OTOGENIC BRAIN ABSCESS MANAGEMENT STRATEGY : AN INSTITUTIONAL EXPERIENCE.

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Abstract:

Otogenic brain abscess is a potentially life-threatening complication of otitis media, which requires a high index of suspension for prompt diagnosis and management. This study is a retrospective analysis of 20 cases of otogenic brain abscess that has been managed at our institute from 2000 to 2018. Although the prevalence has decreased significantly due to the use of antibiotics, the problem still persists. Headache, fever and vomiting are the most common presenting symptoms. The use of advanced imaging techniques has contributed a lot in making the diagnosis faster. In contrast to previous studies where the temporal lobe is the most common site, both cerebellar and temporal lobe involvement has been seen to occur equally among our study population. . Pseudomonas was found to be the most common organism as compared to Proteus mirabilis in most of the recent studies. Immediate therapy with intravenous antibiotics was found responsible for 32% of the sterile cultures. Twelve(60%) of our patients underwent interval mastoidectomy, of which seven patients underwent mastoidectomy at two weeks, and five patients were intervened at six weeks and rest eight were managed in the same sitting. No change was observed in these groups in terms of outcome after six weeks of follow-up. Although rare brain abscess continues to be a serious complication of otitis media which needs immediate attention with a multidisciplinary approach.

Keywords: Brain abscess; Otogenic infection; Otitis media; Magnetic resonance imaging; Computed tomography

Introduction:

Otitis media is a common condition that may rarely lead to intracranial complications, which may be life threatening. Although rare in acute, both acute and chronic otitis media may give rise to these complications. Intracranial complications secondary to otitis media include extradural abscess, subdural abscess, meningitis (with or without encephalitis), otogenic brain abscess and lateral sinus thrombophlebitis. Both immunocompetent and immunocompromised individuals have been noted to suffer from otogenic brain infections. The predisposing factors for brain abscesses include repeated upper respiratory tract infections, sinusitis, chronic suppurative otitis media, trauma, solid organ transplant recipients, acquired immunodeficiency syndrome (AIDS) patients, dental manipulations/ infections and post neurosurgical procedures (1). After meningitis, brain abscess represents the second most common intracranial complication of otitis media (2). Localised inflammation and infection of brain parenchyma defines brain abscess, which is a life-threatening clinical condition demanding immediate attention. It is reported that roughly 50% of the brain abscesses in adults and 25% in children are otogenic in origin (3). Though the incidence has significantly reduced due to the advent of antibiotics (4), nonetheless, it warrants early diagnosis and management. The availability of better imaging techniques like high resolution computed tomography, and magnetic resonance imaging has provided the platform for early diagnosis and intervention. The mortality rate of otogenic brain abscess has come down to 3% from 14 to 35% in the past (5). Intracranial spread occurs through bony defects caused by cholesteatoma, preformed fracture lines, haversian system of veins, the periarterial space of Virchow-Robbins, Trautmann's triangle, venous thrombophlebitis (6). Cerebellar abscess spreads occur mainly through Trautmann's triangle and temporal via tegmen. The treatment modalities for brain abscess are conservative or surgical, which includes burr hole aspiration or craniotomy and abscess drinage. According to Ndubuisi et al. (7), mode of treatment does not affect the mortality rate. The most critical factors influencing mortality were the pre-admission coma score and presentation with seizure. Appropriate antimicrobial therapy is initiated, followed by surgical intervention. Depending on the extent of involvement of the brain compartments, the size, and numbers of abscesses, neurosurgical drainage is performed either through open craniotomy and drainage or by drainage through a burr hole (2). After drainage or in the same sitting mastoidectomy is done to avoid recurrence and remove the source of infection. Identification of microbial cause and antimicrobial susceptibility profile guided specific intravenous antibiotic treatment initiation was found to show better patient prognosis (8). In a study by Penido et al. (9), a 15-year observation revealed that the most common organisms involved are proteus, pseudomonas, streptococcus and Haemophilus species. In the present study, 32% of the culture was sterile, while pseudomonas was found to be the most common culprit. Although rare, brain abscess continues to be a serious and life-threatening clinical condition that calls for immediate medical attention in order to reduce the resulting morbidity and mortality.

Materials and method:

A retrospective study was carried out at our institute that included all the cases of otogenic brain abscess that were admitted and managed from 2000 to 2018. The cases where the outcome of the surgical intervention was not found after at least six weeks of follow up were excluded. Twenty cases met the inclusion criteria, and a detailed analysis was done regarding age, sex, symptoms, signs, imaging, site of an abscess, other otological complications, antimicrobials, surgical procedures and microbiology. (Table 1).

Table 1: Patient data

PA- Pseudomonas aeruginosa, S- Sterile, CNS-Coagulase negative staphylococcus, B-

S. No	Age (yrs.)	Sex	Symptoms	Site of abscess	Surgical Intervention (Mastoid exploration)	Culture/ Microscopy
1	14	F	F, H	Rt Temporal lobe	Interval (6 weeks)	SA, Ss
2	15	M	F, H, V	Lt Temporal Lobe	Interval (2 weeks)	S
3	50	F	H, V, 7^{TH} Palsy	Rt Temporal lobe	Same sitting	PA
4	26	M	F, V, H	Lt Temporal Lobe	Same sitting	S
5	20	F	F, V, H	Rt Temporal lobe	Same sitting	S
6	14	F	F, H, V, AS	Left Parieto-Occipital	Interval (2 weeks)	S
7	34	M	F, H	Rt Cerebellar Tubercular Abscess	Same sitting	CNS
8	30	M	F, H, V	Multiple intra cerebellar abscess	Same sitting	B
9	42	M	F, H, V	Lt Cerebellar	Interval (2 weeks)	PA, PM
10	15	M	F, H, V	Rt Cerebellar	Interval (2 weeks)	PA
11	28	M	F, H, Vertigo	Rt Cerebellar	Interval (6 weeks)	CNS
12	15	M	F, H	Rt Temporal lobe	Interval (6 weeks)	S
13	28	M	F, H	Lt Temporal Lobe	Interval (6 weeks)	PA
14	24	M	F, H	Rt Cerebellar	Same sitting	PA, AC, Ss, CNS.
15	12	F	F, H	Lt Temporal Lobe	Interval (2 weeks)	SA (MSSA)
16	16	F	F, V	Rt Cerebellar	Same sitting	S
17	8	M	F, H, V	Rt Cerebellar & Rt Temporal Lobe	Same sitting	S
18	12	M	F, H, V, LOC	Lt Cerebellar	Interval (6 weeks)	S
19	12	M	F, V, H, LOC	Rt Cerebellar	Interval (2 weeks)	B
20	28	M	H	Left Temporal	Interval (2 weeks)	GPC, SA, Ss

Bacteroides species (Gram negative bacilli), PM-Proteus mirabilis, AC- Anaerobic cocci, Ss-Streptococcus species, SA- Staphylococcus aureus, F-Fever, H-Headache, V-Vomiting, LOC-loss of consciousness, AS-altered sensorium

Results:

Male preponderance was observed with a male: female ratio of 2.3:1. 70% of the cases were males, rest 30% were females (Fig 1).

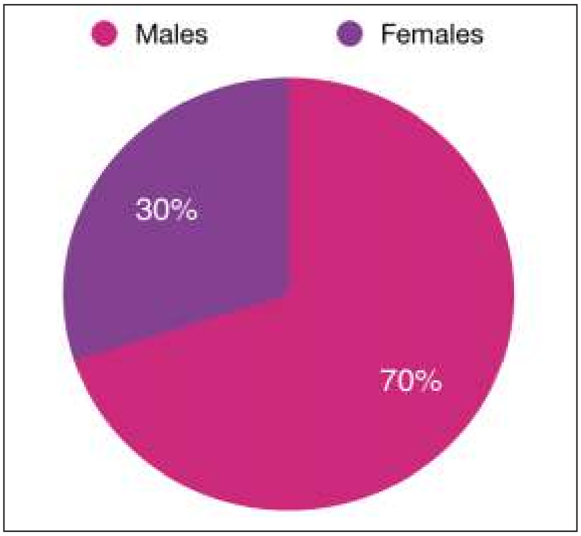


Fig 1: Sex Ratio

Mean age of the patients was 22.15 years, ranging from 8 years to 50 years. Out of these, 45% were below the age of 16 years (Fig 2).

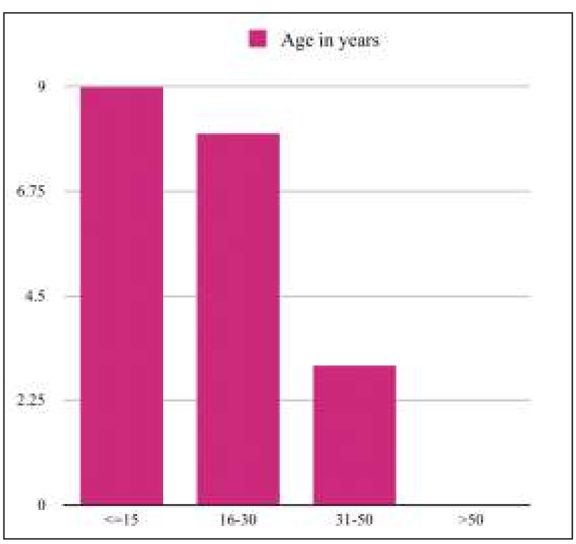


Fig 2: Age Distribution

90% of the patients presented with fever, out of which 2(11%) were associated with chills and rigor, 2(11%) with loss of consciousness and 1(5.5%) with altered sensorium. 95% of the patients suffered from headache and 60% with vomiting. This was consistent with other studies where the headache was the most common symptom. Regarding concomitant complications of COM, one case presented with facial paresis and one with vertigo due to labyrinthine fistula.

Twelve of our patients underwent interval mastoidectomy, of which seven patients underwent mastoidectomy at two weeks, and five patients were intervened at six weeks, and rest eight were managed in the same sitting.

High-resolution CT scans and MRI was done in all cases showing well-defined peripherally enhancing mass lesion. 95% of cases had a solitary abscess, while 1(5%) had multiple abscesses in the cerebellum. Earlier studies and observations have concluded that otogenic brain abscess is more commonly seen in the temporal lobe, but in this study, it was seen that temporal and cerebellar abscesses were equally distributed- 45% each. One case had an abscess in both the sites and one was located in parieto-occipital lobe(Fig 3).

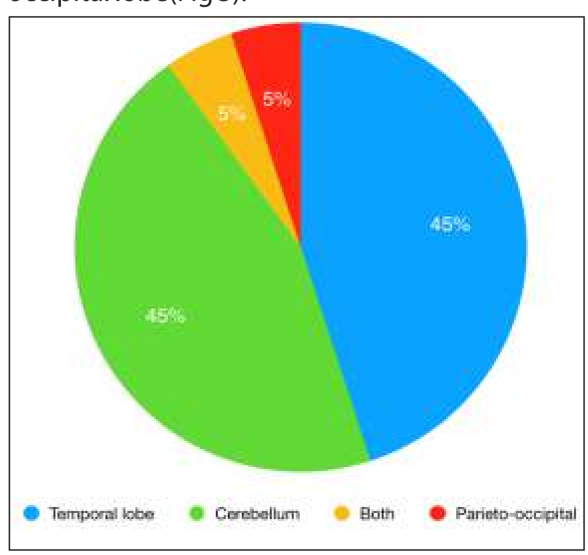


Fig 3: Site of Abscess

If the bony walls of the middle ear cleft are intact, this points towards the fact that the brain abscess has occurred due to thrombophlebitis. 25% of the cases had intact middle ear cleft intraoperatively, out of this only one was temporal lobe abscess, rest were cerebellar. Hence, we might conclude that thrombophlebitis more commonly leads to cerebellar abscess rather than the temporal lobe. In rest of the temporal lobe abscesses, tegmen plate was eroded, which was evident in the CT scan as well. The lateral semicircular canal was eroded in one case, in which the fistula test was positive and was having vertigo. One case with facial paresis had fallopian canal eroded in the mid vertical segment, which was decompressed in the same sitting. Incus was the most commonly eroded ossicle, followed by malleus. Cholesteatoma was found in 70% of the cases, and the rest had granulation tissue.

Most common organism found in culture/microscopy was pseudomonas followed by staphylococci. Proteus was found only in one case. Other organisms included streptococci and gram-negative bacilli (Fig 4).

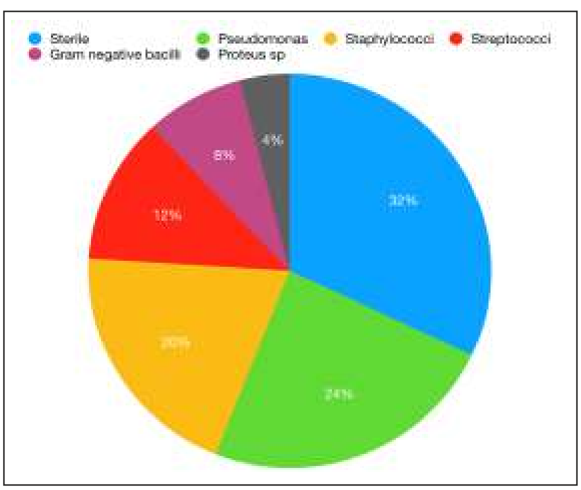


Fig 4: Culture/Microscopy.

Discussion:

The history of intracranial complications of otitis media goes back to 460 BC when Hippocrates noted that acute pain in the ear and continuous high fever might lead to delirium and death (10). It was Morgagni who brought forward the fact that ear infection came first, and brain abscess was secondary (11). In the pre-antibiotic era, complications of otitis media were abundant with high morbidity and mortality. The management of otogenic brain abscess remained in the hands of otological surgeon until sulfonamides and penicillin began to be used in around 1942 (11). With the advent of the antibiotics, intracranial complications of chronic otitis media have become scarce. The estimated incidence now is between 0.3% to 1.97% (12,13), as compared to the pre-antibiotic era, where it occurred in 2.3 to 6.4 % of cases (14).

Otogenic brain abscesses are mostly located in the temporal lobe and cerebellum, with the middle segment of the temporal lobe and lateral lobe of the cerebellum most frequently affected. Formation of brain abscess undergoes four stages (1) wherein the first stage the bacteria invades into the brain tissue resulting in neutrophil astrocytes and microbial cell activation and edema, in the second stage infection spread to the adjacent brain tissue involving macrophages lymphocytes and resulting in necrosis. Development of a vascularized capsule surrounding the lesion characterizes the third stage, which is responsible for the ring enhancing lesion on CT scan. The final stage of a brain infection involves the destruction of the capsule and for the involvement of surrounding healthy brain parenchyma. The occurrence of brain abscess depends on the immune status of the patient type and virulence of microbes involved and use of antimicrobial agents (15).

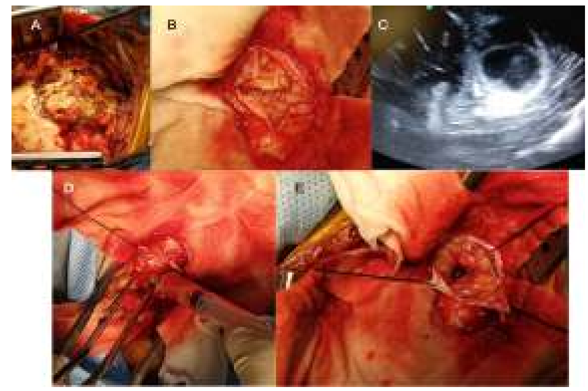
In our study, the cerebellum and the temporal lobe were equally affected (45%), with one case involving both and one case with the involvement of parieto-occipital lobe. The site of abscess varies in different studies from Murthy et al. (16) stating that cerebellar abscesses are four times more common than temporal to vice versa by Samuel J et al. (17). Usually, there is a single abscess; the chance of multiple abscesses varies from 19-33% (18). We had only one case presenting with multiple cerebellar abscesses.

Literature review showed that otogenic brain abscesses are very rare in children; however, our observation does not support this finding. Out of 20 cases, 9 (45%) were below 16 years of age.

The most common presentation of our patients was a headache, fever, and vomiting. Loss of consciousness was found in 10%, altered sensorium in (5.5%) and facial paralysis in 5%. Our patients' presentations are more similar to the literature (16,18). According to a review study done by Maria J. Duarte et al. (19), purulent otorrhoea was found in 5.7% to 92% of cases. In the present study, it was found in 65% of cases.

The management of otogenic abscess varies from conservative management with antibiotics to radical excision. The possibility for conservative management can be considered when there is no neurological deficit, abscess less than 2.5cm, multiple abscesses, and when there is an absolute contraindication for surgery. Guided aspiration can be considered when the abscess size is more than 2.5cm in size or multiple abscesses abscesses near critical areas, and when there is a high chance of complications. Radical excision of the abscess cavity should be considered when there is a multilobulated abscess, posterior cranial fossa location (18). However, the timing of mastoidectomy is controversial. Some state that neurosurgical drainage should be done prior followed by mastoidectomy in the same sitting (2,20,21), while others are convinced for interval mastoidectomy after six weeks (16). In our study, eight patients underwent neurosurgical

Fig 5: Cerebellar abscess drainage. A) Mini craniotomy site (mastoid and occipital bone) B) Dural incision C) USG guided confirmation of abscess depth before drainage D) Abscess drainage E) after complete drainage of the abscess.



(Figure 5) and otological intervention at the same sitting.

Interval mastoidectomy was done in 12 (60%) cases of which underwent surgery and event at six weeks interval and rest 7 had surgery after 15 days. We consider for same sitting intervention when the general condition of the patient is fit for prolonged anesthesia. However, this is not always possible, where the patient will go for neurosurgical intervention first and then plan for interval mastoidectomy. Even though the ideal window period for interval mastoidectomy is six weeks, but most of our patients were from the low socioeconomic status and distant places, we reassessed the patients after their primary neurosurgical intervention at two weeks. If the patient was stable and fit for anaesthesia, we proceeded with mastoidectomy (Figure 6) at two weeks. We did not see any difference in their outcome.

Polymicrobial cultures with the high incidence of anaerobes are reported, most common being Proteus mirabilis (19). Most of the post operative cultures in our series reported no organism growth after 48 hours of incubation. The use of prompt preoperative intravenous antibiotics can be credited for the results. Also, unlike many other studies where the most common gram-negative bacilli found was proteus, in a series, a change in trend was seen shifting to pseudomonas. We also noted the rise in coagulase-negative staphylococcus incidence in contrast to literature (18). This change may be due to increased prevalence of pneumococcal vaccination.

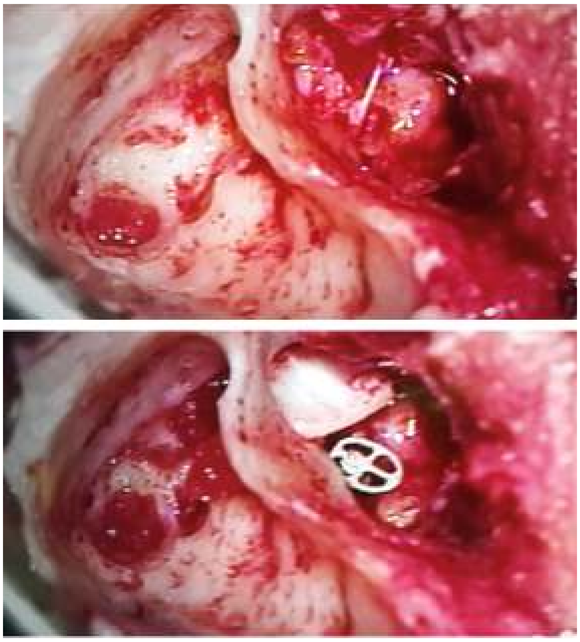


Figure 6: Mastoid cavity and middle ear reconstruction after canal wall intact mastoidectomy.

Current guidelines for the antibiotic coverage are a third-generation cephalosporin plus metronidazole with consideration of adding another drug to provide coverage for methicillin-resistant staphylococcus aureus (MRSA) for at least four weeks (21). This protocol was strictly followed in our study. Although otogenic brain abscesses are rare, one should be vigilant for any clinical signs pointing towards it. Timely diagnosis and prompt treatment with antibiotics, abscess drainage followed by mastoidectomy is the basis for management. Interval mastoidectomy or that done in the same setting does not affect the outcome.

Conclusion:

The incidence and mortality of Otogenic brain abscess have markedly reduced owing to the use of antibiotics, imaging techniques and prompt intervention. Marked male preponderance is seen with headache as the most common symptom. Temporal and cerebellar lobes are equally involved, with pseudomonas as the most common organism. Burr hole aspiration versus craniotomy does not affect the outcome; neither does mastoidectomy that is done in the same sitting or at an interval. A high index of suspicion, early diagnosis, and vigilant intervention trails to a better outcome.

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