Clinicopathological study of otogenic brain abscess

Arunabha Sengupta · Debasish Ghosh · Bijan Basak · Tarique Anwar

Abstract Chronic suppurative otitis media (CSOM) is one of the commonest disease entities encountered in otolaryngology practice. Due to poor economic conditions poor hygiene lack of education and dearth of knowledge about the disease and its complications, we frequently encounter patients of CSOM with extracranial and intracranial complications. Among the intracranial complications otogenic brain abscess is one of the dreaded. With the improvement of healthcare and accessibility of the poor people to healthcare system and development of CT scan, MRI as diagnostic tools incidence of otogenic brain abscess is becoming less due to early diagnosis and interventions. The objectives of this study are to assess the incidence of brain abscesses to explore age, sex, variation to study clinical presentations and common pathogens responsible.

Keywords Chronic suppurative otitis media · Brain abscess

Introduction

Brain abscess is a focal suppurative process in the brain parenchyma. Significant percentage of brain abscesses are of otogenic origin. Otogenic brain abscess almost always develop in the temporal lobe area [1, 3, 5] in or in the cerebellum region [2, 7]. In childrens 25% of all brain [4, 6, 8] abscesses are otogenic, while in the adults the incidence of brain abscess is >50% due to chronic ear diseases. For some unknown reasons otogenic intracranial complications occurs predominately in males. As a rule, otogenic brain abscesses are single and multiple only in rare cases. Incidence on otogenic brain abscesses are becoming less due to early diagnosis and interventions. Conventionally it is well accepted that Chronic suppurative otitis media (CSOM) with cholesteatoma are always unsafe; but in some cases of CSOM where the ear is regarded as safe may also lead to intracranial complications including brain abscesses. It seems pertinent to avoid complacency in any ear with active discharge regardless of the tympanic membrane defect, and no ear infected can be regarded as completely free from the risk of life-threatening complications.

Aims and objectives

1. To study the incidence of brain abscesses in relation to otitis media.
2. To explore age and sex variation along with relationship to socioeconomic status.
3. To study clinical presentations in relation to site and nature of abscesses.
4. To study common pathogens responsible.

Materials and methods

Cases had been selected from patients attending ENT OPD in IPGMER & SSKM Hospital, Kolkata during the period between May 2006 to April' 2007. Patients

Arunabha Sengupta · Debasish Ghosh · Bijan Basak ·
Tarique Anwar
SSKM Hospital, Kolkata, India

A. Sengupta (✉)
E-mail: arunabhasengupta2008@gmail.com

attending ENT OPDs who were suffering from CSOM with intracranial complications was selected initially and those patients having CT scan or MRI with feature of brain abscess were finally selected for present study. A detail history was taken in every case and special emphasis was given on history-related to features of intracranial complications. Past history of otogenic meningitis and brain abscesses with or without, surgical intervention were also ask for. A thorough examination of ear, nose and throat were performed for each case. Presence of any attic perforation or postero-superior retraction pocket with or without cholesteatoma were searched. Fistula test, was done in every cases. Neurological examinations were performed, consciousness, neck rigidity, Kernig's sign [1, 4], cerebellar signs [3, 7], cranial nerve examinations [1, 3, 8], muscle power and tone, planter reflex and jerks, papillary reactions, nystagmus, ophthalmoscopy, speech, gait, etc. were looked for. Selected patients underwent otomicroscopy, CT Scan of brain, MRI of brain (in selected case), hematological and audiological investigations [7]. Sensitivity of CT Scan is >95% in detecting brain abscesses. Without contrast administration a brain abscess typically appear as a hypodense lesion, surrounded by a uniformly enhancing ring and a variable hypodense are of edema extending beyond the ring in CT scan. MRI is extremely sensitive in detecting focal of diffuse parenchymal lesions (like brain abscess) and it appear to be more sensitive than CT scan at detecting brain abscesses in cerebritis phase of its development. Pus from ear and also aspirated pus from brain abscesses were routinely send for culture and sensitivity.

Results

In this study 16 cases of otogenic brain abscess were studied and evaluated. The results were compared with informations obtained by review of literature of the previous workers. Total number of patients attending the ENT OPD in the study period (May 2006–April 2007) was around 65,000 and total number of cases of otogenic brain abscesses in this study are 16. So the incidence of otogenic brain abscess is 0.25 in 100. Annual risk of otogenic brain abscess of a patient suffering from chronic otitis media comes around 0.98 in 1,000.

Among the selected 16 patients 13 were male (81.25%) and 3 were female (18.75%) (Fig. 1). In this study patients in their second decade of life had suffered the most. The incidence in 11–20 years is 43.75% (Fig. 2). Most of the patients in this study had prolonged history of aural discharge in the ipsilateral ear due to chronic suppurative otitis media. Poor socio-economic status, illiteracy and lack of consciousness are important determinants for intracranial complications of CSOM. In this study 9 patients (56.25%)

were below poverty line. Five patients were from lower middle class income group (31.25%) and rest 2 patients (12.50%) were from middle class income group. Among the 16 patients 9 patients came from urban areas and 7 patients came from rural areas. But most of the patients were coming from urban slum areas. One interesting findings in this study is the distribution of the patients according to the history of pond bathing: out of 16 patients 12 patients had history of pond bathing and 4 patients had no history of pond bathing. Most of the patients give history of aural discharge, which was initially muco postero-superior purulent in nature and later became scanty and foul smelling. In this study 15 out of 16 cases had single brain abscess and only 1 patient had multiple brain abscesses. Regarding the site of perforation in the tympanic membrane 10 patients had only attic perforations, 3 patients had only postero-superior marginal perforations, 2 patients had postero-superior retraction pockets and 1 patient had combination of attic and postero-superior marginal perforations.

All patients underwent radical mastoidectomy and cholesteatoma was found in all the cases. Among the 16 patients 9 cases had cerebellar abscesses, 4 cases had temporal abscesses and 3 cases had temporo-parietal abscesses. Regarding the clinical presentations of otogenic brain abscesses there were many signs and symptoms found in the patients. Headache, nausea, vomiting, hearing loss were found in all of the cases. Other features were fever (75%), altered sensorium (50%), generalized weakness (100%), altered speech (43.75%), convulsion (37.5%), focal neurologic symptoms (25%), nystagmus (12.5%), neck rigidity (50%), Kernig's sign (18.75%), hypotonia (81.75%), cerebellar sign (37.5%), photophobia (50%), hemiparesis (8.75%).

Among the 7 patients who had temporal/ temporo-parietal lobe abscess, 3 patients presented with altered sensorium and among the 9 patients who were presented with cerebellar abscess, 5 patients presented with altered sensorium. All patients with otogenic brain abscess presented in the third stage of development of brain abscess; so most of the patients had some form of localizing signs. Among the 16 patients only 2 patients had positive culture reports of the past aspirated from brain abscesses and 14 patients had sterile abscesses. Only 1 patient had died in the 3rd postoperative day, so mortality rate was 6.25%. all the 16 patients had initial 10–14 days of conservative treatment followed by radical mastoidectomy. In most of the cases cholesteatoma and granulation tissues were found with evidence of bone destruction in the form of dehiscent tegmen tympani, posterior cranial fossa dura of sinus plate were found. CT scans with contrast enhancement were done in every case. Abscesses with typical ring enhancement were found in most of the cases. Only 2 patients could afford MRI scan and the parenchymatous lesions were delineated in the MRI scan excellently.

Fig. 1 Pie chart showing male and female patient in our study

Fig. 4 Pie chart showing pus culture report in our study

Fig. 2 Bar chart showing age group of brain abscess in our study

Fig. 5 Pie chart showing percentage of single and multiple abscess

Fig. 3 Pie chart showing site of brain abscess in our study

Discussion

In this study 16 cases of otogenic brain abscesses were studied and evaluated. The results were compared with informations obtained from works of the previous authors.

Total number of cases of otogenic brain abscesses in this study were 16. Total number of patients who attended the ENT OPD of IPGMER and SSKM Hospital in that period of (May 2006–April 2007) were approximately 6,5000. So the incidence of otogenic brain abscesses are 0.25 in 1,000. Among the 6,5000 patients approximately 25% were suffering from CSOM. The annual risk of developing otogenic brain abscesses in a patient suffering from CSOM comes around to 0.98 in 1000.

Among the 16 patients 13 patients were male (81.25%) and 3 patients were female (18.75%). In most of the studies it has been confirmed that males are more prone to develop otogenic brain abscesses than females.

The age incidence of the patients had revealed that the patients in their second decade of the life suffered the most. The incidence in 11–20 years is 43.75%. Next most common age group involved were 31–40 years, comprising of 25% of patients.

Regarding the duration of aural discharge most of the patients in this study had prolonged history of aural discharge, 62.5% patients (10/16 cases) had history of more than 10 years of aural discharge. Twenty-five percent (4/16 cases) patients had history of 5–10 years of aural discharge ND 12.5% (2/16 cases) patients had history of aural discharge for 0–5 years (shortest duration being 8 months). So all the patients were suffering from CSOM. In this study there is no acute otitis media developing otogenic brain abscess.

Among 16 patients studied all of them had otogenic brain abscesses in the ipsilateral ear.

In this study most of the patients with otogenic brain abscesses came from lower socioeconomic status of the society. Among the 16 patients 9 patients were below poverty line (56.25%), 5 patients were from lower middle class (31.25%) and 2 patients were from middle class (12.50%). It is an important findings in this study that low socioeconomic status illiteracy, poor health consciousness were the main causes of CSOM and its one of the most grave literacy and health consciousness, the incidence of otogenic brain abscesses can come down rapidly: which has already been witnessed in developed countries.

In this study 75% (12/16 cases) had already history of pond bathing and 25% (4/16 cases) had no history of pond bathing. Though pond bathing has no direct relationship with the development of otogenic brain abscesses but it may contribute indirectly to persistence of CSOM with occasional exacerbations.

In this study 85.25% (13/16 cases) patients had history of scanty, foul smelling discharge associated with fishy smell of cholesteatoma. Rest (14.75%) of the patients had history of purulent discharge. In almost all the cases discharge were long standing.

Regarding the number of otogenic brain abscesses in the brain the findings of this study corroborates with that of the other workers [1, 3, 4]. Only 1 patients (6.25%) had multiple brain abscesses, rest of the cases had single brain abscess (Fig. 5).

Regarding the site of perforations in the tympanic membrane 62.5% (10/16 cases) patients had only attic perforation. 18.75% (3/16 cases) had only postero-superior marginal perforation. 12.5% (2/16 cases) had postero-superior retraction pocket and 6.25% (1/16 case) patients had both attic and postero-superior marginal perforations.

Most of the patients underwent radical mastoidectomy and cholesteatoma was found in 100% cases [2].

In this study it has been found that among the 16 patients 7 patients had temporal lobe abscesses (43.75%) and other 9

patients had cerebellar abscesses (56.25%) (Fig. 3). Among the 7 patients with temporal lobe abscess 3 had temporo-parietal lobe abscesses. In most studies it has been observed that the temporal lobe abscesses are commoner than cerebellar abscesses. But in the present series, it is found that the cerebellar abscess is commoner. Works of only one worker corroborates with the present series [10].

Regarding the clinical presentations of otogenic brain abscesses there were varieties of clinical features found in the patients in this study. Headache was the most common symptom found in all 16 of the patients (100%). So were the nausea and vomiting (100%). Fever was present in 12 patients (75%), hearing loss was present in 16 patients (100%). Other important signs and symptoms were altered sensorium (50%), altered speech (43.75%), convulsion (37.5%), imbalance (75%), generalized weakness (100%), cachexia (81.25%), nystagmus (12.5%), focal neurological symptoms (25%), postaural fistula (8.75%), neck rigidity (50%), Kernig's sign (18.75%), hypotonia (81.75%), cerebellar sign's (37.5%), facial palsy (12.5%), ear ache (100%), vertigo (31.25%), photo phobia (50%), optic disc edema (12.5%), hemiparesis (18.75%). In the present study cerebellar sings were present in 6 patients. Among those patients who presented with cerebellar abscesses 6 patients were found to have cerebellar sign's (66.7%), 7 patients had presented with tymportal lobe abscesses, among them 2 patients had hemiparesis. Among the 16 patients 7 patients had some problems of speech, but no patients had aphasia. Two patients had edema of optic disc, among them 1 patient had tymportal lobe abscess and the other patient had cerebellar abscess. four patients have history of convulsion among them 2 had tymportal lobe abscesses and other 2 had cerebellar abscesses. No patient had any field defect in his or her vision.

All the patients were first put on medical management with intravenous antibiotics and mannitol (if evidences of increased intracranial tension were present), then the otogenic brain abscesses were aspirated through burrhole approach with the help of neuro surgeons. Pus aspirated were sent for culture and sensitivity test. Patients were then treated conservatively with intra venous antibiotics and topical antibiotics in ear for 10–14 days. Mastoid explorations were needed in all cases after 10–14 days and radical mastoidectomy were performed in all the cases. In all the cases cholesteatoma and associated granulations were found in the ipsilateral ear and in most of the cases evidences of bone destructuion in the form of dehiscence of tegman typanni or posterior fossa dura or sinus plate were found. In all the cases ossicles were found to be necrosed. In 3 cases postaural fistulous tract were found and excized. In all cases wide meatoplasty were performed. Most of the patients recovered well, except 1 patient who died on the 3rd postoperative day. Mastoid cavities became dry and follow up CT scan showed reduced size of mastoid cavities

Fig. 6 CT scan showing left temporal lobe abscess

Fig. 7 CT scan showing left cerebellar abscess

Fig. 8 CT scan showing localised left temporal lobe abscess

or absence of otogenic brain abscesses. In case of residual abscesses the treatment were carried out by neurosurgery department. Most of the patients were given anticonvulsion drugs for lonperiod. Death of 1 patient puts the mortality rate at 6.25% [5, 9].

Regarding the bacteriological study of the otogenic brain abscesses this study hads found that among the 16 patients only 2 patients had positive culture reports. One of them had *Pseudomonous aeruginosa* and *Bacteroids fragilis* and the other had bacillus subtilis in the pus f brain abscess. Rest of the patients (14 cases) had sterile abscess (87.5%). The high percentage of sterile report, is mainly the result of extensive intravenous antibiotic therapy preoperatively (Fig. 4).

It has been observed in the present series that majority of the patients (10/16 cases) presented with sclerotic mastoids without any obvious bone erosion in X-ray of the mastoid bone. Six patients presented with definite evidences of bone erosion. Not a single patient presented with pneumatic mastoid.

CT scan with or without contrast is the most important investigation for diagnosis of brain abscesses. CT scan helps to indentify

- The position and size of the brain abscess, and
- Appearance of localized encephalitis and localized abscesses
- Associated complications such as subdural abscesses and lateral sinus thrombophlebitis
- Progress of an abscess during treatment
- Hydrocephalus or features of raised intracranial tension
- Erosion or destruction of mastoid bone

The role of MRI in detecting otogenic brain abscess is increasing recently. With MRI it is possible to distinguish between pus, abscess capsule, edema, and sub arachnoid space is more obviously than CT scan.

Conclusion

From the above study following conclusions can be made.

- The incidence rate of otogenic brain abscess is 0.25% in 1,000.
- Annual risk of developing otogenic brain abscesses in a patients suffering from chronic suppurative otitis media is 0.98 in 10,000 (approximately one in 10,000).
- Otogenic brain abscesses are more common in male.
- Patients in their second decade of life are more prone to develop otogenic brain abscesses.
- Otogenic brain abscesses develops mainly in patients suffering from CSOM.

- People with poor socio-economic status are more prone to develop otogenic brain abscess.
- Illiteracy and poor health consciousness are important factors in causation of intracranial complications of chronic suppurative otitis media.
- Most of the otogenic brain abscesses are single.
- In this study cerebellar abscesses are more commonly found than temporal lobe abscesses.
- Clinical features depend on the site of otogenic brain abscesses in the brain parenchyma.
- Pus aspirated from otogenic brain abscesses are mostly sterile.
- CT scan with contrast, enhancement is essential for diagnosis of otogenic brain abscesses.

References

1. Kangsnararak J, Fooanant S, Ruckphaopunt K, Navacharoen N, Teotrakul S (1993) Extracranial and intracranial complication of suppurative otitis media: report of 102 cases. *J Laryngol Otol* 107:999–1004
2. Kangsnararak J, Fooanant S, Ruckphaopunt K, Navacharoen N, Teotrakul S (1995) Intracranial complication of suppurative otitis media: 13 years experience. *Am J Otol* 16:104–109
3. Kulai A, Ozatik N, Topeu I (1990) Otogenic intracranial abscess. *Acta Neurochirurgica* 107:140–146
4. Nunez DA, Browning GG (1990) Risk of developing an otogenic intracranial abscess. *J Laryngol Otol* 104:468–472
5. Nunez DA (1992) Etiological role of otolaryngological disease in pediatric intracranial abscess. *J Royal College Surg Edinburg* 37:80–82
6. Samuel J, Fernandez CM, Steinberg H (1986) Intracranial otogenic complications, a persisting problem. *Laryngoscope* 96:272
7. Shambough GE, Glasscock ME. Nonmeningal complications of otitis media. In: *Surgery of the Ear*. 5th Edition, Shambaugh GE, Glasscock ME (Eds.), WB Saunders, Philadelphia
8. Tarkkanen JV. Otogenic brain abscess. *Acta Otolaryngol (Stockh.)* (suppl. 185):1
9. Taylor JC. Treatment of brain abscess. *Br J Neurosurg* 1:173–178
10. Thapa N, Srivastav RP, Amatya RCM, Sinha BK, Bhattarai H, Pradhan B, Guragain RPS, Bhusal CL, Banshuta DK (2001) Complications of chronic suppurative otitis media, attic-aural type - 3 years experience. *J Nepal Med Assoc* 40:77–82