

Study for evaluation of etiology, clinical presentation, audiometric assessment and spontaneous healing of traumatic perforation of tympanic membrane

Manvee Tomar¹, H.Priyoshakhi Devi², Rajlakshmi Khundrakpam³, Achin Pant⁴,
Rituparna Saha⁵

¹Post Graduate Trainee,²Profesor and Head of Otorhinolaryngology,³Senior Resident,^{4,5}Post Graduate Trainee, Regional Institute of Medical Sciences, Imphal, Manipur(India)

Corresponding author: Rituparna Saha

Abstract: Traumatic perforation of tympanic membrane can cause pain, bleeding, hearing loss, tinnitus and vertigo. It can be caused by various etiologies. Diagnosis is based on otoscopy. Treatment is conservative. Antibiotics may be needed for infection. Surgery may be needed for perforations persisting more than 3 months, disruption of ossicular chain or injuries affecting inner ear. Many perforations are small and heal spontaneously. The ear should be kept dry during healing.

Date of Submission: 14-06-2018

Date Of Acceptance: 01-07-2018

I. Introduction:

The tympanic membrane serves as the key component of the tympano-ossicular system for sound transmission.¹The incidence of perforation of tympanic membrane due to trauma is on increase, consequent to an increase of violence and accidents seen in the present life.² The cause of acute rupture of TM include direct trauma by instruments such as cotton swab, pins and sticks, iatrogenic such as syringing, suction and probing of ear and skull fracture.³ Pressure changes include blast injury and open palm trauma (slapping), diving and flying.⁴ Traumatic perforation of tympanic membrane is a common injury that is under reported, hence there is need to educate on unskilled removal of foreign body, early identification, evaluation and referral of patients so as to reduce the morbidity.

It is sometimes associated with injuries to ossicular chain and inner ear. It is a source of great concern to otorhinolaryngologist to restore completely the functional integrity of tympanic membrane and associated structures.

Incidence of perforation of TM is on rise, consequent to increased violence and accidents seen in the present day life.⁵ Whether in war time or in peace time traumatic TM perforations have always been seen in otological trauma. Wani *et al.*⁶ suggested that the mechanism of nonexplosive blast injury is similar to explosive blast injury. However various factors have proven to positively or negatively affect the individual susceptibility to TM rupture. The factors which include previous disease or injury, increased age, inadequate pneumatization and TM position perpendicular to incident wave, increase the likelihood of perforation.

The symptoms of traumatic TM perforation include impaired hearing, aural fullness, tinnitus, otalgia and in severe cases there may be bleeding from ear and vertigo.

Most studies suggest that upward of 90% of traumatic perforations heal spontaneously within 3 months of injury.⁷ The patient besides symptomatic treatment need proper counseling and psychological support. Masterly inactivity should be religiously followed as spontaneous healing is achieved in more than 90% patients over a period of 2–14 weeks. People and health care professionals need to be educated and unskilled attempts at removal of wax and foreign bodies from external auditory canal need to be discouraged.

II. Materials And Methods:

The observational cohort study was undertaken in the ENT Department of RIMS, Imphal, Manipur from October 2015 to September 2017 . The patients with a history of trauma (assault, pin prick, syringing, iatrogenic etc.) sustained not earlier than 4 weeks and with absolutely no previous history of any ear disease were included in the study. A detailed clinical and otoscopic examination was performed and associated symptoms such as vertigo and tinnitus were noted. Tuning fork test, and pure tone audiometry (PTA) was performed on all patients. Follow-up visits were scheduled at 4 week, 8weeks, 12 weeks. The PTA was repeated on each visit. The data retrieved included the following parameters: sex, age and side, cause of injury and symptoms such as earache, hearing loss, tinnitus, and vertigo, bleeding were recorded. The eardrum appearance

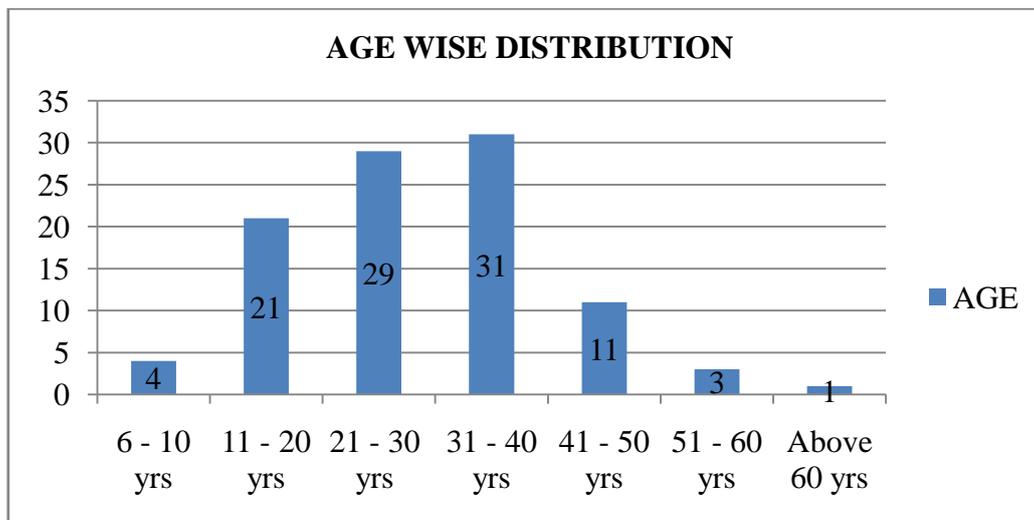
was assessed by otoscope/microscope. The following criteria were used to estimate the relative size of the perforations: small perforation, less than one-fourth of the TM, medium perforation less than one-half of the TM and large perforation, more than one-half of the TM. PTAs were determined for air and bone conductions at 500, 1000, 2000, and 4000 Hz. A conservative management approach was adopted. The patients were advised not to wet the ears and to antedate their appointments if discharge appeared. The data collected was entered and processed in SPSS version 20.0 program.

III. Results:

A total of 100 patients with traumatic TM perforation were enrolled. The group consisted of 46 males and 54 females.

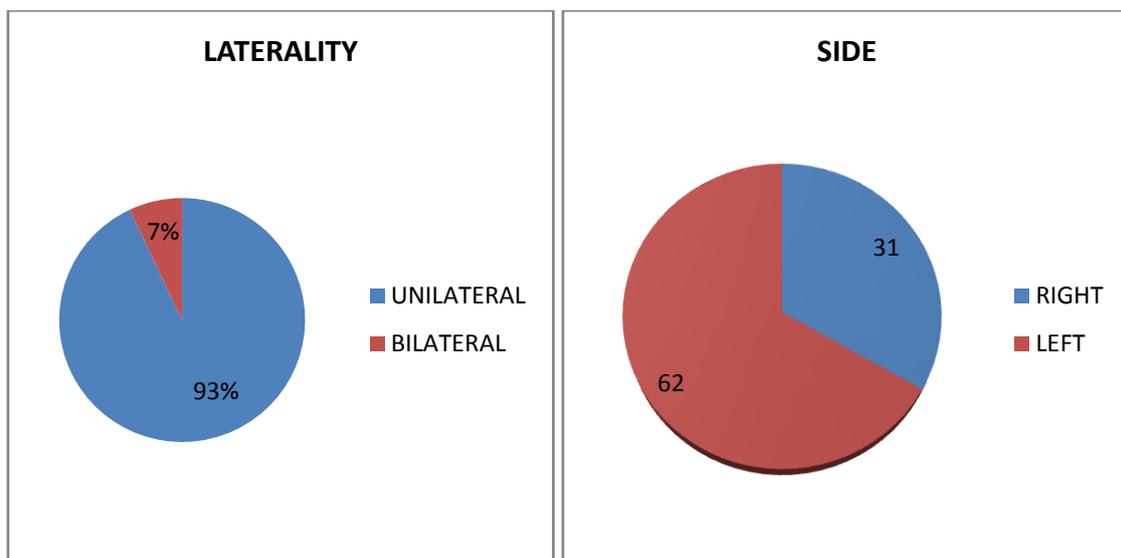
Age distribution

The age ranged from 5 to 69 years. In this series, 31 (31%) of the patients were in the age group of 31–40 years. The youngest patient was a 10 years old.. The oldest patient was a 69-year-old man. [Figure:1]



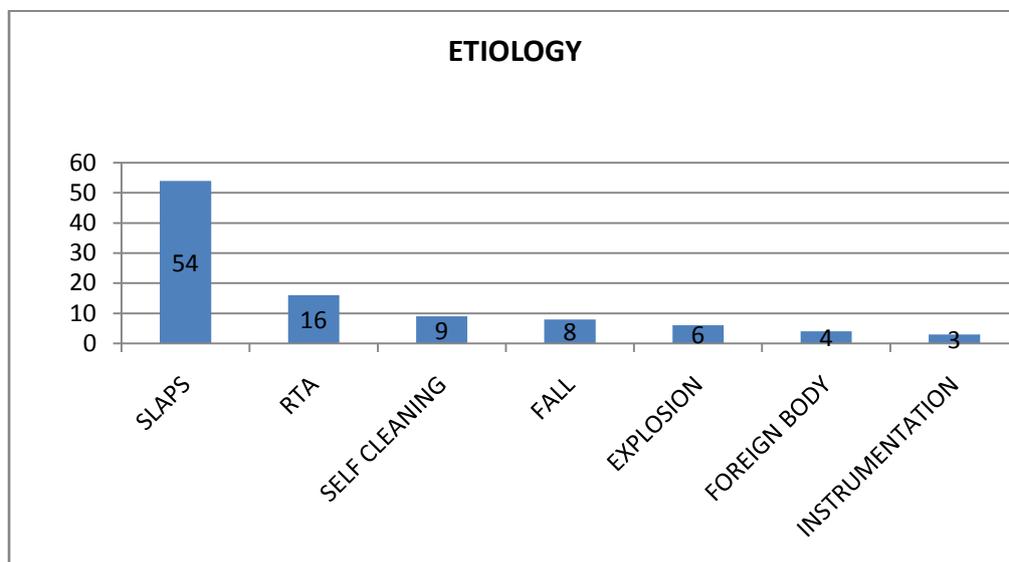
Laterality

93 patients out of 100 had unilateral perforation and 7 patients had bilateral perforation. Out of 93 patients having unilateral traumatic tympanic membrane perforation, left ear is affected in 62 patients and right ear is affected in 31 patients.[Figure 2 & 3]



Etiology

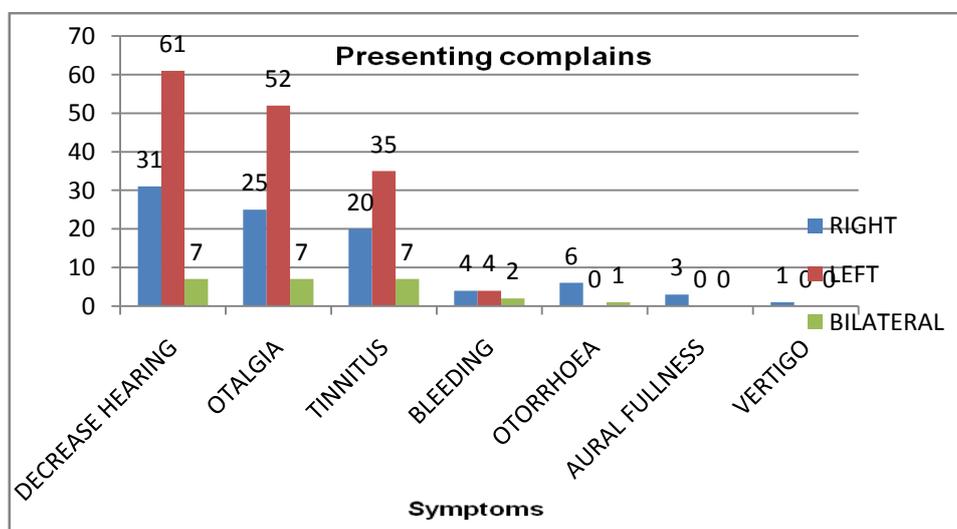
In our study, the most common etiology of traumatic perforation of TM was injury caused due to physical assault (54%) and RTA(16%). Self cleaning accounted for 9% of cases, syringing accounted for 3% of cases and blast injury leading to rupture of TM contributed to 6% of cases [Figure 4].



Presenting

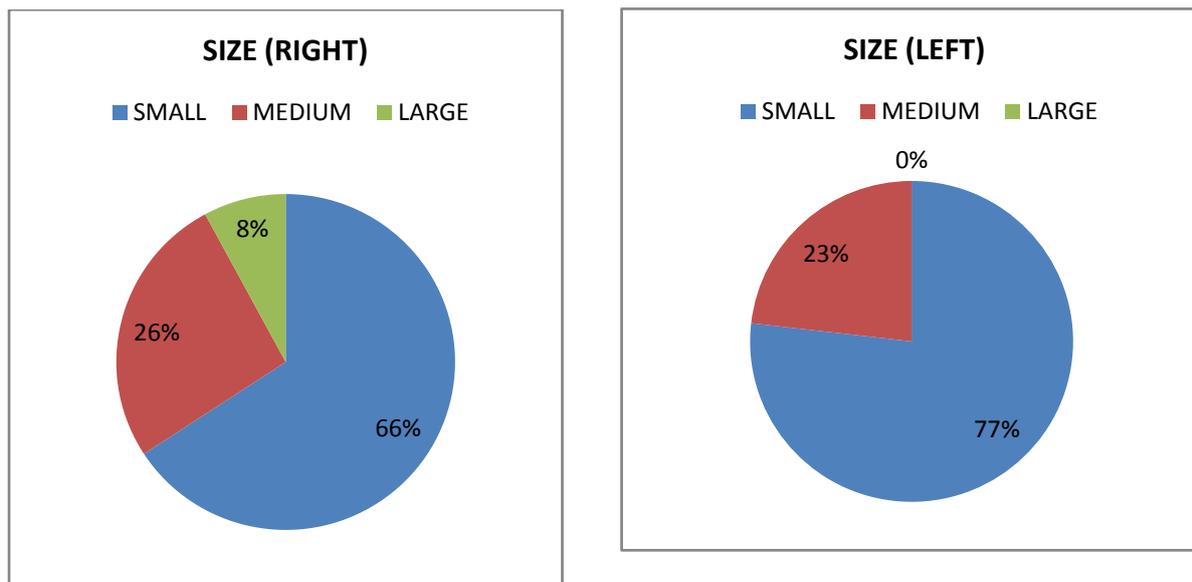
complaints

In our study, decrease hearing was the most common complaint (R 31,L 61,BL 7), the next common complaint was otalgia (84%) followed by tinnitus (62%), bleeding(10%), vertigo (1%)[Figure:5].



Size:

In our study, Out of all right ears affected, 25 cases had small perforation, 10 cases have medium sized perforation and 3 had large perforation affecting three quadrants of the tympanic membrane. Out of all left ears affected, 53 cases had small perforation, 16 cases had medium sized perforation and none had large perforation. [Figure 6].



Number of perforation:

Out of 100 patients, 98 patients had single perforation and 2 patients had multiple perforations (two in number).[Table 1]

No.of perforation	No.of patients	Percentage(%)
SINGLE	98	98
MULTIPLE	2	2

Degree of Hearing loss:

In our study, majority of patients (89%), presented with conductive hearing loss in the range of 26–40 dB, 11% of patients with <55 dB hearing loss.[Table 2]

Deafness	No.of patients	Percentage (%)
MILD DEAFNESS (26-40 dB)	89	89
MODERATE DEAFNESS(41-55 dB)	11	11
TOTAL	100	100

Follow up PTA

Mean PTA value during first follow up month was 22.96±9.55 dB HL and 25.97±8.26 dB HL, for right and left ears respectively. Values during second month of follow up were 27±8.89 and 25.26±7.75 dB HL for right and left ears respectively. During third month of follow up, mean PTA values were 21.96±8.42 and 24.73±7.34 dB HL for right and left ears. [Table 3]

Follow up	Mean PTA	Right	Left
1 st month		22.96±9.55	25.97±8.26
2 nd month		22.27±8.89	25.26±7.75
3 rd month		21.96±8.42	24.73±7.34

Healing:

Out of 100 patients, 46 patients had spontaneous healing of tympanic membrane in 5- 8 weeks, 45 had healing in 9- 12 weeks, 1 had healing during 1- 4 weeks. 8 patients had no spontaneous healing after 12 week. [Table 4]

Healing	No.of case	Percentage (%)
1-4 WEEKS	1	1
5- 8 WEEKS	46	46
9- 12 WEEKS	45	45
NO HEALING	8	8
TOTAL	100	100

Figure 7,8 (Traumatic Perforation),9(Healed TM)



IV. Discussion:

The TM is an important component of sound conduction as its vibratory characteristic is necessary for sound transmission in human beings.⁷ Trauma to TM can be caused by over pressure, blunt or penetrating injuries and barotraumas.⁸ In our study, over pressure was the most common cause of trauma to TM similar to various studies elsewhere.⁹

Traumatic TM perforations are seen in all age groups. In our study, middle age group (20–40 years) has the highest incidence similar to studies undertaken by Gacek and Gacek and Berger *et al.*¹⁰ Male to female involvement was 1.94:1.00. This result is not in accordance with various studies. Lindeman *et al.*¹¹ reported greater prevalence among females similar to study reported by Lou *et al.*¹² There was female preponderance (54%) in my study. 46 (46%) were male patients. Female: Male ratio being 1.7:1.

In our study, 93% of patients had unilateral involvement. The right ear involvement was seen in 26.85% of patients and left ear was involved in 71.10% patients. This could be associated with the fact that most assailants were right handed and likely that most of the acts of trauma such as slap occurred with the assailant and the victim facing each other making the left ear more vulnerable to trauma. Lindeman *et al.*¹¹ and Berger *et al.*¹⁰ reported a similar predilection for left ear. Attempts at removal of foreign bodies from external auditory canal, self-ear cleaning with a variety of objects and wax removal in an unskilled manner either by parents, quacks or primary care physician are other important causes of trauma as are also reported in various other studies. Thus, there is a need for the primary care physician to draw the red lines and routinely consider the referral in all such cases.

In our study, decrease hearing was the most common complaint (R 31,L 61,BL 7), the next common complaint was otalgia (84%) followed by tinnitus (62%), bleeding(10%), vertigo (1%) In the study by Berger *et al.*¹⁰ and Wani *et al.*⁶ hearing loss followed by tinnitus and otalgia were common complaints. In our study, hearing loss increased with increase in size of perforation at each frequency. It is due to hydraulic action arising from the difference in area of foot plate, the most important factor in impedance matching. When the surface area is decreased, there is decrease in amplification and hearing loss will be proportional to the size of perforation.¹¹

Most traumatic perforation have a tendency to heal spontaneously. Out of 100 patients, 46 patients had spontaneous healing of tympanic membrane in 5- 8 weeks, 45 had healing in 9- 12 weeks, 1 had healing during 1- 4 weeks. 8 patients had no spontaneous healing after 12 week. The data strongly suggests that prolonged observation remains an excellent option for patients presenting with traumatic TM perforation. Traumatic perforations often occur in community and generally the prognosis is excellent. The two main factors that predispose to failure of perforation to heal area, loss of tissue, and secondary infection.¹³

Financial support and sponsorship:

Nil.

Conflicts of interest:

There are no conflicts of interest.

References

- [1]. Susan EV, Mehta RP, Rosowki JJ, Neil EO, Merchant SN. Determinants of hearing loss in perforation of tympanic membrane. *Otol Neurotol* 2006;27(2):136-43.
- [2]. Sarojamma S, Raj S, Satish HS. A clinical study of traumatic perforation of tympanic membrane. *IOSR J Dental and Med Sci* 2014;13(4):24-8.
- [3]. Ott MC, Lundy LB. Tympanic membrane perforation in adults: how to manage, when to refer. *Postgrad Med J* 2001;110(2):81-4.
- [4]. Juboori AN. Evaluation of spontaneous healing of traumatic tympanic membrane perforation. *General Med* 2015;2(2):129-31.

- [5]. Robert M. Ear trauma In: Gleeson M, Browning GG, Burton MJ, Clarke R, Hibbert J, Jones NS, Lund VJ, Luxon LM, Watkinson JC, editors. Scott-Brown's otolaryngology, Head and Neck surgery. 7th ed. Great Britain: Edward Arnold Publishers Ltd; 2008. p. 3491-525.
- [6]. Wani A, Rehman A, Lateef S, Malik R, Ahmed A, Ahmad W, et al. Traumatic tympanic membrane perforation: an overview. Indian J Otol 2016;22:100-4.
- [7]. Chun SH, Lee DW, Shin JK. A clinical study of traumatic tympanic membrane perforations. Korean J Otolaryngol 1999;42(2):437-41. Ibekwe TS, Ijaduo GT, Nwaorgu OG. Tympanic membrane perforation among the adults of West Africa. Otol Neurotol 2007 Apr;28(3):348-52.
- [8]. William J, Bojrab DI, Kent GD, Hegyi DF. Otolgic injuries caused by airbag deployment. Otolaryngol Head Neck Surg 1999 Oct;121(4):367-73.
- [9]. Aktas D, Kutlu R. The relationship between traumatic tympanic membrane perforations and pneumatication of the mastoid. ORL J Otorhinolaryngol Relat Spec 2000;62(6):311-5.
- [10]. Berger G, Finkelstein Y, Avraham S, Himmelfarb M. Patterns of hearing loss in non-explosive blast injury of the ear. J Laryngol Otol 1997;111(12):1137-41.
- [11]. Lindeman P, Edstrom S, Granstrom G, Jacobsson S, Vonsyndow C, Westin T. Acute traumatic tympanic membrane perforations: cover or observe. Otorhinolaryngol Head Neck Surg 1988;113(12):1285-7.
- [12]. Lou ZC, Tang YM, Wu XH, Chen JH. Relation between eardrum flap area and healing outcome of traumatic eardrum perforation. Clin J Traumatol 2011;14(5):264-9.
- [13]. Huang P, Zhang S, Gong X, Wang X, Lou ZH. Endoscopic observation of different repair patterns in human traumatic tympanic membrane perforations. Braz J Otorhinolaryngol 2017;694(17):30111-8.

Rituparna Saha " Study for evaluation of etiology, clinical presentation, audiometric assessment and spontaneous healing of traumatic perforation of tympanic membrane ."IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 17, no. 6, 2018, pp 78-83.