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Original Article

Association of Etiological and Pathological Features of Brain Abscess with Outcome

Mushtaq Ahmad Mian[1], Saleem Abbasi[2], Fazal Amin Khan [1], Muhammad Usman [3]
1. Department of Neurosurgery , Rehman Medical Institute, Peshawar; 2. Children Hospital, PIMS, Islamabad;
3 Department of Neurosurgery, Gaju Khan Medical College, Swabi

Abstract

Background: To study the etiological and pathological factors of brain abscess and to relate with the final outcome.

Methods: In this observational study patients with brain abscess were observed in detail with the clinical profile, etiology, microbiology and their final outcome after one year.Chi-square test was applied to associate etiological and pathological factors with management outcome.

Results: The majority of patients were in their 2nd and 3rd decade of life with two third proportion comprising of males. The most frequent etiological factor was chronic suppurative otitis media (CSOM) (55%),followed by head injury (12%) and congenital heart disease (10%). Microbiological data revealed 16% streptococci, 10% staph. aureus, 7% staph. epidermidis and 5% proteus as major pathogens in the study patients. Head injury and CSOM were found associated with death and morbidity in this study.

Conclusion: Brain abscess has multi dimensional causes. CSOM and head injury were found associated with death and severe morbidity as hemiparesis and fits. CT findings and microbiological data were not associated with outcome.

Key Words: Brain abscess, Head injury, Chronic suppurative otitis media

Introduction

Brain abscess is a very serious life threatening infection of the brain parenchyma.[1] It was very lethal in the pre-antibiotic era, however, despite the advent of modern imaging facilities, neurosurgical techniques and new antibiotics, brain abscess remains a potentially fatal central nervous system (CNS) infection.[2,3] The common causes of brain abscess are direct trauma to the brain or spread of infection from contiguous non-neuronal tissue and hematogenous seeding.[4]

Currently the mortality rate from brain abscess is approximately 10%. [5] However, if the abscess ruptures into the ventricular system, the mortality rate may be 80%.[5] Morbidity in survivors is generally due to residual neurologic defects, increased incidence of seizures due to scar tissue foci, or neuropsychiatric changes.[6]

The etiological factors of this brain abscess are suppurative process in middle ear, mastoid and paranasal sinuses.[7] Hematogenous spread can occur through primary foci that include pulmonary infections, endocarditis, dental abscess, skin pustules. Post traumatic brain abscess can result from penetrating injuries, compound depressed fractures and after craniotomy.[7]Many predisposing factors have been identified, these include congenital heart disease with a right-to-left shunt, infections of the middle ear, mastoid, paranasal sinuses, orbit, face, scalp, penetrating skull injury, comminuted skull fracture or intracranial surgery including insertion of ventriculo-peritoneal shunts, dermal sinuses and abnormal immune functions.[6,7] Causative agents vary from time to time according to geographic distribution, age and underlying medical condition of the patients, and the way the infection was contracted. A wide variety of organisms can cause brain abscess, depending on the portal of entry, and up to one third may be polymicrobial.[8]

The prognosis of brain abscess depends on a number of factors but with the availability of effective antibiotics, CT scan and improved surgical techniques, the outcome of brain abscess has dramatically improved but still needs further verification[1,2].

Patients and Methods

This cross sectional study was conducted at the Department of Neurosurgery, Pakistan Institute of Medical Sciences, Shaheed Zulfiqar Ali Bhutto Medical University, Islamabad. A total of 43 patients presenting with brain abscess were enrolled in the study in three years time period from January 2008 to January 2011. A written informed consent was taken from all patients before participation in the study. The study information was gathered on a structured proforma specifically designed for the study. In this study all patients operated in neurosurgery

department of PIMS between January 2008 and 2011 who were diagnosed to have brain abscess were included in the study. These were both males and female patients and of all age groups including children and adults. Patients who were treated medically were excluded from the study. The information of patient's baseline characteristics and clinical signs and symptoms was recorded. The other details during hospitalization, the information regarding management i.e. laboratory work-up, treatment strategy and outcome was also recorded. Condition of the patients was assessed and recorded at each follow-up till one year. The study parameters were associated with the management outcome at the time of discharge of patients. Descriptive analysis was done to calculate the proportions, percentages for categorical variables. Means and standard deviations were calculated for continuous numerical variables. Chi-square test was applied to see the association between etiological and pathological study parameters with the outcome of patients.

Results

In this study the mean ± SD age of patients was 26.7 ± 15.5 years ranging from 1-68 years. Most of the patients 16 (37.2%) and 11 (25.5%) were in their 2nd and 3rd decade of life respectively. Male gender was preponderant 28 (65.1%) (Table 1). Analysis was done by making two categories; one patients who recovered after management and second category comprised of those who died or had disability. The most prevalent cause of brain abscess in this study was CSOM and head injury. Left CSOM was found related to death or disability compared to recovery (50.0% vs 17.9%), however, it was not found statistically significant. Similarly, head injury was also found proportion wise related to death and disability (25.0% vs 10.2%). Meningitis was also found proportion wise associated with death and/or disability in the study (25.0% vs 2.5%). Since the two categories were not equal in numbers and very few but only 4 cases had death/disability, the statistical significance was not proven. (Table 2). The investigative parameters of the study i.e. CT findings and microbiology findings were associated with the two defined outcome categories. It was found out that frontal and temporo-parietal brain abscess was proportion wise related to death or disability in the study (25.0% vs 10.2%) and (25.0% vs 0%) respectively, however, no significant

Table 1: Baseline characteristics of study patients(n=43)

Age categories (years)	Number	%age
1 to 10	4	9.3%
11 to 20	16	37.2%
21 to 30	11	25.5%
31 to 40	5	11.6%
41 to 50	1	2.3%
51 or above	6	13.9%
Sex		
Male	28	65.1%
Female	15	34.9%

Table 2: Association of etiological factors with management outcome (n=43)

	Recovery (n=39)	Death and/or disability (n=4)	p-value
Right CSOM	12 (30.7%)	0 (0.0%)	0.56
Left CSOM	7 (17.9%)	2 (50.0%)	0.18
Head injury	4 (10.2%)	1 (25.0%)	0.40
Congenital heart disease	4 (10.2%)	0 (0.0%)	1.0
B/L CSOM	3 (7.6%)	0 (0.0%)	1.0
Meningitis	1 (2.5%)	1 (25.0%)	0.17
Pulmonary metastasis	1 (2.5%)	0 (0.0%)	1.0
Sinusitis	1 (2.5%)	0 (0.0%)	1.0
Others	6 (15.3%)	0 (0.0%)	1.0

Table 3: Association of investigative parameters with management outcome (n=43)

	Recovery (n=39)	Death and/or disability (n=4)	p-value
CT findings			
Temporal	19 (48.7%)	1 (25.0%)	0.61
Cerebellar	6 (15.3%)	1 (25.0%)	0.52
Frontal	4 (10.2%)	1 (25.0%)	0.40
Fronto-parietal	4 (10.2%)	0 (0.0%)	1.0
Parietal	4 (10.2%)	0 (0.0%)	1.0
Parieto-occipital	2 (5.1%)	0 (0.0%)	1.0
Temporo-parietal	0 (0.0%)	1 (25.0%)	0.09
Culture results			
No growth	23 (58.9%)	2 (50.0%)	1.0
Streptococcus pneumonia	6 (15.3%)	1 (25.0%)	0.52
Staph. aureus	4 (10.2%)	0 (0.0%)	1.0
Staph. Epidermidis	3 (7.7%)	0 (0.0%)	1.0
Proteus Spp	2 (5.1%)	0 (0.0%)	1.0
Pseudomonas	1 (2.5%)	0 (0.0%)	1.0
Acenobacter	0 (0.0%)	1 (25.0%)	0.09

associated could be proven statistically. Moreover, temporal and cerebellar brain abscess was equally distributed among the two management categories. On microbiology, most of the study cases had no growth, however, strep. pneumoniae was found proportion wise related to death and/or disability in the study (25.0% vs 15.6%). Similarly, acinobacter was also found almost significantly associated with death and/or disability (25.0% vs 0%). (Table 3) .On the 6 month follow-up, 37 (86.0%) patients had good recovery whereas 3 (6.9%) had moderate disability while 1 (2.4%) patient had an episode of fits. On the follow-up after 1 year, 40 (93.0%) had good recovery (GOS-5) and 1 (2.4%) patient had moderate disability (GOS-4).

Discussion

In present study the most prevalent causative factors of brain abscess were CSOM, head injury, congenital heart disease and meningitis. CT imaging showed that temporal, cerebellar and frontal abscess were the regions of brain affected. It was found out that left CSOM, head injury and meningitis were prevalently related to poor management outcome i.e. death or disability in the present study. Previous studies have also found a comparable trend of contiguous, haematogenous and neurosurgical or trauma being the main source of brain abscess and the primary driver of poor outcome.[9,10] A recent retrospective analysis by Helweg-Larsen J et al reported that contiguous and haematogenous abscesses were seen in majority of their study cases followed by surgical or traumatic.[11] They found out that brain abscess caused by meningitis was more likely to have adverse outcome after management. Lakshmi V et al witnessed that otogenic abscesses were the main source in their study followed by post traumatic abscess.[6] Moreover, they found that CSOM continues to be the most frequent predisposing condition in all age groups. There is other evidence as well documenting CSOM as a major source of brain abscess[12,13]. Direct extension may also occur through osteomyelitis in the posterior wall of the frontal sinus, sphenoid, and ethmoid sinuses and this path of intracranial extension is quite often associated with subacute and chronic otitic infection and mastoiditis than with sinusitis. Otogenic abscess occurs almost exclusively in the temporal lobe and cerebellum, while abscess associated with sinus infection is predominantly frontal[14]. This was validated by our results as well, where we witnessed CSOM being the single most source of abscess and its poor outcome.

In this study as per CT scan temporal, frontal and cerebellar abscess were the most frequent, however, they have no association with death and/or disability. However, proportion wise temporoparietal abscess was found related to death or disability. A study by Lakshmi V et al reported that trend of frontal, temporal, parietal and cerebellar brain abscess is on a rise.[6] Another study by Muzumdar D et al also witnessed that temporal, parietal and occipital brain abscesses were predominant in their analysis.[15] Microbiological findings were normal in majority of cases, however, Strep. Pneumonia and acenobacter were found related to death or disability in this study. Helweg-Larsen J et al witnessed that streptococcus species and staphylococci infections have role in poor outcome of brain abscess.[11] Moreover, previous literature validated our findings that otogenic abscesses are often associated with Streptococcus milleri and Streptococcus pneumonia organisms.[16,17]

Because brain abscess is a serious life threatening and quality of life affecting infection, it must be diagnosed early and treated aggressively. The outcome of brain abscess has improved over the past years, due to tremendous improvements in cranial imaging techniques, availability of antimicrobial treatment regimens, and the introduction of minimally invasive neurosurgical procedures. Mortality has declined from 40% in the 1960s to 15% noted in the past decade. At current, 70% of patients with brain abscess achieve good outcome, with no or minimal neurologic sequelae. Though data on functional and neuropsychological evaluation after brain abscess are lacking and makes the ground for further detailed research on this topic.[18]

Microbiological and radiological procedures are the accurate and key diagnostic tools for brain abscess provided timely presentation and initiation of treatment. Treatment requires a combination of antimicrobials, surgical intervention and eradication of primary infected foci. A high index of clinical suspicion with early intervention would definitely have a better outcome.[19]

Conclusion

1. Main source of brain abscess is CSOM followed by head injury, congenital heart disease and meningitis which were related to poor outcome.
2. Frontal, parietal and cerebellar sites were common for brain abscess. Frontoparietal site found closely related to death and disability.
3. Strep. pneumonia and acenobacter pathogens were found related to death or disability. The etiological factors, microbiology and radiological

evidence derives the management outcome of brain abscess.

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