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Monitoring the Evolution of Otogenic Brain Abscess--Changing Trends in Management

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Abstract: *This is a one year prospective study conducted in a tertiary referral teaching hospital. The study included 33 cases of otogenic brain abscess with chronic otitis media. HRCT scan of the temporal bone were done to stage the abscess. Depending on the stage, immediate and delayed aspiration with substitution by antibiotic solution were carried out and clinico-radiological outcome compared. This study evaluates the clinical presentation and the role of CT scan in deciding the appropriate time of surgical aspiration of otogenic brain abscess and substituting with antibiotic followed by mastoidectomy. Patients commonly presented with aural discharge, fever and headache with 75.5% cases having temporal lobe abscess. CT scans showing initial encephalitis or latent stage (n=21) were treated conservatively, out of which 28.6% cases showed resolution .Those showing evidence of localization (n= 12) were treated by aspiration with substitution of antibiotic solution, out of which all cases showed resolution. We conclude that close CT scan examination can help to inform the localisation and stage of a purulent inflammatory process in the abscess. This information can be reliably used to predict the timing and modality of surgical treatment i.e aspiration with substitution by antibiotic solution ,with satisfactory postoperative and long-term outcome.*

Keywords : *Chronic suppurative otitis media, HRCT temporal bone, Otogenic brain abscess*

I. Introduction

Otitis media, acute or chronic, is a potentially dangerous disease which may lead to fatal complications. Although meningitis is the most frequent complication,[1,2] otogenic brain abscess remains a serious intracranial complication with relatively high morbidity and mortality despite technological advancements in diagnostics and antibiotic treatment during the last decades. Fifty per cent of brain abscesses in adults and 25 per cent of those in children are otogenic in origin[3] .Other predisposing factors are paranasal sinus infection and congenital heart disease.[4] Otogenic brain abscess may be extradural (most common), subdural, intracranial or intracerebellar. Temporal lobe abscesses are more common than cerebellar abscesses. Subdural abscess are uncommon and have a tendency to extend to nearby areas. The inflammatory process most frequently spreads into the endocranium directly through destruction of the bony walls of the middle ear or through thrombophlebitis or preformed pathways.

II. Objective

- To evaluate the clinico-pathological presentation and to ascertain the role of CT scan in the staging of otogenic brain abscess.
- To assess the outcome of different approaches viz, transcanal, transmastoid and burr-hole aspiration of abscess with substitution by antibiotic solution.
- To assess the clinical outcome of conservative management versus aspiration drainage of brain abscess and otosurgical procedure in the same sitting.

III. Materials And Methods

This was a prospective case series conducted during a five year period (September 2014-September 2015) at Department of Otolaryngology, Silchar Medical College Hospital, an academic tertiary referral center. Thirty-three patients clinically diagnosed as having intracranial abscess that was secondary to suppurative otitis media and confirmed by computed tomographic (CT) scanning. Data regarding age, gender, clinical otorhinological examination , neurologic and ophthalmologic findings were considered. In particular, the CT scan findings were thoroughly studied.

Patients were separated into two groups (Group A and Group B) based on the stages of abscess formation evident in CT scan of brain. Group A consisted of patients whose CT scan showed initial encephalitis or latent stage (Stage 1). These patients were treated conservatively with high-dose antibiotics and steroids under regular clinical and radiological control and a follow-up CT scan was done after 1 week to assess the response. In Group B, patients already had well localized and encapsulated brain abscess in their CT scan on presentation.

All patients with localized abscess underwent immediate transmastoid, transcanal or burr-hole aspiration with wide-bore (6mm) needle with substitution by broad-spectrum reconstituted antibiotic solution of Inj. Ceftriaxone (1gm) under general aneasthesia. The site and direction of placement of needle was done under CT localization of the abscess with antibiotic coverage and systemic steroid. Pus was sent for culture and sensitivity. All patients were operated for modified radical mastoidectomy concurrently or at a later date based on the general condition of the patient using retroauricular or endaural approach.

IV. Results

During the study, a total of 33 cases were diagnosed with otogenic brain abscess. Out of them, 18 (54.4%) were males and 15(45.5%) were females (Fig:9). The mean age was 21 years (range 9 - 65 years). The commonest presenting complaint was headache (90%) followed by fever in 25 cases (75.7%) and drowsiness in 20 cases (60.6%). Convulsion was the presenting feature in 54.5% of cases and 51.5% cases also had vomiting. Nystagmus with vertigo with cerebellar signs & symptoms was seen in 6 (18.1%) patients and one patient had lateral rectus paresis. (Fig:8). In addition to these, all the patients also presented with decreased hearing and discharging ear, the duration varied from childhood to as short as three months.

On otoscopic examination, the commonest type of TM perforation seen was attic perforation (54.54%) followed by posterior marginal perforation in 30.3% patient. Subtotal perforation is seen in 15.15% cases (Fig:10). Cholesteatoma was associated with 75.75% cases. Hearing tests revealed mixed loss in most of the cases (63.63%) and conductive loss in 36.36% cases.

On radiological evaluation, X-ray mastoids showed cholesteatoma in 27 cases (81.8%) and sclerotic mastoid in 6 (18.18%) patients. Contrast enhanced CT scan of temporal bone and brain showed intracranial solitary abscess of varying sizes. Temporal lobe abscess was seen in 25 cases (75.5%) and cerebellar abscess in 8 (24.5%) patients (Fig:11). CT scan features of the abscess revealed initial encephalitis stage or latent stage abscess in 21 cases (Group A) and well localized abscess with capsule formation noted in 12 cases (Group B). The microbiological culture of pus revealed the most common organism to be Proteus mirabilis and Enterococcus 17 cases (51.51%) followed by Pseudomonas aeruginosa in 16 cases (48.48%).

In Group A (n=21), 6 cases had cerebellar abscess and 15 cases had temporal lobe abscess. This group of patients were treated conservatively with systemic antibiotics and steroids under regular clinical and radiological control. They were followed up by repeat CT scan after 1 week to assess the response of the treatment. Out of 21 cases, 6 cases (28.6%) showed resolution of the abscess and conservative management was continued followed by otosurgical procedure (Fig:12). In the rest 15 cases, evidence of localisation (capsule formation) was seen with enlargement of abscess evident in 1 case.

In Group B (n=12), on presentation itself localized abscess was seen in temporal lobe in 10 cases and cerebellar abscess in 2 cases. These patients and the patients from Group A with well localized intracranial abscess (n=27) were offered transmastoid, transcanal or burr-hole aspiration of the abscess with substitution of equal volume of broad spectrum reconstituted antibiotic solution. Transcanal and transmastoid aspiration through dehiscence in the mastoid was done in 11 cases (40.7%) and 8 cases (29.6% cases) respectively. Burr-hole aspiration (6mm needle) was done in 8 cases (29.6%) (Fig:13). This procedure is followed up concurrently with modified radical mastoidectomy or tympanomastoidectomy in 20 cases (74%). In rest of the cases (13 cases) ear operation was done within 1 week when the patients' general and neurological condition stabilized. Repeat aspiration within 1 week due to reformation of abscess was required in 2 cases of transmastoid approach and one case each with burr hole and transcanal approach.

Post-operatively, clinical and radiological improvements were seen in all patients. Three cases (11.11%) had seizures post-operatively and was successfully treated with anticonvulsants. No significant neurological deficit was noted. There was no mortality reported in the series. All cases were followed up at 6 months with only one case reported with epilepsy (Fig:14). Besides 6 cases (22.2%) with moderate conductive hearing loss, 15 cases (45.45%) had severe mixed hearing loss while 12 cases (36.36%) had moderately severe conductive hearing loss in the affected ear. All of the cases had dry ear barring one case which had persistent aural discharge.

V. Discussion

Otogenic intracranial complications are rare but typical follows acute or chronic ear infection like mastoiditis and cholesteatoma. A life-threatening sequelae is the otogenic brain abscess. The commonest cause of the intracranial brain abscess is chronic middle ear infection (73%)[6]. 86.5% of brain abscesses are otogenic in origin while other septic foci are rhinogenic (12.2%) and tonsillary (1.3%).[5]

In our study, the mean age was 21 years (range 9 - 65 years) with male preponderance. Nesić V in his study, reported the median age of 33.5 years.[7] The younger age group in our study suggests that patients in this age-group are more susceptible to intracranial complications due to poor aural hygiene, depleted immunity, lack of early treatment of CSOM and ignorance of its complications. Patients were mostly from rural areas (25

cases,75.5%) and with respect to their level of education, those with elementary or high school degrees were predominant.

On otoscopic examination, the commonest type of TM perforation was attic perforation (54.54%) followed by posterior-superior marginal perforation in 30.3% patient. Cholesteatoma was associated with 25 cases (75.75%). Other studies reported association of cholesteatoma in 58.33%[9] and 95% cases.[10] These types of perforation are unsafe as cholesteatoma formation is common in these location and its bone eroding property provides easy passage of infection through the eroded tegmen tympani or antri. Subtotal perforation, seen in 15.15% cases, were due to mucosal diseases and infected granulation tissue which also leads to intracranial spread of infection. However, intact tympanic membrane with minimal changes may be regarded by the medical profession with a low index of suspicion but can also lead to severe otogenic complications as the disease can be masked by an improper antibiotic therapy[8]. Hearing tests revealed mixed loss in most of the cases (63.63%) which is mainly due to the toxins of infective organism or the enzymatic effects of cholestatoma on the inner ear organs which is in addition to conductive loss from ossicular chain erosions commonly seen in CSOM.

On radiological evaluation, X-ray mastoids showed cholesteatoma in 27 cases (81.8%) and sclerotic mastoid in 6 patients (18.18%) which correlates well with the type of perforation. However, the diagnosis of brain abscess and monitoring of its evolution was done principally by contrast enhanced CT scan of brain which showed solitary abscess of varying sizes visualising annular shadows identified as abscess capsule. Złomaniec J discussed the value of CT contrast medium enhancement in diagnosing cerebral abscess formations[13]. Although, magnetic resonance imaging (MRI) is the study of choice to evaluate otogenic intracranial complications[15], temporal bone CT scan plays an important role in the diagnosis of extracranial and intracranial complications of cholesteatoma in otitis media[14]. The use of CT has meant earlier diagnosis of brain abscess and is significant for deciding upon treatment protocol of these patients.

In our study, temporal lobe abscess was the commonest (75.5%) followed by cerebellar abscess (24.5%). This is due to the close proximity of the middle ear cleft and antrum to the temporal lobe and being separated only by the bony tegmen and antri. Similar was the finding by Sennaroglu L where he reported, temporal lobe abscess in 54%, cerebellar abscess in 44%, and both locations in 2% of cases[10,18]. On the contrary, the converse is true for the paediatric age group[11].

With respect to the stage of the abscess, in Group A (with initial encephalitis stage or latent stage abscess) out of 21 cases, 6 cases were cerebellar abscesses and 15 cases were temporal lobe abscesses. In Group B (localized abscess with capsule formation) out of 12 cases, 10 cases were temporal lobe abscess and 2 case of cerebellar abscess. Double abscess of the cerebellum of otogenic origin[12] and multiple pyogenic brain abscesses may also occur[19]. Other rare presentations are recurrent cerebellar abscess secondary to middle ear cholesteatoma,[16] latent otogenic cerebellar abscess during chronic otitis media[17] and bilateral otogenic cerebellar abscesses [21].

In our study the most common microorganisms cultured from abscess is Proteus mirabilis and Enterococcus (51.51%) and Pseudomonas aeruginosa (48.48%). This finding is similar to several other studies[10,31,29]. This shows that anaerobic organisms are mostly associated with long-standing cholesteatoma and are highly pathogenic so as to cause intracranial complications. Role of non-spore-forming anaerobic microflora in the onset and development of otogenic abscesses of the brain and cerebellum has also been reported[32]. In polymicrobial otogenic abscesses, Streptococcus faecalis, Proteus spp., and Bacteroides fragilis are most commonly found[33]. Otogenic brain abscesses may also contain gas due to fermentation of non-clostridial bacteria[30]. In intracranial-complicating acute otitis media, the commonest organism seen is the Streptococcus pneumoniae (64%)[35]. Pasteurella multocida temporal lobe abscess has also been reported in neglected chronic purulent otitis media[34].

Group A patients were initially treated conservatively with high-dose systemic antibiotics and steroids under regular clinical and radiological control as they had non-localised intracranial abscesses. These cases were in the Stage1 of brain abscess formation. It signifies localized encephalitis of white matter surrounding an infected vein with edema (Fig:1). This stage can be arrested by proper antibiotic therapy. On assessing the response of this treatment by CT scan, 71.4% (15 cases) showed evidence of capsule formation while in one patient there was enlargement of size of the abscess. Complete resolution of the abscess was noted in 6 cases (28.6%). Kumar R reported spontaneous evacuation of cerebellar abscess through the middle ear.[38] This points to the use of conservative treatment of brain abscesses, if the patient is clinically stable and CT provides the possibility of repeated checking of the dynamics of intracranial lesion[22]. In those cases which do not respond to drug treatment or when the size and particular location of the abscess threaten the patient's life should we resort to neurosurgical intervention.

The patients from Group B (n=12), and 15 cases from Group A who now had localised intracranial abscesses (n=27) were in Stage 2 (latent or quiescent) where localisation of the area of encephalitis had occurred (Fig:2). In this stage the symptoms of initial encephalitis subsides and the patient enters a symptom free latent or quiescent. In Stage 3 (encapsulation) the abscess is walled off and abscess cavity contains pus and necrotic

debris (Fig:3). The abscess actively enlarges like any undrained abscess, at the expense of its walls, by pressure necrosis and proteolytic digestion by enzymes. In this stage the actively enlarging abscess produces localizing signs and symptoms, and hence calls for immediate aspiration or excision of the abscess. We found CT evaluation of these stages of abscess formation, the most reliable diagnostic tool enabling visualisation of change and thus timing the surgical treatment and monitoring its success. It also helped us to plan before hand if aspiration during mastoidectomy will be possible. These group of patients were considered for immediate transcanal, transmastoid or burr-hole needle aspiration of the abscess.

Transcanal aspiration of pus through the middle ear was done in 11 patients where there was destruction of the tegmen tympani (Fig4,5). Microscopic examination of the ear was done to assess the area of puncture prior to inserting the wide-bore needle. This procedure is followed up with an otosurgical procedure in the same sitting or within 1 week when the patients' general and neurological condition stabilized. In 8 cases, transmastoid drainage was done concurrently during modified radical mastoidectomy or tympanomastoidectomy operation, in the location where dural or sinus plate erosion either by cholesteatoma or granulation tissue was noted in relation to the CT scan findings (Fig 6). Burr hole aspiration was considered in patients (8 cases) whose CT revealed remote location of abscess in cerebellum (Fig:7). In all the cases, site and direction of placement of needle was done after detailed study of the CT localization of the abscess. CT guided aspiration was not performed as this would make the concurrent ear surgery cumbersome and would also require CT scan facility inside the OT . On aspiration we obtained frank purulent material in all cases and was sent for culture and sensitivity. Through the same route, we substituted the abscess cavity with equal volume of broad spectrum reconstituted antibiotic solution (Inj. Ceftriaxone 1gm). This particular antibiotic was selected empirically due to its broad-spectrum coverage, ready availability in our set-up and cost-effectiveness. Green HT et al elucidated the role of penetration of ceftazidime into intracranial abscess in the therapy of otogenic intra-cranial abscess of origin[23].

In patients receiving transcanal aspiration, intact canal wall tympanomastoidectomy or attico-antrostomy could be done through end-aural approach (9 cases) in whom cholesteatoma was limited. The following advantages were observed: 1) No intraoperative problem was encountered and postoperative complications was less than the transmastoid route, 2) It is minimally invasive 3) It offers the advantage of performing conservative ear surgery in cases of limited disease, 4) It can be done in very morbid patients where general aneasthesia may be contraindicated,5) Inside-out mastoidectomy can be performed if required and a big surgical mastoid cavity avoided, and 6) is suitable for repeat aspiration of recurrent abscess in cases who had already undergone transmastoid aspiration with concurrent mastoidectomy. However, the success of aspirating the abscess through the canal requires good anatomical understanding of the location of the brain abscess based on careful study of the CT scan. However, deeply situated abscess are not possible through this route.

In patients where we have approached through a mastoidectomy for drainage of the pus, we found the transmastoid approach, technically feasible in removing the tract of suppuration, and clearing the cause and effect of pathology, at the same sitting. As exploration of the mastoid is mandatory in all longstanding cases of unsafe type of CSOM and complicating CSOM, modified radical mastoidectomy or tympanomastoidectomy operations were done to eradicate the disease and make the ear safe . The only disadvantage encountered in this procedure is when patients need repeat aspiration. It becomes unsuitable and cumbersome to reopen the wound and aspirate which again requires GA. Our results are supported by earlier studies by Ozkaya S[28] and Kurien M[41]. Other studies describing experience with the trans-mastoid approach to otogenic brain abscesses have also been reported[27,18]. Sennaroglu L in his study reported that most patients had radical mastoidectomy and evacuation of the abscess was done through mastoidectomy in 61%, burr hole drainage in 20% and craniotomy in 15%[10].

Although, the current neurosurgical options are to drain the abscess repeatedly through burr holes or to excise it completely with the capsule through a temporal or sub-occipital route depending on its location, followed by a mastoidectomy by the ENT surgeon to eradicate the primary source of infection, in our study, we could successfully treat mastoid disease and brain abscess in a single surgical intervention. Repeated needling is also avoided with this approach. None of our cases required abscess excision which meant very less neurological deficits. Residual abscess can be subsequently excised, with relatively reduced morbidity. Aspiration drainage with concurrent mastoidectomy is not only safe, but it also removes the source of infection at the same time the complications are being treated, thus avoiding reinfection while the patient is awaiting the ear surgery. Furthermore, aspiration of abscess cavity through the dehiscence during mastoidectomy is helpful in set-ups where neurosurgical facilities are not available. In addition, the treatment is completed with a single, shorter hospital stay, which is more economical for the patient.[41]

In four of our cases (14.8%), where recurrence of abscess was noted, transcanal aspiration was suitably performed within 1 week. Successful treatment of multiple relapsing abscesses of the right cerebral hemisphere of otogenic origin by repeated punctures has also been reported.[20] In the treatment of brain abscess in children too aspiration of the abscess (84% of cases) and antibiotic therapy is suggested[24]. Various other methods of

drainage of cerebral and cerebellar abscesses are with "cigar"-shape draining tampon[39], packing drainage of transmastoid approach[36], ultrasound guided percutaneous aspiration of multiple brain abscesses[25]and diffusion-weighted imaging and proton magnetic resonance spectroscopy in transmastoid drainage of pus[26].

Although otogenic brain abscess carries a 47.2 % risk of a fatal outcome and those patients who survive have a 95 per cent risk of developing epilepsy[37], results from our study showed much improved results. No significant morbidity, mortality, recurrence, or residual neurologic deficit was seen at the 6-month follow-up[9]. In our study, 11.1% had seizures post-operatively and only one case had epilepsy and were successfully treated with anticonvulsants. There was no mortality reported in our study. The overall mortality in various studies were 44.7% [29],36% [2]. In one study, where neurosurgical abscess excision was done, the overall mortality reported was 21% with epilepsy as a sequel seen in 21% of the cases[24]. Other complications reported are hydrocephalus (7%) and 10% had seizures postoperatively.[4] These improved outcome seems to be due to the minimally invasive approach to the brain abscess and eradication of infection foci through ear operation at the same sitting. On post-operative hearing assessment, severe mixed hearing loss was the commonest type of hearing impairment. One case reported persistent aural discharge due to mastoid cavity problem while rest of the cases had dry ear.

Regarding the initial presentation, headache (90%) was the commomest similar to other studies[42,43]. Therefore patients presenting with ear discharge associated with headache should be carefully evaluated for any intracranial pathology. Other presenting features were fever (75.7%), drowsiness (60.6%),convulsion (54.5%),vomiting (51.5%) and nystagmus with vertigo (54.54%) (Fig:8). Fistula test was negative in all the cases. Cerebellar signs & symptoms were present in 75% of cases of cerebellar abscess.The most common abnormality in physical examination was a decrease in the level of consciousness (20 cases, 61%). Similarly, Deric also reported headache (92%), fever (91%) and vomiting (68%) as the most common symptoms, while photophobia and vertigo were less common (38% and 30% respectively)[42]. So, for all practical purposes, all theses symptoms should suggest intracranial pathology if not proved otherwise and proper clinical examination can help us guide in diagnosing otogenic brain abscess and its location.

We found CT evaluation of stages of abscess formation, a very reliable diagnostic tool enabling localization of change, deciding upon the modality and timing of surgical treatment and monitoring of surgical success. Moreover, CT sensitivity is really good for locating multiple abscesses and have all contributed to an improved outcome for this dreaded disease.[40] CT is also indispensable in postoperative control 4 weeks after operation in case of impairment of the patients' general status or in the absence of a therapeutic effect. Therefore, the overall improved outcome of the treatment as compared to previous series should be attributed to the use of CT scan for early diagnosis, staging of the abscess, adopting needle aspiration of abscess contents through minimally invasive routes and substituting it with broad spectrum antibiotics with concurrent otosurgical procedure.

Fig 1: CT brain showing Stage 1 of abscess formation (area of encephalitis of white matter with edema)

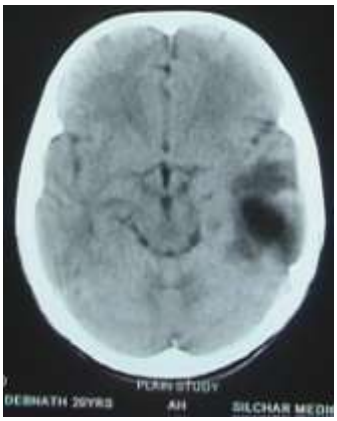

Fig 2: CT brain showing Stage 2 (latent or quiescent) of abscess formation.

Fig 3: CT brain can showing Stage 3 (encapsulation) of abscess formation.

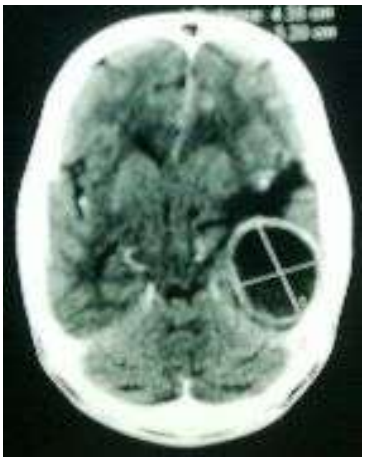

Fig 4: Stage 3 temporal lobe abscess for transcanal approach

Fig 5: Transcanal aspiration of pus through the middle ear

Fig 6: Transmastoid aspiration

Fig 7: Transmastoid aspiration

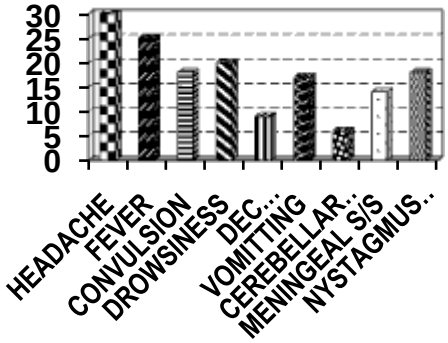

Fig 8: Symptomatic distribution

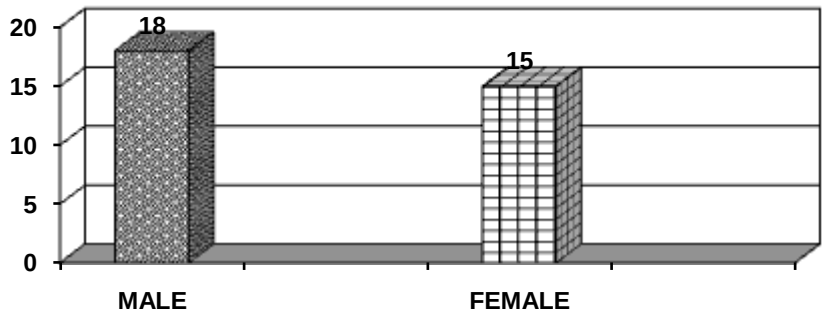

Fig 9: Gender distribution

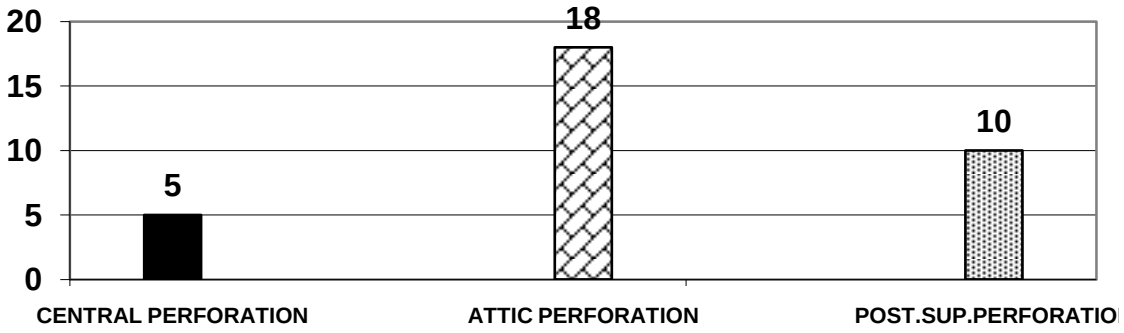

Fig 10: Types of TM perforation seen on otoscopy

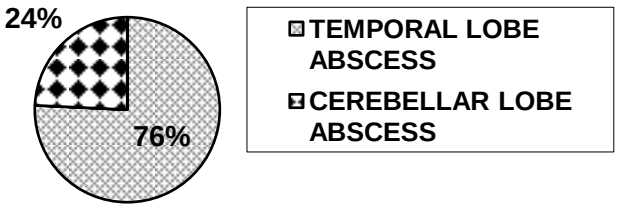

Fig 11: Distribution of location of otogenic brain abscess

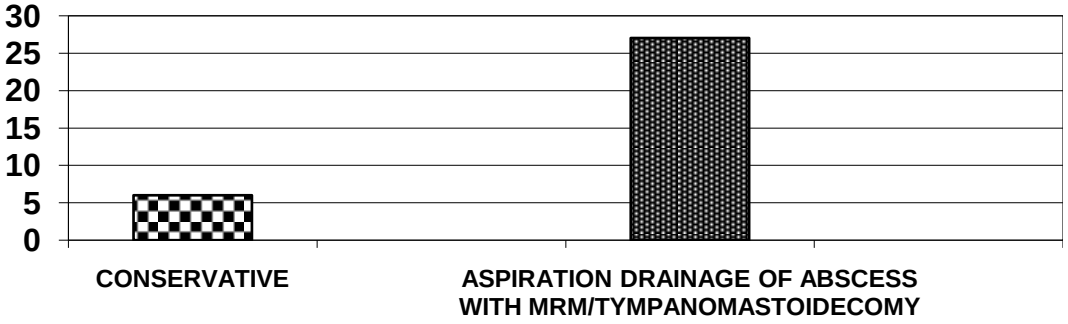

Fig12: Treatment modality offered

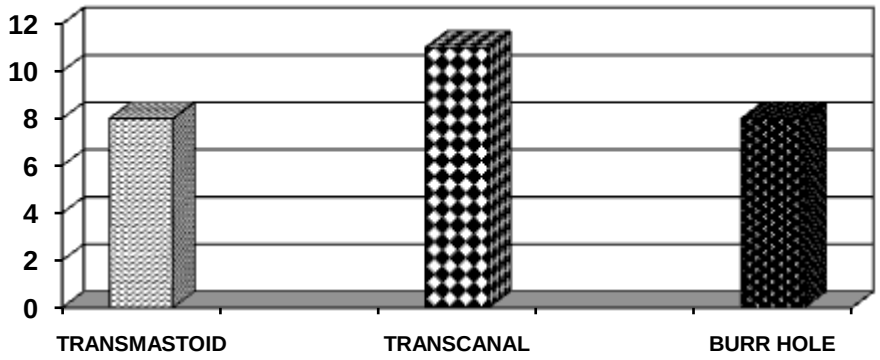

Fig 13: Different approaches of draining brain abscess.

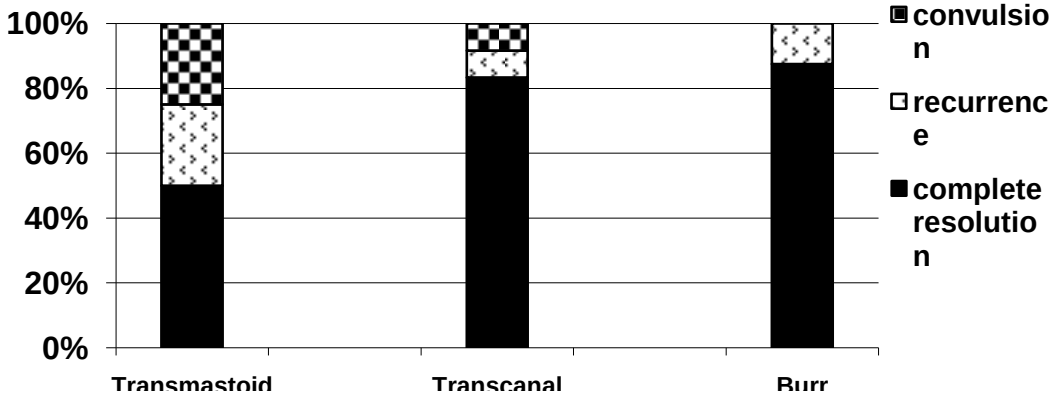

Fig14 : Outcome from the various approaches of draining brain abscess

Table 1: Patients characteristics of cases in Group A

Age/ Sex	CT scan appearance of abscess	Initial Treatment	At 1st weeks	Follow-up Treatment		Treatment outcome
				Modality	Approach	
25/F	Non localized temporal lobe abscess	Sys Ab + St	Complete resolution	C	---	Evidence of resolution
19/M	Non localized temporal lobe abscess	Sys Ab + St	Localisation	Del. Asp+ MRM	TM	Evidence of resolution
12/F	Non localized temporal lobe abscess	Sys Ab + St	Complete resolution	C	--	Evidence of resolution
25/F	Non localized temporal lobe abscess	Sys Ab + St	Localisation	Del. Asp+ MRM	TC	Evidence of resolution
9/F	Large nonlocalised cerebellar abscess	Sys Ab + St	Localisation	Del. Asp+ MRM	B	Evidence of resolution
15/F	Large nonlocalised temporal abscess	Sys Ab + St	Expansion with localisation	Del. Asp+ MRM	TM	Resolution with Convulsion
20/M	Large nonlocalised cerebellar abscess	Sys Ab + St	Localisation	Del. Asp+ MRM	TC	Evidence of resolution
14/F	Non localized temporal lobe	Sys Ab + St	Complete resolution	C	---	Evidence of resolution
65/M	Large nonlocalised cerebellar abscess	Sys Ab + St	Localisation	Del. Asp+ MRM	B	Evidence of resolution
20/F	Large nonlocalised temporal abscess	Sys Ab + St	Localisation	Del. Asp+ MRM	B	Evidence of resolution
4/M	Large nonlocalised temporal abscess	Sys Ab + St	Complete resolution	C	---	Evidence of resolution

20/M	Large nonlocalised temporal abscess	Sys Ab + St	Complete resolution	C	---	Evidence of resolution
13/M	Non localized temporal lobe abscess	Sys Ab + St	Localisation	Del. Asp+ MRM	TM	Recurrence (Repeat aspiration)
25/F	Non localized temporal lobe abscess	Sys Ab + St	Localisation	Del. Asp+ MRM	TC	Evidence of resolution
22/F	Non localized temporal lobe abscess	Sys Ab + St	Complete resolution	C	---	Evidence of resolution
23/F	Non localized temporal lobe abscess	Sys Ab + St	Localisation	Del. Asp+ MRM	TM	Evidence of resolution
14/M	Large nonlocalised cerebellar abscess	Sys Ab + St	Localisation	Del. Asp+ MRM	B	Recurrence (Repeat aspiration)
30/M	Non localized temporal lobe abscess	Sys Ab + St	Localisation	Del. Asp+ MRM	TC	Evidence of resolution
17/F	Non localized temporal lobe abscess	Sys Ab + St	Localisation	Del. Asp+ MRM	TC	Resolution with Convulsion
30/F	Large nonlocalised cerebellar abscess	Sys Ab + St	Localisation	Del. Asp+ MRM	B	Evidence of resolution
30/F	Large nonlocalised cerebellar abscess	Sys Ab + St	Localisation	Del. Asp+ MRM	TM	Evidence of resolution

Del.,Asp: Delayed aspiration, MRM: Modified radical mastoidectomy, Sys Ab: Systemic antibiotic, St: Steroid, TC: Transcanal, TM: Transmastoid, B:Burr hole

Table 2: Patients characteristics of cases in Group B

Age/Sex	CT scan brain	Treatment		Treatment outcome
		Modality	Approach	
24/M	Localized temporal lobe abscess	Imm. Asp + MRM	TM	Evidence of resolution
38/F	Localized temporal lobe abscess	Imm. Asp + MRM	TC	Evidence of resolution
30/M	Localized temporal lobe abscess	Imm. Asp + MRM	TM	Recurrence (Repeat aspiration)
12/M	Localized temporal lobe abscess	Imm. Asp + MRM	TC	Evidence of resolution
47/M	Large localised cerebellar abscess	Imm. Asp + MRM	B	Evidence of resolution
14/M	Large localised temporal abscess	Imm. Asp + MRM	TC	Evidence of resolution
14/M	Large localised temporal abscess	Imm. Asp + MRM	TC	Evidence of resolution
19/M	Large localised temporal abscess	Imm. Asp + MRM	TM	Resolution with Convulsion
9/F	Large localised cerebellar abscess	Imm. Asp + MRM	B	Evidence of resolution
13/M	Large localised temporal abscess	Imm. Asp + MRM	TC	Evidence of resolution
11/M	Large localised temporal abscess	Imm. Asp + MRM	B	Evidence of resolution
13/M	Large localised temporal abscess	Imm. Asp + MRM	TC	Evidence of resolution

Imm.Asp: Immediate aspiration, MRM: Modified radical mastoidectomy,TC: Transcanal, TM: Transmastoid,B:Burr hole

VI. Conclusion

As chronic inflammation of the middle ear is the most frequent cause of otogenic intracranial complications, otogenic brain abscesses should be regarded as a severe complication of untreated cholesteatoma. Patients having discharging ear presenting with headache should not be neglected but evaluated for intracranial

pathology. Early diagnosis is very essential to allow appropriate antimicrobial and successful surgical treatment. CT helps not only for early detection of the intracerebral lesion but also to decide on early surgical intervention like transmastoid ,transcanal or burr hole drainage and otosurgical procedure. Although otogenic intracranial infections usually require both neurosurgical and otolaryngological surgery, in set-ups where neurosurgical facilities are not available, CT scan staging of the intracranial abscess becomes outmost important. Owing to its high informative value, it is possible to exactly define the stage of a purulent inflammatory process and helps us in timely aspiration from intracranial abscess cavity and substituting it with antibiotic solution. Diverging from, the usual norm of abscess excision followed by mastoidectomy, we performed transmastoid or transcanal or burr-hole drainage of pus successfully and treated the mastoid disease and brain abscess in a single surgical intervention**.** It was found that transcanal drainage is a safe procedure and provided excellent post operative results with very few complications and very low recurrence rates. Therefore, transcanal route can be as effective as transmastoid approach, however, proper anatomical localisation of the abscess is important. Therefore, this method merits further investigation in a larger population. This study emphasizes that better prognosis of otogenic brain abscess is possible, if early diagnosis and management is done, for which paediatricians and clinicians should be vigilant about the grave complications of CSOM in daily practice.

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