

Clinical Features and Surgical Results of Brain Abscesses

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Objective : This study is undertaken to review the characteristics, risk factors and the surgical outcomes in long term follow-up of brain abscesses.

Methods : We had reviewed medical records and radiological findings in patients with brain abscess who underwent operations in our hospital from January 1992 to June 2003.

Results : Observed 11 cases were comprised of 8 men and 3 women with 42 years old average age ranging from 17 to 66. Lesions were located at frontal lobe in 5 cases, parietal in 4 cases, temporal in 1 case, and occipital in 1 case. The mean follow-up period was 23.8 months and ranged from 5 to 33 months. The microbial sources of infection had been found in 5 cases (45%). The organisms were identified by using the microbial culture obtained from the excisional biopsy. We had applied all cases with surgical excision. Empirical antibiotic treatment started soon after diagnosis in all cases. The mortality and morbidity of surgical excision were low. Nine patients were neurologically improved. One patient had died after the operation due to acute respiratory distress syndrome (ARDS).

Conclusion : The single and large abscess located in an accessible lesion is a good candidate for surgical excision because of its low morbidity, mortality, and favorable outcome after surgical excision. Further study is required to compare the surgical excision with other treatment modalities of brain abscess.

KEY WORDS : Brain abscess · Surgical excision · Antibiotics.

Introduction

The recent remarkable improvement for the treatment of brain abscess results from the development of advanced surgical technique, antibiotics and diagnostic tools including a computed tomography(CT). As a result, the mortality rate has been decreased until less than 10% from 40~60%⁹⁾. In addition to these, the stereo-stactic surgery of deep brain abscess increased the improvement^{8,16,28,30)}. Although the prevalence of brain abscess is known to be gradually decreased from 5% to 3% per a million of people, Garfield⁹⁾ reported the increased rate of the disease. Here we analyzed the outcomes of surgical excision, as one of surgical modalities of brain abscess.

Materials and Methods

The subjects of our study were 11 patients diagnosed as brain abscess and then treated by surgical excision in

our hospital from January 1992 to July 2003. We analyzed retrospectively hospital records and radiological data. We compared precontrast CT and magnetic resonance image (MRI) with its contrast enhanced findings. Surgical modality was surgical excision through craniotomy in all cases. Outcome was decided by neurological examination and changes of lesions in radiological examination after surgical and perioperative antibiotics. Total eleven patients are reviewed. Follow-up periods were ranged from 5 months to 33 months (mean : 23.8 months). The all cases are analyzed about following factors : sex and age distribution, location of lesions, clinical characteristics, predisposing factors, pathological organism, prognosis, and surgical outcomes (Table 1).

The male to female ratio is eight to three. The age was ranged from 17 to 66 and the mean age was 40. The locations of abscess are frontal lobe (5 cases : 45%), parietal lobe (4 cases : 36%), temporal lobe (1 case), and occipital lobe (1 case). Multiple lesion was not exist. The chief complaints at admission were headache (6 cases : 55%), mental deterioration (2 cases), hemiparesis (2 cases), and seizure (1 case). Mental status at admission are alert in 9 cases and drowsy in 2 cases. Body temperature was afebrile in 8 cases (73%). Afebrile cases are more than twice of febrile cases. There is no difference between number of cases showing normal leukocyte count

• Received : September 7, 2004 • Accepted : November 1, 2004
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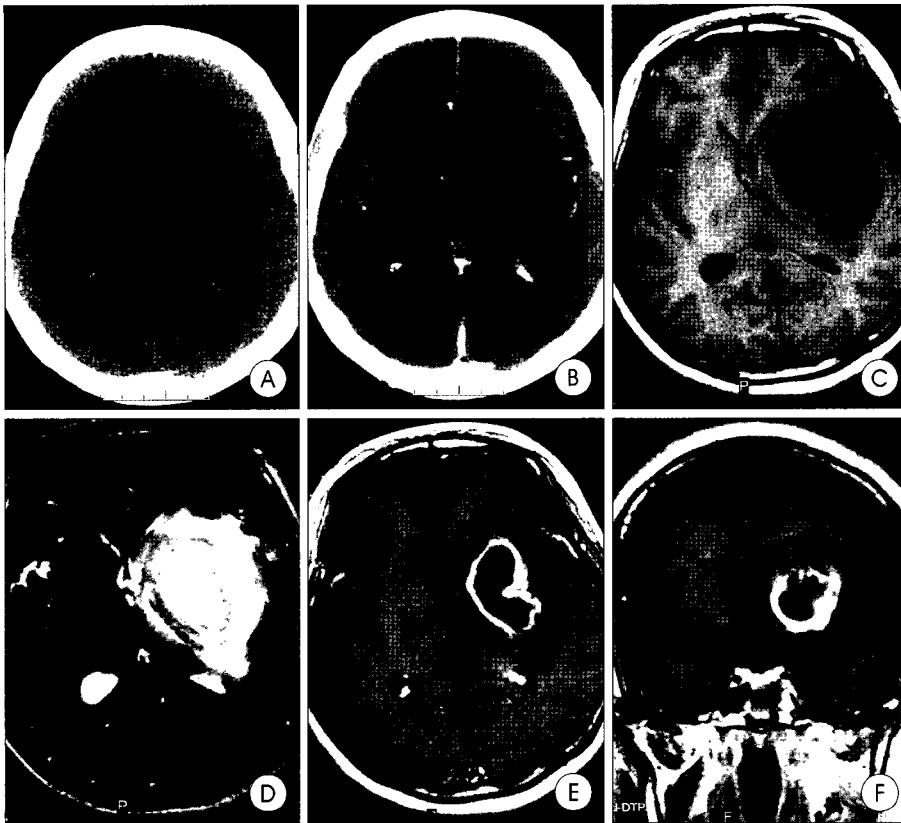


Fig. 1. Precontrast brain computed tomography (A) shows mass-like isodensity with peripheral low density on left temporal lobe. Also, midline shifting to right side and sulci effacement are seen. Contrast-enhanced view (B) shows well enhanced peripheral rim. Brain magnetic resonance image shows mass-like lesion with low signal intensity on the left temporal lobe at T1-axial image (C) and high signal intensity at T2-axial image (D). Gadolinium-enhanced axial (E) and coronal (F) images show well homogeneously enhancing peripheral ring around central lesion.

and leukocytosis because leukocytosis was seen in only 6 cases (54%). The all abscesses are three centimeters or more in diameter which could be an indication of surgical excision. All cases were examined with CT and MRI. Nine cases (73%) showed peripheral rim enhancement around the abscess (Fig. 1), and nodular enhancement was seen in 2 cases.

Results

The primary focus of abscess was confirmed in 5 cases (45%), but 6 cases remained unidentified. Mechanisms of spread from primary lesion were direct extension of prolonged chronic otitis media (1 case) and intracranial infection after head injury (4 cases). The organisms were identified in 6 cases (54%) in culture after the operation, but the others were not. Following anaerobic culture, one enterobacter was observed, whereas staphylococcus (2 cases) and klebsiella (2 cases) were identified in aerobic culture. Mixed infection is existed in one case.

Based on the susceptibility and the effect of antibiotics used

in this study, cephalosporin was the strongest one (10 cases), and followed by penicillin (6 cases), aminoglycosides (4 cases), metronidazole (1 case), and vancomycin (1 case).

Surgical excision through craniotomy was applied in the cases in which the location of abscess was accessible and the size of lesion was relative large. As the result of operations, nine cases showed good outcomes with high improvement based on clinical, neurological, and radiological observations except one case. This expired case was 61 years old, female patient who had symptoms like left hemiparesis and mental deterioration at admission. Pre and postcontrast MRI and CT showed solitary mass-like lesion with peripheral edema in the right basal ganglia. Because clinical and radiologic diagnosis was brain abscess, surgical excision and treatment with empirical antibiotics proceeded as soon as possible. But she died at postoperative seventh

day due to ARDS. Pathological diagnosis was brain abscess.

Discussion

Morand had first operated brain abscess complicated from mastoiditis in 1750²⁹⁾. As diagnostic tools and antibiotics are much improved till now, prognosis is also improved. But brain abscess has still high mortality rate (20~40%)^{1,3,7,13,22)} as infectious disease of central nervous system and intracranial mass lesion demanding urgent operation in recent years. Around world, prevalence of brain abscess is different between countries. It is reported that prevalence decreased from 5% to 3% per a million of people during past twenty years¹⁹⁾.

Most of brain abscess occur in fifth decade^{15,17)}, especially in younger than third decade^{15,17)}. In this study, cases occur in variable age without age difference. There is no difference of prevalence between younger than forty years old and older. Brain abscess frequently occurs in male two times than

Table 1. Characteristics of patient in 11 brain abscesses

Patient No.	Sex	Age(yr)	Location	Size	Fever	Leukocytosis	Primary focus	Organism	Outcome
1	M	51	Rt. F	4cm	(-)	(+)	(-)	(-)	Improve
2	M	28	Lt. F	3.3cm	(-)	(-)	Trauma	enterobacter	Improve
3	M	35	Rt. F	3.5cm	(-)	(-)	Trauma	(-)	Improve
4	M	14	Rt. F	3.8cm	(+)	(+)	Trauma	staphylococcus	Improve
5	M	66	Lt. T	3cm	(+)	(+)	COM	klebsiella	Improve
6	F	54	Rt. O	4cm	(+)	(-)	(-)	(-)	Stationary
7	M	51	Lt. P	3.1cm	(-)	(+)	(-)	multiple	Improve
8	M	55	Lt. P	3cm	(-)	(-)	Trauma	staphylococcus	Improve
9	M	17	Rt. F	3cm	(-)	(+)	(-)	(-)	Improve
10	F	30	Lt. P	3.4cm	(-)	(-)	(-)	klebsiella	Improve
11	F	65	Rt. P	3cm	(-)	(+)	(-)	(-)	Expired

yr : years, Rt : right, Lt : left, F : frontal, T : temporal, O : occipital, P : parietal, cm : centimeter, COM : chronic otitis media

female^{5,26}). In this study, incidence is higher in male two point seven times than female. The causes of high incidence in younger than third decade are described below. First, infection of ears and paranasal sinuses is numerous in this age. Second, incidence of traumatic brain injury like contusion is high. Third, sepsis and congenital heart disease are more frequent in this age³).

Brain abscess has predisposing factors like below. Trauma, direct extension of infection of ears and paranasal sinuses, hematogeneous spread from primary lesion as inflammatory disease of lung, heart may be possible cause of brain abscess²⁷). In general, primary lesion is identified in 10~37% of all brain abscess^{3,21}). In our study, primary foci of five cases (45%) are identified. We assume direct extension of chronic otitis media and infection after head trauma as main pathway of spread. In general, staphylococci and streptococci are most frequent organism of bacterial brain abscess. In recent, there are numerous reports that staphylococci is decreasing and gram-negative organism is increasing in brain abscess due to development of culture technique^{13,25,26}). In this study, organisms of five cases (45%) is not identified. Staphylococci (2 cases), klebsiella (2 cases) and enterobacter (1 case) were cultured in this study. Mixed infection was detected in only one case.

On literature, headache is most common symptom of brain abscess^{3,17,20,21}). Six cases (55%) in our study was identified with headache. Generally, seizure is shown in 30~50% of brain abscess^{6,7}). In this study, only one case (9%) showed seizure as main symptom. Generally, fever exist in nearly 50% of brain abscess⁴). In our study, only three patient (27%) were febrile. Leukocytosis exists in 40~65% of brain abscess^{10,21}). Our study also shows same result. Mortality rate is 9% as one case among eleven cases. The result of this study shows similar

mortality, compared with literatures that mortality rate of brain abscess is below 10%^{8,17,20,25}).

Generally, locations of brain abscess are influenced by focus of primary infection. Locations have been reported variably between reporters. In 1978, McClelland¹⁹) reported that 29% of brain abscess occurred in the temporal lobe, 25% in the frontal lobe, 10% in the parietal lobe, 6% in the cerebellum, 5% in the occipital lobe. Also, he reported that mixed infection by multiple

organism occupied 20% of brain abscess. In our study, five cases (45%) occurred in the frontal lobe and four cases (36%) in the parietal lobe. Only one case of mixed infection existed in our study.

Brain CT is most effective examination as diagnostic tools because CT can detect lesions fast and easily and accurately. With contrast enhancement, peripheral rim enhanced pattern is mostly seen in general. Diseases must be ruled out are primary malignant tumor, metastatic brain tumor, and cerebral infarct, etc¹¹).

Among operations of brain abscess in past, Macewen first introduced drainage of brain abscess in 1883 and Claris Vincent operated surgical excision of brain abscess in 1930^{12,24}). Until now, debates have continued about surgical mortality for brain abscess. Matson recommended simple drainage for deep seated and ill-defined abscess and continuous aspiration for superficial or cerebellar lesion. He also recommended surgical excision for lesion inducing seizure or being primary infectious focus¹²).

There are many reports that stereotactic aspiration of brain abscess has many advantages. This procedure can be proceeded with local anesthesia. Although lesions of posterior fossa are operated with intense accuracy at puncture of abscess and have high surgical risk, there is several reports that stereotactic aspiration can be done for brain abscess somewhat safely^{18,24,27}). Apuzzo²) proved that stereotactic aspiration was safe and practical method in his five hundred cases.

There are two merits that surgical excision has low incidence of recurrence and takes complete recovery of patient after first operation. But there are several demerits that this procedure induces injury to peripheral normal tissue and neurosurgeon must wait stabilization of wall of abscess for a long time. Also,

severe dangerous outcome can be induced in case of a rupture of abscess wall¹⁴. Beller³ reported a fact that mortality rate is most high in aspiration and most low in surgical excision. According to his report, neurological deficits are most frequent in surgical excision and most rare in aspiration. In this study, after the surgical excision of all cases, we experienced good outcomes in ten cases. Only one patient died due to ARDS as a complication of the operation.

Conclusion

We obtained a good outcome in 10 out of 11 cases of brain abscess that were treated with surgical excision in our hospital. We conclude that the accessible and large sized lesion, accompanying aggravated neurological deficit regardless of using antibiotics, is thought to be a good candidate for early surgical excision. Furthermore, we think that another modalities of surgical treatment for brain abscess must be studied and compared with our study.

• Acknowledgement

This article was reported on annual meeting of Korean Neurosurgical Society at Autumn 2003.

References

1. Alderson D, Strong AJ, Ingham HR, Selkon JB : Fifteen-year review of the mortality of brain abscess. *Neurosurgery* **8** : 1-6, 1979
2. Apuzzo MLJ, Chandrasoma PT, Cohen D, Zee CS, Zelman V : Computed imaging stereotaxy: experience and perspective related to 500 procedures applied to brain masses. *Neurosurgery* **20** : 930-937, 1987
3. Beller AJ, Sahar A, Praiss I : Brain abscess: review of 89 cases over a period of 30 years. *J Neurol Neurosurgery Psychiatry* **36** : 757-768, 1973
4. Bhatia R, Tandon PN, Banerji AK : Brain abscess: an analysis of 55 cases. *Int Surg* **58** : 565-568, 1973
5. Brewer NS, MacCarty CS, Wellman WE : Brain abscess : a review of recent experience. *Ann Intern Med* **82** : 571-576, 1975
6. Buonaguro A, Colangelo M, Daniele B, Cantone G, Ambrosio A : Neurological and behavioral sequelae in children operated on for brain abscess. *Childs Nerv Syst* **5** : 153-155, 1989
7. Carey ME, Chou SN, French LA : Experience with brain abscesses. *J Neurosurg* **36** : 1-9, 1972
8. Dyste GN, Hitchon PW, Menezes AH, Vangilder JC, Greene GM : Stereotaxic surgery in the treatment of multiple brain abscesses. *J Neurosurg* **69** : 188-194, 1988
9. Garfield J : Management of supratentorial intracranial abscess : a review of 200 cases. *Br Med J* **2** : 7-11, 1969
10. Gregory DH, Messner R, Zinneman HH : Metastatic brain abscesses : a retrospective appraisal of 29 patients. *Arch Intern Med* **119** : 25-33, 1967
11. Joubert MJ, Stephanov S : Computerized tomography and surgical treatment in intracranial suppuration : report of 30 consecutive unselected cases of brain abscess and subdural empyema. *J Neurosurg* **47** : 73-78, 1977
12. Jung KY, Lim YJ, Kim TS, Kim GK, Rhee BA, Leem W : Clinical analysis of brain abscess. *J Korean Neurosurg Soc* **21** : 977-992, 1992
13. Kaufman DM, Leeds NE : Computed tomography(CT) in the diagnosis of intracranial abscesses. *Neurology* **27** : 1069-1073, 1977
14. Kim JS, Sung YS, Kang JK, Doh JY, Jung HT : Clinical analysis of the brain abscess. *J Korean Neurosurg Soc* **21** : 287-292, 1992
15. Lee SH, Choi BK, Choi KS : Experience with 42 cases of brain abscess. *J Korean Neurosurg Soc* **10** : 739-745, 1981
16. Lunsford LD, Nelson PB : Stereotactic aspiration of a brain abscess using the "therapeutic" CT scanner: a case report. *Acta Neurochir* **62** : 25-29, 1982
17. Mampalam TJ, Rosenblum ML : Trends in the management of bacterial brain abscesses : review of 102 cases over 17 years. *Neurosurgery* **23** : 451-458, 1988
18. Mathisen GE, Johnson JP : Brain abscess. *Clin Infect Dis* **25** : 763-781, 1997
19. McClelland CJ, Craig BF, Crockard HA : Brain abscesses in northern ireland : a 30 year community review. *J Neurol Neurosurg Psychiatry* **41** : 1043-1047, 1978
20. Miller ES, Dias PS, Uttley D : CT scanning in the management of intracranial abscess : a review of 100 cases. *Br J Neurosurg* **2** : 439-446, 1988
21. Morgan H, Wood MW, Murphey F : Experience with 88 consecutive cases of brain abscess. *J Neurosurg* **38** : 698-704, 1973
22. New PFJ, Davis KR, Ballantine HT : Computed tomography in cerebral abscess. *Radiology* **121** : 641-646, 1976
23. Osenbach RK, Loftus CM : Diagnosis and management of brain abscess. *Neurosurg Clin N Am* **3** : 403-420, 1992
24. Park JH, Yoo DS, Kim DS, Huh PW, Cho KS, Kang JK : Continuous irrigation of brain abscess using a double lumen catheter. *J Korean Neurosurg Soc* **29** : 1328-1322, 2000
25. Rosenblum ML, Hoff JT, Norman D, Weinstein PR, Pitts L : Decreased mortality from brain abscesses since advent of computerized tomography. *J Neurosurg* **49** : 658-668, 1978
26. Samson DS, Clark K : A current review of brain abscess. *Am J Med* **54** : 201-210, 1973
27. Stapleton SR, Bell BA, Uttley D : Stereotactic aspiration of brain abscesses : is this the treatment of choice? *Acta Neurochir(Wien)* **121** : 15-19, 1993
28. Walsh PR, Larson SJ, Rytel MW, Maiman DJ : Stereotactic aspiration of deep cerebral abscesses after CT-directed labeling. *Appl Neurophysiol* **43** : 205-209, 1980
29. Webster JE, Gurdjian ES : The surgical management of intracranial suppuration : methods in diagnosis and management, and a report of 23 cases of civilian and 33 cases of military abscess. *Int Abstr Surg* **90** : 209-235, 1950
30. Wise BL, Gleason CA : CT-directed stereotactic surgery in the management of brain abscess. *Ann Neurol* **6** : 457, 1979