

Supratentorial Deep-Seated Bacterial Brain Abscess in Adults: Clinical Characteristics and Therapeutic Outcomes

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Abstract-

Purpose: Supratentorial deep-seated bacterial brain abscess (BBA) in adults is rarely examined solely in the literature. This retrospective study is conducted to examine the clinical characteristics and therapeutic outcome of this specific group of BBA.

Methods: Eight adult patients with supratentorial deep-seated BBA, collected during a study period of 14 years (1994 - 2007), were enrolled. Their microbiological data derived from cerebrospinal fluid (CSF), blood or pus cultures, clinical features and therapeutic outcome were analyzed.

Results: The eight adult cases were six men and two women, aged 41 to 80 years (mean= 61). Preceding medical conditions were found in five of these eight cases, while preceding neurosurgical event was found in one. Of the clinical presentations, hemiparesis (6) was the most common, followed by fever (5), altered consciousness (4), headache (3), septic shock (1), and seizure (1). The main locations of the BBA were the left basal ganglia in five, the left thalamus in two, and the right basal ganglia in one. Causative pathogens were found in six cases and the isolated pathogens were all cultured from CSF specimens. Positive bacteremia which grew *K. pneumoniae* was found in one case. Seven of these eight cases contracted the infection in a community-acquired state. Besides antibiotic treatment, seven of them received a neurosurgical intervention (stereotactic aspiration and/or ventriculoperitoneal shunt). The therapeutic result showed six cases survived and two expired. Five of the six survivors had variable degree of neurologic deficits.

Conclusion: Besides the common clinical features of BBA, supratentorial deep-seated BBA has a high incidence of hemiparesis in the early stages of disease. Most of the involved patients have community-acquired infections and are preceded by a medical condition. Stereotactic aspiration for therapeutic and diagnostic purposes, as well as shunting surgery, is the most common neuro-surgical procedures used for treatment. But despite therapeutic efforts, high mortality and morbidity remain.

Key Words: adult, bacterial brain abscess, deep-seated, hemiparesis, supratentorial.

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INTRODUCTION

Bacterial brain abscess (BBA) is an important brain parenchymal infection that remains potentially fatal despite the advent of modern neuro-surgical techniques, new antibiotics, and powerful neuro-imaging modalities^(1,2). BBA has a rapid evolving course and many factors may influence the therapeutic outcome⁽¹⁻³⁾. Without appropriate treatment, BBA will definitely extend, causing brain herniation by mass effect, or rupture into the

ventricle to produce acute ventriculitis. In both instances, the outcome is usually catastrophic. It is postulated that the proximity between the abscess and ventricle increases the incidence of BBA rupture^(4,5). Therefore, deep-seated BBA has this catastrophic potential and may subsequently results in a poor prognosis⁽⁶⁾. Supratentorial deep-seated BBA is rarely examined solely in the literature, therefore, this report examined the clinical characteristics and therapeutic outcome of eight adult patients with specific group of BBA.

Table 1. Basic clinical data of the eight cases with supratentorial deep-seated bacterial brain abscess

Case No	Age (y/o) / Gender	Causative pathogen	Preceding event	Clinical presentation	Locations of abscess	Antibiotics x duration (day)	Neurosurgical procedure	Outcome
1	41/M	<i>Staphylococcus aureus</i>	Neuro-surgical procedure	Headache, R't hemiparesis	L't thalamus	Vancomycin 2g/day + Rocephin 4g/d x 60 days	Aspiration, V-P shunt	Survival
2	45/M	Coagulase (-) staphylococci	DM	Headache, fever, R't hemiparesis	L't basal ganglia	Vancomycin 2 g/d x 14 days → Linezolid 1.2 g/d x 38 days	Aspiration V-P shunt	Survival
3	49/M	<i>Peptostreptococcus</i>	-	Headache, R't hemiparesis	L't thalamus	Penicillin G 24 MU/d x 18 days → Cefazolin 3g/d x 28 days	Aspiration, V-P shunt	Survival
4	55/M	No growth	Hypo-thyroidism	Fever, R't hemiparesis and sensory impairment	L't basal ganglia	Penicillin G 24 MU/d x 10 days	Aspiration	Died
5	72/F	<i>Klebsiella pneumoniae</i>	DM, cirrhosis	Altered consciousness, R't hemiparesis, seizure	L't basal ganglia	Cefepime 6 g/d x 40 days	-	Died
6	72/F	<i>Klebsiella pneumoniae</i>	DM	Fever, altered consciousness	R't basal ganglia	Rocephin 4 g/d x 20 days	Aspiration, V-P shunt	Survival
7	76/M	<i>B-streptococcus, non-A, non-B, non-D</i>		Fever, R't hemiparesis	L't basal ganglia	Penicillin G 24 MU/d x 60 days	V-P shunt	Survival
8	80/M	No growth	DM	Fever, altered consciousness	L't basal ganglia	Rocephin 4 g/d x 6 days → Fortum 6 g/d x 10 days	Aspiration, V-P shunt	Survival

DM= diabetes mellitus; R't= right; L't= left; M= male; F= female; V-P= ventriculoperitoneal

METHODS

We retrospectively reviewed the microbiological analysis of cerebrospinal fluid (CSF), blood and pus cultures, the laboratory data and the medical records of patients with BBA who were admitted to Chang Gung Memorial Hospital (CGMH)-Kaohsiung in a period of 14 years (1994-2007). During this study period, eight cases with supratentorial deep-seated BBA were included for study. The inclusion criteria of BBA⁽¹⁾ were: 1)



Figure 1. Gadolinium contrast-enhanced T1-weighted image shows rimmed-enhanced lesion (arrow) located at left basal ganglia (Case 8).

characteristic computerized tomography (CT) and/or magnetic resonance imaging (MRI) findings; 2) evidence of brain abscess seen during surgery or histopathologic examination; and 3) classical clinical manifestations including headache, fever, localized neurologic signs and/or consciousness disturbance. The term “deep-seated BBA” was defined as BBA in the basal ganglia, thalamus, corpus callosum, brain stem, vermis, or within the ventricle⁽⁷⁾.

During the study period, a combination of antibiotic therapy and surgical intervention were the mainstay of treatment^(1,5). The final choice of antibiotics was further guided by culture results. Surgical procedures performed included aspiration and/or evacuation, which were determined by the location, number, and configuration of the BBA, as well as the patient’s general medical condition. Demographic data, preceding medical and/or surgical condition, clinical manifestations, laboratory data, and therapeutic outcome of these eight cases were recorded for analysis.

RESULTS

The clinical data of the eight enrolled cases with supratentorial deep-seated BBA are listed in Table 1 and an example case (Case 8) was demonstrated in Figure 1. The eight cases were six men and two women, aged 41 to 80 years (mean= 61 years). Of these, causative pathogens were found in six (Cases 1-3 and 5-7) and the

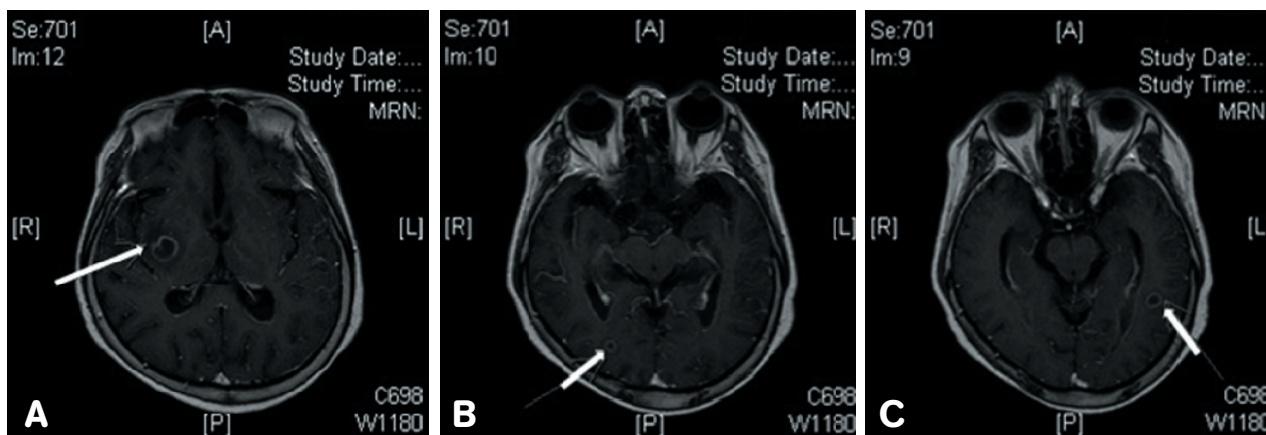


Figure 2. Gadolinium contrast-enhanced T1-weighted images (Case 6) show rimmed-enhanced lesion located at right basal ganglia (A, arrow), right occipital lobe (B, arrow) and left temporal lobe (C, arrow).

isolated pathogens were all cultured from cerebrospinal fluid (CSF) specimens. Case 5 had positive bacteremia and grew *K. pneumoniae*. Except for Case 1, all of the others had community-acquired infections. Of the preceding events, four cases (Cases 2, 5, 6, and 8) had diabetes mellitus (DM), Case 4 had hypothyroidism, and Case 5 had cirrhosis. Case 1 had a neuro-surgical procedure (craniectomy for intra-cerebral hemorrhage) as the preceding event. None of the eight cases had concomitant dental and nasal infections, and sinusitis. There were also no urinary tract and respiratory tract infections in the initial course of treatment. Of the clinical presentations, hemiparesis (6) was the most common, followed by fever (5), altered consciousness (4), headache (3), septic shock (1), and seizure (1).

The main locations of the brain abscess in the eight patients were the left basal ganglia in five (Cases 2, 4, 5, 7, and 8), the left thalamus in two (Cases 1 and 3), and the right basal ganglia in one (Case 6). Besides the deep-seated BBA, Case 6 also had two other small BBAs located at right occipital and left temporal lobes (Figure 2). Of these eight cases, seven cases underwent neuro-surgical procedures aside from antibiotics in the therapeutic course. Among the neuro-surgical procedures, stereotactic aspiration was done in six (Cases 1-4, 6, and 8) and all of the aspirated specimens showed pathologic evidence of abscess which showed marked neutrophilic aggregation. Because of poor medical condition, Case 5 did not receive the procedure of stereotactic aspiration.

In the therapeutic course, hydrocephalus developed in five patients (Cases 1, 3, and 6-8) and all underwent ventriculo-peritoneal shunt procedure. With these therapeutic regimens, none of these eight cases had a ruptured BBA during the therapeutic course. Six patients (Cases 1-3 and 6-8) eventually survived while two expired (Cases 4 and 5). Case 4 died on the 10th day due to intra-cerebral hemorrhage after the procedure of stereotactic aspiration. Case 5 died on the 45th day from a septic shock. Of the six survivals, Case 1 had moderate right hemiparesis; Cases 2 and 3 had mild right hemiparesis; Case 6 fully recovered; Case 7 was able to maintain wheelchair-bound activity; and Case 8 had speech disturbance.

DISCUSSION

In these eight cases with supratentorial deep-seated BBA, only one (12.5%) had post-neurosurgical condition as the preceding event and contracted the infection nosocomially. None of the other seven cases had local cranial lesion. This may imply that supratentorial deep-seated BBA is not usually from contiguous infection. However, despite only one case with positive blood culture in this study, we may postulate that supratentorial deep-seated BBA is usually due to hematogenous spread.

The mean age of these eight patients was 61 years and 62.5% (5/8) had a preceding medical problem, of which DM was the most common. Previous studies also note the high incidence of DM in adult patients with community-acquired bacterial central nervous system infection in Taiwan^(6,7). In this study, *K. pneumoniae* accounted for 25% (2/8), which rose to 66.7% (2/3) if only cases with DM and positive culture result were considered. This is also consistent with previous study results^(1,7-9) that revealed *K. pneumoniae* as the most common pathogen in adults with community-acquired central nervous system infections, especially those with DM as the preceding event. Other implicated pathogens in this study were Gram-positive pathogens 37.5% (3/8), anaerobic pathogens 12.5% (1/8), and negative culture 25% (2/8). This distribution of pathogens in BBA is consistent with previous studies^(1,6) reported from Taiwan and those reported from other countries^(2,3).

In this study, 75% (2/8) of cases are male. This high prevalence of male patients is also consistent with a previous study of overall BBA⁽¹⁾ or *K. pneumoniae*-related BBA⁽⁸⁾. However, this finding is not universal regarding BBA⁽¹⁰⁻¹³⁾. In terms of initial clinical manifestations, hemiparesis was the most common and found in 75% (6/8) of cases. This incidence is higher than those reported in other study groups^(1,10-13) that include overall BBA cases in the analysis. The high incidence of hemiparesis in patients with supratentorial deep-seated BBA can be explained by the high convergence of motor fibers in these areas⁽¹⁴⁾. Despite this, it is still very difficult to explain the high prevalence of left-sided basal ganglia

and thalamus involvement in this study. The incidence of other clinical manifestations, including headache, fever, and altered consciousness in adult patients with deep-seated BBA are similar to those reported from other studies^(1,2,6,10-13). Of the eight cases here, there is hydrocephalus in 62.5% (5/8), which can also be explained partly by the proximity of the ventricle to the supratentorial deep-seated BBAs. To deal with this neurologic complication of BBA, all five involved cases received an insertion of V-P shunt and all survived. Use of ventricular shunting procedures, including V-P shunt, is important for the management of BBA complications⁽¹⁵⁻¹⁷⁾.

To prevent further expansion of BBA and subsequent brain herniation, prompt reduction of the abscess size is one of the important strategies in management^(15,16). As to the neurosurgical intervention for this therapeutic purpose, excision and aspiration are the main therapeutic procedures^(2,15,17). Because of anatomic considerations in supratentorial deep-seated BBA, stereotactic aspiration procedure is usually chosen. A study by Kocherry et al.⁽¹⁸⁾ reviewed the efficacy of stereotactic aspiration in deep-seated brain abscess and showed that 14% (3/22) has mild bleeding into the abscess cavity and 5% (1/22) develop ventriculitis in the post-operative period. In this study, except for Cases 5 and 7, all of the others underwent stereotactic aspiration for both therapeutic and diagnostic purposes. At the same time, five underwent shunting procedure. Despite these efforts, the therapeutic result showed a mortality rate of 25% (2/8) and a high morbidity rate among the survivors. These high mortality and morbidity figures are consistent with those reported in large-series studies of BBA^(1,2).

In conclusion, supratentorial deep-seated BBA is a catastrophic infectious disease of the central nervous system. Besides the common clinical features of BBA, this specific group of BBA has high incidence of hemiparesis in the early stage of disease. Most of the involved patients have community-acquired infections and are preceded by a medical condition, which DM is the most common. Stereotactic aspiration for therapeutic and diagnostic purposes, as well as shunting surgery, is the most common neuro-surgical procedures used for

treatment. But despite therapeutic efforts, high mortality and morbidity remain. However, further large-scale study of this specific group of BBA is needed for a better delineation of the clinical characteristics and therapeutic strategy.

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