbar/sacral region total of 474 screws and in dorsal region 490 screws were introduced. All screws were inserted free hand without fluoroscopic guidance (i.e. Through funnel technique). Accuracy of the placement was checked per operatively with pedicle probe by sounding technique. Before wound closure and whenever in doubt position of screws was checked under fluoroscope. Post operatively patients were subjected for CT scan to confirm the position of the screws.

Results: Out of 964 pedicle screws forty-nine screws (5.08%) were misplaced. Thirty patients complained of dysesthesia. Thirty-six screws (3.73%) were broken at last follow up of 12.6 months. The average surgical time for insertion of the screw without image intensifier is four minutes whereas with image intensifier was 7.5 minutes.

Conclusion: Funnel technique of pedicle screw insertion is safe and time saving.

Keywords: Funnel tehnique, Pedicle screw, Flouroscopic guidance

OP-SP.23-05

Bilateral Decompression with Unilateral Approach in Multilevel Lumbar Spinal Stenosis

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Background: There is a continuous debate whether decompression should be done with or without instrumentation. In this study, we retrospectively analyzed the outcomes of patients who were operated with bilateral decompression with unilateral approach (BDUA) alone for spinal stenosis involving 4 or 5 lumbar levels.
Method: Twenty-one patients meeting the inclusion criteria who were operated with BDUA.
Results: Fifteen patients were female and 6 were male; the mean age was 71.75 years. BDUA was applied for a total of 89 levels. The mean follow-up duration was 33 (5-49) months. VAS scores were used to rate low back and leg pain (significant improvement was observed). A significant increase was noted in walking distances. No instability, adjacent segment problems, or recurrent stenosis were observed at short - and long-term follow-up visits. Decompression has been used alone for the treatment of spinal stenosis for a long time. Whether instrumentation is needed for decompression has always been a subject of debate. Multilevel instrumentation causes significant major and minor morbidities, particularly in this osteoporotic population. Bilateral multilevel decompression with unilateral approach is associated with a lower morbidity, its outcomes are remarkably favorable, and patient satisfaction is better.
Conclusion: In multilevel spinal stenosis surgery, bilateral decompression with a unilateral approach is a surgical option that can be safely applied in suitable patients, associated with a low morbidity, and a suitable surgical option for this age group.
Keywords: Spinal stenosis, Unilateral approach, Bilateral decompression

OP-SP.23-06

Surgical Outcome of Unilateral Partial Painful Foot Drop Due to Lumbar Disc Prolapse

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Aim: To analyze the surgical outcome of unilateral partial painful foot drop due to lumbar disc prolapse.
Method: A retrospective observational study of 43 cases of unilateral partial painful foot drop who underwent fenestration and lumbar discectomy, at neurosurgery department LRH, from January 2001 to January 2006. All the patients presenting with unilateral partial painful foot drop due to lumbar disc prolapse, irrespective of age and gender were included in the study. Patients were observed for improvement in foot drop in terms of MRC grading and in pain at 1 month and 6 months time.
Results: Out of 43 patients 58.14% (n=25) were male and 41.86% (n=18)were female patients. Age of the patients ranged from 18 years to 54 years. Mean age of the patients was 33 years. All the patients were having power at ankle joint (dorsiflexion) less than or equal to MRC grade 3 but more than 1. Single level unilateral lumbar fenestration followed by discectomy was performed in all the patients within one month of onset of foot drop. patients were followed after 1 month and 6 months time. There was improvement in foot drop (MRC grade 4 or 5) and in pain (2 or more than 2 points on VAS) in 81.4% (n=35) and 93% (n=40) after 1 month and 6 months post operatively respectively.
Conclusion: Painful foot drop is one of the complication of lumbar disc prolapse. Early surgery is very effective in restoring the neurology in this case.
Keywords: Painful foot drop, MRC grade, Fenestration, Lumbar disc prolapse, VAS

OP-SP.23-07

Surgical Management of Degenerative Spine Disease at National Hospital Abuja: A Preliminary Report

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Background: The operative management of degenerative spine disease at national hospital Abuja has been a challenge for so many years. Decision-making was impeded by inadequate facilities and manpower. In the last two years, there has been an improvement in the surgical management of patients with this disease. This study aims at giving a preliminary report on the patients with degenerative spine disease that had surgical operation in our institution over the last two years.
Method: A retrospective review of patients with degenerative spine disease who underwent surgical intervention at our institution in the last 2 years (January 2015 – February 2017). Data were retrieved from the hospital record and analysed and results will be presented in tables and figures.
Results: 40 patients comprising 19 males and 21 females were operated during this period. Their mean age was 59 years. All patients had radiculopathy. Lumbar disease accounts for 70%, 30% were cervical while 17% had both. Mean duration between diagnosis and surgery was $4\frac{1}{2}$ months. Follow-up period was between 2-19 months. Interval between onset of symptoms and presentation ranges between 5 weeks and 12 years.59% of patients presented with neurogenic claudication while 77.7% had incomplete motor deficit.50% of the patients presented with their MRI result while 22.7% had the MRI done within 24hrs of request. 70% had instrumented spine surgery, of these 64.3% were lumbar while 35.7% were cervical. Seven (17.5%) patients had postoperative surgical site infection.95% experienced significant symptomatic improvement and satisfaction.
Conclusion: Improvement in the facilities has significantly improved the surgical management of degenerative spine disease in our institution
Keywords: Degenerative spine disease, Radiculopathy, Neurogenic claudication

OP-SP.23-08

Double Hinged Arms Spinal Retractor with Distal Articulation, New Idea

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Aim: To present my patented new idea of Double Hinged Arms Spinal Retractor with Distal Articulation.
Method: Modifying the single arm retractors by adding a second hinge at arm-prongs connection.
Results: It carries the advantages of avoiding having a full retractor

sets, with its its cost, needs of more space in instruments table, training and orientation of nursing staff, and many trials until get proper size. It also provides over the single instrument retractors e.g.Beckman types, the advantages of easy application, proper muscle retraction with prongs appropriately running perpendicular to muscle fibers reducing traumatic application, provides clear and adequate surgical field view, could be adjusted properly regardless wound depth, easy to shift handles from one wound end to the other without removal and re-application and could be used in smaller incisions, as in limited approaches, comparing to other types. Prototype is currently in use with spinal surgeons in Saudi Arabia, Egypt and UK.

Conclusion: In brief it is a single surgical instrument retractor with easy and fast handling, provides complete and effective retraction and clear better view, secured fit, reduces operative trauma to muscle tissues and post-operative pain.

Keywords: Double, Hinged, Spinal retractor, New idea

OP-SP.23-09

Lumbar Spinal Stenosis: Laminectomy or Laminotomy-Capillering ?

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Lumbar spinal stenosis (LSS) relates to the suffering of the nerve roots of the cauda equina compressed in a narrowed lumbar spinal canal. Several surgical options exist**:** classical laminectomy, minimal invasive approach (unilateral laminotomy for bilateral decompression, bilateral laminotomy). The minimal invasive techniques are indicated when the LSS is on a single level or on two levels. Their advantage stems from the reduction of the duration of hospital stay between 2 to 3 days as well as the reduction of the post-operative pain. Most studies are conclusive on the therapeutic benefits of surgery for LLS. Priority should be given to minimal invasive procedures.

Keywords: Lumbar spinal stenosis, Minimal invasive surgery, Spine

OP-SP.24-01

Minimally Invasive Decompression and Stabilization in Stenosis of the Lumbar Spine

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Aim: To compare the results of open and minimally invasive surgery on patients with the lumbar spine stenosis aimed at it`s decompression and stabilization.

Method: Between 2013-2016yy 171 patients with stenosis of the lumbar spine were operated using instrumentation. The average age of patients was 60,9. 136 surgeries (OPEN) were performed open. In 35 surgeries (MAST) we applied minimally invasive decompression using paramedial approaches sized from 4 to 6 cm. We evaluated the severity of pain using NPS and quality of life using OSWESTRY, duration of surgery, blood loss, length of stay in hospital, X-ray load during operation. Fusion of fixed segment was reached by installation of interbody cage (PEEK) with self bone pieces.

Results: the duration of minimally invasive intervention was slightly higher–174 min and 158 min respectively. Instead, blood loss during MAST was significantly lower-150 ml, OPEN-680 ml. Number of X-ray control MAST-46 and OPEN-21. NPS before operation MAST-7,7, OPEN-7,95. Week p/o MAST-3,0, OPEN-3,6, 6 months MAST-1,67, OPEN-2,13, at the time of the survey MAST-1,75, OPEN-2,08. OSWESTRY before surgery was 62% in both. After 7 days MAST-28%, OPEN-32%, 6 months MAST-19,3%, OPEN 19,2%, and at the time of the survey both 17,6%. The average hospital stay was 12 days and 9 respectively.

Conclusion: Against the Background of less invasiveness and much less blood loss, the group MAST got more X-Ray exposure and higher duration of the operation. Activation of patients is more comfortable in the group MAST, which makes it possible to reduce bed-days.

Keywords: Degenerative stenosis, MAST decompression, Stabilisation

OP-SP.24-02

What is the Influence of a Preoperative Conference on Surgeons' Decision-Making for Adult Spinal Disorders? A Prospective Clinical Study from a Spine Hospital

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Background: There are several factors that spine surgeons have to consider when determining a surgical plan for the treatment of spinal disorders. The objective of this study is to evaluate the influence of a preoperative conference on spine surgeons' decision-making in the treatment of adult spinal disorders.

Method: A consecutive series of patients with a variety of adult spinal disorders at a single spine hospital were analyzed. The imaging modalities and clinical examination history of these patients were presented at a daily preoperative conference attended by staff spine surgeons and spine surgery fellows at this spine hospital. The specific surgical plan prior to the preoperative conference and prior to the surgery were compared for each patient.

Results: 506 consecutive patients were reviewed over a 4-month period. Changes in the surgical plan following the preoperative conference occurred in 29 cases (5.7%). 17 of these changes were minor modifications in the same surgical level or inclusion/exclusion of adjacent or other levels in the surgical plan without changing the planned surgical approach. Surgical approach changed in a total of 12 cases (2.3%).

Conclusion: Preoperative conference for the surgical treatment of adult spinal disorders influenced the surgical plan in 5.7% of surgeries. This type of daily preoperative conference appears to have only a minor impact on spine surgeons' decision-making, but instead could be used to provide training and insight to better a fellow or resident's education at the spine institution.

Keywords: Surgical treatment, Preoperative conference, Decision-making

OP-SP.24-03

Minimally Invasive Transtubular Microscopic Surgery for Symptomatic Lumbar Intraspinal Synovial Cysts Decreases the Stabilization Requirements

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Background: We evaluate the efficacy of surgery, and present the advantage of the technic for the treatment of symptomatic lumbar intraspinal synovial cysts, and compare our results with the literature in order to point out if minimally invasive surgery decreases the stabilization.
Method: We analyse retrospectively the data of 21 patients with radiculopathy, refractory to conservative therapy, in whom imaging studies or intraoperative findings confirmed a lumbar facet joint cyst who underwent a minimally invasive cyst excision and nerve root decompression. A minimum of 6 months follow-up were obtain in all cases.
Results: The mean follow-up time was 35 months (range 6-48 months). Clinical outcomes were graded, based on the Macnab modified criteria. Twenty patients reported either excellent (18) or good (2) results, a fair result was reported by one patient. The mean operative time was 115 minutes (range 68-230 minutes). Two patients had intraoperative dural tears that resolved following primary intraoperative dural suture. No patient developed clinical spinal instability.
Conclusion: Treatment of choice for symptomatic synovial cyst is surgical. A MISS using the tubular system is efficient and a safe. Adhesion to the dura is not a contraindication. Fusion should not be performed as standard. Compared with the published stabilization requirements after open surgery for symptomatic lumbar intraspinal synovial cysts, minimally invasive transtubular microscopic surgery for symptomatic lumbar intraspinal synovial cysts decreases the stabilization requirements
Keywords: Minimally invasive transtubular surgery synovial cysts

OP-SP.24-04

Surgical Treatment of Lumbar Disc Herniation; Disc Fenestration or Endoscopic Discectomy

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Background: Lumbar disc herniation is one of the most common conditions, representing 5% of patients presented with low backache. treatment involve conservative treatment, injections or surgery. Surgical intervention may be traditional laminectomy, but most neurosurgeons try to avoid this aggressive procedure and adopt minimally invasive procedures like open disc fenestration and endoscopic discectomy which are known to be associated with less complications. The aims of this study are to compare two groups one of open disc fenestration and the other of endoscopic discectomy regarding the effectiveness of each procedure in treating lumbar disc herniation, and to study the complications associated with each procedure.
Method: Group one constitute the patients who underwent open disc fenestration (198 patients) in the period from 1995 to 2010, is compared to group two (20 patients) who underwent endoscopic discectomy in the period from 2007 to 2010.
Results: Demographic data of the patients were found to be similar is, both procedures were found to be effective in relieving patients symptoms with satisfactory results in 98.5 % 0f patients in group one and in 100% of the patients in group two, no deaths or deterioration were encountered in both groups, group two showed more complications than group one like dural tears and root injury and longer operative time, more costs, longer learning curve encountered, while in group one larger wound and longer recovery time were encountered.
Conclusion: Both procedures were effective, but endoscopy group is associated with more complications and longer learning curve.
Keywords: Endoscopic discectomy, Disc fenestration, Disc herniation

OP-SP.24-05

Failed Back Surgery Syndrome: Is This Patient Created Problem or Surgeon Created Problem?

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Background: Failed back surgery is a nonspecific term that implies that the final outcome of surgery did not meet the expectation of both the patient and the surgeon as it was established before surgery. Expected outcome varies according to the type of structural problems, the number and types of prior surgeries and the psychological health of the patient.
Method: We present 12 cases of failed back surgery. All of them underwent multiple operations on the lumbar spine. The etiology in 6 patients was recurrent disc herniation above the level of fusion. Two patient had nonunion of fusion mass; two had neuropathic pain and iatrogenic instability. In addition 2 patients had facet and sacroiliac joint pain. The number of previous spinal operations varied from 3 to 21. The fellow-up of patient was 6 months to 5 years.
Results: In all of these patients, the first line of treatment was conservative. Four patients underwent revision surgery for removal of implant and discectomy just above the fusion level. In Three patients, pain could not be controlled, and these patients had implantation of spinal cord stimulator. This ultimately gave them relief.
Conclusion: Failed back surgery syndrome is unfortunately common problem with enormous cost to patient, insurer and society. These patients should be treated conservatively with good team work, which include surgeon, psychiatrist, physiotherapist and the pain specialist. Our conclusion come to the fact that more the surgery these patient has more miserable these patients become.
Keywords: Failed back surgery, Recurrent disc herniation, Neuropathic pain

OP-SP.24-06

Comparison of Results of Automated Lumbar Percutaneus Discectomy (APLD) and Percutaneous Laser Disc Decopression (PLLD)

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Background: The effectiveness of APLD and PLDD has not been documented individually, and there has been no comparison of these two techniques. The aim is to document results of and compare APLD and PLDD.
Method: This is a prospective study comparing a consecutive group of APLD and PLDD. Follow up is minimum of 1 year. All cases had the same indication consisting of a bulging disc, radicular symptoms and no neurological loss or sensory loss only. Pain status was measured using a visual analogue scale for both the back and radicular pain. Pain measurements were done preoperation, 6 weeks, 3 months and 1 year after surgery.
Results: There were 21 consecutive APLD cases and 20 consecutive PLLD cases. The APLD group had a pre operation pain ranging from 7-9 leg pain and 2-6 back pain. Three mos FU was 0-4 leg pain and 2-4 back pain. By 6 mos to 1 year two underwent epidural injections and 1 came to surgery. The PLLD group had pre op 6-9 leg pain and 2-5 back pain. At three mos leg pain was 0-3 and back pain 2-5. At 6 mos to 1 year 3 had epidurals and one underwent surgery. There were no complications.
Conclusion: APLD and PLLD are both equally effective for a contained bulging disc with radicular symptoms
Keywords: Percutaneous, Discectomy, Laser

OP-SP.24-07

Lumbar Spine Disc Disease, Minimally Invasive Neurosurgery, Novel Technologies

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The Lumbar Disc Herniated Diseasse is a situation very common to the Physicians, in special to Neurosurgeons.-With the use of clasical technique for Discectomy, this technique is frequently associated with Postoperative Pain and different disabilitty grades.- In the last years the Low Back Pain w/o sciatic, has become an expanding field of Research.- The Incidence is about 8 millions of cases yearly in USA- The Cost Direct and Indirect is about of 25 Billions Dollars by Year.- With the application this Minimally Invasive Neurosurgery applied to N**:**135 patients in last 5 years divided in Two Subgroups; Group 1**:** N=105, were we practiced percuttaneous procedure guided by C arm and lately with Neuronavigator in order to localize intervertebral disc, follow by discography and after we introduced 60-90 ml of ozone depending of disc size.
The Second Group**:** II**:** N=35, we practiced the same procedure and after the discography we introduce a special neddle attached to Device similar a Screwdriver that have in the handle a Micromotor rotative impulsed by dry alkaline.- The neddle is provided of flutted tip and apply the rotating movement that made the discoidectomy and secundarily discompressing the nerve root compromissed.- the procedure in practiced in OR monitoring, sedation by anesthetist and local epidural shot before the procedure.- The patient is mantained in recovery room by 1-2 hours and sent his Home, return his labor or social activitties in very short time.- The rapidly recovery save Cost relative to the open surgery reducing the hospitalization time the postoperative stage.
Keywords: Minimally invasive neurosurgery, Flutted tip, Lumbar disc disease herniated, Percuttaneous

OP-SP.24-08

Spontaneous Complete Resolution of Two Sequestrated Lumbar Disc Herniations at Different Levels and Time Periods in the Same Patient

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Lumbar disc herniations can regress with conservative treatment; however spontaneous complete resolution of two large sequestrated lumbar discs at different levels and time periods in the same patient is very rare phenomenon.
A patient who experienced two large independent sequestrated lumbar discs at different time periods and adjacent levels and spontaneously total disappearance of the disc fragments after conservative treatment, is presented. A 35-year-old woman, presented with a large sequestrated disc herniation with cephalad migration on the left side of spinal canal at the L4-5 level on T2-weighted MRI and the dural sac was seen to be compressed by the fragment. Surgical intervention was offered to the patient but she refused the operation. After 4 years she came to our outpatient clinic and MRI revealed an absence of the free fragment at L4-5 level, but a large L5-S1 right sequestrated and upmigrated lumbar disc. She refused the surgery again tenaciously. Her 3 year follow-up MRI revealed a complete resolution of the sequestrated fragments.
The exact mechanisms proposed for resolution of sequestrated disc herniation has not been determined completely yet. The most likely mechanism for resolution is an inflammatory response elicited against the free fragment. Patients with sequestrated lumbar disc herniation may be managed conservatively,in the absence of intense pain or cauda equina syndrome.. Disc sequestration had a significantly higher rate of complete regression than did disc extrusion and protrusion.
Keywords: Sequestrated lumbar disc herniation, Conservative treatment, Spontaneous resolution

OP-SP.24-09

Outcome of Lumbar Discectomy After One or Two Level Surgery

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Background: To determine the postoperative outcome in patients operated on one or two adjacent levels, due to herniated lumbar disk, according to subjective assessment of the patient.
Method: The study included 60 patients operated on in the Department of Neurosurgery of the Cantonal Hospital in Zenica, from 01.01.2001. to 31.12.2006, due to herniated lumbar disk. Subjects were divided into two groups of 30 patients**:** group operated on one level and the group operated on two adjacent levels.
Results: It was found that there was no statistically significant difference between the value of Oswestry Disability Index of the patients treated at one level and the value of the patients treated at two levels ($p = 5.99$; $\chi 2 = 3.157$). It was also found that there was no statistically significant difference of values of Visual Analog Scale in patients operated on one level and in patients operated on two levels ($p = 0.088$). We compared the individual values of VAS preoperatively in all monitored patients with individual values of VAS postoperatively and found that there is a statistically significant difference ($p < 0.00001$).
Conclusion: This study confirmed the personal observation of no significant differences in clinical outcomes among patients who hade discectomy in one or two adjacent levels. We compared the clinical outcomes of the two groups of patients, based on patient satisfaction with treatment, assessing the intensity of pain and activities of daily living. In both groups of patients is evident significant subjective improvement by comparing preoperative and postoperative values of VAS's.
Keywords: Herniated disc, Discectomy, Pain

OP-SP.25-01

"Capac ñan" Stairway Fashion Hemilaminectomy. A New Minimally Invasive Multilevel Option to Treatment of Cervical Stenosis. An Study with 36 Months of Follow Up

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Background: There are many options to decompress the cervical spine on posterior way in multilevel disease. However muscular injury and instrumentation are big problems in traditional surgery. The minimally invasive procedures can achieve optimal decompression without muscle injury, preserving the posterior ligamentous tension band with less pain, bleeding and hospitalization, providing improvement in short time.
Method: We present an study with 15 patients with symptoms of multilevel cervical stenosis and MRI shows multilevel stenosis too, All the patients underwent minimally invasive uniportal multilevel decompression. We use VAS, Neck Disability index and Nurick clinical scale with follow up of 24 months. We made POP early (2 weeks) MRI and dynamics rx.
Results: The Vas preop was mean 9 and 2 on 24 and 36 months. Neck Disability index was 20 preop and 10 POP 24- 36 months. The Nurick clinical scale shows improvement of one time line. The surgical time was mean 22 min(mean) each level, blood lose 11cc (mean) each level, hospital discharge on 23 hours after surgery and return to daily activities mean 10 days.
Conclusion: The "Capac Ñan" starway fashion minimally invasive hemilaminectomy procedure can be safe and efective to decompress a cervical spinal cord on multilevel disease without instability, muscular injury and let a better time to recovery and return to daily activities. We need more experience to make a final conclusions.
Keywords: Minimally invasive, Spine surgery, Cervical, Stenosis, Multilevel

OP-SP.25-02

Application of the 3 Dimensional Cervical Spine Model for Patient Specific Mass Screw Fixation

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Aim: To describe the application of the life-size three dimensional (3D) patient specific cervical spine models which are used for improving the accuracy of screw insertion in cervical fracture patients.
Method: A total of 10 patients with C2-6 fractures and dislocations were recruited, dual CT scan data from C2-6 pre and post screwing were transformed into 3D patient specific life-size cervical spine model. These models were analyzed to obtain detailed information of each pedicle, VA and curvature of spine were used as an intraoperative reference.
Results: 3D models, allowing visualization of the VA pedicles and screws were developed. The dual CT of the created models was analyzed to ensure proper orientation of the screws. The average dimensional parameters for cervical pedicle screws of both sides were measured and analyzed, which showed no statistically significant differences in the ideal and the actual entry points, inclined angles, and tailed angles.
Conclusion: Life-size 3D model is effective and reliable in achieving an accurate and safe screw insertion during fixation surgery, especially in anatomically abnormal cases such as geriatric patients, abnormal VA and screw malposition. 3D models allowed (1) the visualization of the VA anatomy, (2), evaluation of radiological images after screw insertion, and (3) the use of prebent rods during surgery to contribute to the safety of the cervical posterior fixation, (4) postoperative verification (5) and provided data on flexion and extension movements of the neck vertebra postoperatively.
Keywords: 3 Dimensional, Cervical spine model, Patient specific, Screw fixation

OP-SP.25-03

PICA end Vertebral Artery, Potential Risk for Cervical Spine Surgery

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Background: In cervical spine surgery, dominant side VA is postulated to be preserve. Contrary the importance of non-dominant VA is not discussed, such VA, called PICA end VA, sometimes terminates as poserior inferior cerebellar artery (PICA). The injury of PICA end VA possibly leads to cerebellar infarction. Details are described in this study.

Method: Study 1; 358 cases of head and neck MR angiogram (MRA) were checked. Diameter was mesured at V2 portion. Asymmetry was determined by <75% of dominant side. Relation between frequency of PICA end VA and asymmetry, diameter of VA was analyzed. Study 2; MRA of consecutive 62 cases younger than 39 yrs in 14 months were measured same way, and compared with 324 cases older than 50 yrs.
Results: Of 358 cases, age were 10-94 (67.8±13.8). As typical, both VA configure BA in 296 cases (82.7%), one side were abscent in 18 cases (5.0%). PICA end VA were in 44 cases (12.3%). Diameter of all VA were 3.2±0.76 mm. Diameter of PICA end VA were 2.0±0.55 mm, which were significantly smaller than non-dominant but not PICA end VA, 2.8±0.59 mm ($p<0.001$). 38/44 cases (86.4%) were less than 2.5 mm. Among VA less than 2.0mm, 26/56 cases (46.4%) were PICA end VA. PICA end VA were 1/62 cases (1.6%) and 43/324 cases (13.3%) in ≤39yrs and ≥50yrs, respectively. It is significantly fewer in young population ($p<0.001$).
Conclusion: Although it is not obvious, PICA end VA also shoud be preserved, since potential risk exists. If VA is thin, has large difference in both side, special care should be taken during cervical spine surgery.
Keywords: Cervical spine surgery, PICA end, Vertebral artery

OP-SP.25-04

Technology of Endoscopic Discectomy for Treatment of Cervical Herniations

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Background: Nowadays the problem of choice of the most efficient method in treatment of cervical disc herniations is of most actual and debated problems. The idea of removing disc herniations using endoscope techniques is not new and is successfully utilised in treatment of lumbar disc herniations. But in case of cervical spine only fully endoscopic procedures are performed from 2014 by Yang JS with coauthors and their effectiveness is a questionable matter.
Method: The proposed method of endoscopic portal disc herniation removal was used during past 2 years and it's results were compared with anterior microsurgical approach using a single level cage implantation. 25 patients were included into this study with a comparing group of 25 patients operated using anterior approach with fusion.
Results: Using VAS scale it was confirmed that the degree of local and radicular pain in two groups was not significantly different ($p>0.05$). According to Neck Disability Index (NDI) there was a significant difference between two groups with respect to endoscopic patient group. Data using Odom criteria showed a significantly better results in endoscopic group. During the research it was realized that patients in endoscopically operated group were faster discharged from hospital in 3 [2; 5] compared to 5 [4; 6] days in microsurgical group.
Conclusion: Thus using a newly proposed technology of portal endoscopic treatment of cervical disc herniations showed to be a more efficient method and makes it possible to gain clinical result with significantly lesser operation trauma.
Keywords: Endoscopic spine surgery, Cervical disc herniation, Minimally invasive spine surgery, Portal endoscopic discectomy

OP-SP.25-05

Surgical Outcome of Cervical Corpectomy and Cage Fixation for Cervical Spondylotic Myelopathy

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Aim: To assess the surgical outcome of cervical corpectomy and cage fixation in patient with cervical spondylotic myelopathy.
Method: This retrospective observational study was conducted in the department of neurosurgery MTI, Lady Reading Hospital Peshawar from first January 2014 to 31 december 2015. 36 patients met the inclusion criteria. Patient with either sex and age who had undergone cervical corpectomy and cage fixation for cervical spondylotic myelopathy secondary to compression of spinal cord from anterior were included in the study.
Results: Out of 36 patients with CSM, 24 (66.7%) were male and 12 (33.3%) were female. Age ranged from 34-72 years (mean 54.2 years). Clinical presentation were hypoesthesia (82%), limbs weakness (59%), gate ataxia (59%), neck and interscapular pain (46%) and urinary bladder dysfunction (20%).The disease duration ranged from 4 months to 8 years (mean 4.2 years). Parasthesias in the limbs and gate problems were the common presentations. Parasthesias showed dramatic and immediate improvement in 31 (86.1%) while a significant reduction in gate problems, fine movements of hands and other features were also noted in follow-up period. The surgical complications included srew displacement (n=1, 2.8%), implant subsidence (n=2, 5.6%), infection (n=3, 8.3%), transient recurrent laryngeal nerve pareses (n=2, 5.6%), transient dysphagia (n=1, 2.8%), esophageal fistula (n=1, 2.8%) and prevertebral hematoma (n=1,2.8%) were observed. Post op, cervical curve and allignment was satisfactory in 34 patients. The patients were followed after 2 weeks, 2 months and 6 months.
Conclusion: In cervical spondylitic myelopathy with compression from the anterior, cervical corpectomy and cage fixation is an effective and less invasive approach.
Keywords: Cervical spondylotic myelopathy, Corpectomy, Cervical cage fixation

OP-SP.25-06

A Modified Technique of Unilateral Open-Door Laminoplasty Using Ultrasonic Osteotome and Hydroxyapatite Laminar Spacers for Cervical Spinal Stenotic Myelopathy

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Background: Cervical laminoplasty has been widely accepted as one of the major treatments for cervical myelopathy and various modifications and supplementary procedures have been devised to achieve proper decompression and stability of the cervical spine. Ultrasonic devices first appeared in 1952 and were quickly adapted, and their use was expanded. The author present the retrospectively analyzed results of a modified unilateral open-door laminoplasty using ultrasonic osteotome and hydroxyapatite (HA) spacers.

Method: From June 2008 to May 2013, among patients diagnosed with cervical spondylotic myelopathy and OPLL, the patients who received laminoplasty were reviewed. Clinical outcome was assessed using Frankel grade and Japanese Orthopaedic Association (JOA) score. The radiologic parameters were obtained from plain films, 3-dimensional computed tomography and magnetic resonance images.
Results: A total of 125 cervical laminae were operated in 38 patients. 11 patients received 4-level laminoplasty and 27 patients received 3-level laminoplasty. Postoperatively, the mean Frankel grade and JOA score were significantly improved from 3.97 to 4.55 and from 12.76 to 14.63, respectively ($P < 0.001$). Radiologically, cervical curvature was worsened from 19.1° to 15.6° ($p=0.025$). The percentage of range of motion preservation was 73.3%. The axial dimension of the operated spinal canal was increased from 1.75 to 2.70 cm2 ($p<0.001$).
Conclusion: In our study, unilateral open-door laminoplasty using HA spacers and miniplates appears to be a safe, rapid and easy procedure to obtain an immediate and rigid stabilization of the posterior elements of the cervical spine. This modified laminoplasty method showed effective expansion of the spinal canal and favorable clinical outcomes.
Keywords: Cervical vertebrae, Laminoplasty, Spinal cord compression, Ossification of posterior longitudinal ligament, Ultrasonic osteotome, Hydroxyapatites

OP-SP.25-07

Anterior Microdiscectomy and Cage Implantation without Plating as a Treatment Option of Cervical Degenerative Disc Disease on One or Two Levels

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Aim: To present our experience using the anterior cervical microdiscectomy with PEEK cage implantation but without anterior plating performed due to cervical degenerative disk disease (CDDD).
Method: Over a time span of eight months (September 2015-April 2016), twenty-six consecutive patients (26/247) with CDDD were enrolled in prospective study. Patients were aged 33 to 62 years.
Results: All patients were operated on through the right anterior cervical approach. Six patients (23%) were treated on two levels. Co-morbidity was not present in 11 patients (42%). Followed up was 11-19 months. Mean age was 47. Majority of patients were female (77%). Previous disk surgery was performed in 9% patients. Motor weakness was present in upper limbs (73%, mainly flaccid) and lower limbs (23%, spastic), while numbness was found in arms and legs, 100% and 14% respectively. Sphincter disturbances were found in 11% and Babinski's sign were confirmed in 8 % of patients. Cervical spondylotic myelopathy was found in 31% of the patients and 64% of them had some degree of degenerative kyphosis. On the first postoperative day, cage position and cervical spine alignment was evaluated by 3D CT. Average postoperative hospital stay was 3 days. Follow up evaluation included MRI and showed the regression of preoperative neurodeficit. There were no postoperative complications including infections. None of the patients needed blood transfusions.
Conclusion: There was no complication connected with surgery. A microdiscectomy with cage implantation without plating resulted in improving of sensory and motor function for majority of patients.
Keywords: Microdiscectomy, Cervical, PEEK cage, Degenerative disc disease

OP-SP.25-08

Clinical Outcome of Anterior Cervical Decompression for Cervical Myelopathy

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Aim: To determine the clinical outcome of anterior cervical decompression for cervical myelopathy in terms of improvement in Nurick grade.
Method: Prospective observational study was done at Neurosurgery department unit "A" at Medical Teaching institution, Lady Reading hospital, Peshawar. Duration of the study was one year, from July 2015 to June 2016. Total number of patients was 32.we included patients with spodylotic myelopathy. Anterior approach was adopted in all cases. Patients were followed for a period of 6 months post operatively. Outcome was measured in terms of improvement in Nurick grading post operatively and post op complications.
Results: Results were analyzed using SPSS 21.0. Mean age was 47.2 years. 87.5% (n=28) were males and 12.5% (n=4) were females. Pre op Nurick grade was 15.62% (n=5) in Nurick grade 1, 28.12% (n=9) in Nurick grade 2, 37.5% (n=12) Nurick 3, 12.5% (n=4) in Nurick 4 and 6.25% (n=2) in Nurick grade 5. Post operatively the Nurick grade was, 28.12% (n=9) nurick grade 1, 43.75% (n=14) Nurick grade 2, 9.37% (n=3) Nurick 3 and 6.25% (n=2) in Nurick 4. No patient was in Nurick grade 5 post operatively. 12.5% (n=4) patients had no symptoms or mild neck pain post operatively that improved with medications. urinary symptoms improved in all cases.
Conclusion: Anterior cervical decompression is a safe and appropriate treatment for cervical spondylitic myelopathy. Younger patients with good pre operative functional status (Nurick grade) and maximum 2 levels of involvement have better outcome following anterior surgery.
Keywords: Cervical myelopathy, Anterior approach, Nurick grade

OP-SP.25-09

Cervical Spondylosis

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A retrospective study of 1127 levels operated in 609 cervical spondylosis patients with & without Radiculo/Myelopathy. The surgical indications, surgical technique including (Laminectomy +- Fusion, Laminoplasty, Multi-level ACDF, Corpectomy, TDR & Hybrid procedures), complications, series analysis, case presentation with videos & the surgical outcome will be discussed.
Keywords: Cervical, Spondylosis, Myelopathy, ACDF, Corpectomy, Arthroplasty

OP-SP.26-01

Kyphoplasty Cement Encapsulation Biodegradable Balloon Catheter - Animal Study

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Background: Kyphoplasty procedure were introduced and performed to stop the pain caused by pathologic spinal fractures, stabilize the bone, and to restore some or all of the lost vertebral bodyheight due to the compression fracture. The major concerns with the technique is extravasation of cement. We tested the feasibility of a Cement Encapsulation Biodegradable Balloon Catheter in Kyphoplasty therapy over14days in healthy animal model.
Method: Cement Encapsulation Biodegradable Balloon Catheter System comprised of five components**:** Biodegradable Shaft, Non-compliant Biodegradable Balloon, Silicone Inflation Valve; one-way valve to hold cement inside balloon catheter, Delivery Stainless Steel Shaft, temporary inflation shaft removed from balloon catheter after inflation, Balloon Catheter Release Shaft, push shaft. Balloons were percutaneously implanted, under X-Ray guidance, into vertebral body of 4 levels L1-L4. Two animals underwent Kyphoplasty therapy followed by Cement Encapsulation Biodegradable Balloon Catheter implementation inflated with contrast medium to mimic PMMA inflation. Animal model used; Sheep, 2 Females weighing between**:**75-90 kg. One animal was deadened post procedure and the harvested spine was sent to CT scanning to learn about the balloon and catheter formation. Second animal was kept alive to examine balloon degradation process. Every other day the live animal was X-Rayed to examine the balloon integrity.
Results: The balloons degraded over a period of 12-14 days in the live animal model. The implant procedure was accepted by Kyphoplasty therapies trained physicians. No adverse events were recorded.
Conclusion: A pre-clinical diagnosis of balloon inflation on the vertebral body showed that the material and procedure was safe in-vivo. Synthetic polymers can be prepared to enhance performance of the balloon catheter.
Keywords: Implantable biodegradable balloon, Kyphoplasty, Balloon kyphoplasty, Vertebral fracture, Osteoporosis

OP-SP.26-02

Influence of Vertebral Bone Marrow Edema on Outcome in Non-Acute Osteoporotic Patients Treated with Percutaneous Vertebroplasty

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Background: Although PV is widely used to treat osteoporotic collapsed vertebral compression fractures (VCF); little is known about the influence of BME in osteoporotic VCF or about its relation with relief of pain. The aim of this study is to prospectively investigate the influence of presence of bone marrow edema (BME) in non acute osteoporotic verterbral compression fractures on postoperative clinical outcome in patients treated by percutaneous vertebroplasty (PV).
Method: Prospective cohort study. Sixty seven patients with non acute osteoporotic verterbral compression fractures treated with PV. They were divided into edema group (56 patients with apparent vertebral BME in their magnetic resonance (MR) images), and non edema group (11 patients with no vertebral BME detected in their MR images). Pain was evaluated one week, one month, six months, and one year post procedure using visual analogue scale. Statistical analysis including a 2-tailed t test comparing postoperative data with preoperative values was done.
Results: A good clinical response to PV procedure was seen in all patients. Significant difference was seen between two groups in one week, and one month follow up periods. Regarding pain relief in the other periods of follow up, no significant difference was seen between two groups.
Conclusion: PV resulted in significantly clinical improvement in patients with BME pattern than in those without in one week and one month follow up periods. But the absence of vertebral BME did not influence pain relief in patients with osteoporotic VCFs in six months, and one year post procedure.
Keywords: Bone marrow edema, Osteoporotic vertebra, Vertebroplasty

OP-SP.26-03

94 Cases of Kyphoplasty: The Improvement of Pain Management in Vertebral Fractures

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Background: Approximately 1.5 million fractures secondary to osteoporosis occur in the United States each year; 700,000 of these are spine fractures—more than hip and wrist fractures combined. Worldwide, 1 in 3 women and 1 in 8 men over the age of 50 are affected by osteoporosis.
Method: We show in this paper the positive experience in 94 cases of osteoporotic vertebral fractures, treated with kyphoplasty in comparison to other surgical techniques like vertebroplasty We selected only cases with vertebral osteoporotic fractures, with back pain using a simple verbal 0-10 numerical rating scale (verbal NRS).
Results: Open procedures require larger incisions to give the surgeon more room to operate. Kyphoplasty gives surgeons a way to fix the broken bone without the problems associated with open surgery. Unlike open surgery, which involves an incision and the use of larger instruments. The goal of kyphoplasty is to return the fractured vertebra as close as possible to its normal height. This is done by specific and special technique. This reduces pain (verbal NRS) and spine deformity (kyphosis), enabling patients to get back to normal activities.
Conclusion: Our results show kyphoplasty is a safe and effective method to relieve pain (verbal NRS) and correct the deformity associated with an osteoporotic VCF. All patents had a shorter recovery and pain relief in 90% of cases, some deficits of strength also got better. The technique is successful in relieving the pain of fractured vertebrae. When well indicated, the method shows better recovery time and pain relief to patients
Keywords: Kyphoplasty, Improvement of pain management, Vertebral fractures

OP-SP.26-04

Management of Thoracolumbar Fractures Based on TLICS Guidelines by an Innovative Mini Open Thoracotomy Approach

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Background: Thoracolumbar fracture treatment is controversial, mostly managed with the concept- no deficit, no surgery. Both conservative and posterior approach showed deterioration in terms of development of instability, implant failure. The TLICS guidelines and anterior approach makes treatment more definitive and a single sitting operation with better correction of sagittal, coronal plane, kyphosis, adequate decompression of neural tissue. The purpose of this study is validation of TLICS scoring system and to determine the mini open thoracotomy as effective stabilising treatment.
Method: Prospective cohort study was applied to a consecutive 42 patients with thoracolumbar fracture between 2013 May and 2017 March. 21 patients (TLICS>4) underwent mini open-thoracotomy, corpectomy with end plated expandable cage screw rod construct. Restoration of saggital and coronal balance, kyphotic correction, neurological deterioration, pulmonary function tests and diaphragmatic movements were recorded.
Results: Conservative and observant group had no deterioration. Operative group had satisfactory correction of kyphosis with no neurological worsening with the follow up period of upto 4 years, VAS score and the pulmonary function tests, diaphragmatic movement normalised by 12th post op day.
Conclusion: TLICS is practical and simplistic guideline for treating thoracolumbar fractures. Mini open thoracotomy (Anterior approach) to the thoraco-lumbar fractures seems to be a safe therapeutic strategy and ideal stabilisation method.
Keywords: Thoracolumbar fracture, Kyphotic angle, Mini open thoracotomy

OP-SP.26-05

Clinical and Radiological Effect of Unilateral or Bilateral Percutaneous Vertebroplasty for Vertebral Compression Fractures

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Osteoporosis and associated fractures are the cause of morbidity especially in older adults, It also decrease quality of life severely. The aim of this retrospective analysis is to examine clinical and radiological effectivity unilateral percutaneous vertebroplasty for treatment of osteoporotic vertebral compression fractures compared with that of bilateral treatment. Between 2003-2016 203 patients who suffered back pain and/or leg pain because of vertebral compression fracture were treated with unilateral or bilateral PVP. Of all 122 patients were females and 81 were males, ages ranging 45 to 87 years.59 females and 46 males operated by bilateral percutaneous vertebroplasty. In addition to this,63 females and 35 males treated by unilateral percutaneous vertebroplasty. All patients underwent follow up radiologic examination at 1 month postoperatively with CT scan and lateral thoracolumbar graphy and functional outcome was analyzed by Oswestry Disability Scale.
Finally, this study suggested that there was no significant difference between unilateral or bilateral percutaneous vertebroplasty in Oswestry Disability Scale. The surgery time of unilateral approach is much less than that of bilateral approach patients with bilateral PVP surgery have been injected more cement than patients with unilateral PVP surgery. We suggested that if the length of compressed vertebral body corpus is less den %50, using unilateral approach as the preferred surgical technique for treatment of vertebral compression fracture due to less operation time, minimal cement injection, limited X-ray exposure, The result of our study suggest both approaches are reliable and safe, also provide improvement of life quality
Keywords: Unilateral percutaneous vertebroplasty, Osteoporotic vertebral compression fractures, Bilateral percutaneous vertebroplasty

OP-SP.26-06

Relationship Between Pain, Social Support and Socio-Economic Indicators in Individuals with Spinal Cord Injury

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Background: Chronic pain is one of the common problems associated with spinal cord injuries (SCI), which causes many complications. We aimed to evaluate the relationship between pain and injury characteristics and socio-economic factors in individuals with SCI in Iran, between 2012 and 2013.
Method: The participants were 140 individuals with SCI, 101 (72%) men and 39 (28%) women, with mean age of 29.4 ±7.9 years. The Persian version of the Brief Pain Inventory (BPI) was used to measure the pain and the Multidimensional Scale of Perceived Social Support (MSPSS) was used to measure social support.
Results: About 50.7% Complained about having pain, which 79.3% had bilateral pain. The most common locations of pain were lower limbs and back. The most quality of pain were described as aching (41.4%), and tingling (32.9%). Patients with a medium level of education had the least pain compared to high and low level of education. SCI individuals with good economic situation reported higher frequency of having pain. There was no significant relationship between pain and social support. There was positive correlation between pain and impairment of mood, normal work, relations with other people and lack of sleep (P<0.001).
Conclusion: These findings revealed the importance of socioeconomic factors such as economic situation and educational level in understanding chronic pain in people with SCI and provide further support for the bio-psychosocial model. Hence, multidisciplinary evaluations and treatment strategies are

advocated, including biomedical, psychological, and psycho-social interventions.
Keywords: Pain, Social support, Socio-economic indicators, Spinal cord injury

OP-SP.26-07

Evaluation of Insidentaly Detected Pathology Results of Patients with Vertebral Fracture Treated by Vertebroplasty and Kyphoplasty: A Retrospective Study

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Background: Vertebroplasty and kyphoplasty are minimally invasive techniques, used to treat vertebral compression fracture (VCF). Etiology of the VCF varies between patients. Although osteoporosis and trauma are major etiologic factors in patients with VCF, unexpected results could be found in 11 patients. The aim of this retrospective study was to determine the insidentaly detected pathology results of patients with vertebral fracture treated by vertebroplasty and kyphoplasty.
Method: From February 2010- November 2015, 616 patients with VCF were treated by kyphoplasty and vertebroplasty at Izmir Kâtip Çelebi University Ataturk Reseach and Training Hospital. Vertebral biopsies were obtained from 533 patients during vertebral augmentation technique. Average patient age was 62.4 years including 388 females and 228 males. Histological evaluation of biopsy specimens from vertebral compression fractures was performed.
Results: The biopsy results of 505 patients showed various stages of bone healing. Among these patients malignancy was identified in 23 patients while 43 patients had a history of malignancy. 6 patients had unsuspected malignancy and 1 patient had paget disease. Infection was detected in 4 patients. In our study the rate of unsuspected malignancy was 1.1%.
Conclusion: Tissue examination is useful and may reveal pathologic fractures. Insidentally detected biopsy result could change the treatment of the patients. The bone biopsy should be reserved for the patients which the preoperative radiological diagnosis have a suspicion of non-osteoporotic etiology.
Keywords: Vertebroplasty, Kyphoplasty, Insidental biopsy, Malign, Infection

OP-SP.26-08

Spinal Cord Injury - Assessing Tolerability and Use of Combined Rehabilitation and NeuroAiD (SATURN Study): A Preliminary Result

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Background: NeuroAiD, a combination of natural products, has been shown to be safe in aiding neurological recovery after brain injuries. The primary objective of this study is to evaluate the safety and potential efficacy of NeuroAiD in spinal cord injury (SCI).
Method: SATURN (clinical trials. gov NCT02537899) is an exploratory prospective cohort study of patients with moderately-severe to severe SCI (American Spinal Injury Association (ASIA) Impairment Scale (AIS) A and B) treated with open-label NeuroAiD in addition to standard care and followed for 6 months. Anonymized data were prospectively collected at baseline, months 1, 3, and 6 and includes demographics, diagnosis, neurological and functional state assessed by the Spinal Cord Independence Measure (SCIM), ASIA-International Standard for Neurological Classification Spinal Cord Injury (ISNCSCI) and Short Form (SF)-8 Health Survey. NeuroAiD treatment, compliance, concomitant therapies, and side effects were collected. The co-primary endpoints were safety and AIS grade.
Results: To date, eleven patients (AIS A 8, AIS B 3) were recruited out of target sample size of 30. Nine patients completed follow up at month (M)1 (AIS A 3, AIS B 1, AIS C 2, and AIS D 3). Six patients completed follow-up at M3 (AIS A 2, AIS C 1, and AIS D 3) and M6 4 (AIS A 2 and, AIS D 2). One patient died within 1 month of SCI, which were deemed unrelated to study treatment but due to underlying disease.
Conclusion: NeuroAiD is safe and preliminary results are encouraging in patients with moderately severe to severe SCI.
Keywords: Spinal cord injury, Safety, Efficacy, NeuroAiD

OP-SP.26-09

Transpedicular Corpectomy in Thoracolumbar Column Traumatic Fractures

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Background: The treatment of traumatic thoracolumbar spine fractures requires consideration of certain basic principles, decompression, correction of instability, sagittal balance and the restoration of capacity. After evaluation of the relevant cases, the multidisciplinary team should decide what treatment to follow. The transpedicular corpectomy is a complex procedure that can provide benefits to the patient, reducing the number of interventions,

inpatient time, the morbidity associated with thoracic or lumbar lateral approach without increasing the risk of postoperative neurological deficits. The aim of this study is to present our cases of patients with post-traumatic thoracolumbar fractures.
Method: The pre postoperative the completion of this procedure findings, trans. In all cases the arthrodesis was performed with 360 transpedicular corpectomy, managing to restore the biomechanical principles of the spine in a single surgical time with a posterior approach.
Results: Our patients Frankel scale E in the preoperative evaluation, accomplished the arthrodesis 360 in a single surgical time, preserving functionality, without increasing morbidity or complications associated with side access. Both they presented as the only thing important neuropathic pain in the immediate postoperative period that solved satisfactorily with drug treatment. The other patients preserving the functionality and Frankel scale evaluation in the postoperative, with appropriate and expected rates of bleeding since the procedure, unconditioned increase in postoperative complications, decreasing the length of hospital stay compared to the usual technique in 2 surgical times and lateral approaches for corpectomy.
Conclusion: It was concluded that the transpedicular corpectomy and thoracolumbar posterior instrumentation is a useful and safe for the resolution of post-traumatic lesions
Keywords: Transpedicular corpectomy, Thoracolumbar column, Traumatic fractures

OP-TEC.01-02

Modern Technologies of Phantom Modeling for Neurosurgery

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Stereotactic operations require high-precision methods of neuroimaging, specialized and precise surgical instruments and computational methods for localization of intracerebral "targets". Despite the development of modern tools introscopy and surgical robotics, the main problem is to ensure the accuracy of the surgical instrument guidance to the target structure. This is due to the need to convert multiple coordinate systems**:** stereotactic intracerebral, operative field, introscopy imaging, stereotaxic manipulator. We used the printer WANHAO Duplicator i3. The initial data are tomographic slices of the head. Volume is segmented on the basis of X-ray density of the Hounsfield scale. This makes it possible to determine the structure for reconstruction. In the next step, the three-dimensional model is reproduced by three-dimensional printing. The results suggest the possibility of using rapid prototyping technology to create natural objects not only for training but also for tasks of phantom modeling stereotactic operations. The next step is to develop a technology to create neurosurgical phantom. It must take into account the relative position of anatomical structures and their binding to the coordinate system of the stereotaxic apparatus. This will develop spatial thinking of surgeon. Also, using the full-scale model can be carried out modeling of surgery, taking into account individual anatomical variability in the individual patient according to a CT scan. The perspective of work is to improve the realism of full-scale models that will be not only in appearance and geometric shape, but also by the properties of the materials as close to the real anatomical structures.
Keywords: Stereotactic neurosurgery, Three-dimensional printing, Stereotaxic apparatus, Neuroimaging

OP-TEC.01-03

Intelligent Arm Supporting System (iArmS) for Microneurosurgery

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Background: Continuous precise procedures are strictly required throughout surgery. To perform surgical procedure without any assistance of hand or arm supporting must cause surgeon's hand trembling and fatigue, which reduce quality of surgery. Surgeon's arm can be stabilized by leaning on somewhere, however, it is difficult to find arm/hand-rest at appropriate position. We have developed an intelligent armrest which follows surgeon's hand automatically utilizing robotics technology.
Method: The iArmS consisted of an arm holder and a holder supporting device. It works as a passive controlled machine, powered by counter-weight and controlled by brakes. The arm holder always pushes up the surgeon's arm from the bottom side. The pushing force makes the friction force between surgeon's arm and the arm holder. Thus the arm holder can be moved to another position wherever surgeon wants. The mode of the device is changed automatically by the force sensor and encorders in each joints**:** supporting device locking or moving. From Spring 2015, iArmS was commercially available in Japan. Over 100 cases of clinical neurosurgical operation were performed by using iArmS.
Results: The iArmS decreased surgeon's fatigue and reduced surgeon's hand tremor. The wider insertion angle of surgical instrument could be arranged and iArmS reduced difficulty in performing surgical procedures. There were no complications related to usage of iArmS.
Conclusion: The iArmS is a useful tool for holding the surgeon's arm comfortably and following the surgeon's arm automatically. We conclude that iArmS is a useful tool for holding the arm comfortably.
Keywords: Robotics surgery, Microneurosurgery, Arm supporting device

OP-TEC.01-04

Ventriculo-Peritoneal Shunt Versus Theco-Peritoneal Shunt in Improving Visual Outcome in Patients with Idiopathic Intracranial Hypertension, A Systematic Review

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Background: Idiopathic intracranial hypertension has an incidence

of 1 to 3 people per 100,000 people per year, occurring most commonly in obese, young women. IIH is associated with severe morbidity, due to a significant threat to sight and severe headache. Several management options have been proposed. Conservative measures centre on weight loss. Pharmacological therapy includes mainly diuretics. Refractory sight-threatening cases demand surgical intervention, in the form of CSF diversion or optic nerve sheath fenestration. Other treatments include venous sinus stenting and bariatric surgery. The aim of this study is to review and summarize available knowledge on the role of VP shunt versus LP shunt in improving visual outcomes in patients with IIH.
Method: A systematic review of published English literature from 1985 to 2014. We searched electronic database (MEDLINE) via PubMed and bibliographies; additionally, references of the articles included in the analysis were reviewed. Analytic studies and well conducted descriptive studies were included.
Results: The choice of shunt type in managing IIH is still debatable, probably depending on local availability and expertise. Obviously, there is no apparent difference between VPS and LPS in improving visual outcomes and headache.
Conclusion: The concept of chronic CSF diversion is sufficient to manage the symptomatology of IIH regardless the type of shunt used. Secondary outcomes shows that VPS has less complications rate, revision rate and less incidence of symptoms recurrence compared to LPS in the treatment of IIH.
Keywords: Idiopathic intracranial hypertension, Pseudo-tumor cerebri, VP shunt, LP shunt, Improving visual outcome, Visual field and acuity

OP-TEC.01-05

Use of Neuro-Robotic Exoscope for Cranial Neurosurgery in Pakistan

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Aim: To report experience on the use of exoscope in a developing country; ours, outside North America. Identify areas in which the exoscope offers, distinct advantage over the microscope
Method: Retrospectively reviewed the charts of all the consecutive cranial cases operated at Aga Khan University Hospital, Karachi, using the exoscope from April 2016-October 2016. Frequency and percentages were calculated.
Results: 31 cases were identified, 28 (90.3%) operated for brain tumors. 1(3.3%) case each of Arterio-Vascular Malformation, Mesial Temporal Sclerosis and Arnold Chiari malformation was treated. Frequently observed tumor was Oligodendroglioma in 7 (22.6%) followed by WHO Grade 1 Meningioma and GBM in 6(19.4%). 28 (90.3%) operations, supra-tentorial pathology; frontal lobe being the most common location seen in 14(45.2%). Neuro-robotic exoscope along with neuro-navigation was used in all surgeries. HD monitors provided excellent quality images and field dpeth. Iincreased anticipation and involvement of the OR staff, improving patient safety. Easy integration with the navigation systems was possible and radiologic Digital Tractography images on the screens. Greatly reduced operative morbidity, maximizing safety of resection. Gross total resection was attempted in 19 and successfully achieved in 18 (95%) on post-operative MRI. 2(6.5%), intra-operative complication of cranial nerve injury and 4(12.9%), post-operative new neurologic deficit. No intra/post-operative deaths.
Conclusion: Exoscope provided excellent optical images, permitted fine micro-dissection and marked improvement in physician comfort. Disadvantages, lack of stereopsis may be overcome by experience and improvements in design. The long working distance permits operating with standard instruments and a much smaller learning curve. It is ideally suited for teaching purposes.
Keywords: Neuro-robotic, Exoscope, Cranial, Developing country

OP-TEC.01-06

Use of Telemedicine as a Management Tool in a Neurosurgery Reference Center

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Systematized ways of management are essential on neurosurgical care of military personnel, due to continental size of Brazil. Brazilian Army established a Reference Center for neurosurgical treatment at the Military Area Hospital of São Paulo - HMASP, which added to the Army Central Hospital, Military Area Hospital of Porto Alegre as part of the Military Organizations endowed with neurosurgeons. In order to systematize the transfer of patients within the national territory, a telemedicine system was implemented with periodic meetings, to manage the transfers, treatments, returns and discussion of cases. The implementation of telemedicine as a management tool in neurosurgical care within the scope of the Brazilian Army Health Service promoted a significant paradigm break. Regions that did not have military neurosurgeons and depends on civil neurosurgeons, came to have specialized 24-hour neurosurgeon opinion every day of the year. Bi-weekly meetings between neurosurgery services (Rio, São Paulo and Porto Alegre) and physicians present in regions that did not have military neurosurgeons enabled the standardization and diffusion of treatment protocols, as well as avoiding unnecessary transfers and surgeries, promoting sensible savings resources with clinical safety. Telemedicine has proved to be an important tool in specialized health care, especially for institutions that make it available in remote regions, lacking in resources or specialists. It promoted greater clinical security to non-specialists located remotely, through tele-tutoring, as well as sensible economy and rationalization in the application of resources, through better management.
Keywords: Telemedicine, Brazilian army, Neurosurgery reference center

OP-TEC.01-07

Cerebral Lesion Localisation Using Cost Effective Craniomaper

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Accurate craniotomy placement is essential in neurosurgery. A craniotomy using craniomaper can be well localised to brain lesion. Localisation can be improved using intraoperative ultrasound, stereotactic system & neuronavigation. Neuronavigation has become a standard but this tool is not available in most parts of our country due to its high cost. We have used a special frame designed to surface mark the lesion during computed tomography (CT) scanning of the brain. The more precise localization provided thereby facilitated planning and performance of surgery.

Craniomaper is an external plastic frame embedded with radio opaque markers placed around the patient head during CT scanning. The vertical and horizontal lines of the frame serve as a guide to a particular site. A CT topogram is superimposed over the frame. The radioopaque markers are visible on an axial plane, from the anterior to the posterior direction. Any particular axial section of interest is marked by laser light inside the gantry, and the distance from the midline is counted following the markers. Then, the most target part is outlined by a permanent marker pen. It accurately provides a 2D plane, whereas a 3D plane cannot be exactly defined as in the image guidance system.

A rapid, simple and inexpensive CT technique has been developed for marking the scalp prior to craniotomy. It is safe to use the frame and needs no special training. It is also not costly and can address the issue, where image guidance/stereotactic systems are not available.

Keywords: Craniomaper, Localisation, Cost effective

OP-TEC.01-08

New Generation of Intraoperative CT Scan System

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Our first generation intraoperative CT (iCT**:** Toshiba X vision) had been installed since 1997 in a preexisting operating room. The old iCT had been used in 1077 cases**:** 609 tumor surgery, 90 cerebrovascular disease, 195 cervical disorders, 111 emergency head trauma and 72 other miscellaneous diseases such as HIV biopsy. Unexpected hemorrhagic complications were found in four cases, such as intraparenchymal hemorrhage or subdural/epidural hematoma, that were evacuated immediately. There were several problems about iCT and neurosurgical equipment. The Mayfield type head fixation flame made of carbon had the metal spring inside which made the radiological artifact hinder the underlining brain tissue. The brain-new a synthetic resin radiolucent head clamp (DORO) contained gel type spring not metal spring that showed no artifact. However, head titanium pins have still radiological artifacts, so that we have to think where to set the pins. As to radiological artefact, we developed carbon electrodes and non-metal VEP stimulator. A new iCT (Siemens Somatom 64 slices) has been adopted in a brand new operating room since 2014. The diameter of the old gantry was 680 mm. Any type of surgical position were possible to set. However, the park-bench position was available but difficult. The size of new iCT gantry is 780 mm in a diameter. Every image was obtained within 15 minutes and image quality was sufficient for interpretation. Image data was transferred directly from the scanner into the neuro navigation system to update registration during surgery. We discuss our ideal iCT systems comparing iMRI.

Keywords: Intraoperative CT, Surgical complication, Operating theater

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Evaluation of Safety, Effectiveness and Reproducibility of the Use of Telemedicine for Neurosurgical Screening

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Aim: To demonstrate the safety, efficacy and reproducibility of telemedicine in the screening of neurosurgical patients referred from peripheral hospitals to neurosurgery reference centers.

Method: Retrospective study of 48 patients referred for neurosurgeon evaluation after having CT scan requested by a general physician. Five independent neurosurgeons evaluated summary history, age, Glasgow Scale, pupils and CT images sent by smartphone and decided among three medical managements**:** 1 - hospital discharge; 2 - Admission / observation in general health service. 3 - Hospitalization in neurosurgical service (immediate surgery or Intensive Care Unit observation). Responses were compared between the evaluators and the actual treatment indicated by the neurosurgeon who assisted the patient.

Results: There were 22 (45.83%) trauma cases, 14 (22.92%) cases of altered consciousness level, seven (14.58%) headache cases and five (10.42%) stroke cases. Four patients died (8.33%). Thirty (62.5%) were hospitalized and five (10.42%) underwent surgical treatment. Eighteen patients (37.5%) were discharged from hospital after initial evaluation (37.5%). There was 100% agreement among the evaluators in cases indicated to remain in neurosurgical service (67% in the indication of immediate surgery) and 66.6% regarding patients that could be discharged from hospital. 100% of the patients who underwent surgical treatment had indication of neurosurgery service hospitalization by the evaluators. Thirteen of the patients (72.2%) who were discharged from hospital after evaluation also had this indication by the evaluators.

Conclusion: The screening of patients with suspected neurosurgical pathology done through telemedicine is safe, reproducible and may help in patients treatment and screening in remote regions.

Keywords: Telemedicine, Neurosurgery screening, Remote diagnosis, Neurosurgery