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Hearing loss and ossicular status in cholesteatoma

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ABSTRACT

Background: Chronic otitis media with cholesteatoma is associated with hearing loss. Cholesteatoma causes bone erosion leading to ossicular chain defects. These ossicular lesions are only detected intraoperatively. If the ossicular status could be detected preoperatively by audiometric parameters, it would aid in better information to the patient, surgeon and preparation for the surgery. The aim of this study is to describe the intraoperative ossicular status, preoperative hearing status and to correlate them in patients with cholesteatoma.

Methods: This is a retrospective case series study conducted in a tertiary care centre. Data was collected from inpatient files of 47 patients who underwent surgery for cholesteatoma from January 2016 to December 2017. Air and bone conduction thresholds, air- bone gaps from pure tone audiometry (PTA) reports were collected. The status of the ossicles was collected from the operative notes.

Results: PTA revealed hearing loss in all the patients, predominantly conductive loss (83%). Ossicular defects were noted in 87% with incus most frequently involved (78.7%). Ossicular lesions were significantly associated with worse air conduction, bone conduction thresholds and air bone gap.

Conclusions: Cholesteatoma is frequently associated with ossicular defects. PTA shows worse parameters in ossicular defects. But, it doesn't reflect the status of ossicle involved or the number of ossicles involved.

Keywords: Cholesteatoma, Hearing loss, Ossicular chain

INTRODUCTION

Chronic suppurative otitis media (CSOM) is a common condition in patients attending otorhinolaryngology outpatient department. The prevalence of CSOM in India is classified under highest (>4%) by WHO. Globally the estimated CSOM incidence rate is 4.76 per thousand people for a total of 31 million cases. ¹

Chronic suppurative otitis media (CSOM) is the term designated when there is persistent or intermittent otorrhea through a permanent defect in the tympanic membrane (TM) and it is frequently associated with inflammatory mucosal disease in the middle ear and the mastoid cells.² Atticoantral disease is the variant of CSOM where inflammation can involve bony external canal wall, attic, antrum and mastoid air cells. It is

associated with cholesteatoma. Cholesteatoma is a major cause of morbidity including dangerous intratemporal and intracranial complications and dictates early surgical intervention.³

Cholesteatomas are retraction pockets or cysts lined with squamous cell epithelium and filled with keratin debris occurring within the pneumatized spaces of the temporal bone. The name is a misnomer as cholesteatoma is not a true neoplasm and does not contain cholesterol. Cholesteatomas have a propensity for growth, bone destruction, and chronic infection.²

Cholesteatoma shows a matrix of keratinised stratified squamous epithelium with a peri-matrix envelope, separated by an inflammatory layer rich in lymphocytes and mast cells which are thought to play a major role in symptoms and complications.⁴ Bone absorption is stimulated by several factors, like inflammation, local pressure and cytokeratins.⁵ Abramson defined the enzymatic concept in which epithelial origin enzymes are considered to be responsible for bone destruction and showed the presence of collagenases and hydrolysis in cholesteatoma.⁶ Ferlito et al suggested that bone erosion is caused by the collagenases produced by the components of squamous and fibrous epithelial tissues.⁷ The hypothesis of bone absorption by this biochemical action was later incorporated by other agents, such as tumour necrosis factor (TNF), interleukins (IL-1a) and prostaglandins (PGE2).⁸⁻¹⁰

Bone erosion commonly cause ossicular destruction. According to Swartz, ossicular destruction is certainly the most common problem among cholesteatoma complications and the type of destruction depends on its origin and the way it spreads itself. ¹¹

Pathologies that interrupt the ossicular chain result in large hearing losses. Complete disruption of the ossicular chain can result in a 60 dB hearing loss.⁴

Pure tone audiometry (PTA) is an audiological evaluation that measures the thresholds of air and bone conduction for pure tone sounds. This is used to determine the type of hearing and quantify it. ¹³ Hearing loss can be classified as normal (<25 dB), mild (26-40 dB), moderate (41-55 dB), moderately severe (56-70 dB), severe (71-90 dB) and profound (>91 dB). ¹⁴

The aim of this study was to describe the status of ossicles, common erosions of ossicular chain and evaluate the hearing loss in patients having CSOM with cholesteatoma, and to correlate hearing loss with ossicular status in these patients.

METHODS

This was a retrospective hospital based case series study conducted in the department Otorhinolaryngology, S. Nijalingappa medical college and HSK hospital, Bagalkot. The study group composed of 47 patients of CSOM with cholesteatoma of all ages and either sex. Data was obtained from inpatient files for a period of 24 months from January 2016 to December 2017 from the tertiary care hospital. Patients who were diagnosed with CSOM and had undergone pure tone audiometry and submitted to otological surgery which showed cholesteatoma were included in the study. Patients with other concomitant ear diseases were excluded.

Pure tone audiometry reports were evaluated to determine the hearing status and to calculate the air conduction threshold, bone conduction threshold and air-bone gap at 0.5-1-2kHz. The hearing loss was classified as per ASHA, 1981. The status of the ossicles were collected from the operative notes, any ossicular erosions and integrity of ossicular chain were noted.

Data was collected and compiled using Microsoft Office Excel 360. Quantitative data analysis was carried out using statistical software SPSS version 24.0 and a p level of 0.05 was considered to be statistically significant.

RESULTS

The data collected consisted of 47 patients between 6 to 60 years of age with a mean age 20 years. 26 were males (55.3%) and 21 females (44.7%). Of the 47 ears studied, 19 (40.4%) were right and 28 (59.6%) were left sided.

Table 1: Distribution of air conduction threshold (AC) in decibels.

AC	Frequency	Percentage (%)
26-40	6	12.8
41-55	23	48.9
56-70	16	34.0
71-90	1	2.1
>90	1	2.1
Total	47	100.0

Table 2: Distribution of bone conduction threshold (BC) in decibels.

BC	Frequency	Percent
<25	39	83.0
26-40	6	12.8
41-55	1	2.1
>90	1	2.1
Total	47	100.0

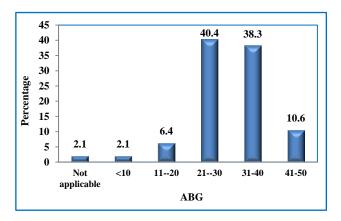


Figure 1: Distribution of air bone gap (ABG).

The PTA values for air conduction threshold (Table 1) was most frequently seen between 41-55 dB (48.9%), followed by 56-70 dB (34%) and 26-40 dB (12.8%). The mean air conduction threshold was 53 dB and no patient had air conduction threshold <25 dB. The bone conduction threshold (Table 2) was <25 dB in 39 patients (83%), with a mean of 19 dB and only 2 patients had bone conduction threshold >40 dB. The air-bone gap (Figure 2) of >20 dB was seen in 42 patients (89.4%). 39

had conductive hearing loss (83%), 7 patients had mixed hearing loss (14.9%), 1 had sensorineural loss (2.1%).

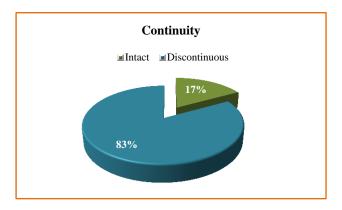


Figure 2: Ossicular chain continuity.

The operative notes revealed the incus to be the most commonly eroded ossicle seen in 37 (78.7%) patients followed by malleus in 29 (61.7%) and then by stapes in 19 (40.4%). Lesions of all 3 ossicles were noted in 14 patients (29.8%). Ossicular chain discontinuity was noted introperatively in 39 (83%) of the patients (Figure 2). Intact and non-eroded ossicles were noted in only 6 patients (12.8%).

Table 3: Intraoperative ossicular status.

Ossicle	Status	Frequency	Percentage (%)
Malleus	Present	18	38.3
	Eroded	29	61.7
Incus	Present	10	21.3
	Eroded	37	78.7
Stapes	Present	28	59.6
	Eroded	19	40.4

Table 4: Relationship between ossicular condition and hearing.

Ossicular condition	AC	BC	ABG
Normal (6)	42	15	18
Eroded (41)	55	21	27

Table 5: Relationship between ossicular defect and hearing.

Ossicular defect	AC	BC	ABG
Malleus (29)	54.97	19.17	35.34
Incus (37)	54.78	18.27	32.30
Stapes (19)	57.05	19.89	35.79
P	0.95	0.98	0.38

Subjects affected by ossicular chain defects had significantly worse air conduction threshold, bone conduction threshold and air-bone gap (Table 4). In Table 5, PTA in relation to particular ossicular lesion is reported. There is reduced air conduction threshold and

air-gone gap seen with lesions of individual ossicles. There is no significant difference in PTA parameters noted between individual ossicular erosion (p>0.05) as shown by the ANOVA test.

DISCUSSION

The aim of this study was to account the ossicular defects, hearing status and to correlate these findings in patients of cholesteatoma. Majority of the patients in the study presented in the second decade of life which was in accordance with a previous study by Wahid et al.³

Chronic otitis media is a disease associated with hearing loss and ossicular erosion. One of the important issues in the management of cholesteatoma is the hearing reconstruction as about two-thirds show ossicular defects. ^{15,16}

The present sample showed ossicular defects in 41 of the 47 patients (87.2%), which is similar to a study on ossicular lesions in cholesteatoma conducted by Albera et al. 17 Incus was found to be the most frequently involved ossicle (78.7%). This is in accordance with a study conducted by Tos on 426 ears with cholesteatoma, where lesion of incus was the most common ossicular defect (74%). 15 Incus erosion as the most common ossicular defect was also noted in other studies of ossicular lesions. 4,17 In our study stapes was found to be the least frequently eroded ossicle (40.4%). This however was not similar to the finding of studies by Dornelles et al and Albera et al, where malleus was reported to be the least eroded ossicle. 4,17

The PTA revealed increased air conduction threshold and air bone gap suggestive of conductive hearing loss in most of the samples. The mean pure tone air conduction threshold was 53 dB, and mean air bone gap was 32 dB. Similar increase in air conduction threshold an air bone gap was reported by Martins et al. ¹⁸ A study conducted by Eisenman et al, found cholesteatoma to be associated with a decrease in neurosensory function. ¹⁹ We found sensorineural component in PTA of 17% of our sample.

This study showed worse threshold values of air conduction, bone conduction and air bone gap in case of ossicular defects as compared to intact ossicles. Albera et al, mentioned that ossicular lesion determines poorer hearing in terms of PTA parameters as compared to intact ossicular status. However they also reported that air and bone conduction threshold impairment was related to the ossicle involved and number of ossicles involved, which is in contrast to the findings of our study.¹⁷

CONCLUSION

Ossicular defects and ossicular chain discontinuity is frequently seen in CSOM with cholesteatoma. PTA does not reflect the exact status of ossicle involved or the number of ossicles involved. However, the air conduction and bone conduction thresholds and air bone gap were worse in cases of cholesteatoma with ossicular defects. Thus, making restoration of the ossicular chain crucial for hearing reconstruction in surgeries for cholesteatoma.

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