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# Correlation of tympanic membrane perforations with hearing loss

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## ABSTRACT

**Background:** Tympanic membrane perforations are common cause of hearing loss. This study was designed to analyze the relation between tympanic membrane perforation and hearing loss.
**Methods:** In this prospective study, patients with dry tympanic membrane perforations of safe type were included. The patients were divided into groups in according to size, site and duration of perforation.
**Results:** 49 patients with 70 dry tympanic membrane perforations were studied. Data was analyzed statistically using paired t-test. Hearing loss increased as the size of perforation increased. Posterior quadrant perforations were associated with more hearing loss as compared to anterior quadrant perforations. Also duration of disease was in linear relation with mean hearing loss.
**Conclusions:** The degree of conductive hearing loss as a result of tympanic membrane perforation would be expected with the size, site and duration of perforation.

**Keywords:** Tympanic membrane, Conductive hearing loss, Perforation

## INTRODUCTION

Tympanic membrane separates middle ear from the external ear, measuring 9-10 mm vertically and 8-9 mm horizontally. It transmits sound in middle ear.[1] Apart from conduction of sound waves across the middle ear, the tympanic membrane, also sub-serves a protective function to the middle ear cleft and round window niche.[2] Chronic otitis media (COM) has been defined as a longstanding inflammatory condition of the middle ear and mastoid associated with or without a perforation of the tympanic membrane.[3] COM with a perforation often is accompanied by a past and present history of intermittent otorrhea and conductive hearing loss. Since the prehistoric times, chronic suppurative otitis media (CSOM) has played a key role in causing the middle ear disease and is considered as the main cause for hearing loss in most of the developing countries.[4,5] Tympanic membrane (TM) perforation reduces the total ratio of surface area, allowing the sound waves to directly pass through the middle ear. It is a highly prevalent condition and an important cause of preventable hearing loss.[6] Perforated eardrum results in conductive hearing loss, and this range is reported not to exceed 50 dB.[7-9]

The objective of this study was to analyze the correlation between tympanic membrane perforation and hearing loss.

## METHODS

***Study duration:*** This study was done in patients attending ENT OPD in SKIMS Medical college and hospital, Bemina from September 2018 to February 2019.

***Study design:*** A prospective study design was made and sample size was set at 70 perforated ears in 49 patients of safe CSOM.

***Inclusion criteria***

Inclusion criteria were patients of both gender aged >15 years and <50 years; patients having bilateral or unilateral CSOM of safe type; no history of ear discharge for at least 6 weeks.

***Exclusion criteria***

Exclusion criteria were patients <15 years were excluded due to possible difficulty in testing, patients >50 years were excluded because of presence of presbycusis, patients having mixed type of hearing loss, ossicular chain fixation or disruption, patients with unsafe type of CSOM.

***Data collection***

A thorough history was taken in each case and patients underwent detailed ENT examination. The type, degree and frequency of hearing loss were determined by PTA (pure tone audiometry). Average AC threshold was calculated at 500, 1000 and 2000 Hz.

Depending upon the area of perforation of tympanic membrane, patients were divided into 3 groups.

- Group I- Small perforation.
- Group II- Medium perforation.
- Group III- Large perforation.

Depending upon the site of perforation of tympanic membrane, patients were divided into 3 groups.

- Group A- Anterior (anteroinferior and anterosuperior quadrant) perforation.
- Group B- Posterior (posteroinferior and posterosuperior quadrant) perforation.
- Group C- Central (multiple quadrants) perforation.

Depending upon the duration of disease, patients were divided into 3 groups.

- Group 1- <1 year
- Group 2- 1-5 years
- Group 3- >5 years

The association of degree of hearing loss was matched with the characteristics of perforation and result thus obtained was evaluated.

***Statistical analysis:*** The results of our study were analysed on SPSS Software using paired t test.

## RESULTS

A total of 49 patients with unilateral or bilateral CSOM (total perforated tympanic membranes=70) were included in the study. Maximum patients were in age group of 20 to 30. In our study number of males were 29 and females were 21 with M:F ratio of 1.38:1. Bilateral CSOM was seen in 21 patients, left CSOM in 19 patients and right CSOM in 9 patients. Otorrhea was the presenting complaint in 100% patients followed by impaired hearing.

**Table 1: Size of perforation (n=70).**

| Size of perforation | No. of patients | Mean hearing loss |
|---|---|---|
| **Group I** | 16 | 28.42±3.44 |
| **Group II** | 31 | 35.16±3.39 |
| **Group III** | 23 | 40.4±4.96 |

On comparing the mean hearing loss of group I, group II and group III, difference was found to be statistically significant (p<0.001). Thus there is significant increase in mean hearing loss from small perforation to medium perforation and most in the large perforation.

**Table 2: Site of perforation (n=70).**

| Site of perforation | No. of patients | Mean hearing loss |
|---|---|---|
| **Group A** | 11 | 27.11±3.12 |
| **Group B** | 16 | 36.96±2.79 |
| **Group C** | 43 | 42.4±4.34 |

On comparing the mean hearing loss of group A, group B and group C, difference was found to be statistically significant with p<0.001. Thus we concluded that there is significant increase in mean hearing loss from anterior perforation to posterior perforation.

**Table 3: Duration of perforation (n=70).**

| Duration of perforation | No. of patients | Mean hearing loss |
|---|---|---|
| **Group 1** | 18 | 25.89±6.20 |
| **Group 2** | 32 | 30.91±8.12 |
| **Group 3** | 20 | 36.49±11.10 |

From the above result, we observed that mean hearing loss increased significantly as the duration of disease increased.

## DISCUSSION

The study included 49 patients, 21 patients had involvement of both ears so total number of ears involved in this study were 70.

***Demographic profile***

In this study, most common affected age group was 20–30 years. The possible reason could be that this group is socially more active and is more health conscious. This finding is in accordance with Deepak et al and Prasansuk et al.[10,11] The number of males in the study group was higher than the number of females (M:F=1.38:1). Rafique

et al in their study found M:F ratio of 1.25:1. Kurian also reported higher incidence of disease in males. The most common symptom was ear discharge (on and off) from the diseased ear which is consistent with study of Kumar et al.[13,14]

### *Size of perforation*

When comparing the degree of hearing loss with various size of perforation, it was observed that hearing loss increased with increased size of perforation. Our result was comparable with Vijayshree et al, Kumar et al and Pannu et al.[6,14,15] Baumann et al also reported a linear relation between the size of perforation and amount of hearing loss.[16]

### *Site of perforation*

In our study posterior quadrant perforations have higher mean hearing loss than anteriorly located perforations with statistically significant p value. However, hearing loss was highest in perforations involving multiple quadrants. This view has been supported by Vijayshree et al, Bianca et al and Malik et al.[6,17,18] This can be attributed to the direct exposure of round window to the sound waves resulting in cancellation of phase difference between the oval and round windows. However, Herkat et al, Kumar et al and Pannu et al differed in this view in their study.[14,15,19]

### *Duration of disease*

In our study, hearing loss increased as the duration of disease increased. On comparing hearing loss in all the three groups, it was observed that average hearing loss increased significantly as the duration of disease increased. Our observation regarding the duration of disease is similar to Pannu et al.[15]

## CONCLUSION

Tympanic membrane perforation causes hearing loss ranging from mild to moderate. From our study, we concluded that the hearing loss increased with size of perforation and with posterior location of tympanic membrane perforation. A thorough knowledge of all these results would allow us to clinically predict the hearing loss based on size and site of perforation.

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## REFERENCES

1. Ogisi FO, Adobamen P. Type 1 Tympanoplasty in Benin:A 10-year review. Nigerian Postgraduate Med J. 2004;11(2):84–7.
2. Voss SE, Rosowski JJ, Merchant SN, Peake WT. Non-ossicular signal transmission in human middle ears: Experimental assessment of the "acoustic route" with perforated tympanic membranes. J Acoust Soc Am. 2007;122(4):2135–53.
3. Fisch U, May JS, Linder T. Tympanoplasty, Mastoidectomy and Stapes Surgery. 2nd ed. Ann R Coll Surg Engl. 2010;92(1): 81.
4. Booth JB. Management of chronic suppurative otitis media. Scott-Brown's Otology. 1997;3:10-1.
5. Shrestha R, Baral K, Neil W. Community ear care delivery by community ear assistants and volunteers: a pilot study. J Laryngol Otol. 2001;115(11):869-73.
6. Nahata V, Patil CY, Patil RK, Gattani G, Disawal A, Roy A. Tympanic membrane perforation:Its correlation with hearing loss and frequency affected – An analytical study. Indian J Otol. 2014:20(1):10-5.
7. Voss SE, Rosowski JJ, Merchant SN, Peake WT. How do tympanic-membrane perforations affect human middle-ear sound transmission? Acta Otolaryngol. 2001;121(2):169-73.
8. Voss SE, Rosowski JJ, Merchant SN, Peake WT. Middle-ear function with tympanic-membrane perforations. II. A simple model. J Acoust Soc Am. 2001;110(3):1445-52.
9. Voss SE, Rosowski JJ, Merchant SN, Peake WT. Middle-ear function with tympanic-membrane perforations. I. Measurements and mechanisms. J Acoust Soc Am. 2001;110(3):1432-44.
10. Dessai TD, Philip R. Influence of Tympanic Membrane Perforation on Hearing Loss. Glob J Oto. 2017;5(5):55-73.
11. Prasansuk S, Hinchcliffe R Tympanic membrane perforation discriptors and hearing levels in otitis media. Audiology. 1982;1:43-51.
12. Rafique M, Farrukh MS, Shaikh AA. Assessment of Hearing Loss in Tympanic Membrane Perforation at Tertiary Care Hospitals. JLUMHS. 2014;13(1):32-6.
13. Kurian CA, Reghunandanan SG, Viswanathan K, Mohammad Iqbal MK, Ravi A. Homologous dura for myringoplasty. Indian J Otolaryngol Head Neck Surg. 1996;48(2):150–2.
14. Kumar N, Chilke D, Puttewar MP. Clinical Profile of Tubotympanic CSOM and Its Management With Special Reference to Site and Size of Tympanic Membrane Perforation, Eustachian Tube Function and Three Flap Tympanoplasty. Indian J Otolaryngol Head Neck Surg. 2012;64:5-12.
15. Pannu KK, Chadha S, Kumar D, Preeti. Evaluation of hearing loss in tympanic membrane perforation. Indian J Otolaryngol Head Neck Surg. 2011;63:208-13.
16. Baumann I, Gerendas B, Plinkert PK, Praetorius M. General and disease specific quality of life in patients with chronic suppurative otitis media—a prospective study. Health Qual Life Outcomes. 2011;29(9):48.

17. Bianca N, Doina V, Ermil T. Annals of the University of Lower Danube Galati. Medicine Beam XVII. 2011;2:17.
18. Malik S, Ashrafi K, Sohail Z, Afaq S, Nawaz A. Determinants of variable hearing loss in patients with chronic suppurative otitis media. Pak J Otolaryngol. 2012;28:45-7.
19. Herkal K, Ramasamy K, Saxena SK, Ganesan S, Alexander A. Hearing loss in tympanic membrane perforations:an analytic study. Int J Otorhinolaryngol Head Neck Surg. 2018;4(5):1233-9.

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