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Research Paper

Management of Brain abscess -An institutional experience in a tertiary care hospital of eastern India.

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Abstract
AIM: Despite significant improvement in imaging techniques, laboratory modalities, surgical procedures, and antibiotic treatment, brain abscess remains a difficult clinical entity with significant high case fatality rates. Among the most frequent origins are otogenic and cardiogenic. Only a very small percentage of patients have a classic clinical appearance. Aspiration through a burr hole has Good clinical results and shortens hospital stays. Methods: This was a retrospective analysis of cases admitted at our institute with brain abscess having surgical indication from 2019 to 2023.We examined the demographic profile, management practises, and results of these cases using Microsoft Excel 2007.

Results:
45 cases in total were taken on for surgical management with a male to female ratio of 2.4:1, there were 13 females and 32 males. The study population's median age was 18 years, and the range of ages was 9 yrs. to 60 years. The most frequent source was otogenic. The most frequent site of an abscess was the temporal lobe. The most typical clinical manifestation, which was experienced by 86.27% of the study population, was headache. All cases were first treated by aspirating the abscess through a burr hole. Only 3.92% (n = 2) of the cases ultimately needed the capsule to be surgically removed. The number of instances requiring numerous aspirations was just 11.76% (n = 6). E. coli and Pseudomonas aeruginosa were the were the most common organisms grown.

Conclusion: *Mortality caused by brain abscess has dramatically decreased as a result of the development of current neuroimaging equipment. The otorhinolaryngology team's collaboration and attempts to address the primary cause have also improved patient outcomes in cases with otogenic brain abscess. Therefore, source management is crucial for treating the brain abscess.*

Keywords: *Tubercular abscess, Otogenic brain abscess*

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I. INTRODUCTION

In developing country the brain abscesses account for up to 8% of intracranial masses, as compared to very low as 2% incidence in the western world [1,2]. There is a lack of information on the exact prevalence of brain abscess in Bihar. Brain abscess continues to be a difficult clinical entity with very high case fatality rates despite recent improvements in imaging techniques, laboratory modalities, surgical procedures, and antibiotic treatment. Changes in epidemiology, clinical spectrum, predisposing factors , and prevalence of involved bacterial pathogens are responsible for this. High mortality is seen in brain abscess, and even more in immunocompromised patients .

A variety of organisms, including bacteria, mycobacterium, fungi, parasites (protozoa and helminthes), have been linked to its developement[3]. Other factors associated are head trauma or after neurosurgical treatments. In developing nations, it is usual for brain abscesses to develop as a result of contiguous spread from

Para meningeal foci of infection, such as the mastoids, sinuses, and middle ears. Many people who have brain abscesses also have ear infections or cardiac issues, particularly cyanotic heart disease.

Despite the prompt use of modern antibiotics in the treatment of predisposing causes of cerebral abscesses, the incidence of this disease has changed little and, if anything, seems to be increasing. This may be a result of the increase in the immunosuppressed population .

In this study we share our experience in patient of Brain abscess managed surgically and represent the clinic-demographic profile, microbiology, and surgical outcomes and analyzes the factors with an impact on morbidity, mortality, and outcome at IGIMS Patna a tertiary institute in eastern india.

II. Material And Methods

This was a retrospective study done in admitted patient between 2019 to 2023 at IGIMS Patna for Brain abscess **.** We collect data from medical record department of 45 consecutive cases

with brain abscesses, operated between January 2019 to April 2023 at IGIMS by the same surgical team. The Demographic data, clinical presentation, neurological status at admission, number of days to diagnosis, anatomical location and number of lesions, predisposing factors, etiology, treatment, complications and outcome were assessed.

Etiology were classified as infection originating through hematogenous spread, contiguous spread, open head injury, neurosurgical procedures, or unknown causes. Outcome was assessed through the Glasgow Outcome

Scale. Any complication associated with it were noted . Referral cases were excluded from study.Any abscess less than 2.5 cm and managed conservatively were also not included in study.

The diagnosis was mainly based on CECT head and MRI with MRS

Preoperative investigations included: chest x-rays, blood tests, urinevsamples, EKG, and bacteriological examinations when possible in some cases of infective foci located peripherally.

The treatment policy that was followed at our institute was antiedema measures in the form mannitol and dexamethasone until surgical intervention was completed and steroids were tapered after that. Antiepileptic medications were instituted for all supratentorial abscesses for a minimum of 1 month and continued in patients with seizures for a period of 2 years.

At our institute Burr hole and drainage was standard therapy with intraoperative use of Ultrasound for abscess cavity localisation and it also add in aspiration of abscess through burr hole. Cases which are multiloculated and are large with thick capsule walled and associated edema were treated by craniotomy and excision of abscess cavity. After drainage, samples were sent for Gram stain, culture and sensitivity. Patients were treated with initial empirical triple broad spectrum antibiotics which included vancomycin 15 mg/kg IV 8 hourly, ceftriaxone 25 mg/kg IV in two dived doses and metronidazole 15 mg/kg IV in 3 divided

Doses. Antibiotics were escalated according to culture and sensitivity,and continued for 6 weeks post op. Follow-up head CT was performed in 1 week before discharge from hospital.

Table -1 Clinical presentation

S.N	Clinical presentation	Frequency	Percentage
1	**Headache**	**38**	**84.4 %**
2	**Ear discharge/Ache**	**24**	**53.3%**
3	Focal deficiet	**9**	**20.0%**
4	Vomiting	**7**	**15.55%**
5	**Altered sensorium**	**4**	**8.88%**
6	**Seizure**	**3**	**6.66%**
7	**Fever**	**8**	**17.77%**

Table-2 Etiology

SN	Source/Etiology	Frequency	Percentage
1	**Otogenic**	**24**	**53.33 %**
2	**Tubercular**	**6**	**13.33 %**
3	**Cardiogenic**	**5**	**11.12 %**
4	**Traumatic**	**2**	**4.44 %**
5	**Post Craniotomy**	**2**	**4.44 %**
6	**Unknown**	**6**	**13.33 %**
Total		**45**	**100 %**

Table -3 Location of Lesion

S.N	Frequency	Percentage
Temporal	19	42.2
Frontal	8	17.7
Parietal	7	15.5
Cerebellar	6	13.3
Multiple	2	4.4
Subdural empyema	1	2.4
Epidural	1	2.4
Thalmic	1	2.4
Total	45	100

Table -4 Surgical Procedure

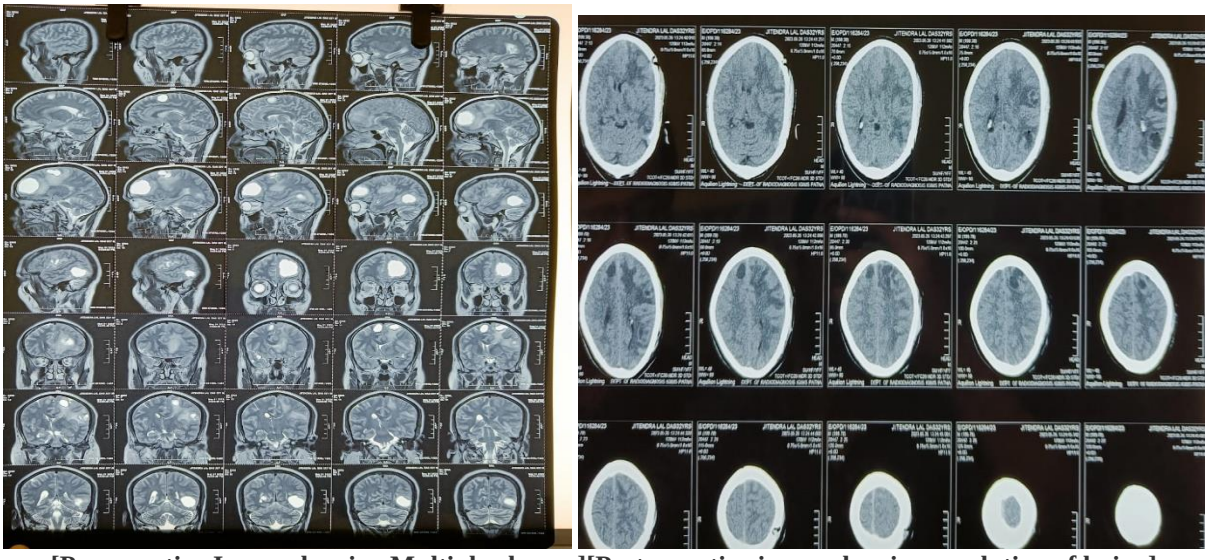
S.N	Surgery	Frequency	Percentage
1	Burr Hole and Aspiration	33	73.33 %
2	Burr Hole and multiple Aspiration	4	8.88 %
3	Craniotomy and subdural empyema drainage	2	4.44 %
4	Craniotomy and capsule Excision	5	11.11 %
5	Craniotomy and epidural Abscess Drainage	1	2.22 %

Table-5 Complication

Complication	Surgical site infection	Pseudomeningocele	Pyoventricle	Recurrent aspiration	Neurodeficit
Frequency	2	1	1	1	1

Table -6

Culture Positive	13
Culture Negative	32



[Preoperative Image showing Multiple abscess][Postoperative image showing resolution of lesion]

Figure showing Brain abscess pre op and post

III. RESULTS

In the present study, there were 45 cases in in which 32 were male and 13 were female with a ratio of 2.4:1 .Mean age of study population was 43.6 years years (range: 9-62 years) The median number of days to diagnosis was 7 (range: 2-48 days).

Clinical presentation

The most common presenting features [Table 1] were Headache and ear discharge in our study population. Almost all patients were complaining of some degree of headache. Of those patients with CSOM (*n* = 24),53 % had history of ear discharge. Focal neurological deficits were seen in about 20 % of the study population. Vomiting was seen in 15 % of the cases .About 6 % of the study population presented to the emergency department in a state of altered sensorium with seizure. Out of 45 cases 8 had history of fever .The majority of cases presented in a immunocompromised state in the form of malnutrition tuberculosis , chronic ethanol abuse, chronic liver disease, and diabetes).All were negative for HIV infection or intravenous abuse. Association with heart defects was present in 8.33% of cases

In our study majority of cases were otogenic in origin [Table 2]. There were 24 cases of otogenic origin as a result of chronic suppurative otitis media (CSOM), followed by other identified sources including tubercular 6 , cardiogenic lesion 5, and others 15 cases . In 13.33% cases, the cause of brain abscess was not identified.
The temporal lobe was the most common site [Table 3] followed by frontal and parietal . Supratentorial location was more common than infratentorial location.
Almost all cases were managed with Burrhole and aspiration of the abscess initially. Craniotomy and excision of abscess wall was done in 5 cases .Only 2 cases was managed by Craniectomy and abscess drainage for subdural empyema. In 2 cases of CSOM , MRM was done at a later date by ENT department for recurrent abscess with mastoiditis. [Table 4].

Microbiology and complication-

Most of the specimens sent for culture and sensitivity were sterile presumably due to the use of preoperative antibiotics. Only 46.6% showed positive culture.
Most common isolates were staphylococcus in 9 cases followed by proteus and klebsiella and mixed growth.. All cases were treated with appropriate antibiotics for 8 weeks.
Major complications observed are listed in Table 5. There were one death seen which was a case of cyanotic heart disease .common minor complication noted was thrombophlebitis likely due to prolonged use of IV antibiotics.

Outcome

All surviving patients were followed up in outpatient clinic for at least 3 months. All of them had Glasgow outcome scale of 5/5. Surgical site infection and pseudomeningocele was resolved at the 6 week follow up visit. Facial palsy resolved in 3 cases, with residual palsy present in 1 case at follow-up cessation (3 months).

IV. DISCUSSION

Brain abscess comprises approximately 8% of all space occupying lesions in the brain in developing countries**[1,2]**. Abscess is the second most common type of intracranial complication of otogenic origin, with temporal lobe being the most common site of pathology. Clinical presentation varies among patients. The classic triad of fever, headache and focal deficit is rarely seen. Features of raised intracranial pressure with or without localizing signs require early radiological imaging to avoid inadvertent delay in management**[4]**. Contrast enhanced CT scan of the head is the mainstay of diagnostic modalities**[5]**, providing rapid means of detecting the lesion. MRI, combined with diffusion-weighted (DWI) and apparent-diffusion coefficient (ADC) images, is a valuable diagnostic tool in differentiating brain abscess from primary, cystic, or necrotic tumors with positive predictive value of 98% and negative predictive value of 92%**[6]**. Cultures of blood and cerebrospinal fluid identify the causative pathogen in approximately one quarter of patients. Cultures of cerebrospinal fluid may be valuable in patients with coexisting meningitis. Lumbar puncture can lead to herniation in such situations**[7]**.

There is no pragmatic rule for the treatment of brain abscess. Treatment of each case is individualized depending up on the location, size, and stage of abscess. The mainstay of treatment is prompt action and initiation of antibiotics. However, surgery is crucial for the identification of the causative pathogen and for the purpose of reducing the size of the abscess.

With the use of modern stereotactic neurosurgical techniques, almost any brain abscess that measures at least 1 cm in diameter is amenable to stereotactic aspiration, regardless of location. Stereotactic navigation systems can be used for abscess drainage**[8]**.

Nonoperative management of small abscess with broad spectrum antibiotics is also common. In the present study we managed the cases with burr hole and abscess aspiration with USG Assiatance for localisation.

Abscess wall excision was done in cases which required additional procedures, like evacuation of subdural or epidural pathology. It was also indicated that following multiple aspirations fail to result in abscess resolution.

Another important aspect of care is managing the primary source. A number of studies have shown good results with concurrent abscess drainage and mastoidectomy in the same setting without added morbidity in cases with CSOM. They have shown low recurrence rate, though not statistically significant**[9]**. Other procedures being carried out include transmastoid approaches for abscess**[10]** drainage

Brain abscess is seen in 5%-18% cyanotic congenital heart diseases and these individuals are 10 times more prone to develop brain abscess then those without cyanotic heart disease. Tetralogy of Fallot is the most common cardiac condition associated with brain abscess. Right-to-left shunt, hypoxia, acidosis, and increased viscosity decrease the perfusion in the brain resulting in micro infarcts, which provide the milieu for organisms to form abscesses.

Important criteria for evaluating treatment are the neurologic condition of the patient and abscess size on imaging. Cranial imaging should be performed immediately if there is clinical deterioration; after 1 to 2 weeks if there is no improvement; and on a biweekly basis for up to 3 months until clinical recovery is evident**[11]**. Culture positivity is low in cases of brain abscess. In the present study, organism growth is seen only in 28.8% cases. In a study done in India, only 20% culture growth was noted whereas in China only 13% showed organism growth **[12]**. Use of antibiotics before samples are drawn may be the reasons behind the higher number of negative culture reports. However, metagenomics analysis and nucleotide sequence analysis are being used in some centers to identify the responsible organism and they have been able to identify bacteria that have never been incriminated as a cause for brain abscess**[13]**.

Tract hematoma, abscess cavity hematoma, extension of abscess into the ventricles, surgical site infection,meningitis, sinus thrombosis and mortality are known complications of brain abscess management. Apart from this, drug-related complications including minor rashes (potentially due to phenytoin use) are common side effects.

We commonly use anti-epileptics at least for 1 month and continue if seizure is present. Cerebral hemisphere was the most common site (84.32%) of abscess in the present study, which was similar to the previous study done by Sharma et al**[14]**. One patient developed hematoma adjacent to the aspiration site, which can be explained either by direct injury to the vessel during aspiration or reactive hemorrhage due to rapid decompression of the abscess.

In the present study one patient died in post op day 2 who was a case of multiple brain abscess with cyanotic congenital heart disease and came with features of raised ICP. in pre-CT era, mortality rate was about 40%-60%. This has decreased to 6%-17% currently **[15,16]**. Preoperative GCS remains the best prognostic factor **[16]**. Patients with intraventricular extension of abscess carry higher mortality rates of up to 48%, even in this modern era[**17]**.

In conclusion, with the advent of modern technology in radio imaging, mortality rates of brain abscess have improved over the decades as compared in the past. Outcomes may be poor if not treated early which is particularly challenging given non-specific presentation of many patients with brain abscess. Thus, a high index of suspicion is required in patients with features of raised ICP.

Burr hole with aspiration is an excellent option for surgical management. Major craniotomy and excision should be preserved for multiloculated, recurrent, large size abscess cavities only. Use of USG in localisation of abscess is very important.Culture positivity is very low, so longer broad spectrum intravenous and/or oral antibiotics help in early resolution. Involvement of the otorhinolaryngology team to address the primary source has further helped improve outcomes in cases of otogenic brain abscess.

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