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Ossicular chain status in cases of cholesteatomatous chronic otitis media in eastern Nepal

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ABSTRACT

Background: Ossicular erosion and disruption of ossicular chain is a frequent complication of cholesteatomatous chronic otitis media leading to hearing loss. **Aims and Objectives:** To find out the status of ossicles and ossicular chain in patients of choleasteatomatous chronic otitis media undergoing surgery. **Materials and Methods:** This is a descriptive, cross sectional study conducted among 52 patients of chronic suppurative otitis media with cholesteatoma undergoing surgery at Biratnagar Eye Hospital, Ear Department over 3 years. In each patient the condition and the integrity of ossicular chain was evaluated in order to determine the presence and site of lesion of each ossicles. The data was analysed and expressed in numbers and percentage. **Results:** Among 52 cases, 27(51.92%) were male and 25(48.08%) were female. The age range was 16 to 50 years. The mean age was 25.6 years. The commonest age range was of 16-20 years, 21 (40.38%). The chief complaints of the patients were ear discharge seen in 52 (100%) cases and hearing loss in 45 (86.5%) cases. Malleus was found intact in 37 (71.1%) cases and absent in 7(13.5%). Handle erosion was found in 3(5.8%) cases. Head and handle erosion was found in 5(9.6%) cases. Incus was found intact in only 6 (11.5%) cases and absent in 11 (21.2%) cases. Long and lenticular process was eroded in 35(67.3%) cases. Intact suprastructure of Stapes was found in 27(51.92%) cases. Suprastructure erosion was found in 25(48.08%) cases. Intact ossicular chain was found only in 6(11.5%) cases. M+S+ was found in 17(32.7%) cases followed by M+S- in 14(26.9%). M-S+ was found in 4(7.8%) cases. All the ossicles eroded were found in 11(21.1%) cases. **Conclusion:** In this study of cholesteatomatous ears, the Malleus was found to be the most resistant ossicle to erosion, whereas, Incus was found to be the most susceptible.

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

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INTRODUCTION

Chronic Suppurative Otitis Media (CSOM) is a leading cause of conductive hearing impairment in adults secondary to the damage of the ear drum and middle ear ossicles induced by chronic inflammation present in the tympanic cavity. Ossicular erosion, a frequent complication of CSOM, may lead to total failure of middle ear mechanism resulting in substantial hearing loss.[1] The degree of hearing loss varies with size and position of tympanic membrane defect, status of ossicular chain and presence of middle ear pathology.[2,3]

Both types of CSOM, tubotympanic (safe), as well as atticoantral (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.[2,3,4] Partial or total destruction of ossicles is seen in approximately 80% of patients with cholesteatoma, whereas in chronic otitis media

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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.[2,5,6]

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, the process called Demineralization.[2,7] The proposed mechanism for erosion is chronic middle ear inflammation as a result of overproduction of cytokines—TNF alpha, interleukin-2, fibroblast growth factor, and platelet derived growth factor, which promote hypervascularisation, osteoclast activation and bone resorption causing ossicular damage. TNF-alpha also produces neovascularisation and hence granulation tissue formation. CSOM is thus an inflammatory process with a defective wound healing mechanism.[2,5,8] This inflammatory process in the middle ear is more harmful the longer it stays and the nearer it is to the ossicular chain.[5]

Destruction of the ossicular chain result in large hearing losses. Complete disruption of the ossicular chain can result in a 60 dB hearing loss.[2,9-11]

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.[2]

Basically there are four major ossicular defect, the most common is the involvement of 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 stapedial foot plate. The reason of the erosion of long process of incus by cholesteatoma, being most frequently encountered defect of ossicular chain is due to its delicate structure rather than its tenuous blood supply.[2,5,8]

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 complete ossicular chain disruption, and a tympanometry shows a high compliance.[12,13]

High resolution CT scan of temporal bone also provides good information regarding the status of ossicles.

MATERIALS AND METHODS

This descriptive, cross sectional study was conducted among 52 patients diagnosed as chronic suppurative otitis media with cholesteatoma undergoing surgery at Biratnagar Eye Hospital, Ear Department between January 2014 to December 2016.

Inclusion Criteria

1. Patients aged 16 years or more.
2. Patients diagnosed with cholesteatomatous chronic otitis media.
3. Patients willing to give consent.

Exclusion Criteria

1. Patients who were less than 16 years age.
2. Patients having malignancy of middle ear.
3. Patients suffering of otitis externa.
4. Patients with previous history of ear surgery.

After thorough history, preoperative otologic evaluation (otoscopy and otomicroscopy) and basic audiolological assessment such as PTA, Tympanometry, Speech audiometry was carried out. Imaging study like HRCT of the temporal bone was also carried out where necessary. 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 format.

In each patient the condition and the integrity of ossicular chain was evaluated in order to determine the presence and site of lesion of each ossicles. The data was analysed and expressed in numbers and percentage.

RESULTS

This descriptive, clinical study was performed among 52 patients of CSOM with cholesteatoma who underwent tympanomastoidectomy.

Among 52 cases, 27 (51.92%) were male and 25 (48.08%) were female (Table 1).

The age range was 16 to 50 years and the mean age was 25.6 years. The largest group, 21 (40.38%) cases were of the range 16 to 20 years. The least common were those over 50 years group, only 2 (3.85%) cases. The chief complaints of the patients were ear discharge, seen in 52 (100%) cases and hearing loss in 45 (86.5%) cases (Table 2).

Malleus was found intact in 37 (71.1%) cases and absent in 7 (13.5%).Handle erosion was found in 3 (5.8%) cases. Head and handle erosion was found in 5 (9.6%) cases (Table 3).

Incus was found intact in only 6 (11.5%) cases and absent in 11 (21.2%) cases. Long and lenticular process was eroded in 35(67.3%) cases (Table 4).

Intact suprastructure of Stapes was found in 27 (51.92%) cases. Suprastructure erosion was found in 25 (48.08%) cases (Table 5).

Intact ossicular chain was found only in 6 (11.5%) cases. Intact Malleus and Stapes with eroded Incus was found in 17 (32.7%) cases followed by Intact malleus with eroded Incus and erode Stapes in 14 (26.9%). Absent or eroded Malleus and Incus with Intact Stapes suprastructure was found in 4 (7.8%) cases. All the ossicles eroded were found in 11 (21.1%) cases(Table 6).

Table 1: Gender distribution

Gender	Number	Percentage
Male	27	51.92
Female	25	48.08

Table 2: Age distribution

Age range	Number	Percentage
16-20 years	21	40.38
21-30 years	16	30.77
31-40 years	13	25
41-50 years	2	3.85

Table 3: Status of malleus

Status of malleus	Number	Percentage
Intact	37	71.1
Absent	7	13.5
Handle erosion	3	5.8
Head and handle erosion	5	9.6

Table 4: Status of incus

Status of incus	Number	Percentage
Intact	6	11.5
Absent	11	21.2
Long and lenticular process erosion	35	67.3

Table 5: Status of stapes

Status of stapes	Number	Percentage
Intact suprastructure	27	51.92
Suprastructure erosion	25	48.08

Table 6: Status of ossicular chain

Status of ossicular chain	Number	Percentage
Intact ossicular chain (M+, I+, S+)	6	11.5
Malleus present, stapes suprastructure present (M+, S+)	17	32.7
Malleus present, stapes suprastructure absent (M+, S-)	14	26.9
Malleus absent, stapes suprastructre present (M-, S+)	4	7.8
Malleus absent, stapes suprastructure absent (M-, S-)	11	21.1

DISCUSSION

Chronic supportive otitis media (CSOM) is a persistent disease which can cause severe destruction of middle ear and mastoid leading to irreversible sequelae.[2]

In this study, we studied a total 52 patients of CSOM with cholesteatoma to assess the intra-operative ossicular status. The presenting complaints were that of ear discharge in 52 (100%) cases & hearing impairment in 45 (86.5%) cases. The lesser number of hearing loss as presenting complaint, in relation to discharging ears could be attributed to the difficulty in appreciating minor degrees of hearing loss by the patient. The hearing loss would be noticed only when the disease has progressed sufficiently to cause a significant impairment of hearing by perforation or ossicular destruction.[4]

Majority of our patients 21 (40.38%) were in the age group of 16 to 20 years followed by 16 (30.77%) in the age group of 21-30 years. In present study, young adults were found to be more affected similar to other studies.[4,9]

Malleus was found to be the most resistant ossicles in our study. Malleus was found intact in 37 (71.1%) cases and absent in 7 (13.5%).Handle erosion was found in 3 (5.8%) cases. Head and handle erosion was found in 5 (9.6%) cases. Overall, 28.9% of Malleus in our study was necrosed. Sade et al found Malleus necrosis in 26.00% cases in their study similar to our study.[5] However, in a study by Mohammadi G and colleagues observed Malleus erosion to be 43.9% in their study.[9] 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%).[6]

In our study, Incus was observed as the commonest ossicle to be necrosed. Incus was found intact in only 6 (11.5%) cases and absent in 11 (21.2%) cases. The commonest part to get eroded was the long and lenticular process of the Incus, 35 (67.3%) cases.

Saurabh Varshney et al. showed intact Incus in 15% cases, eroded in 45% and absent in 40% cases.[4] Austin reported the most common ossicular defect to be the erosion of Incus, with intact Malleus and Stapes, in 29.50% cases[10] Kartush found erosion of long process of Incus with an intact Malleus handle and Stapes superstructure (type A) as the most common ossicular defect.[11]

In this study, Stapes was founded intact in 27 (51.92%) cases and eroded in 25 (48.08%) cases. Saurabh Varshney et al. reported erosion of Stapes in 51.67% cases and intact Stapes in 48.33% cases.[4] Sade reported Stapes involvement in 36% case.[5] However, Austin reported erosion of Stapes at around 15.50% cases.[10]

Regarding the status of ossicular chain, intact ossicular chain (M+S+I) was found in only 6 (11.5%) cases. Intact Malleus and Stapes with eroded or absent Incus (M+S+) was found in 17 (32.7%) cases. Intact malleus with eroded Incus and Stapes (M+S-) in 14(26.9%) cases. Absent or eroded Malleus and Incus with Intact Stapes suprastructure (M-S+) was found in 4(7.8%) cases. All the ossicles eroded (M-S-) were in 11 (21.1%) 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.[10] Kartush found erosion of long process of Incus with an intact Malleus handle and Stapes superstructure as the most common ossicular defect.[11]

In unsafe CSOM, Saurabh Varshney et al found only 9 (15.00%) cases with intact ossicular chain. M+S+ was seen in 8 (13.33%) cases, M−S+ in 12 (20.00%) cases, M+S− in 16 (26.67%) cases and M−S− in 15 (25.00%) cases.[4]

CONCLUSION

Erosion of ossicles and ossicular chain is a common finding in cholesteatomatous ears. In this study, the Malleus was found to be the most resistant ossicle to erosion, whereas, Incus was found to be the most susceptible. The erosin of ossicles leading to hearing loss in cholesteatomatous chronic otitis media is a matter of concern because of its long-term effects on communication and language development. Early diagnosis and intervention by a skilled Otologist should be helpful to reduce this morbidity.

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Authors Contribution:
SKT- Concept and design of the study, manuscript preparation, data collection, statistically analyzed and interpreted, critical revision of the manuscript; **NG and RA-** reviewed the literature, helped in preparing first draft of manuscript, collected data; **SKS and AA-** reviewed the literature, statistically analyzed and interpreted, helped in preparing first draft of manuscript.

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