ORIGINAL ARTICLE ASIAN JOURNAL OF MEDICAL SCIENCES

Cholesteatoma ear with increased bone conduction threshold should no more be missed - A prospective study

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Submission: 03-04-2022 Revision: 26-06-2022 Publication: 01-08-2022

ABSTRACT

Background: Cholesteatoma is a collection of keratinized squamous epithelium in middle ear and pneumatic areas of temporal bone. It can be said as an invasive disease which is often associated with sensorineural hearing loss. It is seen that hearing loss varies with the location of disease, duration of disease, and extension of cholesteatoma. **Aims and Objectives:** The aim of this study is to see the association of cholesteatoma and bone conduction threshold difference as compared to contralateral normal ear. **Materials and Methods:** This study was done between August 2019 and December 2021 at our tertiary care center. It is a prospective study of 50 patients. **Results:** In our study, we saw that there is a considerable sensorineural hearing loss associated with cholesteatoma depending on which varies with location and extension. **Conclusion:** Our study shows that the more extensive the cholesteatoma more is the sensorineural hearing loss.

Key words: Bone conduction; Cholesteatoma; Hearing loss sensorineural

Access this article online

Website: http://nepjol.info/index.php/AJMS

DOI: 10.3126/ajms.v13i8.44275

E-ISSN: 2091-0576

P-ISSN: 2467-9100

INTRODUCTION

Cholesteatoma is the collection of squamous epithelium at abnormal place. Cholesteatoma ear is mostly associated with conductive hearing loss but the prevalence of sensorineural hearing loss is increasing with increase in duration and extension of disease. Inflammatory mediators cause bone erosion and ossicular disruption which lead to impediment of sound transmission resulting in hearing loss. Advanced disease makes hearing loss worse and further causes loss in higher frequency range. There is also variation in bone conduction (BC) difference depending on the location of disease. Studies have been done in the past showing significant BC differences in cholesteatoma ears while many studies do not show uniform consensus.

Aims and objectives

This is a prospective study done at our tertiary care center to find out association between cholesteatoma and BC threshold difference compared to contralateral normal ear.

MATERIALS AND METHODS

Patients who were presenting in the ENT out-patient department of Patna Medical College and Hospital with one- sided ear discharge were put up for evaluation. This study was done between August 2019 and December 2021 at our tertiary care center. It is a prospective study of 50 patients. Protocol of the study was laid out and those who were following the inclusion and exclusion criteria were selected for our study. Consent was taken from all the patients for participation in the study. The study was

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pre-approved by the Institutional Ethics Committee for the final permission.

Inclusion criteria

The inclusion criteria were – confirmed cases of cholesteatoma, patients with unilateral COM, age group 15–46 years, sensorineural hearing loss, and other ear normal.

Exclusion criteria

The exclusion criteria were – bilateral COM with cholesteatoma, bilateral adhesive otitis media, retraction pockets, discharging ear, congenital cholesteatoma, conductive and mixed hearing loss, history of head injury, noise exposure, ototoxic drugs, familial hearing loss, occupational hazards, and history of previous ear surgery.

Patients age, sex, and basic details were noted. Ear which was to be operated on was examined by otoscope followed by dry mopping and microscopic examination. Computed tomographic scan was done of every patient to identify site, extent of lesion, and associated bony anomalies. The findings regarding fistula of lateral canal, condition of the ossicles, its relationship with cholesteatoma, and hearing loss were illustrated. The findings were corroborated with intraoperative findings.

Cholesteatoma was further categorized based on its site:

- Attic
- Attic and antrum
- Attic and tympanic cavity
- Tympanic cavity and antrum
- Tympanic cavity and mastoid cavity.

Audiometry was done to find out air conduction (AC) and BC thresholds at frequencies of 1 kHz, 2 kHz, and 4 kHz in each ear. Differences in BC thresholds between ears with cholesteatoma and healthy ears of each patient were calculated followed by difference in BC-AC between the ear with cholesteatoma and the normal ear was analyzed. Differences in scores were noted for diseased and healthy ears. The ABG was calculated as the difference between the AC and BC thresholds at 1 kHz, 2 kHz, and 4 kHz for diseased ears.

Statistical analyses

P<0.05 was considered statistically significant and the statistical test was two tailed. Statistical analysis was done using SPSS software version 24.0 for Windows. Categorical variants were described as percentage and frequency. Continuous variants were described as mean, median, and standard distribution which were calculated by Kruskal–Wallis test to compare the BC differences. To determine the relationship between BC differences, the Mann–Whitney U-test was used.

RESULTS

We selected 50 patients for the study. There were no drop outs of patients so total number of patients in the study group remained 50. Age group ranged from 15 to 46 with mean value 31.5, standard deviation when calculated was 8.6 and variance 75.2. Males in the cohort were 44% and females 56% (Table 1, Figures 1 and 2).

Distribution of cholesteatoma varied at different locations in the temporal bone and ear. Middle ear involvement was

Table 1: Age distribution statistics

Statistics	Age
n	
Valid	50
Missing	0
Mean	31.80
Std. error of mean	1.227
Std. deviation	8.673
Variance	75.224
Skewness	−0.178
Std. error of skewness	0.337
Range	31
Minimum	15
Maximum	46
Percentiles	
25	24.50
50	33.00
75	38.25

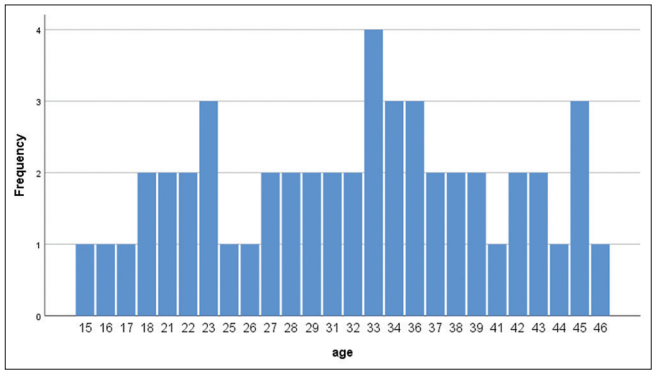

Figure 1: Age distribution

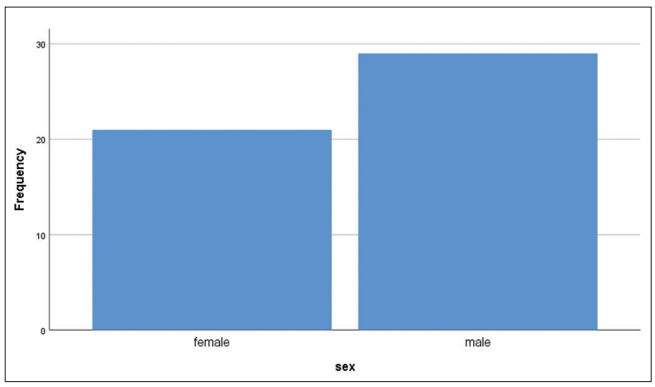

Figure 2: Sex distribution

Table 2: Bone conduction threshold mean in diseased ear at different frequencies (P<0.01)

Location	Bone conduction threshold (dB) at 4 kHz	Bone conduction threshold (dB) at 2 kHz	Bone conduction threshold (dB) at 1 kHz
Epitympanum	26.3±1.5	25±2.7	24±0.25
Epitympanum and Antrum	28±2.6	27±3.0	25±1.8
Tympanic Cavity	30±5.0	28±3.5	28±1.0
Tympanic Cavity and Antrum	33±2.5	32±1.6	28±2.1
Tympanic Cavity, Epitympanum, and Antrum	38±8.0	33±6.0	30±6.0

22% which was maximum and least association was seen when antrum, attic, and middle ears were involved with 18%. Rest of the areas such as attic, attic with antrum, and middle ear with antrum showed quite similar frequencies of occurrence (Chart 1).

On pure tone audiometry, mean BC threshold at 1.0 kHz was 30 dB±6.0 SD, at 2 kHz, it was 33.0 dB±6.0 SD, and at 4 kHz, it was 38 dB±8.0 SD, when tympanic cavity, epitympanum, and antrum were involved (Table 2). P-value was shown to be <0.01 which is statistically significant. Average hearing threshold was 38 dB in patients with cholesteatoma and 20 dB average hearing threshold was seen in normal contralateral ears. BC threshold difference (between cholesteatoma ear and normal ear) mean value highest was seen in combined attic, antrum, and middle ear involvement which was 16 followed by middle ear 12.2, middle ear with antrum 10.5, attic and antrum 7.8, and sole attic disease was 6.3. P-value was found to be 0.023 which is statistically significant (Table 3).

Table 3: Bone conduction threshold difference mean at different locations

Location	Bone conduction threshold difference mean (dB)
Attic	6.3
Attic and Antrum	7.8
Middle ear	12.2
Middle ear with Antrum	10.5
Middle ear, Attic, and Antrum	16

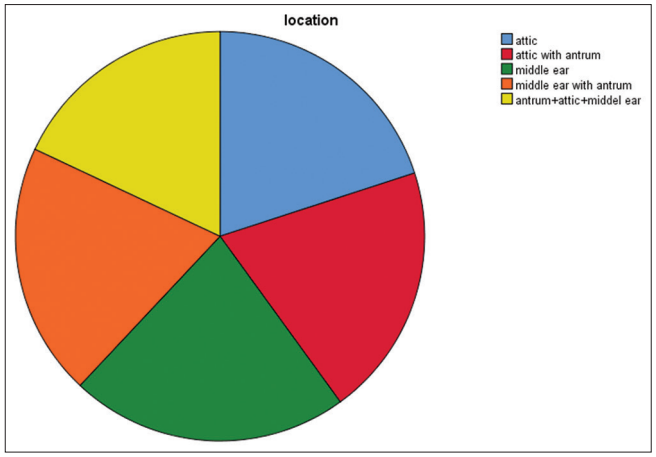

Chart 1: Distribution of cholesteatoma

DISCUSSION

Hearing loss is one of the chief symptoms in cases of cholesteatoma. Cholesteatoma is a collection of desquamated epithelium filling up the middle ear space, attic, antrum, and mastoid cavity, leading to bone and ossicular erosion which results in hearing loss. Some studies have shown relation between sensorineural hearing loss and cholesteatoma. Inflammatory mediators secreted by cholesteatoma might be the cause of hearing loss. Eisenman and Parisier[1] did study on 145 patients and showed that BC threshold is increased in high frequency range due to the inflammatory markers passing through the oval window. Rosito et al.,[2] came out with more BC differences at frequencies of 2 kHz and 3 kHz. Various studies have been done in the past, while some has shown acceptable relation between cholesteatoma ears with sensorineural hearing loss while many did not give an impression of correlation.[3-5] Therefore, there still remains unsolved consensus relating to cholesteatoma and sensorineural hearing loss.[6,7] In our study, we came out with BC threshold differences depending on the site of cholesteatoma involvement. BC threshold difference mean value was highest when there was combined attic, antrum, and middle ear involvement which was 16. This was followed by middle ear with BC average of 12.2. Whereas when middle ear with antrum was involved, it was 10.5, attic and antrum 7.8, and cholesteatoma solely in the attic gave BC threshold difference mean of 6.3. The relationship of cholesteatoma with hearing loss was considerably significant. We found that hearing loss is more in extensive cholesteatoma and involvement of mastoid, attic, and tympanic cavity gives a comparatively higher BC threshold difference. An average of 35 patients in our study had BC difference more than 10 at an average of 1 kHz, 2 kHz, and 4 kHz. Average hearing threshold was 38 dB in patients with cholesteatoma and 20 dB average hearing threshold was seen in normal contralateral ears. Paparella et al.,[8] emphasized the disastrous results of chronically discharging ear for the inner ear. The cochlear damage has been contributed to the seeping of toxins through the round window, causing injury to the hair cells mainly

in the cochlear base. It has been recommended that inflammatory mediators may enter the inner ear through the round window membrane and cause damage of the hair cells, especially in the basal turn of the cochlea where the higher frequencies are represented.[1] The permeability of the round window membrane raises due to long- term inflammation.[9] This pathogenesis might prove the early appearance of an interaural difference in BCT obtained on PTA at higher frequencies, that is, 4 kHz in patients with unilateral cholesteatoma ears.[10] There are still lots of study needs to be done to show association between cholesteatoma and hearing loss based on sites and structures involved.

Limitations of the study

In our study, the sample size is not large.

CONCLUSION

Patients should be well versed with the severity of cholesteatoma and its treatment options available so as to prevent complications related to advanced disease. The sensorineural hearing loss it can cause could be debilitating and it increases with increase in extension. Our study shows that the more extensive the cholesteatoma more is the hearing loss. We found that hearing loss is more in extensive cholesteatoma and involvement of mastoid, attic, and tympanic cavity gives a comparatively higher BC threshold difference.

ACKNOWLEDGMENT

We are grateful to all our patients who gave consent for this study.

REFERENCES

1. Eisenman DJ and Parisier SC. Is chronic otitis media with cholesteatoma associated with neurosensory hearing loss? Am J Otol. 1998;19(1):20-25.
2. Rosito LP, Netto LS, Teixeira AR and Da Costa SS. Sensorineural hearing loss in cholesteatoma. Otol Neurotol. 2016;37(3):214-227. https://doi.org/10.1097/MAO.0000000000000952
3. Da Costa SS, Rosito LP and Dornelles C. Sensorineural hearing loss in patients with chronic otitis media. Eur Arch Otorhinolaryngol. 2009;266(2):221-224. https://doi.org/10.1007/s00405-008-0739-0
4. Luntz M, Yehudai N, Haifler M, Sigal G and Most T. Risk factors for sensorineural hearing loss in chronic otitis media. Acta Otolaryngol. 2013;133(11):1173-1180. https://doi.org/10.3109/00016489.2013.814154
5. Yehudai N, Most T and Luntz M. Risk factors for sensorineural hearing loss in pediatric chronic otitis media. Int J Pediatr Otorhinolaryngol. 2015;79(1):26-30. https://doi.org/10.1016/j.ijporl.2014.10.025
6. Levine BA, Shelton C, Berliner KI and Sheehy JL. Sensorineural loss in chronic otitis media. Is it clinically significant? Arch Otolaryngol Head Neck Surg. 1989;115(7):814-816. https://doi.org/10.1001/archotol.1989.01860310052021
7. de Zinis LO, Campovecchi C, Parrinello G and Antonelli AR. Predisposing factors for inner ear hearing loss association with chronic otitis media. Int J Audiol. 2005;44(10):593-598. https://doi.org/10.1080/14992020500243737
8. Paparella MM, Morizono T, Le CT, Mancini F, Sipilä P, Choo YB, et al. Sensorioneural hearing loss in otitis media. Ann Otol Rhinol Laryngol. 1984;93(6 Pt 1):623-629. https://doi.org/10.1177/000348948409300616
9. Walby AP, Barrera A and Schuknecht HF. Cochlear pathology in chronic suppurative otitis media. Ann Otol Rhinol Laryngol Suppl 1983;103(Suppl):1-19. https://doi.org/10.1177/00034894830920S201
10. Papp Z, Rezes S, Jokay I and Sziklai I. Sensorineural hearing loss in chronic otitis media. Otol Neurotol. 2003;24(2):141-144. https://doi.org/10.1097/00129492-200303000-00003

Authors Contribution:
S- Concept and design of the study, prepared first draft of manuscript, and interpreted the results; **SZ-** Reviewed the literature and interpreted the results; **RK-** Reviewed the literature and manuscript preparation, statistical analysis, and interpretation; and **VS-** Concept and design of the study.

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Source of Support: Nil, **Conflict of Interest:** None declared.