

Original Article

Status of Ossicles in Cholesteatoma

Lt Col Mohammad Delwar Hossain¹, Brig Gen Md Nasir Uddin Ahamed²,
Major Mohammad Misbah Al Kabir Sumon³, Major Bhuiyan A.R.M. Shoyeb⁴

Abstract

The study was conducted to detect and analyze the different types of ossicular chain defect in chronic suppurative otitis media with cholesteatoma on mastoid exploration and to identify the ossicle most commonly eroded by the disease process. A total 60 cases of CSOM with cholesteatoma of different age groups, who underwent surgery were included in this study and their intra operative ossicular chain findings were noted. 100% cases were presented with long standing aural discharge. It was observed that cholesteatoma was more common in male (60%) than female (40%) and 53.33% patients were in young age group (21-35 years). 90% cases showed ossicular erosion while only 10% cases showed intact ossicles. The incus was found to be absent in 15% cases and eroded in 75% cases. And the malleus was observed as the most resistant ossicle to be eroded.

Key words: Ossicular chain, cholesteatoma, Malleus, Incus, Stapes

Introduction

Background: Chronic suppurative otitis media has been an important cause of middle ear disease since pre-historical time. It is one of the most common ear disease in developing countries which represents the terminal stage of the disease continuum of otitis media, is characterized by irreversible change in middle

ear cleft. The otoscopic findings in a patient with CSOM include the presence of a defect or perforation of pars tensa or pars flaccida.¹ It is a worldwide health problem and is still prevalent in the modern antibiotic era². Poor living conditions, overcrowding, poor hygiene and nutrition have been suggested as the basis for the widespread prevalence of CSOM in developing countries.³ Prevalence of CSOM on developing countries represents a wide range- 0.4% to 33.3%. In Bangladesh it's prevalence is 12.44%⁴, 7.39%.⁵ Hearing loss arising from COM is a matter of serious concern because of its long-term effects on communication, language development and educational process. In Bangladesh 16.95% of mild to moderate conductive hearing loss in children and young adults was due to CSOM^{4,5}. The degree of hearing loss varies with size and position of tympanic membrane defect, status of ossicular chain and presence of middle ear pathology.^{1,3}

1. Post Doctoral Fellowship in Implantation Otolaryngology, Classified ENT specialist, Head-Neck & Cochlear Implant Surgeon, Combined Military Hospital (CMH), Dhaka Cantonment.
2. Commandant, Combined Military Hospital (CMH), Dhaka Cantonment
3. Resident, Fellowship Training
4. Resident, Fellowship Training

Address for correspondence: Dr. Lt Col Mohammad Delwar Hossain, Cochlear Implant Center Combined Military Hospital (CMH), Dhaka Cantonment, Dhaka 1206, Cell: +88-01731823234, +88-01769014796, Email: delwar1064.bd@gmail.com

Both types of CSOM, tubotympanic which is considered safe, as well as atticoantral which is considered as unsafe, may lead to erosion of the ossicular chain. This propensity for ossicular destruction is much greater in case of unsafe CSOM due to presence of cholesteatoma and/or granulations.^{1,2,3} Partial or total destruction of ossicles is seen in approximately 80% of patients with cholesteatoma, whereas in chronic otitis media without cholesteatoma, ossicular chain erosion can be seen in approximately 20% cases. Cholesteatoma may cause bone erosion and result in intra temporal and intracranial complications, with high mortality and morbidity rates.^{1,8,10} Cholesteatoma has the capacity for progressive and independent growth at the expense of underlying bone and has a tendency to recur after removal. Although cholesteatoma more commonly found in the middle ear and mastoid, the disease can also occur in external ear canal, CP angles and very rarely it may present as a lump on the side of patient's head eroding the squamous temporal bone with intracranial extension.^{1,3}

Erosion of the bone is an established pathological characteristic of cholesteatoma. The mechanism of bone destruction is widely debated. First ever interpretation in this regard was that destruction of bone occurs due to pressure exerted by the expansion of cholesteatoma. Some other investigators suggest that a chemical process is responsible for lytic effect of the bone. According to the data obtained by Raman through spectroscopy, the inorganic substances present in normal bone of living body seems to dissolve in otorrhoea fluid, which has been rendered acidic due to fatty acids. This process is called Demineralization.^{1,6} The Interleukin-I has been found in cholesteatoma by immune peroxidase and immunofluorescence

technique. Interleukin-I can directly activate osteoclasts by producing osteoclast activating factor. It also promotes migration of inflammatory cells and stimulates fibroblast to produce prostaglandin and collagenase^{1,7,8}. This inflammatory process in the middle ear is more harmful the longer it stays and the nearer it is to the ossicular chain⁸. Destruction of the ossicular chain result in large hearing losses. Complete disruption of the ossicular chain can result in a 60 dB hearing loss^{1,9,11,12}. Whatever may be the mechanism of bone destruction, the fact is that cholesteatoma spreads in and across the middle ear cleft with a potential to both intracranial and extra cranial complications, ranging from severe ear pain, foul smelling ear discharge, deafness to well-known complications like facial paralysis, meningitis, sigmoid sinus thrombosis, epidural abscess and brain abscess.¹ Basically there are four major ossicular defect, the most common is the involvement of only long process of incus with intact malleus and stapes. The second most common defect is erosion of stapes supra structure as well as loss of incus. Third, the cholesteatoma growing into the middle ear involving the malleus handle and stapes remain intact. Finally there may be loss of all ossicles except the stapedia foot plate. Erosion of the long process of incus by cholesteatoma is the most frequently encountered defect of ossicular chain. The reason is due to its delicate structure rather than its tenuous blood supply^{1,7,8}.

The destroyed ossicles can be seen during surgical interventions under microscope. The tuning fork test is also an indicative of conductive hearing loss. But sometimes hearing may be normal when ossicular chain is intact or when cholesteatoma bridges the gap between the destroyed ossicles. An audiogram indicates a normal bone conduction but an air-bone gap up to 60dB

when there is ossicular disconnection, and a tympanometry shows a high compliance. High resolution CT scan of temporal bone also provides good information regarding the status of ossicles.

Methods:

This cross sectional study was done among 60 patients diagnosed as CSOM with cholesteatoma at ENT Dept. CMH Dhaka between January 2014 to June 2015. They underwent tympanomastoidectomy and ossicular chain reconstruction with auto/homologus incus or malleus head and sometimes with TORP/PORP. Assessment of data was carried out during surgery and recorded in a standard form of each patient. We included only subjects operated on by the same surgeon (Principal author). Otologic evaluation based on otoscopy, otomicroscopy, videotoendoscopy was carried out before surgery. Preoperative basic audiological assessment such as PTA, Tympanometry, SRT was done in all patients. Imaging study like HRCT of the temporal bone also carried out prior to surgery.

In each patient we carefully evaluated the condition of ossicular chain in order to determine the presence and site of lesion of each ossicles. We also evaluated manually the integrity of the ossicular chain during surgery

Result

This prospective clinical study was performed among 60 patients underwent mastoid exploration diagnosed as CSOM with cholesteatoma. Among them 36(60%) were male and 24(40%) were females. The age group was 05 to 65 years and the largest group was 21-35 years (53.33%). The least common in over 50 year group that was only 2 cases(3.33%). The primary complaints of the patients were ear discharge, seen in 100% cases and hearing loss in 89% cases.

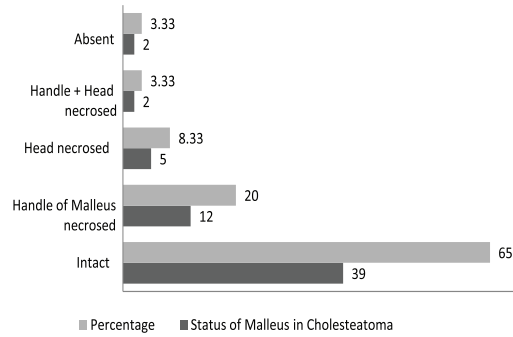


Chart 1: Status of Malleus in Cholesteatoma

Malleus was found intact in 39 (65%) cases, necrosed in 19 (31.67%), absent only 02 cases (3.33%) and the commonest part to be eroded is handle of malleus, 12(20%) cases.

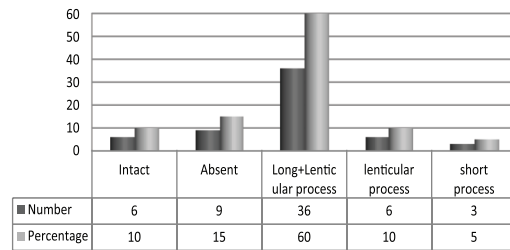


Chart 2: Status of incus in cholesteatoma

Incus was found intact in only 6 (10%) cases, absent in 9 (15%) cases and necrosed in 45(75%) cases and most common necrosed part is the long + lenticular process(60%) followed by lenticular process alone (10%).

Intact superstructure necrosed

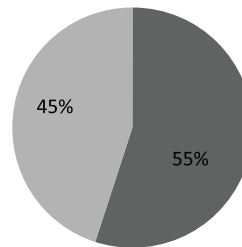


Chart 3: Status of stapes

It is shown that 33 cases (55%) have intact stapes & 27(45%) cases showed erosion of the superstructure of stapes.

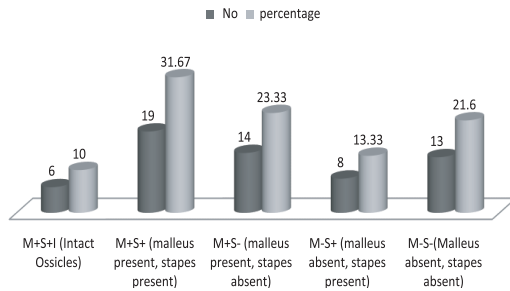


Chart: 4: Status of Ossicular chain

Intact ossicles was found only in 6(10%) cases. Ossicular chain was eroded in 90% cases. Most commonly found intact malleus & stapes with eroded incus in 19(31.67%) cases followed by intact malleus with eroded incus and stapes in 14(23.33%) cases

Discussion

Chronic supportive otitis media (CSOM) is a persistent disease which can cause severe destruction of middle ear and mastoid leads to irreversible sequel.¹

In this study, we studied a total 60 patients of CSOM with cholesteatoma to assess the intra-operative ossicular status. All the 60 cases of chronic supportive otitis media were presented with the most common complaints of ear discharge (100%) & hearing impairment (100%). During surgery, cholesteatoma alone and cholesteatoma with granulations appeared to be the commonest finding.

Cholesteatoma was common in male 36(60%) than in female 24(40%) which correlates with that of another study by Saurabh et al.²

Majority of our patients 32 (53.33%) were in the age group of 21-35 years followed by 16(26.67%) in the age group of 36-50 years and 10(16.67%) cases in group of 5-20 years

while only 2(3.33%) cases were above 50 years of age. In present study, young adults of age 21-35 years were found more indisposed than older ones.^{2,9} This findings regarding the age of the patient correlates with another study, Saurabh Varshney et al² and Ghodrat Mohammadi.⁹

Malleus was found to be the most resistant ossicle. Intact Malleus was found in 39(65%) cases, necrosed in 19(31.67%) cases and absent only in 2(3.33%) cases. The most common part to be necrosed was the handle of malleus 12(20%) cases. In a study by Ghodrat Mohammadi⁹ malleus erosion was 43.9%. Sade et al.⁸ also found malleus necrosis in 26.00% cases which correlates with our finding. In a study by Kurien and colleagues these figures were: incus 100% and malleus 67%, with stapes involvement occurring more in children than in adults (95% vs 67%)¹⁰

Incus was observed as the commonest ossicle to be necrosed in case of cholesteatoma. Intact incus was found in only 6(10%) cases, was absent in 9(15%) cases and founded to be eroded in 45(75%) cases. The commonest part to get erosion is the long process of the lenticular process of incus 36(60%) cases. The lenticular process alone damaged in 6(10%) cases and the short process only in 3(5%) cases. Saurabh Varshney et al. showed intact incus in 15% cases, eroded in 45% and absent in 40% cases². The most commonly necrosed part was the lenticular process (40%) followed by long process (38.33%) which are very similar with our result. Austin reported the most common ossicular defect to be the erosion of incus, with intact malleus and stapes, in 29.50% cases¹¹. Kartush found erosion of long process of incus with an intact malleus handle and stapes superstructure (type A) as the most common ossicular defect¹².

In this study, stapes was found intact in 33(55%) cases and get eroded in 27(45%) cases. Saurabh Varshney et al. also reported erosion of stapes in 51.67% cases and intact stapes in 48.33% cases². Sade reported stapes involvement in 36% case.⁸ Austin reported erosion of stapes at around 15.50% cases¹¹.

Regarding the status of ossicular chain, intact ossicular chain (M+S+I) was found in only 6(10%) cases, M+S+ was found in 19(31.67%) cases, M+S- in 14(23.33%) cases, M-S+ in 18(13.33%) cases and M-S- in 13(21.67%) cases. Austin reported the most common ossicular defect to be the erosion of incus, with intact malleus and stapes (M+S+) in 29.50% cases which is very similar to our study¹¹. Kartush found erosion of long process of incus with an intact malleus handle and stapes superstructure as the most common ossicular defect.¹²

Conclusion

Chronic supportive otitis media is a common health hazard in ENT practice all over the world. Cholesteatoma erodes ossicular chain and result in loss of hearing. Hearing loss arising from COM is a matter of serious concern because of its long-term effects on communication, language development and educational process specially in pediatric group. Early diagnosis and intervention by skilled Otolaryngologist is recommended to regain hearing as well as to prevent disability and complications.

References

1. George G Browning et al. Chronic Otitis Media. M Gleeson, editor. Scott-Brown's Otolaryngology, Head Neck Surgery, 7th ed. Vol-3, Hodder Arnold, 2008; 237c: 3395-3445
2. Saurabh Varshney et al. Ossicular chain status in chronic suppurative otitis media in adults. Indian J otolaryngology Head Neck Surgery, oct-dec 2010, 62(4):421-426.
3. Holger Sudhoff and Mirko tos. Pathogenesis of attic cholesteatoma: clinical and histochemical support for combination of retraction theory and proliferation theory. The American journal of otology, 21:786-792.
4. Alam KMN, Ali MI, Huq MM, Hanif MA. Prognostic factors influencing anatomical and functional outcome of Myringoplasty. Bangladesh journal of Otorhinolaryngology 2013; 19(1): 18-23.
5. Islam MS, Islam MR, Rahman MA, Bhuiyan MAR, Rashid MS, Datta PG. Pattern and degree of hearing loss in chronic suppurative otitis media. Bangladesh journal of Otorhinolaryngology 2010; 16(2): 96-105.
6. Orisek BS, Chole RA, Pressure exerted by experimental cholesteatoma. Arch otolaryngology head-neck surgery 1987; 113; 386-91.
7. Deka RC (1998) Newer concepts of pathogenesis of middle ear cholesteatoma. Indian J Otol 4(2): 55-57
8. Sade J, Berco E, Buyanover D, Brown M (1981) Ossicular damage in chronic middle ear inflammation. Acta Otolaryngol 92:273-283
9. Ghodrat Mohammadi, Masoud Naderpour, Mehrnoosh Mousaviagdas. Ossicular Erosion in Patients Requiring Surgery for Cholesteatoma. Iranian Journal of Otorhinolaryngology.No.3, Vol.24, Serial No.68, Summer 2012
10. Kurien M, Job A, Mathew J. Otogenic intracranial abscess: current craniotomy and mastoidectomy: changing trends in a developing country. Arch Otolaryngol Head Neck Surgery 1998; 124: 1353-6
11. Austin DF. Ossicular reconstruction. Arch Otolaryngol. 1971 Dec; 94(6):525-35.
12. Kartush JM. Ossicular chain reconstruction. Capitulum to malleus. Otolaryngol Clin North Am. 1994 Aug; 27(4):689-715.