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Spectrum of Surgical Complications of Temporal Lobe Epilepsy Surgery: A Single - Center Study

Temporal Lob Epilepsi Cerrahisinin Cerrahi Komplikasyon Spektrumu: Tek Merkezli Çalışma

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ABSTRACT

AIM: Although surgery is the most effective means of eliminating or reducing seizures in cases of medically refractory epilepsy, the expected or unexpected surgical complications must also be kept in mind in order not to decrease patients' quality of life. The aim of this present study was to assess the surgical complications of temporal lobe epilepsy surgery and their effects on the disease course in patients with intractable epilepsy arising from the temporo-mesial structures.

MATERIAL and METHODS: The records of 58 patients who underwent temporal lobectomy and/or selective amygdalahippocampectomy at Gülhane Military Medical Academy between January 2000 and August 2010 were reviewed for peri- and post-surgical complications.

RESULTS: Post-surgical complications were detected in 7 patients (12%). The most common complication of ES was infection in 2 patients (2.9%). Other complications were hemorrhagic infarction, paresis of the frontal branch of the left facial nerve, subdural effusion, anxiety disorder, depressive disorder and late-onset psychosis.

CONCLUSION: The results of our study suggest the importance of post-operative care and long-term follow up in order to achieve favorable seizure outcome after epilepsy surgery.

KEYWORDS: Epilepsy, Epilepsy surgery, Surgery complication

ÖZ

AMAÇ: İlaca dirençli epilepsilerin azaltılmasında ya da ortadan kaldırılmasında en etkili yöntem cerrahi olsa da, hastanın yaşam kalitesinin azalmasını önlemek için, beklenen veya beklenmeyen cerrahi komplikasyonlar da akılda bulundurulmalıdır. Bu çalışmanın amacı da, temporal lob epilepsi cerrahisinin cerrahi komplikasyonlarını ve bunun temporo-mezial yapılardan kaynaklanan, ilaca dirençli temporal lob epilepsili hastaların seyri üzerindeki etkilerini değerlendirmektir.

YÖNTEM ve GEREÇ: Ocak 2000 ve Ağustos 2010 tarihleri arasında Gülhane Askeri Tıp Akademisi'nde temporal lobektomi ve/veya selektif amigdalahippokampektomi yapılan toplam 58 hastanın cerrahi işlem sırasında ve sonrasında ortaya çıkan komplikasyonlar retrospektif olarak değerlendirilmiştir.

BULGULAR: Hastaların 7'sinde (12) cerrahi komplikasyon gözlendi. En sık görüleni 2 hastada (%2.9)gözlenen enfeksiyon idi. Diğer komplikasyonlar, hemorajik infarkt, sol fasiyal sinirin frontal dalında parezi, anksiyete bozukluğu, depresif bozukluk ve geç başlangıçlı psikoz idi.

SONUÇ: Çalışmamızın sonuçları, epilepsi cerrahisinden sonraki başarılı sonuçların, cerrahi sonrası bakımın ve hastaların uzun süreli takibinin önemine işaret etmektedir.

ANAHTAR SÖZCÜKLER: Epilepsi, Epilepsi cerrahisi, Cerrahi komplikasyon

INTRODUCTION

Surgical removal of the epileptic focus has been approved as an effective therapy for patients with seizures that may be focal in origin, that are continuing to occur despite treatment with antiepileptic drugs (AEDs), and whose quality of life (QOL) is significantly impaired by epilepsy. The primary goal of epilepsy surgery (ES) is for the patient to be able to lead a seizure-free life, and preferably discontinuation or reduction of AEDs (2,8,17,22). However, similar to all of the other neurological surgeries, peri- and post-surgical complications may also accompanied with ESs, and physicians should always be aware of these complications in order to facilitate the assessment of the risk/benefit ratio of ES. Ideal ES would eliminate seizures without causing any functional deficits. It is a well-known fact

that some neurological complications may occur, preexisting psychopathology may deteriorate, cognitive functions may be altered or de novo psychopathological syndromes may appear after ES (1,16,19,25).

Studies on the effectiveness of ES have focused on seizure outcome but there are few reports on assessing the complications of ES (9,12,20,23,27). The aim of this present study was to assess the surgical complications of ES and their effects of on disease course in patients with intractable epilepsy arising from the temporo-mesial structures.

MATERIAL and METHODS

A consecutive, retrospective analysis of complications of ES was surveyed among 58 patients who underwent anteromedial temporal lobectomy (AMTL) and/or amygdalahippocampectomy (AHCT) at Gülhane Military Medical Academy between January 2000 and August 2010. In AMTL, 3.5 cm of the temporal pole from temporal tip was removed including half of the superior temporal gyrus and the middle and inferior temporal gyri. In AHCT, surgical removal of the amygdala, anterior part of the tail of the hippocampus and the entire head and body of the hippocampus and parahippocampal gyrus were performed. Epileptic foci of the patients were determined and the decision of surgical procedure was made according to the results of long-term video-electroencephalography (v-EEG) monitoring, brain magnetic resonance imaging (MRI), single photon emission computed tomography (SPECT), positron emission tomography (PET) and neurophysiological tests results. Patients presenting with any space-occupying lesion, a cavernoma, or with a strictly lateral neocortical epileptic focus were excluded.

Records of 58 patients were reviewed for peri- and post-surgical complications (infections, intraparenchymal infarcts (hemorrhagic or ischemic), peripheral nerve injuries, epidural or subdural effusions, paresthesia or paresis, cognitive and behavioral changes, and death) of ES. Seizure recurrence after ES was not considered a surgical complication. Seizure type, duration of seizure, the underlying etiology of seizures, surgical procedure, seizure frequency before and after the surgery, AED therapy, and follow-up period of each patient were all recorded and their association with the surgical complications were evaluated.

RESULTS

Of the patients, 5 were female and 2 were male, and the mean age was 33.3 years (range 25-45 years). They were all right-handed and the side of the cerebral hemisphere supporting language function (from the Wada test and functional MRI) was left for each patient. The patients did not undergo any AED regimen changes after ES during the follow-up period (mean 3.3 years). And pre-surgical and post-surgical blood levels of the antiepileptic drugs (AEDs) were also identical and within the therapeutic ranges. No death was reported related to ES. Post-surgical complications were detected in 7 patients (12%). The most common complication of ES was infection (2.9%).

Subacute hemorrhagic infarction localized at the right posterior temporal region was detected in patient-1 in the brain CT performed 10 days after ES. Complete resorption of the hematoma was observed on follow-up brain CT performed 6 weeks after the diagnosis. She continued the same AED regimen and her seizures were brought partially under control.

Paresis of the frontal branch of the facial nerve was detected in patient-2 just after the ES and persisted also during her follow-ups.

Neck stiffness, fever and alterations in consciousness were detected in patient-3 5 days after the surgery and a diagnosis of bacterial meningitis was made upon cerebrospinal fluid examination. The patient was treated with antibiotics at the intensive-care unit and was discharged with complete recovery 7 weeks after the ES.

Subdural effusion was detected in patient-4 2 months after the ES in the brain MRI. She was not re-operated and the subdural effusion resolved spontaneously within 2 months. Additionally, seizures persisted in patient-4 but decreased in frequency and severity. During her long-term follow-up, she was diagnosed with psychosis 2 years after the surgery. She was treated with haloperidol, 20 mg/ day in divided doses. Her delusions persisted and promethazine 20 mg/day was added to her treatment. She became symptom-free 6 weeks after the treatment and was discharged. She recovered completely 18 months after the ES.

Patient-5 complained of palpitations, shaking and chest pain 2 months after the surgery. She was started Escitalopram 20 mg/day with a diagnosis of de novo anxiety disorder after ES. During her long-term follow-up, her anxiety disorder was brought under control.

Irritability, aggressiveness, social withdrawal in personality and left hemi-numbness developed in patient-6 2 months after the surgery. With a diagnosis of depressive disorder, she was prescribed Citalopram 40 mg/day in divided doses and partially recovered from her personality complaints during her follow-up period.

Infection of the bone flap was detected in patient-7 10 days after the surgery. He was treated with intravenous antibiotics and recovered within 3 weeks. He underwent vagus nerve stimulation procedure 3 years after the surgery because his seizures persisted after ES and the frequency of seizures decreased approximately 80% during follow-ups.

The characteristics of the patients were summarized in Table I.

DISCUSSION

ES may be associated with substantial rate of morbidity and even mortality. Surgical complication rates of ES have been reported to be between 3.6% and 15.2% (4,9,12). Our surgical complication rate was also12% without any mortality.

Behrens et al. reported that the most common complication of ES was infection. Of 708 surgical procedures performed in

Table I: Characteristics of the Patients

Patient number	Age	Gender	Duration of disease (year)	Seizure type(s) prior to surgery	Etiology	AEDs (before and after surgery)	Seizure frequency (before surgery)	Surgical procedure	Seizure frequency (after surgery)	Surgical complication	Follow-up period after surgery (year)
1	25	Female	17	CPS, SGTCS	Right MTS	CBZ, LEV, TP	2-3/month	Right AMTL + Subtemporal AH	2-3/month	Hemorrhagic infarction localized in the right posterior temporal region	3
2	30	Female	33	CPS	Left MTS	VPA, OXC, LEV	2-3/month	Left AMTL	No seizure	Paresis of the frontal branch of the left facial nerve	1
3	29	Male	27	CPS, SGTCS	Left HS	CBZ, TP	1-2/month	Left AMTL + Subtemporal AH	No seizure	Bacterial meningitis	2
4	39	Female	38	CPS, SGTCS	Right MTS	VPA, CBZ, LEV	1-2/week	Right AMTL + Subtemporal AH	1-2/month	Subdural effusion (2 months after the surgery) + psychosis (2 years after the surgery)	4
5	26	Female	11	CPS, SGTCS	Right MTS	VPA, CBZ	1-2/month	Right AMTL	No seizure	Anxiety disorder	5
6	39	Female	14	CPS	Right HS	CBZ, TP, LEV	1-2/week	Right AMTL + Trans-sylvian AH	No seizure	Depressive disorder	3
7	45	Male	20	CPS	Right MTS	CBZ, LEV	10-15/ month	Right AMTL	5-10/month (after VNS, 1-2/month)	Flap infection	5

CPS: *Complex partial seizure,* ***SGTCS:*** *Secondary generalized tonic-clonic seizure,* ***MTS:*** *Mesial temporal sclerosis,* ***HS:*** *Hippocampal sclerosis,* ***AMTL:*** *Anteromedial temporal lobectomy,* ***AH:*** *Amygdalohippocampectomy,* ***AITL:*** *Anteroinferior temporal lobectomy,* ***VPA:*** *Valproic acid,* ***CBZ:*** *Carbamazepine,* ***OXC:*** *Oxcarbazepine,* ***LEV:*** *Levetiracetam,* ***TP:*** *Topiramate,* ***LTG:*** *Lamotrigine,* ***VNS:*** *Vagal nerve stimulation.*

429 patients, they found a meningitis rate of 1.4% and a skin flap infection rate of 3.5% (4). Tanrıverdi et al. also reported that infection was the most common complication (1.0%) of their 2449 ES procedures (23). In our study, the most common complication of ES was also infection (2 out of 7 patients) which suggests the importance of surgical techniques and post-surgical intensive-care.

We detected a lesion of the frontal branch of the facial nerve in one patient (patient-2) after ES. The frontal branch of the facial nerve superior to the zygoma courses within the superficial temporal fascia. Therefore, knowledge and respect for the facial nerve, particularly the frontal branch, are of paramount importance in the safe execution of surgical procedures in the temporal area (24).

Asztely et al. have reported the long-term (approximately 10 years) follow-up results of 70 patients who underwent ES. In the psychiatric follow-up of this cohort, 36% of the patients had a diagnosis of anxiety and/or depressive disorder in the first 2 years after operation. 29% of the patients reported having had problems with depression and/or anxiety since the 2 year follow-up, without any clear relation with seizure status (2). It has been reported that the presence of post-surgical psychiatric morbidity is significantly related to a pre-surgical history of anxiety and/or depressive disorder, but not to seizure outcome (10,14,21). However, patients 5 and 6 in our study developed anxiety and depressive disorders respectively although they had no evident history of anxiety or depression before ES. These findings suggest that development of anxiety and depression after ES may not only be related with pre-surgical history but also with the surgical procedure.

Wrench et al. have reported de novo depression in 5 patients who underwent ES. Four out of 5 cases occurred within the first 3 months following surgery, and all were preceded by significant post-surgical irritability reported by the patient's family (25). Similar to these findings, patients 5 and 6 (both of whom had undergone anteromedial temporal lobectomy) developed anxiety and depression also within 3 months following ES. Hypoperfusion on SPECT or hypometabolism on PET in the anterior temporal lobe, inferior frontal lobe, and anterior cingulate have been identified as the predominant regional abnormalities seen in patients with primary clinical depression (6,15). Therefore, patients who have undergone an anterior temporal lobectomy procedure during ES should be followed-up regarding the risk of developing anxiety or depression. Additionally, we believe that de novo anxiety or depression after ES is not temporarily linked to post-surgical seizure outcomes, because these 2 patients became seizure-free after ES.

De novo obsessive-compulsive disorder and excessive masturbation cases have also been reported after ES (10,19). These reports are suggestive that psychiatric problems as a complications of ES may be manifested in various clinical presentations. Psychosis after temporal lobectomy has been shown to have a clustering in the early postoperative period and most of the reported cases occurred within 5 months of the surgery (18,22). One of our patients (patient-4) who developed subdural effusion 2 months after ES also developed psychosis 2 years after ES during the follow-up period. It has been reported that patients with bilateral functional and structural abnormalities, particularly of the amygdala, are at particular risk (11,21). Blumer et al. have also argued that there is a causal link between temporal lobectomy and psychosis (5). Based on the literature and our experience, it is suggestive that follow-up duration should be kept longer for the patients who have undergone ES (especially anteromedial temporal lobectomy and/or amygdalahippocampectomy) in order to assess the risk of developing late-onset psychosis.

The main determinative factors of the risk of ES complications may be listed as the surgical procedure itself, the surgeon's experience, the patient's age and other health conditions and post-surgical care. However, other factors such as pre-surgical neural-network organization of the patients and neural re-organization during the recovery period still remain unclear (7,26,7). Further and well-designed studies are needed to explain the relationship between the neural re-organization and seizure outcomes after ES.

The limitations of this study should be considered. Our sample size was very small and the results were not compared with those of a control (or a reference) group. However, there are only a few studies on the surgical complications of ES (9,12,23,27). In conclusion, we underline that ES has a broad spectrum of surgical complications and suggest that patients be monitored closely before, during and also after the surgery.

Studies have shown that the QOL of the patients with intractable epilepsy improves after ES and post-surgical QOL is clearly related to seizure outcome (3,17). However, further studies with larger patient groups are needed in order to assess the complications of ES on patients' QOL.

REFERENCES

1. Andersson-Roswall L, Engman E, Samuelsson H, Malmgren K: Cognitive outcome 10 years after temporal lobe epilepsy surgery: A prospective controlled study (CME). Neurology 74:1977-1985, 2010
2. Asztely F, Ekstedt G, Rydenhag B, Malmgren K: Long term follow-up of the first 70 operated adults in the Goteborg Epilepsy Surgery Series with respect to seizures, psychosocial outcome and use of antiepileptic drugs. J Neurol Neurosurg Psychiatry 78:605-609, 2007
3. Aydemir N, Ozkara C, Canbeyli R, Tekcan A: Changes in quality of life and self-perspective related to surgery in patients with temporal lobe epilepsy. Epilepsy Behav 5:735-742, 2004
4. Behrens E, Schramm J, Zentner J, König R: Surgical and neurological complications in a series of 708 epilepsy surgery procedures. Neurosurgery 41:1-10, 1997
5. Blumer D, Wakhlu S, Davies K, Hermann B: Psychiatric outcome of temporal lobectomy for epilepsy: Incidence and treatment of psychiatric complications. Epilepsia 39:478–486, 1998
6. Drevets WC, Videen TO, Price JL, Preskorn SH, Carmichael ST, Raichle ME: A functional anatomical study of unipolar depression. J Neurosci 12:3628-3641, 1992

7. Duchowny M: Clinical, functional, and neurophysiologic assessment of dysplastic cortical networks: Implications for cortical functioning and surgical management. Epilepsia 50: 19-27, 2009
8. Grivas A, Schramm J, Kral T, Von Lehe M, Helmstaedter C, Elger CE, Clusmann H: Surgical treatment for refractory temporal lobe epilepsy in the elderly: Seizure outcome and neuropsychological sequels compared with a younger cohort. Epilepsia 47: 1364-1372, 2006
9. Heller AC, Padilla RV, Mamelak AN: Complications of epilepsy surgery in the first 8 years after neurosurgical training. Surg Neurol 71: 631-637, 2009
10. Kulaksizoglu IB, Bebek N, Baykan B, Imer M, Gurses C, Sencer S, Oktem-Tanor O, Gokyigit A: Obsessive-compulsive disorder after epilepsy surgery. Epilepsy Behav 5:113-118, 2004
11. Lawrie SM, Whalley HC, Job DE, Johnstone EC: Structural and functional abnormalities of the amygdala in schizophrenia. Ann N Y Acad Sci 985:445-460, 2003
12. Lee JH, Hwang YS, Shin JJ, Kim TH, Shin HS, Park SK: Surgical complications of epilepsy surgery procedures: Experience of 179 procedures in a single institute. J Korean Neurosurg Soc 44: 234-239, 2008
13. Mace CJ, Trimble MR: Psychosis following temporal lobe surgery: A report of six cases. J Neurol Neurosurg Psychiatry 54: 639–644, 1991
14. Malmgren K, Starmark JE, Ekstedt G, Rosén H, Sjöberg-Larsson C: Nonorganic and organic psychiatric disorders in patients after epilepsy surgery. Epilepsy Behav 3:67-75, 2002
15. Mayberg HS, Lewis PJ, Regenold W, Wagner HN Jr: Paralimbic hypoperfusion in unipolar depression. J Nucl Med 35:929-934, 1994
16. Meldolesi GN, Di Gennaro G, Quarato PP, Esposito V, Grammaldo LG, Morosini P, Cascavilla I, Picardi A: Changes in depression, anxiety, anger, and personality after resective surgery for drug-resistant temporal lobe epilepsy: A 2-year follow-up study. Epilepsy Res 77:22-30, 2007
17. Moritake K, Mikuni N, Akiyama Y, Nagai H, Maruyama N, Takada D, Daisu M, Nagasako N, Hashimoto N: Postoperative quality of life outcome and employment in patients undergoing resection of epileptogenic lesions detected by magnetic resonance imaging. Neurol Med Chir (Tokyo) 49:281-286, 2009
18. Narayanan D, Varghese ST, Dinesh D: New-onset psychosis after temporal lobectomy. J Neuropsychiatry Clin Neurosci 20: 500-501, 2008
19. Ozmen M, Erdogan A, Duvenci S, Ozyurt E, Ozkara C: Excessive masturbation after epilepsy surgery. Epilepsy Behav 5:133-136, 2004
20. Schmidt D, Stavem K: Long-term seizure outcome of surgery versus no surgery for drug-resistant partial epilepsy: A review of controlled studies. Epilepsia 50: 1301-1309, 2009
21. Shaw P, Mellers J, Henderson M, Polkey C, David AS, Toone BK: Schizophrenia-like psychosis arising de novo following a temporal lobectomy: Timing and risk factors. J Neurol Neurosurg Psychiatry 75:1003-1008, 2004
22. Stavem K, Bjørnaes H, Langmoen IA: Long-term seizures and quality of life after epilepsy surgery compared with matched controls. Neurosurgery 62:326-335, 2008
23. Tanriverdi T, Ajlan A, Poulin N, Olivier A: Morbidity in epilepsy surgery: An experience based on 2449 epilepsy surgery procedures from a single institution. J Neurosurg 110:1111-1123, 2009
24. Tchakerian A, Raulo Y, Baruch J: Surgical injury of the temporo-frontal branch of the facial nerve. Anatomical study and clinical consequences. Ann Chir Plast Esthet 37:18-26, 1992
25. Wrench JM, Wilson SJ, O'Shea MF, Reutens DC: Characterising de novo depression after epilepsy surgery. Epilepsy Res 83:81-88, 2009
26. van Dellen E, Douw L, Baayen JC, Heimans JJ, Ponten SC, Vandertop WP, Velis DN, Stam CJ, Reijneveld JC: Long-term effects of temporal lobe epilepsy on local neural networks: A graph theoretical analysis of corticography recordings. PLoS One 2:e8081, 2009
27. Varoglu AO, Saygi S, Acemoglu H, Ciger A: Prognosis of patients with mesial temporal lobe epilepsy due to hippocampal sclerosis. Epilepsy Res 85:206, 2009