

# A Clinical Study of Perforations of the Tympanic Membrane in a Tertiary Care Hospital

Yelma Bhooma Reddy<sup>1\*</sup>, M Hemanth Rao<sup>2</sup>

<sup>1</sup>Department of ENT, Rajiv Gandhi Institute of Medical Sciences [RIMS], Adilabad, Telangana State, India

<sup>2</sup>Assistant Professor, Department of ENT, Rajiv Gandhi Institute of Medical Sciences [RIMS], Adilabad, Telangana State, India

\*Corresponding author: Yelma Bhooma Reddy

| Received: 06.04.2019 | Accepted: 14.04.2019 | Published: 30.04.2019

DOI: [10.21276/sjm.2019.4.4.5](https://doi.org/10.21276/sjm.2019.4.4.5)

## Abstract

Tympanic membrane perforations are encountered by Otologists in clinical practice. It is the most common cause of hearing loss. We in the present study tried to evaluate the size and location of perforation to the degree of hearing loss and the outcome of treatment of these patients in our hospital. Methods: This prospective observational study was conducted in the Department of ENT, Rajiv Gandhi Institute of Medical Sciences [RIMS], Adilabad. A detailed clinical history including the name, age, sex, address, occupation, presenting complains, past history and physical examination and ENT examinations under microscopy was done to assess the size, site, and shape of perforation including Pure Tone Audiometry. All the patients underwent Myringoplasty through postaural approach using underlay technique taking temporalis fascia as graft material. Results: A total of n= 40 patients were included in the study male patients were n=24(60%) and n=16 (40%) were female patients and the male to female ratio was 6:4 with the predominance of male patients common cause of the injuries was related to RTA 18(45%). The right ear was involved in n=18(45%) of cases left ear was involved in n=21 (52.5%) and bilateral involvement was seen in n=1(2.5%) of cases. n=40 patients underwent myringoplasty in the Grade I perforations the preoperative hearing loss was  $29.59 \pm 6.65$  and in the postoperative, after 12 weeks  $17.05 \pm 4.4$  dB and the audiometric gain was 12.54 dB. In Grade II it was  $35.40 \pm 5.44$  dB and postoperative 12 weeks were  $18.51 \pm 3.5$  dB audiometric gains was 16.89 dB. The Grade III had pre-operative levels  $37.95 \pm 6.10$  dB and the audiometric gain 19.84 dB and similarly in Grade IV  $37.95 \pm 6.10$  dB and the audiometric gain was 25.95 dB. Conclusion: It can be concluded the tympanic membrane perforations are very common in men with the frequency of posterior perforations are greater and the hearing loss does not vary substantially with the location of the perforation. Surgical intervention of perforations is required when they fail to heal spontaneously and the audiometric gain following myringoplasty was more where the size of perforations was large.

**Keywords:** Perforations, Tympanic membrane, Myringoplasty, Tertiary Care Hospital.

**Copyright © 2019:** This is an open-access article distributed under the terms of the Creative Commons Attribution license which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use (NonCommercial, or CC-BY-NC) provided the original author and source are credited.

## INTRODUCTION

Hearing loss is one of the important reasons for disability and social apprehension and permanent perforations of the tympanic membrane in chronic Otitis Media are one of the important causes for correctable hearing loss in society [1]. Tympanic membrane perforation causes the reduction of effective surface area for sound transmission. Studies have shown that there are differences in the hearing loss with similar size and locations of perforations [2]. Vaidya *et al.*, has reported a greater degree of hearing the loss in posterior perforations [3]. The frequencies of perforations of the tympanic membrane are on the rise as a result of increasing road traffic accidents and violence [4]. There are also other causes for the perforations that include insertion of sharp objects in an attempt to clean the ears and accidental perforations due to foreign bodies. The traumatic perforations remain under-reported because most of them will be small and

heal on its own. However, in many cases, it can cause bleeding, hearing loss, tinnitus, and vertigo. Some patients may report with whistle sounds during blowing of nose and sneezing [5]. Surgical procedures may be required for cases where the perforations are persistent for long durations and those which tend to disrupt the ossicular chain and those affecting the inner ear or facial nerve. There are several factors that may affect the outcome of the surgical approach (endaural, postaural) and the technique (Underlay or overlay) site of perforations and type of graft utilized. The underlay technique is the most widely used and relatively simple to perform as in this technique the graft is placed entirely medial to the remaining membrane and malleus. However, this technique is ideal to repair small and easily visualized perforations blunting and lateralization of the graft is prevented [6]. However, there is still ambiguity about prognostic factors in myringoplasty and there are significant differences in

the reported success rates for achieving an intact tympanic membrane after surgery. With this background, we in the present study tried to evaluate the etiology of tympanic membrane perforations and the outcome of treatment by myringoplasty in a tertiary care hospital.

**MATERIAL AND METHODS**

This prospective observational study was conducted in the Department of ENT, Rajiv Gandhi Institute of Medical Sciences [RIMS] Adilabad. Institutional Ethical committee permission was obtained for the present study. Written consent was obtained from all the participants of the study. The study included patients presented between dry perforations aged between 15 to 50 years and excluded patients were those not in the age groups and those with middle ear infections and those not willing to participate in the study. A detailed clinical history including the name, age, sex, address, occupation, presenting complains, past history and physical examination and ENT examinations under microscopy was done to assess the size, site, and shape of perforation including pure tone audiometry. The modified Hughson and Westlake procedure was used for estimating the threshold for air

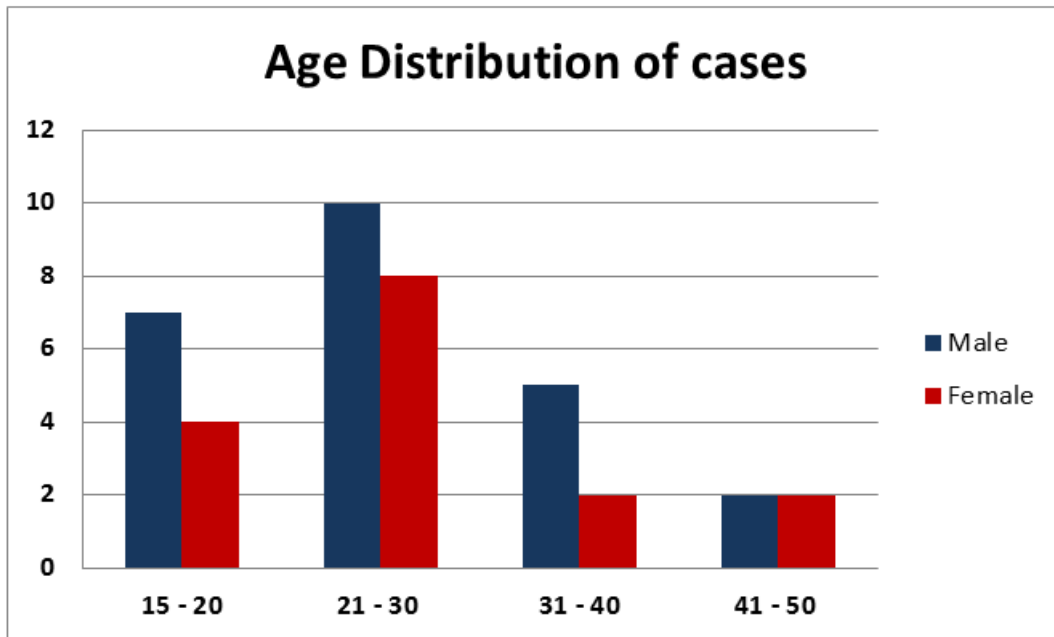
and bone conduction the frequencies were evaluated from 250 to 4000 Hz [7]. All the patients underwent myringoplasty through postaural approach using underlay technique taking temporalis fascia as graft material. The intraoperative otomicroscopy was performed in all patients and the maximum vertical and horizontal diameters of perforations were measured using ophthalmic vernier calipers. All the patients were followed at the intervals of 2 weeks up to 6 months after surgery.

**RESULTS**

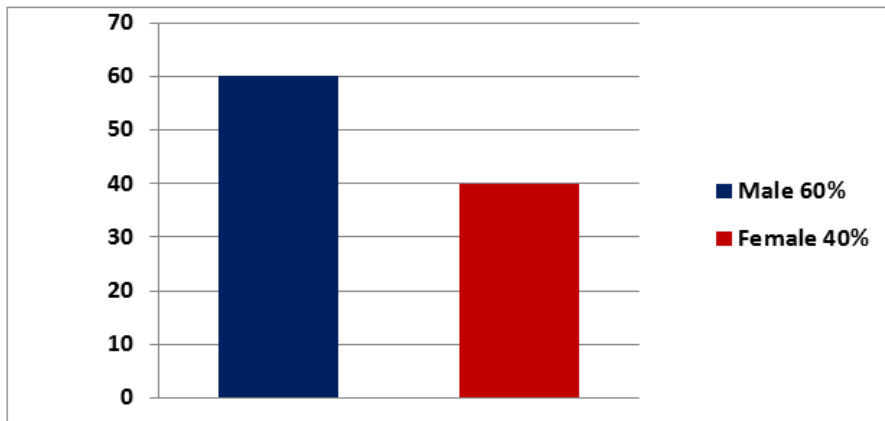
The mechanism of injury was noted in the present study, the most common cause of the injuries was related to RTA 18(45%). The second common cause of injury was due to insertion of a foreign object in the ear in 17(42.5%) of cases. Blow on the ear was the cause of tympanic membrane perforation in 2(5%) and miscellaneous causes of injury were in 3 cases 3(7.5%) given in Table-1. In the present study, the total number of male patients were n=24(60%) and n=16 (40%) were female patients and the male to female ratio was 6:4 with the predominance of male patients (Figure-1).

**Table-1: Showing the method of tympanic membrane perforation in the study**

	Male	Female	Total	Percentage
<b>Road traffic accidents [RTA]</b>	14	4	18	45
<b>Foreign objects in the ear</b>	7	10	17	42.5
<b>Blow on ear</b>	2	0	2	5
<b>Miscellaneous</b>	1	2	3	7.5
<b>Total</b>	24	16	40	100



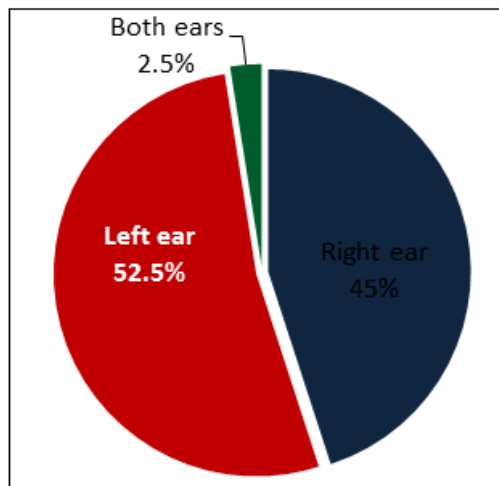
**Fig-1: Age wise distribution of cases in the present study**



**Fig-2: Showing the sex wise distribution of cases in the study**

The frequency of sides involved in the perforation of the tympanic membrane in the present study was as follows; the right ear was involved in

n=18(45%) of cases left ear was involved in n=21 (52.5%) and bilateral involvement was seen in n=1(2.5%) of cases shown in Figure-3.



**Fig-3: Distribution of cases based on side of involvement of injury**

**Table-2: Showing the mean size of TM perforations and hearing loss**

Size of Perforations	Male	Female	Total (%)	Mean hearing loss in dB
Grade I	11	6	17 (42.5%)	29.59 ± 6.65
Grade II	7	5	12 (30.0%)	35.40 ± 5.44
Grade III	4	3	07 (17.5%)	37.95 ± 6.10
Grade IV	2	2	04 (10.0%)	43.23 ± 4.92
<b>Total</b>	<b>24</b>	<b>16</b>	<b>40 (100%)</b>	<b>36.45 ± 5.56</b>

The size of tympanic membrane perforations were graded based on their size grade I was a pinpoint perforation or linear tear up to 2mm, grade 2 was defined as small perforation of size < 25% of size of tympanic membrane, grade III was medium perforation with size range from 25-50% and grade IV was a large

perforation of > 50% of the tympanic membrane. The mean hearing loss in Grade I was 29.59 ± 6.65 dB, in Grade II the mean hearing loss was 35.40 ± 5.44 dB, in Grade III 37.95 ± 6.10 dB and Grade IV was 43.23 ± 4.92 dB the overall mean hearing loss was 36.45 ± 5.56 dB (Table-2).

**Table-3: Distribution of perforations based on the location and mean the hearing loss in dB**

Location of perforation	Male	Female	Total (%)	Mean hearing loss in dB
Anterior	4	1	5(12.5)	32.51 ± 5.74
Posterior	15	6	21 (52.5)	33.98 ± 6.33
Mixed	5	9	14 (35)	37.80 ± 5.75
<b>Total</b>	<b>24</b>	<b>16</b>	<b>40 (100)</b>	<b>36.45 ± 5.56</b>

Based on the site of perforation the hearing loss in Posteroinferior group n=21 (52.5%) patients was  $32.51 \pm 5.74$  dB. In the anteroinferior group n=5 (12.5%) hearing loss was  $33.98 \pm 6.33$  dB and in mixed cases n=14 (35%) the hearing loss was  $37.80 \pm 5.75$  dB

similarly the shape of perforation was circular in n=13 oval in n=10 and irregular in n= 13 cases respectively No significant difference in hearing loss based on the shape was seen in the study.

**Table-4: The results of Myringoplasty in the patients of different groups with air conduction results in pre and post-treatment**

Size of Perforations	Total (%)	Audiometric results (dB)		Audiometric gain in dB (Mean ± SD)
		Pre-Operative (Mean ± SD)	Post-Operative (12 weeks) (Mean ± SD)	
Grade I	17 (42.5%)	$29.59 \pm 6.65$	$17.05 \pm 4.4$	12.54
Grade II	12 (30.0%)	$35.40 \pm 5.44$	$18.51 \pm 3.5$	16.89
Grade III	07 (17.5%)	$37.95 \pm 6.10$	$18.11 \pm 4.1$	19.84
Grade IV	04 (10.0%)	$37.95 \pm 6.10$	$17.28 \pm 3.9$	25.95
Total	40 (100%)	$36.45 \pm 5.56$	$17.80 \pm 3.8$	18.80

All the n=40 patients underwent myringoplasty in the Grade I perforations the preoperative hearing loss was  $29.59 \pm 6.65$  dB and in the postoperative, after 12 weeks  $17.05 \pm 4.4$  dB and the audiometric gain was 12.54 dB. In grade II it was  $35.40 \pm 5.44$  dB and postoperative 12 weeks were  $18.51 \pm 3.5$  dB audiometric gain was 16.89 dB. The Grade III had pre-operative levels  $37.95 \pm 6.10$  dB and the audiometric gain 19.84 dB and similarly in grade IV  $37.95 \pm 6.10$  dB and the audiometric gain was 25.95 dB.

**DISCUSSION**

The tympanic membrane is a thin semi-translucent and whitish membrane that discriminate the middle ear from the external ear. It extends obliquely at the medial end of external auditory meatus and forms the major part of the lateral wall of the middle ear cavity. Its dimensions in the adult are 10mm X 5mm. It is composed of three layers; the outermost epithelial, the middle fibrous layer containing circular and radial fibers and the inner mucosal [8]. Traumatic tympanic membrane perforations are caused by blast, barotraumas or due to insertion of sharp objects [9-11]. The pathophysiology of TM perforations in trauma is due to sudden rise in the pressure of external auditory canal which then leads to rupture of the thinnest part of the membrane. Among the causes, the most common cause found in males is RTA while the common cause in the female is due insertions of cotton swabs [10]. The similar picture has been noted in the present study with n=14(58.33%) due to RTA in male patients and in female patients n=10 (62.5%) were due to insertion of foreign bodies in the ear. In the present study, we also found male preponderance for the tympanic membrane perforations as compared to the females by the ratio of 6:4 other studies in this field has also demonstrated higher male prevalence in TM perforations [12, 13]. The present study found the mean age group of the male involved was 29.6 years and in the females it was 24.12 years. The youngest patient was a 15-year-old male and the oldest was 45 years old female. In similar studies Lindeman *et al.*, have reported the mean age of

24.1 years while FI Wahid *et al.*; have reported mean age of 26.75 years [12, 14]. The most common side affected in the present patients was left side 52.5% of cases and right ear in 45% of cases and bilateral involvement in 2.5% of cases. Other similar studies have also found similar predisposition for left ear in the injuries of tympanic membrane [14-16]. In this study small perforations Grade, I was found in 42.5% of the patients and Rai S *et al.*, [17] in their study found 55.2% cases had small perforations. In the present study, we had large perforations in 10% of the cases while a study M Elanchezian *et al.*, had found large perforations in 7.0% of their cases [5]. In the present study, the posteroinferior quadrant of the tympanic membrane was most commonly affected n=21 (52.5%) patients and anteroinferior quadrant was affected in n=5 (12.5%) of patients and mixed cases n=14 (35%). Posteroinferior quadrant is most commonly involved in trauma due to the fact that it is more laterally placed and more easily accessible. Hence direct trauma is more likely to involve the posteroinferior quadrant. In our study, we found n=29 (72.5%) had inverted margins and n=11 (27.5%) had everted margins. The percentage of inverted margins is more due to the flow of pressure wave after the trauma that travels from outside to the inside of the ear. Al-Obiedi SH also reported a higher incidence of inverted than everted margins in his series [15]. In the present study we also found hearing loss proportional to amount of perforations but significant difference was noted in the mean hearing loss across the different shape of perforations in agreement with study by MS Rao *et al.*, [18] out of our 40 patients the success rate following myringoplasty was in n=37(92%) of cases it was also noted the size of perforations were not related to success following myringoplasty the 3 failures were found in Groups II, III and IV respectively. The mean audiometric gain in grade I was  $17.05 \pm 4.4$  dB, in Grade II the mean audiometric gain was 16.89 dB and in Group III the mean audiometric gain was 19.84 dB and the Grade IV the mean audiometric gain was 25.95 dB. Therefore, it was found that the mean audiometric gain in Grade IV with the

largest perforation is significantly more than the other groups. Wasson J D *et al.*, have similar observation they found that the audiological gain was maximum with large perforations [19].

## CONCLUSION

Within the limitations of the present study, it can be concluded the tympanic membrane perforations are very common in men with the frequency of posterior perforations are greater and the hearing loss does not vary substantially with the location of the perforation. Surgical intervention of perforations is required when they fail to heal spontaneously and the audiometric gain following myringoplasty was more where the size of perforations was large.

## REFERENCES

1. World Health Organization. (2004). Chronic suppurative otitis media: burden of illness and management options.
2. Hamilton, J. (2008). Chronic Otitis Media in childhood. In: Gleeson M, Browning G, editors. Scott-Brown's Otorhinolaryngology, Head and Neck Surgery. 7th ed, Volume I. London: Edward Arnold publishers; 929.
3. Vaidya, S., Sharma, J. K., & Singh, G. (2014). Study of outcome of tympanoplasties in relation to size and site of tympanic membrane perforation. *Indian Journal of Otolaryngology and Head & Neck Surgery*, 66(3), 341-346.
4. Peter, J. K., & Paul, H. K. (2001). Principle of trauma. In Byron J Bailey Head and Neck Surgery - Otolaryngology Volume 61. 3rd edition, Edited by: Byron, J., Karen, H., Gerald, B., Harold, C., Jonas, T., Eugene, M., Robert, K., Anthony Pazos, Chri Gralapp, Lippincott Williams & Wilkins Publishers, 69 of 202.
5. Elanchezian, M., & Vijay-Babu, D. (2017). Clinical study of etiological factors, clinical course and outcome of traumatic perforation of tympanic membrane in rural Tertiary Care Centre. *Indian Journal of Applied Research*, 7(10):49-50.
6. Sergi, B., Galli, J., De Corso, E., Parrilla, C., & Paludetti, G. (2011). Overlay versus underlay myringoplasty: report of outcomes considering closure of perforation and hearing function. *Acta Otorhinolaryngologica Italica*, 31(6), 366-371.
7. Margolis, R. H., Wilson, R. H., Popelka, G. R., Eikelboom, R. H., Swanepoel, D. W., & Saly, G. L. (2015). Distribution characteristics of normal pure-tone thresholds. *International journal of audiology*, 54(11), 796-805.
8. Rabbani, S. G., Rashid, M. A., Mahmud, K., Chowdhury, M. A., & Razzak, M. A. (2015). Traumatic Rupture of Tympanic Membrane: A Study of 70 Cases. *Bangladesh Journal of Otorhinolaryngology*, 21(1), 38-42.
9. Aktaş, D., & Kutlu, R. (2000). The relationship between traumatic tympanic membrane perforations and pneumatization of the mastoid. *ORL*, 62(6), 311-315.
10. Hempel, J. M., Becker, A., Müller, J., Krause, E., Berghaus, A., & Braun, T. (2012). Traumatic tympanic membrane perforations: clinical and audiometric findings in 198 patients. *Otology & Neurotology*, 33(8), 1357-1362.
11. Lou, Z. C., Lou, Z. H., & Zhang, Q. P. (2012). Traumatic tympanic membrane perforations: a study of etiology and factors affecting outcome. *American journal of otolaryngology*, 33(5), 549-555.
12. Wahid, F. I., & Nagra, S. R. (2018). Incidence and characteristics of Traumatic Tympanic Membrane perforation. *Pakistan journal of medical sciences*, 34(5), 1099-1103.
13. Dawood, M. R. (2015). Spontaneous healing of traumatic tympanic membrane perforation. *Mustansiriyah medical journal*, 14(1), 24-29.
14. Lindeman P, Edström S, Granström G, Jacobsson S, von Sydow C, Westin T, et al. Acute traumatic tympanic membrane perforations. Cover or observe? *Arch Otolaryngol Head Neck Surg* 1987;113(12):1285-87.
15. Al-Obiedi, S. H. (2009). Spontaneous healing of traumatic perforations of the tympanic membrane. *Annals of the College of Medicine Mosul*, 35(1), 26-32.
16. Berger, G., Finkelstein, Y., & Harell, M. (1994). Non-explosive blast injury of the ear. *The Journal of Laryngology & Otolaryngology*, 108(5), 395-398.
17. Rai, S., Koirala, K., & Sharma, V. (2013). Role of nasal decongestants in spontaneous healing of traumatic tympanic membrane perforation. *Nepalese Journal of ENT Head and Neck Surgery*, 5(1), 14-16.
18. Sreedhar Rao, M, Kishor, K., Rajesh, C., & Prasad, A. S. (2017). Clinical study of the impact of size, site & shape of tympanic membrane perforation on surgical closure with Audiological improvement for chronic otitis media – our experience. *Indian Journal of Applied*, 7(9): 273.
19. Wasson, J. D., Papadimitriou, C. E., & Pau, H. (2009). Myringoplasty: impact of perforation size on closure and audiological improvement. *The Journal of Laryngology & Otolaryngology*, 123(9), 973-977.