## **Original Research Article**

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# A clinical study of traumatic tympanic membrane perforation

Fida Harish A. T.\*, Raghavendra Prasad K. U.

Department of ENT, Hassan Institute of Medical Sciences, Hassan, Karnataka, India

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\*Correspondence: Dr. Fida Harish A. T.,

E-mail: fidaharish993@gmail.com

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#### **ABSTRACT**

**Background:** Tympanic membrane (TM) which forms the partition between external auditory canal and middle ear may be ruptured by trauma. Traumatic TM perforation is a commonly observed condition. Though, several therapeutic interventions have been described, conservative follow-up until spontaneous complete recovery is the most common choice.

**Methods:** It was a prospective cohort study conducted during a period of 10 months from July 2020 to April 2021, carried out in 30 patients who presented to outpatient department of ENT and casualty of Hassan institute of medical sciences hospital with traumatic TM perforation. After taking informed consent, detailed history was taken, thorough examination of ear was performed and characteristics of perforation were noted. Pure tone audiometry (PTA) was conducted, data was statistically analysed.

**Results:** Mean age group was 33.1 years and 73.3% were males. Ear pain was the commonest symptom with accidental trauma being the most common cause. 70% of them had left TM perforation and posteroinferior quadrant was mostly involved.

**Conclusions:** Traumatic TM perforation is commonly seen in young adults following accidental trauma and assault. Earache, sudden hearing loss and tinnitus are the common symptoms. Most of the cases heal spontaneously with conservative management.

Keywords: TM, Trauma, Perforation, PTA

### **INTRODUCTION**

Tympanic membrane (TM) forms the partition between external acoustic canal and middle ear. It is slightly oval in shape and forms an angle of about 55 degree with the floor of meatus. It is divided into two parts- pars tensa, which forms most of the TM and pars Flaccida or the Shrapnel's membrane. It protects the middle ear cleft and amplifies and transmits sound waves from external auditory canal through ossicular chain to oval window and cochlea due to its vibratory characteristic. 3

TM could be ruptured by trauma due to hair pin, matchstick or unskilled attempts to remove a foreign

body, sudden change in air pressure e.g., a slap on the ear or a sudden blast, pressure by a fluid column, e.g., diving or forceful syringing, fracture of temporal bone etc. The common manifestations of traumatic TM perforation are sudden severe pain, bleeding, hearing impairment, tinnitus and dizziness. This symptomatology depends upon the site and severity of perforation. Treatment of TTMP range from inactive watchful waiting, active intervention to surgical intervention.

Our department receives significant number of patients with traumatic TM perforation. So, taking up this study would help to evaluate the incidence, clinical features, characteristics and factors influencing the outcome and thus to adopt proper line of management.

#### **METHODS**

This prospective cohort study was conducted during a period of 10 months (including 4 months follow up) from July 2020 to April 2021, among the patients who presented to outpatient department of ENT and casualty of Hassan Institute of Medical Sciences Hospital with traumatic TM perforation.

Based on the data available as per the casualty and OPD register of ENT department of our hospital, for past 1 year, on an average, 4-5 patients per month have presented with traumatic TM perforation. Thus, the sample size was taken as 30, as the study was conducted for a period of 6 months or the number of patients who presents within the study period duration.

Institutional ethics committee approval was obtained. Patients willing to be included in study and patients of all age group and gender with traumatic TM perforation were included in the study. Those patients with non-traumatic TM perforation as well as the traumatic perforation of TM with severe head injury, unconscious patients or patients with polytrauma were excluded from the study.

The patients fulfilling the inclusion and exclusion criteria were selected using simple random sampling. The procedure protocol of the intended study was explained to the patients and informed written consent was taken from them. Demographic data was recorded. A detailed history was taken to find out the symptomatology, the cause of perforation, the time of presentation etc. Thorough examination of ear, nose and throat and otoscopic examination of ears were performed. The characteristics of the perforation like size and site of perforation was noted. Less than 25% of TM involvement was considered as small size perforation, 25-50% involvement was considered as medium sized perforation and 50-75% was considered as large sized perforation. PTA of the included patients was carried out at the time of presentation, at 3 months and at the end of 4 months. If the patient had pain at the time of presentation, the first PTA assessment was delayed for 7 days. Outcome of injury in terms of healing of the perforation and associated complications was also assessed. The patients were followed up for a period of 4 months. The data was statistically analysed employing frequency percentage using SPSS software.

#### **RESULTS**

Thirty patients who presented to the outpatient department of ENT and casualty of Hassan institute of medical sciences hospital with traumatic TM perforation were included in the study. Out of which, 22 patients were males (73.3%) and 8 were females (26.7%). Most of the patients fell under 20-30 age group (n=14 [46.7%]).

Table 1: Gender distribution of patient studied.

Sex	Frequency	Percent (%)
Female	8	26.70
Male	22	73.30
Total	30	100.00

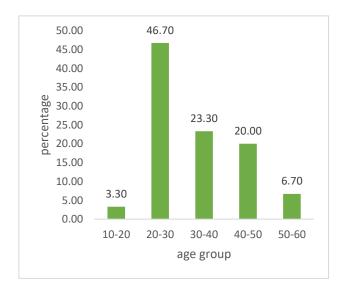


Figure 1: Age distribution of patient studied.

Majority of the patients presented with complaints of ear pain (n=17 [56.7%]), followed by decreased hearing (n=12 [40%]). Eight patients presented with tinnitus (26.7%), two patients with aural fullness (6.7%) and one patient presented with bleeding from ear (3.3%).

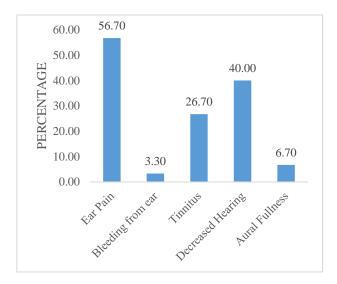


Figure 2: Clinical symptoms of patients studied.

Most of the patients presented with the complaints within 6 hours (n=15 [50%]). Around 12 patients (40%) presented after 1 day and rest of the patients presented between 6 hours to 1 day.

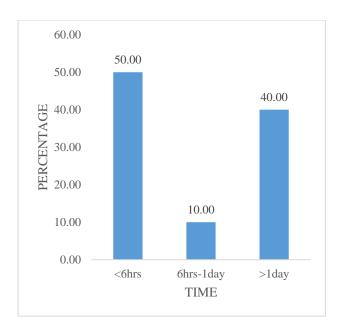


Figure 3: Time of presentation of the patients.

Overall, the common causes of perforation were accidental trauma (n=14 [46.7%] followed by assault (n=12 [40%]). Accidental hit against wall, hit by cow, sudden exposure to loud noise etc were included among the causes in accidental trauma. Only 1 patient presented with traumatic tympanic perforation due to RTA. One patient had presented with foreign body in ear (tick) which on examination was seen lying on the TM. The attempted removal caused perforation of the TM and this was included as the iatrogenic cause.

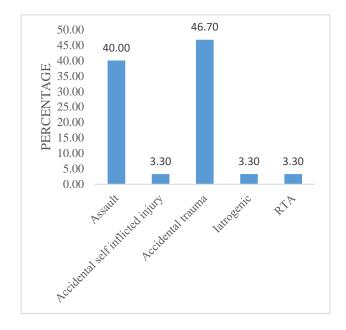


Figure 4: Cause of perforation.

Out of the 30 patients included in the study, 21 patients (70%) had left ear involvement and the rest 9 patients (30%) were affected on the right ear. Majority of the patients (n=25 [83.3%]) had only one perforation in the

TM, whereas, 5 patients (16.7%) had two perforations in the TM on the same side. 27 patients (90%) had small sized perforation and only 3 patients (10%) had medium sized perforation. Posteroinferior quadrant was the commonest quadrant involved (n=15 [50%]) followed by anteroinferior quadrant in 5 patients (16.7%) and involvement of both anteroinferior and posteroinferior quadrant was seen in 3 patients (10%). PTA performed at the time of presentation revealed minimal hearing loss (15-25 dB) in 15 patients (50%) and normal values in rest of the 15 patients (50%). The repeat PTA performed at 3<sup>rd</sup> and 4th month of presentation revealed normal values in all the patients. All the patients were managed and conservatively none of them developed complications and the traumatic perforation healed within 3 months in all patients.

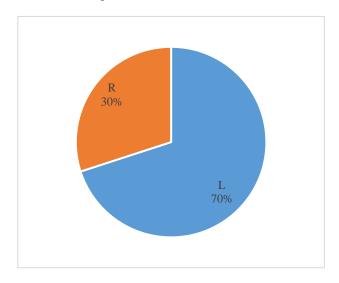
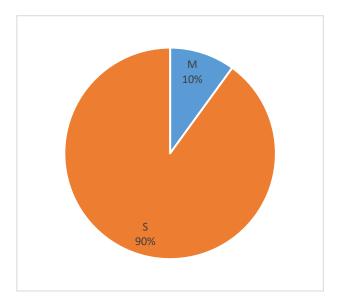


Figure 5: Ear involved.

R-right, L-left



**Figure 6: Size of perforation.** S-small, M-medium.

Table 2: Quadrant of TM involved.

Quadrant of TM involved	Frequency	Percent (%)
AI	5	16.70
AI, PI	3	10.00
PI	15	50.00
PI, AI	1	3.30
PI, AS	1	3.30
PI, AI	1	3.30
PS	2	6.70
PS, AS	1	3.30
PS, PI	1	3.30
Total	30	100.00

AI-anteroinferior, PI-posteroinferior, AS-anterosuprior, PS-posterosuperior.

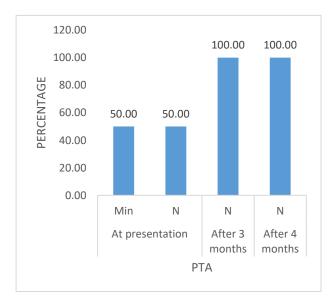


Figure 7: PTA findings at presentation, after 3 months and 4 months.

Min-minimal hearing loss, N-normal.

## **DISCUSSION**

Trauma can affect any part of the body and remains a regular occurrence relating to activities and lifestyle of humans.<sup>5</sup> The most common type of trauma-induced otologic dysfunction includes Simple traumatic tympanic membrane perforation (TTMP).<sup>6</sup> The male preponderance observed in this study resonates with the reports of the study conducted by Afolabi et al.<sup>7</sup> This finding could be a result of more outdoor activities in males when compared to females. In this study, the commonest age group affected was 20-30 years. Other studies have reported age ranges of 29.2 to 33.6 years.<sup>7,8</sup>

In this study, the common presenting symptoms of the patients were ear pain (56.7%), decreased hearing (40%) and tinnitus (26.7%). In a study conducted by Sogebi et al, hearing loss was the commonest symptom with which the patients presented accounting to 64.2 %, followed by tinnitus in 50.9 % and earache in 41.5%.<sup>5</sup> 50% of the

patients included in this study presented within 6 hours and about 40% of the patients reported after 1 day. Other studies have reported a mean duration of presentation as 3 days.

In this study, accidental trauma was the commonest cause of traumatic TM perforation, followed by assault. Lou et al and Sarojamma et al in their studies have reported assault to be the commonest cause of TM perforation. <sup>8,9</sup> This difference that was noticed may be because of the reluctance that the common people show to reveal the truth.

Left ear was the commonest ear to be involved, and so was the result as observed by many of the earlier studies. As opined by Sarojamma et al in their study, it may be due to the fact that slap was a major etiological factor and a right-handed person tends to slap the victim over the left ear. In our study, majority of the patients had single perforation in the TM on examination and about 5 patients had two perforations in the TM and most of it were of small sized perforation. This might be the reason for normal PTA results in 50% of the patients, at the time of presentation.

As per the results of our study, posteroinferior quadrant (50%) was the commonest to be involved, followed by anteroinferior quadrant (16.7%). As the TM lie obliquely in the medial end of external auditory canal, with the angle of 55°, the posterior part is more lateral than its anterior part. So, during assault or any other trauma, the force will be transmitted first to posterior part of TM when compared to anterior part, as it is more lateral. This is thought to be the cause of common posteroinferior quadrant involvement when compared to anteroinferior, in our study. The less common involvement of posterosuperior quadrant may be because it is protected by the external auditory canal wall. Whereas, Sogebi et al have reported that almost half (46.9%) of the perforations were located in the antero-inferior part of the TM.<sup>5</sup>

As most of the cases of traumatic TM perforation heals spontaneously within two months, otolaryngologists have however been advised to be reluctant in offering surgical intervention in cases of TTMP without significant symptoms. <sup>10</sup> All the study participants in our study were managed conservatively and their perforations healed within an average duration of 3 months, without development of complications.

Active interventions for treating traumatic TM perforation include topical application of substances like epidermal growth factor, enoxaparin, and ascorbic acid to stimulate epithelization for quick closure and to prevent formation of sclerotic plaques in the perforated membrane. As per the observations of other studies, factors associated with poor healing were posterosuperiorly-located perforations, large sized perforations and penetrating injuries to the TM. If not taken care, the TM injury can predispose to middle ear infection which

has grave consequences including facial nerve paralysis, formation of cholesteatoma, perilymph fistula, intracranial infections and may require ear and intracranial exploration. When traumatic ear injuries are associated with damage to contiguous facial structures and the brain, significant morbidity or mortality can occur. Effective management and prevention and reduction of complications must be given utmost attention to achieve a good outcome. The outcome may be related to the cause, mechanism, treatment and complications associated with the injuries. <sup>5</sup>

#### Limitations

This was a study conducted during a short period of time. Though we received more patients with traumatic TM perforation during the study period, all of them could not be included in the study as they failed to follow up due to the covid pandemic situation.

#### **CONCLUSION**

Traumatic TM perforation can affect any age group, commonly seen in young adults following accidental trauma and assault. Earache, sudden hearing loss and tinnitus are the main symptoms. Male preponderance and left ear involvement are commonly observed. Most of the patients present immediately after injury. The commonest quadrant of TM involved is posteroinferior followed by anteroinferior. PTA performed at time of presentation did not reveal any significant hearing loss. Majority of the cases heal spontaneously without developing complications. Early identification and evaluation are necessary to reduce the attendant morbidity.

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Ethical approval: The study was approved by the

Institutional Ethics Committee

## REFERENCES

- Dhingra PL, Dhingra S. Diseases of ear, nose and throat, 7<sup>th</sup> ed. RELX India Private Limited. 2017.
- Browning GG, Burton MJ, Clarke R, Hibbert J, Jones NS, Lund VJ et al. Scott-Brown's Otorhinolaryngology, Head and Neck Surgery, 7<sup>th</sup> ed. CRC Press. 2008.
- 3. Wahid FI, Nagra SR. Incidence and characteristics of Traumatic Tympanic Membrane perforation. Pak J Med Sci. 2018;34(5):1099.

- 4. Jellinge ME, Kristensen S, Larsen K. Spontaneous closure of traumatic tympanic membrane perforations: observational study. J Laryngol Otol. 2015;129:950-54.
- 5. Sogebi OA, Oyewole EA, Mabifah TO. Traumatic tympanic membrane perforations: characteristics and factors affecting outcome. Ghana Med J. 2018;52(1):34-40.
- 6. Conoyer JM, Kaylie DM, Jackson CG. Otologic surgery following ear trauma. Otolaryngol Head Neck Surg. 2007;137:757-61.
- 7. Afolabi OA, Aremu SK, Alabi BS, Segun-Busari S. Traumatic tympanic membrane perforation: an aetiological profile. BMC Res Notes. 2009;21(2):232.
- 8. Lou ZC, Lou ZH, Zhang QP. Traumatic tympanic membrane perforations: a study of etiology and factors affecting outcome. Am J Otolaryngol. 2012;33:549-55.
- 9. Sarojamma S, Raj S, Satish HS. A Clinical Study of Traumatic Perforation of Tympanic Membrane. J Dental and Medical Sci. 2014;13:24-8.
- 10. Smith M, Darrat I, Seidman M. Otologic complications of cotton swab use: one institution's experience. Laryngoscope. 2012;122:409-11.
- 11. Lou Z, Yang J, Tang Y, Fu Y. Topical application of epidermal growth factor with no scaffold material on the healing of human traumatic tympanic membrane perforations. Clin Otolaryngol. 2016c;41(6):744-9.
- 12. Bilge A, Gunes A, Dagli M, Koybasioglu FF, Guvey A. The impact of topical and systemic enoxaparin sodium use on traumatic tympanic membrane perforation and myringosclerosis. Eur Arch Otorhinolaryngol. 2016;273(10):3035-41.
- 13. Güneş A, Mutlu M, Akin İ. The Impact of Systemic and Local Administration of Ascorbic Acid on Traumatic Perforation of Tympanic Membrane and Myringosclerosis. J Int Adv Otol. 2015;11:48-52.
- 14. Neuenschwander MC, Deutsch ES, Cornetta A, Willcox TO. Penetrating middle ear trauma: a report of 2 cases. Ear Nose Throat J. 2005;84:32-5.

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