

ORIGINAL ARTICLE

Clinical Presentation and Surgical Outcomes of Brain Abscesses. A Cross-Sectional Clinical Study from a Tertiary Care Hospital

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**ABSTRACT**

Background: Brain abscess remains a potentially fatal neurological emergency in underdeveloped settings. Timely surgical intervention significantly improves outcome, provided diagnosis is prompt. The purpose of this study is to ascertain the clinical presentation, imaging, microbiological profile and surgical outcome of brain abscess in a tertiary center.

Methodology: A cross sectional clinical study was conducted at Department of Neurosurgery, Aziz Fatimah Hospital Faisalabad, Pakistan between January 2024 to December 2024. Fifty six patients with brain abscess according to clinical and radiological criteria were included. Abscess size, location and clinical status dictated whether patients had burr hole aspiration or craniotomy. Data were recorded and analyzed on pre and postoperative clinical evaluations, radiological findings, microbiology reports and outcomes.

Results: The mean age of the patients was 34.8 ± 13.2 years; 2.2 male: female. The most common presenting symptoms were headache (82.1%), fever (67.9%), and altered consciousness (44.6%). Most commonly involved were the frontal lobe (39.3%) and temporal lobe (23.2%). The most common source was otogenic and hematogenous spread. The predominant isolates were *Streptococcus* spp. and *Staphylococcus aureus*. In 42 patients, Burr hole aspiration was performed and in 14 patients, craniotomy. In 85.7% of cases postoperative improvement was noted. Complications included residual neurological deficits (8.9%), seizures (10.7%) and in-hospital mortality rate was 5.3%.

Conclusion: Brain abscess remains a clinical problem in developing healthcare system. Timely identification, optimized antimicrobial therapy along with appropriate surgical management has a favorable outcome. Optimal recovery and lowering of morbidity and mortality require a multidisciplinary approach.

Keywords: Brain abscess, Seizures, Neurological Deficits, hematogenous, *Staphylococcus aureus*.

INTRODUCTION

Brain abscess is a focal, intracerebral infection, started as localized area of cerebritis and evolves into a collection of pus which is encapsulated within the brain parenchyma¹. It is a serious, and sometimes fatal, central nervous system (CNS) condition which should be diagnosed and treated as soon as possible⁸. However, despite these

improvements in neuroimaging, neurosurgical techniques, and antimicrobial therapy, brain abscesses continue to be related to high morbidity and mortality, especially in low resource settings and among patients with immunosuppression¹⁰.

Brain abscess presents with a nonspecific clinical picture that might mimic brain tumor or encephalitis. Symptoms include headache, fever, vomiting, seizures

and focal neurological deficits, though this triad is seen in less than half of cases². Radiological diagnosis is primarily by CT and MRI to identify ring enhancing lesions. They are essential to microbial guide appropriate antibiotic therapy through either aspirated pus or blood cultures³.

Treatment still focuses on surgical intervention, particularly for abscesses that are larger or causing mass effect⁵. The most commonly used surgical techniques are Burr hole aspiration and craniotomy and the choice between the two depends on abscess size, location, multiplicity, and the patient's neurological condition⁶. The objective of this study is to investigate the clinical profile, microbiological spectrum, radiological features and surgical outcome of patients with brain abscesses admitted in a tertiary care hospital⁷. This study aims to present the current management practices and early diagnosis, and multidisciplinary care are important for improving prognosis by analyzing the outcomes in the surgically treated 56 patients.

MATERIALS AND METHODS

Study design

This was a cross sectional clinical study on the 12 months from Jan 2024 to Dec 2024 at the department of neurosurgery Aziz Fatimah Hospital Faisalabad, Pakistan. A total of 56 patients with brain abscess were included in the study according to clinical signs, radiological imaging, and intraoperative findings.

Inclusion Criteria

All patients of any age and sex with radiologically proved brain abscess who underwent surgical intervention (burr hole aspiration, or craniotomy) were included. This was confirmed by contrast enhanced CT or MRI showing a ring enhancing lesion with surrounding edema, and clinical symptoms (headache, fever, seizures, neurological deficit).

Exclusion Criteria

The study excluded patients with sterile cystic lesions, tumors, or who have had previous surgical intervention elsewhere.

Data Collection

Demographic information, clinical presentation, comorbidities, predisposing factors (otosclerosis, sinusitis, trauma or immunosuppression) and symptoms duration were recorded. Baseline hematological investigations were done in all patients and blood cultures were collected before starting the antibiotic therapy. Lesion location, number and size were reviewed for imaging studies (CT/MRI).

Surgical Management

Burr hole aspiration or craniotomy was chosen based on size (>2.5 cm), location (superficial vs. deep), multiplicity of lesions and neurological status of the patient. Deep seated or multiple abscesses were better treated with Burr hole aspiration, while superficial lesions with mass effect or recurrence were treated with craniotomy. Gram stain of the pus samples, culture, and sensitivity testing were done intraoperatively.

Postoperative Care and Follow-up

All were treated with intravenous broad spectrum antibiotics, which were tailored after culture sensitivity results. Glasgow Coma Scale (GCS) was used to assess postoperative neurological status which was documented regularly. Residual or recurrent abscess was followed up with imaging within 2 weeks of surgery followed by additional imaging, as needed.

Data Analysis

The data were analyzed using SPSS software version 26.0. Means, standard deviations and percentages were calculated as descriptive statistics. We analyzed categorical variables using Chi-square test and continuous variables using Student's t-test. Statistically significant was a p value <0.05.

Ethical Considerations

The study was performed according to the principles of the Declaration of Helsinki. Before study initiation, ethical approval was obtained from the institutional review board. All patients or legal guardians gave informed written consent.

RESULTS

The mean age of the 56 patients diagnosed with brain abscess was 34.8 ± 13.2 years and the clinical profile of the 56 patients was a male predominance (male to female ratio of 38:18). The classic but often nonspecific presentation of intracranial infections was confirmed by the most frequently reported symptoms, which were headache (82.1%) and fever (67.9%). In 35.7% of the cohort the seizures were due to cortical irritation or mass effect and altered consciousness was present in 44.6% of the cohort indicating the severity of the condition in almost half the cases. Also, 30.4% of patients had focal neurological deficits, related to the localized impact of the abscess on brain function, as determined by the anatomical location of the abscess. These findings highlight the varied and sometimes overlapping spectrum of brain abscess symptomatology that requires a high clinical suspicion for diagnosis (Table 1).

Radiological and microbiological analysis of 56 patients showed frontal lobe to be the most often involved site (39.3%), temporal lobe (23.2%), and parietal lobe (17.8%). This distribution includes areas of the brain that are sensitive to such infections which are incidentally located adjacent to the ears and sinuses. The most common etiological source was otogenic spread (33.9%), which may indicate chronic middle ear infections as a predisposing factor. Importantly, systemic infections such as endocarditis or pulmonary sources, as hematogenous dissemination occurs in 30.3% of patients, are significant contributors. Streptococcus species were the most commonly isolated organisms (26.8%), followed by Staphylococcus aureus (21.4%), and anaerobic bacteria (12.5%), indicating that brain abscesses are polymicrobial and that tailored antimicrobial therapy should be based on culture results (Table 2).

Surgical intervention for brain abscesses consisted of burr hole aspiration in 42(75%) of patients and craniotomy in 14(25%) of patients, which was usually performed for superficial, multiloculated, or recurrent abscesses. Surgical management in combination with antibiotic therapy was effective in 85.7% of patients, as 85.7% of patients showed postoperative clinical improvement. Complications were reported in some cases (postoperative seizures in 10.7% and residual neurological deficits in 8.9%) and these represent the potential for the delayed presentation or deep seated abscess. In this condition, there was 3.6% minor wound infections and 5.3% overall in hospital mortality rate, which indicates that this condition is critical and has to be managed promptly by the team of specialties (Table 3).

Table 1: Demographic and Clinical Characteristics of Patients (n = 56)

Parameter	Value
Mean Age (years)	34.8 ± 13.2
Gender (Male:Female)	38:18
Most Common Symptoms	Headache (82.1%), Fever (67.9%)
Seizures	20 (35.7%)
Altered Consciousness	25 (44.6%)
Focal Neurological Deficits	17 (30.4%)

Table 2: Radiological and Microbiological Findings

Parameter	Frequency (%)
Frontal Lobe Involvement	22 (39.3%)
Temporal Lobe Involvement	13 (23.2%)
Parietal Lobe Involvement	10 (17.8%)
Otogenic Source	19 (33.9%)
Hematogenous Spread	17 (30.3%)
Streptococcus spp.	15 (26.8%)
Staphylococcus aureus	12 (21.4%)
Anaerobes	7 (12.5%)

Table 3: Surgical Intervention and Outcomes

Parameter	Frequency (%)
Burr Hole Aspiration	42 (75%)
Craniotomy	14 (25%)
Postoperative Improvement	48 (85.7%)
Postoperative Seizures	6 (10.7%)
Residual Neurological Deficits	5 (8.9%)
Wound Infection	2 (3.6%)
In-Hospital Mortality	3 (5.3%)

DISCUSSION

Brain abscess remains an uncommon but challenging clinical condition with significant morbidity and mortality, especially in the developing world, where the patient presents late and where access to specialized neurosurgical care is limited¹¹. As in other studies from

these regional settings, we found that brain abscesses occur primarily in young to middle aged adults and male, which was corroborated by our study of 56 patients. Headache and fever are the presenting symptoms that underline the need for prompt neuroimaging when the constellation of symptoms is suggestive but not specific¹².

Most commonly, abscesses in this study appear in the frontal and temporal lobes, as is typically the spread of infection from otogenic and sinus sources. In low and middle income populations, otitis media and mastoiditis continue to be common, and are preventable risk factors for intracranial complications if not treated¹³. In addition, this cohort was infected hematogenously, usually from pulmonary or cardiac foci. It stresses the importance of a comprehensive systemic evaluation to ascertain major sources of infection and to start early antibiotic coverage¹⁴.

In accordance with the global epidemiological patterns of brain abscesses, *Streptococcus* spp. and *Staphylococcus aureus* were the leading pathogens found microbiologically. The identification of anaerobic organisms in a large proportion of cases further supports the use of broad spectrum antimicrobials active against both aerobes and anaerobes until culture results become available¹⁵. Treatment is mainly surgical and burr hole aspiration remains the favored treatment due to its minimally invasive nature and its ability to drain localized pus collections. Seventy five percent of patients underwent burr hole aspiration, and craniotomy was reserved for selected patients based on lesion characteristics. The overall postoperative improvement rate of 85.7% denotes the efficacy of surgical drainage and proper antimicrobial therapy¹⁶.

Despite this, complications, including seizure and neurological deficits, underscore the need for early diagnosis and intervention to avoid irreversible damage¹⁷. The in hospital mortality rate of 5.3% in this study is quite low and comparable to that reported in recent literature, indicating that prompt and targeted neurosurgical and medical treatment can significantly reduce fatal outcomes. Yet, this also highlights the necessity to strengthen neurosurgical care access, improved imaging availability and referral systems, particularly in rural and underserved areas¹⁸.

On the whole, the results of this study support the importance of a multidisciplinary approach including neurosurgery, infectious disease, radiology, and intensive care physicians in the management of brain abscess¹⁹. The cornerstone of improving outcomes in affected patients is early identification of source infections, timely surgical intervention and culture guided antibiotic therapy²⁰.

CONCLUSION

Brain abscess remains a clinical problem in developing healthcare system. Timely identification, optimized antimicrobial therapy along with appropriate surgical management has a favorable outcome. Optimal recovery

and lowering of morbidity and mortality require a multidisciplinary approach.

More large scale and multicenter studies are needed to develop standardized treatment protocol and to evaluate long term neurological outcome⁹.

DECLARATION

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Authors contribution

Each author of this article fulfilled following Criteria of Authorship:

1. Conception and design of or acquisition of data or analysis and interpretation of data.
2. Drafting the manuscript or revising it critically for important intellectual content.
3. Final approval of the version for publication.

All authors agree to be responsible for all aspects of their research work.

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Competing Interests

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Conflict of Interest

The authors declared no conflict of interest.

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