Original article:

Evaluation of hearing loss in relation to site & size of tympanic membrane perforation

[1]Dr. Anup Agrawal , [2]Dr. Beni Prasad* , [3]Dr. Sunil Sharma

[1]Resident, [2]Head of Department, [3] Senior Resident

Department of ENT, National Institute of Medical Science & Research, Jaipur (Rajasthan)

Corresponding author*

Abstract.

This prospective study was done to assess the hearing loss in relation to size & site of tympanic membrane perforation. A total of 100 patients with age between 15-45 years were studied from the outpatient Department of ENT, NIMS Jaipur, from Jan 2016 to June 2017. All Cases with inclusion and exclusion criteria, audiometric evaluations were done. All cases were grouped according to site and size of perforation.

This study shows that hearing loss increases with the increase in size of perforation and with the involvement of posterior quadrant. Maximum hearing loss observed in this study was 42.5 dB and minimum 21.5dB.

Keyword- hearing loss, Site of perforation, size of perforation, tympanic membrane

INTRODUCTION

Tympanic membrane(TM) perforation is a condition as old as the evolution of human species.[1] Ear is the most pressure sensitive organ of the body and is susceptible for rupture with altered pressure.[2]

TM perforation is one of the most common cause of Hearing impairment. Cause of TM perforation include infection (most common), barotraumas like air pressure changes associated with air travel, scuba diving and a direct blow to the ear- such as the impact of an automobile air bag, A loud sound or blast- as from an explosion or gunshot, Foreign objects in your ear, Severe head trauma etc.

TM perforation may be temporary or permanent depends mainly on cause. Most common symptom from TM perforation is hearing loss other symptoms are pain, discharge, tinnitus, vertigo. It causes conductive type of hearing loss except on blast injury where it causes sensory neural type of hearing loss.

Site of Perforation in tympanic membrane-

1. In Pars Tensa
2. In pars Flaccida (attic perforation)

Pars Tensa

Pars tensa may have Central perforation and marginal perforation.

Central= if the perforation is surrounded by tympanic membrane

Marginal = if Perforation is not completely surrounded by tympanic membrane.

Central Perforation=

1. Anterio-superior= If perforation is anterior to handle of malleus and superior to imaginary line going horizontally from umbo
2. Antero-inferior = If perforation is anterior to handle of malleus and inferior to imaginary line going horizontally from umbo

www.ijbamr.com P ISSN: 2250-284X , E ISSN : 2250-2858

3. Postero-superior= if perforation is posterior to handle of malleus and superior to imaginary line going horizontally from umbo.
4. Postero-inferior= if perforation is posterior to handle of malleus and inferior to imaginary line going horizontally from umbo.
5. Subtotal= very large perforation of pars tensa where parts of pars tensa and/or annulus of Tympanic membrane is still preserved.

   Marginal= perforation even destroys even the annulus and reaches sulcus tympanicus. It may be-

   1. Posterosuperior
   2. Anterior
   3. Inferior
   4. Total

According to size of the perforation, these are classified as: (a) Small (area involving one quadrant) (b) Medium (area involving 2 quadrants) (c) Large (area involving 3 quadrants) (d) subtotal (area involving all quadrants)

Level of hearing can be divided into normal to hearing impairment in progressive order into minimal, mild, moderate, moderately severe, severe and profound hearing loss.[3]

MATERIALS AND METHODS

Total of 100 cases attending ENT OPD, National Institute of Medical Science Research & Hospital, jaipur during 1.5 year period from Jan 2016 to June 2017 were taken up for the study. Inclusion criteria were dry central TM perforations of age group 15-45 years having only conductive type of hearing loss of all sex, race, religion. This was the cross sectional prospective study.

Exclusion criteria were preexisting or congenital hearing loss, SNHL, atticoantral diseases and actively discharging ears.

After taking detailed history, thorough otoscopic examination of ear were carried out to confirm that the perforation was central and dry. After that Tuning fork tests (Weber's , Rinne's and absolute bone conduction) were carried out with 512 Hz forks. 1024 and 256Hz forks were used wherever necessary.

Similarly Pure Tone Audiometry (PTA) was carried out in each case to confirm that the hearing loss was of conductive type and to determine its level.

X-rays of mastoid bones-Towne's and Lateral-Oblique views were done in all cases to rule out atticoantral diseases. The data analysis was carried out using SPSS.

RESULT

A total of 100 patients who presented in Department of ENT, National Institute of Medical Science Research & Hospital, Jaipur over a period of 1.5 year from January 2016 to june 2017,with inclusion and exclusion criteria, Data of all the patients were collected.

The results are as follows:

www.ijbamr.com P ISSN: 2250-284X , E ISSN : 2250-2858

Table 1- Age Distribution

Age Distribution (Year)	No. of patient	Percentage (%)
15-25	**41**	**41**
26-35	**37**	**37**
36-45	**22**	**22**
Total	**100**	**100**

Age distribution: In our study, the maximum numbers of patients were in the age group of 15-25 years & minimum were in age group 36-45 year.

Table 2- Sex Distribution

Sex	No. of patient	Percentage (%)
Male	**55**	**55**
Female	**45**	**45**
Total	**100**	**100**

Sex Ratio: The total number of male and female patients in our study was 55 and 45 respectively.

Table 3: Hearing loss according to size of perforations

Size	PTA			Total
	16-25dB	26-40dB	41-55dB	
Small	**29**	**19**	**3**	**51**
Medium	**6**	**14**	**9**	**29**
Large	**-**	**4**	**7**	**11**
Subtotal	**-**	**2**	**7**	**9**
Total	**35**	**39**	**26**	**100**

Hearing loss according to size of perforation: Table-3. shows that out of all 51 small perforations, 56.8% had minimal, 37.3% had mild and only 5.9% had moderate hearing loss.

Similarly, out of 29 medium sized perforations, 48.3% had mild and 31% had moderate hearing loss ,20.7% had minimal.

Out of 11 large perforations, 63.6% had moderate hearing loss and 36.4% had mild hearing loss.

Again, among 9 subtotal perforations, 77.8% had moderate hearing loss and 22.2% had mild hearing loss.

The observations were all in speech frequency<2000Hz. The differences were statistically significant ($p<0.05$).

www.ijbamr.com P ISSN: 2250-284X , E ISSN : 2250-2858

Table 4: Hearing loss according to site of perforation

Site Of TM Perforation	PTA			Total
	16-25dB	26-40dB	41-55dB	
Antero-superior	4	1	-	5
Postero-superior	4	2	1	7
Antero-inferior	14	6	1	21
Postero-inferior	7	10	1	18
Anterior	1	3	-	4
Posterior	-	1	6	7
Inferior	5	10	3	18
Posterior + Antero-inferior	-	1	4	5
Anterior + Postero-inferior	-	3	3	6
Subtotal	-	2	7	9
Total	35	39	26	100

Hearing loss according to site of perforation: Table-4 shows that, Out of 5 cases involving anterosuperior quadrant, 20% had mild hearing loss and 80.0% had minimal hearing loss.

Out of 7 cases involving posterosuperior quadrants, 57.0% cases had minimal, and 28.6 % cases had mild & 14.3% had moderate hearing loss.

Out of 21 cases of perforations involving anteroinferior quadrant 66.7.0% cases had minimal, 28.6% had mild and

4.8% had moderate hearing loss.

Again, Out of total 18 cases involving posteroinferior quadrant 55.6% had mild, 38.9% had minimal and 5.6% had moderate hearing loss.

Out of 4 cases involving anterior quadrant, 75% had mild & 25% had minimal hearing loss.

Similarly, out of 7 cases involving posterior quadrant, 85.7% had moderate hearing loss & 14.3% had mild hearing loss.

However, out of 9 cases of perforations involving all 4 quadrants, 77.8% had moderate and 22.2% had mild conductive hearing loss with no any cases with minimal hearing loss. The differences were statistically significant ($p<0.05$).

DISCUSSION

For calculation of average hearing loss (air conduction threshold) three speech frequencies namely 500Hz, 1000Hz and 2000Hz were selected. Pure tone audiometry had been used for assessment of hearing level in this study.

In this study the most commonly affected age group was 15-25 years with 41 (41%) patients. The reason could be

www.ijbamr.com P ISSN: 2250-284X , E ISSN : 2250-2858

that this age group is socially active and health conscious.

The findings of this study are similar to that of Prasansuk et.al, who studied 30 ears of 15 patients aged between 13-25 years of age.[4]

Hearing loss in relation to site of perforations:

As our results suggest (Table 3), as the size of the perforation increased, the amount of hearing loss increses. The data indicate a direct relationship between the size of perforation and the degree of hearing loss.

Maximum hearing loss observed was 42.5 dB and minimum 21.5dB. Similar findings were reported by Ahmad and Ramani.[5]

Perforation size was found to be most important determination of hearing loss by Voss SE et al in their various series in 2001.[6]

Many studies of perforations both in animals and human studies reveal a direct correlation between the size of the perforation and the hearing loss.[5,7,8,9] Our study also confirm the above mention findings that the size of the perforation has a major role on hearing loss.

Berger et al in 1997 carried out a prospective study if hearing loss in 120 cases with non explosive blast injury during 6 years period. They also found that the severity of conductive hearing loss to be proportionate with the size of perforation.[10]

Hearing loss in relation to site of perforations: One hundred forty five cases of chronic suppurative otitis media with central perforations and intact, mobile ossicles were clinically analyzed by Durko et al.[11] Hearing loss in perforations involving posteroinferior quadrant was found to be upto 30 dB while in rest of central perforations average of 20 dB conductive hearing loss was found.

Berger et al in the same year in his study over 120 cases also found of all locations,perforations involving the posterioinferior quadrant of the ear drum were associated with largest a-b gap.[10]

Audiometric assessment revealed that none of the patients suffered the ossicular chain damage. Likewise, posterior perforations having greater hearing loss than anterior ones were revealed by Yung MW (1983) in the study of 100 cases.[12]

In present study out of 100 cases, 52 cases involving posterior quadrant, 42.3% cases had moderate conductive hearing loss, 36.5% (19cases) had mild-26-40 dB and only 21.2% (11cases) had minimal hearing loss.

CONCLUSION

This study attempts to correlate the degree of hearing loss to different sizes and sites of perforation.

In the present study it has been shown that the hearing loss increases as the size of the perforation increases, and also hearing loss increases with the involvement of posterior quadrant.

REFERENCES:

1. Howard M.L. Complete round window fistula. Ear Nose Throat J 1976; 55: 382-3.
2. Patow CA, Bartels J, Dodd KT (1994) Tympanic membrane perforation in survivors of a SCUD missile explosion. Otolaryngol Head Neck Surg 110(2): 211-221.

3. Philip AY. Pure Tone Air Conduction Testing In: Handbook of Clinical Audiology; Jack Katz ed, 4th edition, Marryland: Williams and Wilkins 1994,105.
4. Prasansuk S. and Hinchcliffe R. Tympanic membrane perforation discriptors and hearing levels in otitis media. Audiology. 1982;21:43-51.
5. Ahmed SW and Ramani GV. Hearing Loss in perforations of the tympanic membrane. J. Laryngol Otol. 1979;93: 1091-8.
6. Vose SE, Rosowski JJ, Merchant SN, Peake WT. Middle ear function with tympanic membrane perforations .I. Measurements and mechanisms. J Acoust SocAmer 2001; 110: 1432-44.
7. Anthony WP and Harrison CW. Tympanic membrane perforation effects on audiogram. Archives of Otolaryngology 1972; 59:506-510.
8. Austin DF. Sound conduction of the diseased ear. J. Laryngol.Otol. 1978; 92: 367-393.
9. Bigelow D.C., Swanson P.B., and Saunders J.C. The effect of tympanic membrane perforation size on umbo velocity in the rat,Laryngoscope 1996; 106:71-76.
10. Berger G, Finkelstein Y, Avraham S, Himmelfar M. Pattern of hearing loss in non- explosive blast injury of the ear. J Laryngol Otol 1997: 111: 1137-41.
11. DurkoT, Latkowski B.Extrameatal myringoplasty in the treatment of tympanic membrane perforations. Otolaryngol Pol 1997; 51: 274-7.
12. Yung MW. Myringoplasty: hearing gain in relation to perforation site. J Laryngol Otol 1983; 97:11-7.

www.ijbamr.com P ISSN: 2250-284X , E ISSN : 2250-2858