

# Gram Negative Bacillary Brain Abscess: Clinical Features And Therapeutic Outcome

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## Abstract

### Background:

This study was conducted to analyze the clinical features and therapeutic outcome for brain abscesses caused by gram negative bacilli.

### Methods:

41 patients with gram negative bacillary brain abscess, out of a total of 278 cases, 25 males and 16 female aged 2-72 years were reviewed at IMS, BHU and JN Medical College Hospital AMU, over a 17 year period for Predisposing factors, clinical feature and therapeutic outcome.

### Results:

The most common presenting symptoms were headache, vomiting, fever and altered sensorium. At the time of admission 26.10% had GCS <9. Temporal and temporoparietal was the commonest site and 14.6% had multiple abscesses. The common predisposing factors were otic infection, penetrating trauma and chest infections with diabetes mellitus being the main underlying disease. CT and MRI facilitated early diagnosis. Surgical intervention was done in 97.1% cases. The most common pathogen isolated was pseudomonas in otogenic group, E. coli in head injury group and Klebsiella in hematogenous spread. 39.04% cases were multidrug resistant with pseudomonas being the main culprit. The overall mortality was 26.8% with the presence of septic shock and multidrug resistance being the poor prognostic factors.

### Conclusion:

Brain abscesses caused by gram negative bacilli are not rare and often have a high prevalence of septic shock, multidrug resistance and death. Clinical presentation and therapeutic outcomes vary according to different pathogenic species. In light of high mortality rate an early diagnosis and prompt management is essential to maximize the chance for survival.

## INTRODUCTION

Despite the recent advances in imaging techniques methods neurological procedure, brain abscess still is a serious problem in developing countries. The site of the primary infection or the underlying condition is a determinant of etiology of brain abscess. Approximately 80% of patients with a brain abscess have some known predisposing factors while the remaining 20 percent are cryptogenic. The most common pathogens reported have been streptococci and staphylococci, but recently there is rising trend in gram negative bacillary abscess. Gram negative bacilli are a heterogeneous group of organisms widely distributed in plants, soil, water and human intestinal tract. Further these organisms are important cause of nosocomial infections particularly for patient with impaired defenses suffering from head trauma and recovering from neurosurgery. This

study is conducted to analyze the clinical feature and therapeutic outcome for brain abscess caused by gram negative bacilli.

## PATIENTS AND METHODS

Over a period of 20 years (Jan 1986 to Nov. 2006) 278 patients of brain abscess admitted in the Neurosurgery Departments of Institute of Medical Sciences, BHU and J N Medical College, AMU were reviewed, out of which 41 patients were retrospectively identified as having gram negative bacillary brain abscess. Criteria for definite diagnosis of brain abscess were (i) characteristic CT/MRI findings of brain abscess (ii) isolation of organism from pus postoperatively.

All patients were given ceftriaxone and metronidazole empirically which was changed according to sensitivity

report. Surgical treatment included either aspiration and or excision of the abscess. Recovery was evaluated 2 months after discharge. Mortality was defined as any cause of death occurring during the hospitalization.

**RESULTS**

Out of 278 cases of brain abscess, 41 cases were due to aerobic gram negative bacilli. 25 were male and 16 were female. The age ranged from 2 months to 72 years with majority less than 20 years of age (65.9%) Table 1.

**Figure 1**

Table 1: Age distribution

Age (in yrs)	Cases	Percentage
0-20	27	65.9
21-40	10	24.4
41-60	3	7.3
61	1	2.4

The majority of the patients presented with symptoms of raised intracranial pressure i.e. headache and vomiting closely followed by fever and altered sensorium (68.3% and 51.2% respectively). History of seizure either focal or generalized was present in 31.7% cases.

At the time of admission significantly large number of cases (26.10%) had Glasgow coma scale score (GCS) less than 9 as compared to non gram negative bacilli infected patients (9.5%, n = 237) (Table 2).

**Figure 2**

Table 2: Clinical symptomatology

Symptom	Total cases	Percentage
Headache	3	81.00
Nausea/vomiting	0	73.2
Fever	28	68.3
Seizure	13	31.7
Altered sensorium	21	51.2
Large Head size	1	2.4
Papilloedema	20	48.8
Pupillary abnormality	5	12.2
GCS Score scale		
13-15	2	56.1
9-12	7	17.1
3-8	11	26.8

Temporal and temporoparietal region was the commonest site followed by cerebellar and frontal region but the interesting finding was that 14.6% of cases had multiple abscesses compared to only 5.7% cases in non Gram negative group (Table 3).

**Figure 3**

Table 3: Location of Gram Negative brain abscess

Site	Cases	Percentage
Temporal/temporoparietal	14	34.2
Cerebellar	8	19.5
Frontal	7	17.1
Frontoparietal	4	9.8
Parieto-occipital	1	2.4
Occipital	1	2.4
Multiple	6	14.6

**Figure 4**

Predisposing factor	<i>Pseudomonas aeruginosa</i>	<i>Klebsiella pneumonia</i>	<i>Eschechria coli</i>	<i>Protetis ssp.</i>	<i>Salmonella spp.</i>
Chronic suppurative oitis media (n = 21)	14	0	2	5	0
Compound head injury (n = 7)	2	0	4	1	0
Chest infection (thoracic empyema, bronchiectasis) (n = 4)	1	2	0	1	0
Septic focus elsewhere i.e. skin (n = 6)	1	4	0	1	0
Cryptic (n = 3)	1	0	0	1	1
Total	19	6	6	9	1

Predisposing factors for infection (Table 4) included contiguous spread from otogenic foci (n = 21), haematogenous spread (n = 10), compound head injury (n = 7) and unknown (n = 3). Analyzing the associations for the causative pathogens and the underlying conditions, *pseudomonas aeruginosa* was the major pathogen associated with otogenic infections, while *E. coli* was isolated in cases of compound head injury. *Klebsiella* was associated with haematogenous spread with diabetes mellitus being the predisposing underlying condition.

40 out of 41 patients with brain abscess underwent both surgical and antimicrobial therapy. Out of 40 patients who underwent surgical treatment 2.2% (n=5) were managed by aspiration. 9.8% (n=4) with aspiration followed by excision and 76.1% (n=31) with total excisions.

Two patients subsequently experienced abscess recurrence and in both *pseudomonas* was the offending pathogen and was multidrug resistant. Overall out of 41 cases, 20 cases (39.04%) were multidrug resistant in contrast to only 16.2% in non gram negative groups. The overall mortality in this group was 26.8% as compared to 11% in other group.

**DISCUSSION**

Brain abscess continues to be an important cause of hospital admissions and mortality in developing countries, particularly due to late diagnosis, resistance of organisms and changing microbial flora. The most common organisms reported have been streptococci, staphylococci and aerobic organisms [1, 2]. But the incidence of gram negative bacillary brain abscess in on the rise as in our series (15.6%). Also in recent years, middle ear infection as the source of

intracranial suppuration has declined in advanced countries but we still encounter a large number of otogenic brain abscesses (51.22%) which probably reflects upon the inadequate and delayed treatment.

An interesting finding was large number of *pseudomonas*, isolates (46.46%) particularly in otogenic group. On reviewing the literature overall incidence of *pseudomonas* as the causative organism has been found to be low. It was isolated in 4 of 89 cases in series of Belier et al [3] and 3 out of 78 by Bhalia [4]. Also *pseudomonas* was associated with high mortality and recurrence owing to multidrug resistance.

*Klebsiella pneumonia* was the most prevalent pathogen in cases of haematogenous spread, associated with multiple brain abscess with diabetes mellitus being main underlying condition. The patients with *klebsiella* infection had a high incidence of septic shock (66.65%) necessitating prompt treatment. Reviewing the literature, *klebsiella* was the major isolate in metastatic brain abscess and is associated with diabetes mellitus [5, 6].

The overall mortality in the whole series was 13% but in gram negative group it was 26.8%. The poor prognostic factors were presence of septic shock, low GCS with time of presentation and multidrug resistance. In a study done at Chang Gung Memorial Hospital, Taiwan [7] the mortality rate for gram negative bacillary brain abscess was 28% with appropriate antimicrobial therapy and septic shock being the prognostic markers. In our series presence of multidrug resistance was most strongly associated with mortality.

**CONCLUSION**

Brain abscess caused by gram negative bacilli are not rare and often have a high prevalence of septic shock, multidrug resistance and death. Clinical presentation and therapeutic outcomes vary according to different pathogenic species. In light of high mortality rate an early diagnosis and prompt management is essential to maximize the chance for survival.

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