ORIGINAL ARTICLE

The Frequency of Otogenic Intracranial Complications in Chronic Suppurative Otitis Media with Cholesteatoma

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ABSTRACT

Objectives:

1. *To determine the frequency of otogenic intracranial complications in chronic suppurative otitis media with cholesteatoma.*
2. *To discuss the diagnosis and management of patients presenting with otogenic intracranial complications.*

Study Design: *It was a prospective, descriptive and cross – sectional study using convenience sampling technique.*

Materials and Methods: *This was a combined study conducted in the ENT Department of Postgraduate Medical Institute, Hayatabad Medical Complex, Peshawar and the ENT Department of Mardan Medical Complex, Mardan over a period of 3 years from January 1, 2007 to December 31, 2009. Cases presenting with chronic suppurative otitis media with cholesteatoma were studied and the frequency of otogenic intracranial complications occurring in these cases was calculated.*

Results: *A total of 85 cases were studied. The ages of the patients ranged from 8 to 40 years. All the patients had chronic suppurative otitis media with cholesteatoma. The commonest complaint in cases with suspected intracranial complications was deep seated earache followed by persistent headache. Meningitis and extradural abscesses were the commonest intracranial complications. The frequency of intracranial complications in our study was found to be 11.76%.*

Conclusion: *Otogenic intracranial complications due to cholesteatoma continue to pose a significant risk to the patients. High index of suspicion is essential for diagnosis and skilful management of otogenic intracranial complications. Early recognition is possible and these cases should be managed in close collaboration with a neurosurgeon.*

Keywords: *Suppurative otitis media, Cholesteatoma, Meningitis, Brain abscess, Surgery.*

INTRODUCTION

Suppurative otitis media (SOM) is purulent inflammation of the middle ear cleft. The attico-antral variety of SOM is usually associated with cholesteatoma. The term "cholesteatoma" was first used by Johannes Muller in 1838. It is an epidermal inclusion cyst of the middle ear and / or mastoid with a squamous epithelial lining and contains keratin debris and desquamated epithelium. Natural history is progressive growth with erosion of surrounding bone due to pressure effects and activation of osteoclasts.[1] The pathological processes chiefly involve the attic / epitympanic and mastoid regions.

The otogenic intracranial complications include; meningitis, extradural abscess, sigmoid sinus thrombosis, subdural abscess, brain abscess and otitic hydrocephalus. Meningitis is the commonest complications followed by extradural abscess formation. Brain

abscess is one of the most serious complications associated with SOM in general and the unsafe type of CSOM in particular. Otitis media is the most common bacterial infection in children. Approximately 70% of children are affected by the age of 3 years. In children nearly 25% of brain abscesses are otogenic in nature, whereas in adults who are more prone to chronic ear infections the percentage rises to 50%.[2]

Nadol and Schuknecht (1993) found that in cases of cholesteatoma, intracranial spread of infection occurred directly through bony erosion.[3] Development of complications also depend on such factors as high virulence of organisms, poor resistance of patient, inadequate antibiotics treatment, resistance of organisms to antibiotics and presence of chronic systemic disease. Intracranial spread of infection can also occur through thrombophlebitis and pre-formed pathways. The latter may include congenital dehiscences, patent sutures, previous skull fractures and surgical defects. The periateriolar spaces of Virchow – Robin are thought to provide access for infection into the brain tissue.

In this era of broad spectrum antibiotics, the overall incidence of otogenic intracranial complications has reduced but still poses a significant threat.[4] Modern imaging modalities such as CT and MRI can make the diagnosis easily in such cases. Therefore it is important to detect and manage these patients well in time to reduce the mortality and morbidity associated with intracranial complications.

MATERIALS AND METHODS

The study included 85 patients fulfilling the required criteria and presenting to ENT Department of Postgraduate Medical Institute, Hayatabad Medical Complex, Peshawar and the ENT Department of Mardan Medical Complex, Mardan. All patients with chronic ear discharge lasting for more than 3 months and associated with cholesteatoma were included in the study. After obtaining informed consent, detailed history and clinical examination was carried out. The development of intracranial complications was suspected when the patient had either of the following signs and symptoms; Persistent headache, deep seated otalgia, persistent fever, nausea and vomiting, neck rigidity, papilla-edema, focal neurological deficit, ataxia, seizures and mental status changes associated with foul smelling ear discharge. Patients with suspected intracranial complications were admitted to the ward and underwent imaging studies (CT / MRI). Fundoscopy, Pus C/S studies and pure tone audiograms were obtained in all cases to determine the hearing status of the patients. Other investigations such as haematological, CSF analysis were carried out where appropriate.

All the patients with intracranial complications were started on high doses of intravenous antibiotics on empirical basis. Urgent consultations were made with neurosurgical colleagues in all these cases. In cases of intracranial abscess formations, the patients were shifted to the care of Neurosurgeon who treated the abscess surgically via burr-hole aspirations. Imaging studies (CT scan) was utilized to monitor the efficacy of treatment in case of intracranial abscesses. Once the patients were stabilized, all the patients with intra cranial complications underwent radical mastoiddectomy in 4 – 6 weeks period to eradicate the source of infection.

The data was documented on a proforma. The results were analyzed to determine the frequency of patients developing otogenic intracranial complications. The management of these patients has been discussed.

RESULTS

A total of 85 cases were included in the study. The ages of the patients ranged from 8 to 40 years with the mean age of 35 years. The male: female ratio was 3.3:1. All the patients had active discharge from the ears. All the patients had hearing loss and persisting headache of varying severity. The signs and symptoms leading to suspicion of having developed intracranial complications are detailed in Table 3. The commonest

Table 1: *The sex distribution of the patients.*

S #	Sex	Number	Percentage
1.	Male	65	76.5%
2.	Female	20	23.5%

Table 2: The age distribution of the patients.

S #	Age Group	No. of Patients	Percentage
1.	Up to 10 years	16	18.82%
2.	11 – 20 years	24	28.23%
3.	21 – 30 years	34	40.00%
4.	31 – 40 years	11	12.95%

complaint was deep seated earache (80%) followed by persistent headache (76.47%). Meningitis and extradural abscesses were the commonest intracranial complication (3.53%) observed in the study. The detail of intracranial complications has been shown in Table 4. The frequency of intracranial complications in our study was found to be 11.76%.

Table 3: *The presenting features in cases with suspected intracranial complications.*

S #	Clinical Features	No. of Patients	Percentage
1.	Deep seated otalgia	68	80%
2.	Persistent headache	65	76.47%
3.	Fever	23	27.06%
4.	Nausea and vomiting	20	23.52%
5.	Nystagmus	17	20.00%
6.	Neck rigidity	9	10.58%
7.	Papilloedema	4	4.71%
8.	Focal neurological deficits	2	2.35%
9.	Ataxia	2	2.35%
10.	Seizures	3	3.53%
11.	Mental status changes	1	1.18%

Table 4: *The types of observed intracranial complications.*

S #	Type	Number	Percentage
1.	Meningitis	3	3.53%
2.	Extradural abscess	3	3.53%
3.	Cerebritis	1	1.18%
4.	Cerebellar abscess	2	2.35%
5.	Lateral sinus thrombophlebitis	1	1.18%

DISCUSSION

Otitis media, acute or chronic, is a potentially dangerous disease which may lead to fatal complications.[5,6] Cholesteatoma is thought to be responsible for the many complications of CSOM, in particular the intracranial ones. In our series, we restricted ourselves to the study of intracranial complications caused by chronic suppurative otitis media with cholesteatoma. The incidence of cholesteatoma varies greatly. Tos and colleagues found an incidence of 3/100,000 in children and 12.6 per 100,000 in adults.[1] The true incidence of cholesteatoma in our population is unknown. Although not representative of the magnitude of the problem in our country, Memon MA and colleagues in 107 cases of mastoid explorations, found cholesteatoma in 11.5% cases.[7]

A lot of work can be found in the literature to study the incidence of otogenic intracranial complications but majority of the studies have reported these complications in the retrospect, and in the context of suppurative otitis media including both the acute and chronic forms. The main focus of interest has been the otogenic brain abscess. The generally accepted figure for otogenic intracranial complications in the literature is 2 – 3%. Memon MA and colleagues in their study found a rate 2.3% for intracranial complications in unsafe variety of CSOM.[7] A study from Turkey by Osama U et al puts this figure at 1.97%.[8] In 1995, Kangsanarak et al conducted a review of 24,321 patients with otitis media. This review revealed an intracranial complication rate of 0.36%.[9] In our study the relative frequency of these complications is 11.76% which is quite a higher figure. The possible explanation for this is delay in seeking treatment due to illiteracy, poverty, ignorance and lack of medical facilities.

The imaging modalities to diagnose and monitor intracranial complications include CT and MRI. CT is the most reliable diagnostic tool enabling localization of the change, timing of surgical treatment and monitoring of surgical success.

Meningitis is an inflammatory response to bacterial infection of the pia-arachnoid. Meningitis was observed in (3.53%) of patients in our study. The diagnosis of meningitis, like others, is made by history, clinical examination and laboratory investigations. Lumbar puncture and CSF analysis, after ruling out papilloedema, is crucial to making definitive diagnosis. Imaging studies usually in the form of contrast enhanced CT should be used as an adjunct and to look for concomitant intracranial complications. Treatment is started with high doses of intravenous antibiotics on empirical basis.

Temporal lobe and cerebellum are the two common locations for otogenic brain abscess. We studied a case of temporal lobe cerebritis and 2 cases of cerebellar abscesses. This finding is in contrast to the findings in the majority of studies where involvement of

the temporal lobe by otogenic infection is the commonest findings. Deric et al found 28 cerebral and one cerebellar abscess, whereby Sennoroglu et al found 54% cerebral and 44% cerebellar abscess in their studies.[10,11] Extradural abscesses were the commonest findings in our study. According to Mawson, extradural abscesses are a common intracranial complication that may be symptomatic or asymptomatic and a chance finding at surgery.[12] In contrast enhanced CT scanning of the brain, an extradural abscess is visualized as a hypodense area between the dura and tegmen or between the sinus plate and sigmoid sinus.[13] The early stages of brain abscess formation produce symptoms of an infective focus with fever, headache, and earache. If antibiotics have been administered, fever is not present. Glasscock and Shambaugh (1990) reported that fever in brain abscess, is usually low grade and some patients may have a subnormal temperature.[14] The later stages produce symptoms of raised intracranial pressure and focal neurologic deficit. For a temporal lobe abscess, this includes altered sensorium, homonymous hemianopia, aphasia (if the abscess is left-sided), and facial hemiparesis. For cerebellar abscess, gait ataxia, coarse intention tremor, nystagmus, and past – pointing are typical.[12,13] In our cases Ataxia and nystagmus were the commonest complaints. However, there were no other cerebellar signs observed in our study. Contrast enhanced CT scanning of the brain is diagnostic. In brain abscess, the classic ring lesion produced by a hypodense central area (owing to pus) and an enhancing rim (produced by the abscess wall) is characteristically seen. When the capsule has not formed only hypodense areas with patchy enhancement suggestive of cerebritis or cerebellitis are visible.

***Lateral sinus thrombosis usually presents with persistent high grade fever with rigors and chilling, otalgia, and neck pain along the upper end of the sternomastoid muscle. The classical presentation is very rare these days because the course is usually modified by antibiotic treatment. Contrast enhanced CT scanning of the brain may show the characteristic delta sign. The more definitive investigation is MRI. The findings on MRI will depend on the degree of residual flow and the age of the thrombus. In the early or acute phase (first 3 to 5 days) of venous thrombosis, an isointense signal on T_1WI and a hypointense signal on T_2WI have been described. In the later phase (5 to 30 days later), the thrombus becomes hyperintense on T_1- and T_2WI. When in doubt, it is safer to explore the mastoid and the diagnosis is easily established in the majority of cases by intraoperative findings of discolored dura over the sinus and absence of blood on aspiration of the sinus with a wide-bore needle.

Except meningitis, the treatment of intracranial complications include primary neurosurgical approach The principle of surgical management is that treatment of the intracranial disease takes precedence over the ear disease except in situation where the ear disease is considered to be a continuous source of reinfection for the endocranium and in cases of lateral sinus thrombophlebitis where concomitant mastoidectomy provides access to the sinus. In the rest of cases, radical mastoid exploration takes place once the complications have been dealt with neurosurgically and the patient's general condition stabilized, usually in a 4 – 6 weeks time.[13,15] The initial regimen used in our sitting for all the intracranial complications consisted of high doses of benzyl penicillin, chloramphenicol, gentamycin and metronidazole. Appropriate changes to the treatment were made once the causative organism(s) were identified and reports of pus culture and sensitivity became available. In addition supportive therapy was also given. All the patients with intracranial abscesses in our series were referred to the care of neurosurgeon. The brain abscesses were surgically managed by Neurosurgeon via repeated burr-hole aspirations. Wanna and George B are of the opinion that in selected cases direct drainage of the abscess may not be necessary if a patient's symptoms, neurologic status, and radiographic findings progress favorably.[16]

The cases with meningitis and cerebritis were managed conservatively on the advice of neurosurgical colleague. A single case of lateral sinus thrombosis in our study was managed by combined ENT and Neurosurgical team at the time of radical mastoidectomy. In other patients, radical mastoidectomy to eradicate the focus of infection in the ear was carried out in a 4 – 6 week period.

In the preantibiotic era, the mortality rate from intracranial complications of otitis media was reported to be as high as 76.4% which now has fallen to 5 – 15%.[9] Rupture of a brain abscess is associated with a high mortality rate (up to 80%) even in the modern era. The frequency of neurological sequelae in persons who survive the intracranial complications varies from 20 – 79% and is predicated on how quickly the diagnosis is reached and treatment is started.[17]

CONCLUSION

Though fewer incidents than in the past occur, otogenic intracranial complications due to cholesteatoma

continue to pose a significant risk to the patients with high mortality and morbidity rates. High index of suspicion is essential for diagnosis and skilful management. It is important to identify all such patients as classical presentation of intracranial disease has become a rarity in the era of antibiotics. Urgent CT/MRI scan of temporal bone and brain should be acquired in cases with suspected intracranial complications. These cases should be managed in close collaboration with a Neurosurgeon.

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REFERENCES

1. Tos M. Incidence, etiology and pathogenesis of cholesteatoma in children. Ann Oto Rhino Laryngol Aug 1988; 93 (8): 769-80.
2. Thorne MC, Chewaproug L, Elden LM. Suppurative complications of acute otitis media: changes in frequency over time. Arch Otolaryngol Head Neck Surg. Jul 2009; 135 (7): 638-41.
3. Nadol JB, Suhuknecht H F. Complication of chronic otitis media. In Surgery of the ear and temporal bone. Raven press Ltd. New York. 1993; 171-191.
4. Alam J, Zaidi SH, Mohammad IA, Hasan S, Siddiqui IA, Ahmed R et al. Is cholesteatoma on the decline? Pak J Otolaryngol. 1999; 15: 2-3.
5. Gower D, McGuirt WF. Intracranial complications of acute and chronic infectious ear disease: a problem still with us. Laryngoscope. Aug; 1983; 93 (8): 1028-33.
6. Samuel J, Fernandes CM, Steinberg JL. Intracranial otogenic complications: a persisting problem. Laryngoscope. Mar 1986; 96 (3): 272-8.
7. Memon MA, Matiullah S, Ahmed Z, Marfani MS. Frequency of un-safe chronic suppurative otitis media in patients with discharging ear. J Liaquat Uni Med Health Sci May – Aug 2008; 7 (2): 102-5.
8. Osama U, Cureoglu S, Hosoglu S. The complications of the chronic otitis media. Report of 93 cases. J Laryngol Otol. 2000; 114 (2): 97-100.
9. Kangsanarak J, Navacharoen N, Fooanant S, Ruckphaopunt K. Intracranial complications of suppurative otitis media: 13 years' experience. Am J Otol. Jan 1995; 16 (1): 104-9.
10. Sennaroglu L, Sozeri B. Otogenic brain abscess: Review of 41 cases. Otolaryngol Head Neck Surg 2000; 123: 751-5.
11. Deric D, Arorovic N, Dordevic V. Pathogenesis and methods of treatment of otogenic brain abscess. Med Pregl 1998; 51: 51-5.
12. Mawson SR. Complications of suppurative otitis media; Diseases of the ear. London: Edward Arnold, 1988: 479-507.
13. Ludman H. Complications of suppurative otitis media. In: Kerr AG, John H.eds. Scott – Brown's Laryngology and Head and Neck Surgery. Vol. 3. 6th ed. Oxford: Butterworth/Heinemann, 1997: 3/12/1-28.
14. Glassock ME, Shambaugh JR. Intra-cranial complication of otitis media. Surgery of the ear. 4th ed. Philadelphia: WB Saunders, 1990: 249-75.
15. Schwager K, Carducci F. Endocranial complications of acute and chronic otitis media in children and adolescents. Laryngorhinootologie. Jun 1997; 76 (6): 335-9.
16. Wanna, George B, Dharamsi, Latif M, Moss, Jonathan R et al. Contemporary management of intracranial complications of otitis media. Otology and Neurotology. Jan 2010; 31 (1): 111-7.
17. Tseng JH, Tseng MY. Brain abscess in 142 patients: factors influencing outcome and mortality. Surg Neurol. Jun 2006; 65 (6): 557-62.