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A Study of Correlation between Shape, Site and Size of Tympamic Membrane Perforation and Its Effect on Hearing

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Abstract: **Objective**: *To analyze the hearing loss in tympanic membrane perforation based on shape, site and size of the perforation.*
Study design*: Prospective hospital based study design*
Setting*: ENT OPD at NSCB Medical College & Hospital (tertiary referral centre)*
Materials and methods*: Patients reporting to ENT OPD with unilateral or bilateral CSOM Safe type were selected between March 2015 and August 2016. The inclusion criteria were of dry central perforation, pure conductive hearing loss and intact ossicular chain. These patients were subjected to Tuning fork tests and pure tone audiometry before and after patch paper test.*
Results*: 54 patients were selected with unilateral or bilateral ear involvement making a total of 70 cases. Maximum patients belonged to low socioeconomic strata and rural areas and were of young adult age group. On the basis of shape, the circular shaped perforations had greater hearing loss (50% having moderate hearing loss) than oval and reniform (62.5% having mild hearing loss) perforations. Hearing loss was more with perforations with both anterior and posterior quadrants involvement (48% having moderate hearing loss). All cases improved in hearing post patch test with irrespective of type of shape, site or size of the perforation.*
Conclusion*: All the three criteria of shape, site and size of perforation have significant relation with hearing loss. All had similar improvement post patch with these three variables. Paper patch test is a simple and reliable indicator of hearing loss improvement in central perforations with intact ossicular chain and can be used as a criterion for selection of patients for type I tympanoplasty.*
Keywords: *conductive hearing loss, paper patch, tympanic membrane perforation, audiometry*

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I. Introduction

Hearing is essential to build up thought and ideas, to shape personality and to experience life fully. CSOM can lead to conductive hearing loss up to 60 db which constitutes a serious handicap [1] and is one of the commonest causes for hearing impairment in India.

Many studies have shown that the size of the perforation affects the degree of conductive hearing loss. Larger the perforation of the tympanic membrane, the greater is the decibel loss in sound perception. It has been theorized that posterior based perforations are associated with greater hearing loss as these perforations are closer to the round window, and thus there is loss of the phase differential. The shape of the perforation still remains a point of contention. [2]

In an extensive review of literature we found only one by Prasansuk et al(1982) that discusses shape of perforation and hearing levels in otitis media.[3] The present study is aimed to analyze the correlation between shape, site and size of tympanic membrane perforation and extent of hearing loss it caused in the patients.

II. Materials And Methods

After obtaining clearance from the Ethical and Scientific Committee of NSCB Medical College Hospital 54 Patients were included in the study after obtaining their written informed consent. These patients having central tympanic membrane perforation on otological examination underwent tuning fork tests and audiometry. Under aseptic precautions, cigarette paper patch dipped in liquid paraffin was applied all over the perforation. Following this tuning fork tests and audiometry were again carried out in each case and analyzed. On the basis of shape, perforations were divided into: circular, oval or reniform perforations. With respect to handle of malleus, the perforations were classified as anterior, posterior perforations or those with both features. Area wise involvement of pars tensa was the basis of size determination of the perforation: small 25%, medium 25-50%, large 50-75%, subtotal is involvement of whole except the annulus.

Table 1: Hearing loss assessment was studied as per WHO grades of hearing impairment (2008) [4]

Grade of Impairment	Corresponding audiometric ISO value
No impairment	25 db or better
Slight or mild	26-40 db
Moderate	41-60 db
Severe	61-80 db
Profound	81 db or more

*the audiometric ISO values are averages of values at 500, 1000, 2000, 4000 Hz.
The hearing loss categorized as minimal, mild, moderate and severe were summarized in frequency and percent distribution and Chi-square or Fishers exact test was performed as appropriate. Mean difference between pre & post-treatment was analyzed by using paired t-test. For test the statistical significance level was set at $p<0.05$.

III. Results

In the present study, out of 70 cases, 29 patients (56%) were in younger age group of 16-30 years. 50 patients (71%) belonged to rural area and 47 patients (67%) came from lower socioeconomic status. Unilateral disease was more (48%) commonly found than bilateral disease (22.8%) with no predilection for side. 21 patients (32%) presented with history of an average duration of ear discharge of 6 months - 3 years. 32% patients presented with prior history of otorrhea followed by hearing loss. 64.2% patients had otorrhea with ipsilateral deviated nasal septum.
Hearing loss was classified as Minimal, Mild, Moderate and Severe. The shape, size, site of perforation and its correlation with hearing loss is depicted in table.

Table 2: shape of perforation and hearing loss

Shape	Minimal	Mild	Moderate	Severe
Oval	8(30%)	9(34%)	8(30%)	1(3%)
Circular	2(5%)	11(30%)	18(50%)	5(13%)
Reniform	0	5(62%)	3(37%)	0

Maximum circular perforations (50%) had moderate hearing loss, while maximum reniform perforations (62%) had mild hearing loss.
Oval perforations had almost equal incidence of minimal, mild and moderate hearing loss

Table 3: site of perforation and hearing loss

Site	Minimal	Mild	Moderate	Severe
Anterior	7(22%)	11(35%)	11(35%)	2(6%)
Posterior	0	8(57%)	6(43%)	0
Both	1(4%)	8(32%)	12(48%)	4(16%)

Perforations with both anterior and posterior involvement had 48% incidence of moderate hearing loss and 16% severe hearing loss, while perforations restricted to anterior aspect had equal incidence of mild and moderate hearing loss. Only posteriorly limited perforations had 57% incidence of mild hearing loss and 43% of moderate hearing loss.

Table 4: size of perforation and hearing loss

Size	Minimal	Mild	Moderate	Severe
Small	1	0	0	0
Medium	8(22%)	15(41%)	12(33%)	1(3%)
Large	0	6(30%)	12(60%)	2(10%)
Subtotal	1(7%)	4(31%)	5(38%)	3(23%)

With large perforations maximum patients showed moderate hearing loss(60%), while subtotal perforations had severe hearing loss(23%) more than as shown by any other perforation.
Table 5 below represents mean improvement in hearing loss decibel wise as seen in different types of perforation on the basis of site size and shape. There was almost similar mean improvement in hearing loss post patch test for different types of perforation all the three variables as seen from Table 5.

Table 5: improvement in hearing post patch test in all three variables

		Mean improvement (decibel wise)
Shape of perforation	circular	12.8
	oval	11
	reniform	14
Site of perforation	anterior	12.3
	posterior	13
	both	11.5
Size of perforation	medium	12.3
	large	12.5
	subtotal	12.1

IV. Discussion

Demographic profile

In this study of 70 cases, maximum number of cases i.e. 56% reported in age group 16-30 years. The mean age of our study sample is 28 years. Nahata et al(2014) and Bhusal et al (2004) also observed maximum patients from similar age group.[5,6]

This might be explained by shorter and straight Eustachian tube in children compounded by recurrent URTIs, thus predisposing them to easy passage of infection from nose to ear which later could manifest as chronic suppurative otitis media. Male to female ratio is 1:1.2 suggesting almost equal incidence of central tympanic perforations in both the genders. Maximum patients i.e. 67% belonged to lower group and 71% patients were from rural area while only 28.5% were from urban area. This difference was due to illiteracy, poor sanitary conditions & poor personal hygiene more prevalent in rural population leading to increased incidence of disease. Kumar et al (2012) also agreed with prevalence of the disease in lower socioeconomic class. [7]

Right sided disease was seen as 51% while left sided disease was 49% suggesting almost equal incidence. 92% patients presented with otorrhea as the chief complaint followed by hearing loss. Most patients (32%) presented with prior history of otorrhea of duration between 6 months and 3 years, with an average duration of 1 year. This is indicative of neglect of patient and family to the complaint of ear discharge. Delay in diagnosis attributes to a variety of reasons such as lack of optimum health services, lack of medical knowledge and poor hygienic conditions.

64.2% of the patients had otorrhea with ipsilateral deviated nasal septum. This is indicative of significant correlation between otorrhea and ipsilateral deviated nasal septum which can be explained by increased propensity of infection on the side of septal deviation and its subsequent passage through the Eustachian tube to the middle ear. Also, out of the 61 patients having deviated nasal septum, 57% had left sided deviation while 42% had right sided deviation.

Shape of perforation and hearing loss

Overall circular shaped perforations were found in majority occurrence (51.4%). Prasansuk et al (1982) described shape of perforation as a factor affecting hearing levels in otits media, but this study is an attempt to establish a correlation between type of shape and amount of hearing loss caused by it. [3]

As discussed in table 1, maximum circular perforations had moderate hearing loss while reniform perforations had mild hearing loss. Large and subtotal perforations mostly assume circular shape on account of their large gap in surface area and in many of these cases there was foreshortening of handle of malleus, so larger deficit in hearing was seen.

Site of perforation and hearing loss

In this study anterior perforations were more in occurrence 44.2% (31 patients). Table 2 suggests that maximum hearing loss of moderate – severe grade was seen with perforation having both anterior and posterior involvement. The results of our study support that site of perforation has correlation with degree of hearing loss with posterior perforation having 43% hearing loss of moderate grade while anterior perforations had 35% hearing loss of moderate degree. This finding is inclusive of the fact that perforations involving both the quadrants also included major component of posterior perforation. However Pannu et al (2011) [8] and Kumar et al (2012) [7], differed in their study and suggested that location of perforation does not affect the degree of hearing loss.

Size of perforation and hearing loss

Among the small, medium, large and subtotal perforations; overall medium sized perforations were found to be most common 51.4% (36 patients). The study observed that more the size of perforation more was the hearing loss as depicted in table 3. This can be explained as the larger perforations result in loss of middle

ear and mastoid volume and there is more chance of diminution of phase effect as the size of perforation increases due to direct exposure of sound pressure to round and oval windows. Perforation size was found to be the most important determinant of hearing loss by Voss SE et al in their various series in 2001. [9][10] Nepal et al (2004) [11] in their study quoted direct proportional relation of hearing loss with size of the perforation.

V. Conclusion

It was concluded that shape affects the hearing loss. Circular perforations had greater hearing loss as compared to oval and reniform. More the size of perforation greater was the hearing loss. Site of perforation also played an important role in impairment of hearing. Perforations with both anterior and posterior quadrants involvement showed greater hearing loss than those restricted to either posterior or anterior part of the membrane. The present study has significant $p=0.001$ ($p<0.05$) correlation of hearing loss with respect to site, shape and size of tympanic membrane perforation. there was similar improvement between post patch improvement in hearing with all the three variables.

References

[1]. Krunger, Tonndorf: Tympanic-membrane perforation in cats with experimentally induced tympanic membrane perforation. J Acoustic Soc Am 1978

[2]. Telian SA, Schmalbach CE, Chronic Otitis Media In: Ballenger's Otorhinolaryngology Head and Neck Surgery; JB Snow and JJ Ballenger eds, 16th edition, Hamilton: BC Decker, 266.

[3]. Prasansuk, Suchitra, and R. Hinchcliffe. "Tympanic membrane perforation descriptors and hearing levels in otitis media." *Audiology* 21.1 (1982): 43-51.

[4]. WHO Report of the Informal Working Group on Prevention Of Deafness And Hearing Impairment Programme Planning. Geneva, 1991.

[5]. Bhusal CL, Guragain RP, Shrivastav RP. Size of tympanic membrane perforation and hearing loss. J Nepal Med Assoc 2006;45:167-72.

[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;2014:10-5.

[7]. 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.

[8]. Pannu KK, Chadha S, Kumar D, Preeti. Evaluation of hearing loss in tympanic membrane perforation. Indian J Otolaryngol Head Neck Surg 2011;63:208-213.

[9]. Voss SE, Rosowskii JJ, Merchant SN, Peake WT. How do tympanic membrane perforations affect human middle ear sound transmission? Acta Otolaryngol 2001;121:169-73.

[10]. Voss SE, Rosowskii JJ, Merchant SN, Peake WT. Middle-ear function with tympanic membrane perforations .I. Measurements and mechanisms. J Acoust Soc Am.2001;110:1432-44.

[11]. Nepal A, Bhandary S, Mishra SC, Singh I. Assesment of quantitative hearing loss in relation to morphology of central tympanic membrane perforations. Nepal Med Coll J 2007 Dec;9(4):239-44.

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