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Aspiration or Capsule Excision? Analysis of Treatment Results for Brain Abscesses at Single Institute

Abse Aspirasyonu mu Kapsül Eksizyonu mu? Bir Merkezden Abse Tedavi Sonuçları

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ABSTRACT

AIM: Aspiration of the abscess cavity versus excision of capsule are still in debate for the capsulated, large, superficially located abscesses.

MATERIAL and METHODS: Twenty patients who had large, solitary, capsulated, and superficially located lobar abscesses were analyzed retrospectively to compare the efficiency of two different surgical approaches and their impact on postoperative antibiotic use and the length of hospital stay.

RESULTS: Nine patients underwent the capsule excision and 11 patients had the aspiration of their abscesses. There were no differences in terms of age, sex, location of abscesses, and radiographic features. There were 3 residual/recurrence in the aspiration group, who needed a second aspiration whereas; no residual/recurrence was observed in the excision group. Postoperative utilization of antibiotics was significantly less in the excision group (Mean: 26.7 days in the excision group vs. 46.6 days in aspiration group). Length of hospital stay for the purpose of iv antibiotic administration was significantly shorter in the excision group in close correlation with iv antibiotic use.

CONCLUSION: Our study demonstrated that excision of abscess capsule was superior to aspiration in terms of efficiency of surgical intervention and postoperative cost of the treatment in a highly selected group of brain abscesses.

KEYWORDS: Abscess, Capsule excision, Aspiration, Brain

ÖZ

AMAÇ: Yüzeyel yerleşimli, büyük ve kapsüllü abselerin sadece aspire edilmesi veya kapsülün çıkarılması konusu halen tartışmalıdır.

YÖNTEM ve GEREÇ: Yirmi hastada yüzeyel yerleşimli, büyük, kapsüllü abselerin sadece aspire edilmesi veya kapsülün çıkarılması retrospektif olarak incelendi ve uygulanan cerrahi yöntemin antibiyotik kullanım ve hastane yatış süresine, nükse etkisi araştırıldı.

BULGULAR: Dokuz hasta kapsül eksizyonu, 11 hasta aspirasyon ile tedavi edilmiştir. Yaş, cinsiyet, yerleşim ve radyolojik olarak fark saptanmamıştır. Aspirasyon grubunda 3 hastada kalıntı veya nüks saptanmış ve abseler tekrar aspire edilerek tedavi edilmiştir. Eksizyon grubunda kalıntı veya nüks saptanmamıştır. Postoperatif antibiyotik kullanım süresi anlamlı olarak eksizyon grubunda az bulunmuştur (Ortalama: Eksizyon 26.7 gün, aspirasyon grubunda 46.6 gün). Hastanede yatış süresi de intavenöz antibiyotik kullanımı ile paralel şekilde anlamlı olarak eksizyon grubunda azalmıştır.

SONUÇ: Bu çalışma seçilmiş hasta grubunda kapsül eksizyonunun aspirasyona cerrahi tedavinin etkinliği ve postoperatif tedavi masrafları açısından üstün olduğunu göstermiştir.

ANAHTAR SÖZÜKLER: Abse, Kapsül eksizyonu, Aspirasyon, Beyin

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INTRODUCTION

The ancient treatment of a brain abscess was the drainage (3, 23). After introduction of antibiotics, the treatment paradigm has changed and multimodality treatment including different surgical techniques and antibiotics were instituted. Better neuroimaging has led to earlier diagnosis of brain abscesses with an improved outcome (9,25). Management of brain abscess has evolved with more precise and less invasive surgical techniques. Currently, abscesses with diameters of more than 25 mm are being treated surgically followed by appropriate antibiotics; with systemic antibiotics given for six to eight weeks or two weeks of intravenous antibiotics followed by up to four weeks of oral therapy (4,14,17,24,32,39). However, there is always a debate whether the capsulated, firm, large, superficial abscesses should be excised or aspirated. Our institution has a series of brain abscesses with more than 400 cases treated since 1965. On hundred thirty abscesses before 1993 were published previously (32). We reviewed the cases retrospectively thereafter with special emphasis on efficiency and cost-effectiveness of different surgical approaches for superficially located, large, capsulated lobar brain abscesses.

MATERIALS and METHOD

Patient Selection

Cases for study were culled from a database of patients with brain abscess. The eligibility criteria included the following: (a) Patients with the diagnosis of abscess receiving inpatient treatment at Hacettepe University between January 1993 and December 2007, (b) Superficially located, lobar, single brain abscess, (c) Preoperative and postoperative computerized tomography (CT) available for review, (d) Abscesses with diameters of more than 25 mm, (e) Ring enhancement as an indication of capsule formation on post-contrast CT images, (f) Follow-up for at least 8 weeks with control CT. Twenty patients out of 406 patients treated at Hacettepe University with the diagnosis of brain abscess met the criteria and were selected for review.

Each patient's data were evaluated and analyzed for the following criteria: (1) Age at presentation, (2) Gender, (3) Symptoms, (4) Surgical intervention as aspiration of abscess vs. excision of abscess capsule, (5) Recurrence, (6) Duration of hospital stay, (7) Duration of antibiotic use

Statistical Analysis

The t-test was used to assess the significance of the differences between the aspiration and excision groups for age, duration of hospital stay and duration of antibiotic use. A p value less than 0.05 was accepted as significant.

RESULTS

Age and Gender

There were 11 patients in aspiration group and 9 patients in capsule excision group. The mean age for aspiration group was 41.7 years of age (SD±12.5) and that for capsule excision was 30 years of age (SD±19) and the age difference was not significantly different (Two sample test of means t=1.6 p=0.11). There were 3 patients under the age of 18 in the excision group. All patients in the aspiration group were male, andthere was only one female patient in the excision group.

Recurrence

There was no recurrence in the excision group in the follow up CT scans obtained 2 months after the surgery.

Three patients had residual/recurrence in their follow-up in the aspiration group. The first patient (Patient number 2 at Table 1) was a 60-year-old gentleman who had a frontal abscess treated with the aspiration of abscess and 6 weeks of sulbactam-ampicilline intravenously (iv). The pus culture from the first aspiration revealed H. influenza. Follow-up CT at two months revealed a residual or recollection of pus in the abscess cavity and he underwent second aspiration and another 6 week course of sulbactam-ampicilline intravenously was applied. He had no recurrence. The second patient (Patient number 4 at Table 1) was a 31 year-old male who presented with a frontal abscess. The abscess was aspirated and the culture revealed no microorganism. While he was on iv sulbactam-ampicilline for 15 days, he had no resolution in his symptoms despite the treatment and head CT revealed residual/recurrence of the abscess. He underwent a second aspiration and the antibiotics were changed to Ceftriaxone and metronidazole for another 6 weeks. He had no recurrence in his follow-up. The third patient (Patient number 5 at Table 1) was 40-year-old gentleman presenting with an occipital abscess. The abscess was aspirated, but head CT 15 days postoperatively showed residual/recurrence of the abscess while he was still

on sulbactam-ampicilline. He underwent another surgery with repeat aspiration. He received Ceftriaxone and Metronidazole for 6 weeks and had no recurrence thereafter. None of the recurrences needed capsule excision. The patient's features are summarized in Table 1.

Duration of Antibiotic Use and Length of Hospital Stay

All patients received antibiotics postoperatively. Antibiotic choice was made using strategies of pediatric and adult infectious disease departments considering the suspected source of the infection, the culture results and the clinical condition of patients. The antibiotics given are listed in Table 1. Sulbactam-ampicilline (SAM) was the first choice. Whenever a patient needed an intravenous antibiotic, he/she was hospitalized throughout the course of treatment. Therefore, duration of intravenous antibiotic use correlated well with the hospital stay. Three patients in the excision group and one patient in the aspiration group received antibiotics orally (po) as part of their treatment. The most common practice

Table I: Patient characteristics

	Age (y)	Sex	Symptoms and Signs	Localization	Surgery	Postop NS	Antibiotics	Abuse (d)	HS
1	27	M	Seizure	Frontal	A	No seizure	Sulbactam+Ampicilline IV 42 d	42	42
2	60	M	Seizure	Frontal	A	No seizure	Sulbactam+Ampicilline IV 42 d	90	90
3	46	M	R hemiparesis	Parietal	A	No motor deficit	Sulbactam+Ampicilline IV 30 d Cefotaxim+Metronidazole IV 10 d	40	40
4	31	M	H/A, fever	Frontal	A	Symptom free	Sulbactam+Ampicilline IV 15 d Ceftriaxone+Metronidazole IV 42d	57	57
5	40	M	H/A, R hemianopia	Occipital	A	Persistent hemianopia	Ceftriaxone +Metronidazole IV 48d	48	48
6	51	M	Diplopia, L hemiparesis	Occipital	A	Symptom free	Sulbactam+Ampicilline IV 12 d	12	12
7	25	M	H/A	Temporal	A	Symptom free	Sulbactam+Ampicilline Iv 42 d	42	42
8	51	M	Seizure	Parietal	A	No seizure	Sulbactam+Ampicilline IV 42d	42	42
9	52	M	H/A	Occipital	A	Symptom free	Sulbactam+Ampicilline IV 14 d	14	14
10	26	M	H/A	Temporal	A	Symptom free	Sulbactam+Ampicilline IV 42 d	42	42
11	50	M	H/A, R hemiparesis	Occipital	A	Persistent but improved hemiparesis	Ceftriaxone+Metronidazole IV 42 d Sulbactam+Ampicilline Po 42 d	84	84
12	21	M	H/A	Occipital	E	Symptom free	Sulbactam+Ampicilline IV 10d, Teicoplanin Iv 10d Sulbactam+Ampicilline Po 10 d	30	20
13	48	M	Imbalance, somnolence	Parietal	E	Symptom free	Sulbactam+Ampicilline IV 42d	42	42
14	51	F	Seizure	Frontal	E	No seizure	Ceftriaxone+Metronidazole IV 15 d	15	15
15	24	M	H/A	Occipital	E	Symptom free	Sulbactam+Ampicilline po 10 d	10	3
16	4	M	Seizure	Parietal	E	No seizure	Amikacin+Metronidazole IV 28 d	28	28
17	45	M	R hemiparesis	Occipital	E	No motor deficit	Sulbactam+Ampicilline IV 21 d	21	21
18	16	M	L hemiparesis	Parietal	E	No motor deficit	Sulbactam+Ampicilline IV 42 d	42	42
19	52	M	Diplopia, L hemiparesis	Occipital	E	No motor deficit	Sulbactam+Ampicilline IV 12 d	12	12
20	9	M	H/A, vomiting	Parietal	E	Symptom free	Metronidazole+Vanco+Cefotaxim IV 19 d, Sulbactam+Ampicilline po 21 d	40	19

Abbreviations: M: male, F: female, R: right, L: Left, H/A: Headache, A: Aspiration of abscess, E: Excision of capsule, Postop NS: Postoperative neurological status at 2 month follow-up, y: year, d: day, HS: hospital stay, Iv: intravenous, Po: per oral, Vanco: Vancomycin

was to apply antibiotics for 6 weeks. However, antibiotic treatments were deemed to be sufficient in 8 cases where early imaging revealing no evidence of residual disease. Those patients did not show recurrence in their follow-up. Not surprisingly, 6 of the 8 patients who received a shorter course of antibiotic treatment were in the excision group. Statistical analysis of the data regarding antibiotic use substantiated a significant difference between the aspiration and the excision groups. The length of antibiotic use in the excision group was 26.7 days (SD±12.8) in comparison to 46.6 days (SD±24) in the aspiration group, which was significantly longer (t=2.23, p=0.03). Similarly, hospital stay was longer in the aspiration group [46.6 days (SD±24)] compared to the excision group [22.4 days (SD±13)]; which also disclosed a significant difference (t=2.7, p=0.01).

The results are summarized in Table II.

DISCUSSION

Prognosis of brain abscess depends on the anatomic location, number and size of abscesses, stage of abscess formation, age of the patient, and neurological status of the patient. The prognosis is worse for patients with intraventricular rupture, associated meningitis, ependymitis or empyema, an unknown primary source, sterile pus or culture, large abscess, presence of hydrocephalus, metastatic abscess, neonates and infants, multiple deep-seated abscesses, inaccurate diagnosis, and/or congenital cyanotic heart disease (1,12,18,26,29,32,33,37,39).

The treatment of brain abscess necessitates a multidisciplinary approach, including neuroradiological evaluation, surgical intervention, use of antibiotics and eradication of primary infected foci. Neuroimaging studies are instrumental in detecting and localizing abscesses and in following their progress (9,34). After a preliminary diagnosis of brain abscess was established under the guidance of clinical and radiological tools, treatment can be tailored for the patient. By and large, the surgical intervention is necessary for the abscesses with diameters of greater than 25 mm (17,32).

The surgical management of brain abscess has evolved significantly in recent decades because of advances in neuroanesthesiology and the development of more precise and less invasive surgical techniques. Surgical treatment can involve either aspiration of abscess cavity or excision of the capsule. The choice of procedure has been the subject of much debate. In one series of 140 patients, patients underwent repeated aspiration, capsule excision and medical treatment only and mortality did not differ among different treatment groups (38). In the literature, there is no prospective, randomized study to compare the efficiency and the cost-effectiveness of aspiration of the abscess versus excision of the abscess capsule.

The Aspiration of Abscess

The aspiration method is considered by many authors (7, 17) to be safe and enables identification of the causative agent for subsequent antibacterial therapy. The advantages of aspiration are its simplicity and less surgery related morbidity (15). However, the relapse rates after abscess aspiration range from 18.6 (5) to 32% (26,36) of patients. Fatal outcomes are still very numerous: between 11.8 and 22% (4,37).

Stereotactic aspiration of brain abscess was preferred by some authors because of the satisfying

Table II: Analysis of results for excision vs. aspiration

	Aspiration	Excision	*p*
Number of patients	11	9	
Gender M/F	11/0	8/1	
Mean Age	41.7	30	*p*=0.11
Patients<18y	0/10	3/10	
Residual	2	0	
Recurrence	1	0	
Duration of antibiotic use	46.6	26.7	*p*=0.03*
Length of hospital stay	46.6	22.4	*p*=0.01*

results with precise localization and aspiration (10,14,21,27,28). Real time ultrasound guidance is another method for minimally invasive abscess drainage through a burr hole. Utilizing ultrasound may minimize the risks associated with stereotactic frame placement while providing sufficient reliability and accuracy (30). Frameless neuronavigation is another method to localize and aspirate the abscesses; nevertheless shifting of structures is the main drawback of those systems compared to real time imaging guided techniques.

Aspiration alone can be sufficient for good outcome at any stage of the abscess formation (18,20). A large abscess can be aspirated via a burr hole and completely decompressed, with an immediate reduction of mass effect and intracranial pressure. The limitation for aspiration is a multi-loculated abscess, and recurrent abscess formation after surgery is significantly higher than in patients with uniloculated abscess.

Stereotactic management of brain abscess has become widespread with the introduction of CT-guided stereotaxy (11,16,28). CT-guided stereotactic aspiration is particularly advantageous in the management of deep-seated abscesses (e.g. brain stem, cerebellum, or diencephalic structures adjacent to the ventricle), multiple abscesses, and abscesses located in eloquent areas of the brain, where excision would be inappropriate (11,16,28). The failure of stereotactic aspiration of brain abscesses in a series of 29 patients may be either due to inadequate aspiration or lack of catheter drainage, as well as chronic immunosuppression, or inappropriate antibiotic therapy (13).

Excision of the Capsule

Several reports have advocated excision as the procedure of choice because it is often followed by a lower incidence of recurrence and shorter hospitalization (1,29,37). The excision of an abscess together with the capsule shows better results, particularly in pediatric age group (8,17,22,35,39). If the abscess aspiration proves ineffective, all authors, as a rule, use the method of excision with the capsule (5,7,17,26). It is known that the abscess capsule becomes rather thick when the abscess has already existed for 3 or 4 weeks. The capsule is clearly seen on CT with contrast enhancement. During this period the capsule can be removed safely due to a minimal risk of perforation and the possibility of its complete separation from the brain parenchyma.

Large superficial abscesses that have proved resistant to multiple aspirations and have not showed volume reduction, have adhesions to the dura, or a large brain surface area, should be excised to achieve a cure. Complete excision of the abscess and the surrounding capsule appears to be required only in patients with multi-loculated abscesses (for whom closed-needle aspiration procedures have failed) or in cases due to more resistant pathogens (19,31). Abscesses containing gas are resistant to antibiotics and are better treated with excision (6). Post-traumatic abscesses containing foreign bodies or contaminated retained bone fragments require excision to prevent recurrence (2,17). Abscesses resulting from fistulous communication, such as trauma or congenital dermal sinus, require excision of the infected granulation tissue and closure of the fistula. Abscesses localized to one lobe and contiguous to the primary source are better treated with excision along with the primary focus. The abscess may be excised during the late capsular (chronic) stage or after aspiration. However, excision is inappropriate for abscesses in the cerebritis stage, for deep-seated abscesses in eloquent areas, and for cases of multiple abscesses.

Eligibility criteria for the capsule excision are superficially located lobar abscesses with diameters more than 25 mm, demonstration of capsule formation in preoperative neuroimaging modalities, multiloculated abscesses and solitary lesions. Postoperative antibiotic therapy may vary depending on patients' systemic and neurological status, culture results, etiology of brain abscess and probably on the infection control policy of the hospital.

CONCLUSION

Our study demonstrated that the excision of abscess capsule was superior to the aspiration in terms of efficiency of surgical intervention and postoperative cost of the treatment in a highly selected group of brain abscesses.

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