

TRAUMATIC PERFORATION – ETIOLOGY, OUTCOME AND FACTORS AFFECTING THE OUTCOME

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ABSTRACT

INTRODUCTION

Traumatic tympanic membrane perforation is the most common type of trauma – induced otologic dysfunction. The study is aimed to evaluate factors affecting healing of traumatic tympanic membrane perforation after 12 weeks.

MATERIAL AND METHODS

A prospective observational study conducted at UCMS, Bhairahawa, Nepal. Sixty patients with traumatic tympanic membrane perforation were evaluated on the basis of causes of trauma, symptoms, otoscopic examination, size of perforation and other factors affecting the outcome of perforation. Healing status of tympanic membrane was assessed 12-week post injury.

RESULTS

The age of the patients ranged from 4-79 years with mean age (years) of 27.84 ± 13.16 . Otalgia was seen in 36 (60%) followed by hearing loss 21 (35%) and least common was vertigo 2 (3%). Most common etiology for injury was 'Slap' (30%) followed by fall injury and physical assault excluding slap with each comprising 16%. Number of patients with small, medium and large perforations were 27 (45%), 21 (35%) and 12 (20%) respectively.

After 12 weeks, 46 (77%) cases had healed perforation with best healing seen in younger patients having age group 11-40 years (26.28 ± 13.5) and least in age group >60 years (52 ± 25.11) with p value of 0.01. 97% cases of smaller perforation had healed tympanic membrane whereas in larger perforation healing was observed in only 42 % cases.

CONCLUSION

Age, size of perforation, types of traumas have significant effect on outcomes of spontaneous healing. With cautious care and strong aural precautions, the prognosis of tympanic membrane perforation spontaneous healing is favourable.

KEYWORDS

Outcome, Traumatic, Tympanic membrane

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INTRODUCTION

Trauma is a common occurrence in human activities and lifestyle, and it can affect any portion of the body. The ear is positioned within the cranio-facial bone, which is vulnerable to environmental stress such as contusion, concussion, decompression, and penetrating injuries such as fractures.¹ The tympanic membrane (TM) is a delicate translucent fibrous membrane which separates the external ear from the middle ear, and it may rupture, tear or perforate when traumatized. The TM damage can predispose to middle ear infections, which can result in facial nerve paralysis, cholesteatoma development, perilymph fistula, intracranial infections, and may require surgical exploration. Simple Traumatic Tympanic Membrane Perforation (TTMP) remains the most common type of trauma induced otologic dysfunction.² In some studies, prevalence of tympanic membrane perforation can reach upto 7.8% and accounted for all patients seen in Ear, Nose, and Throat (ENT) Department. The high prevalence is likely due to peculiarity of developing country with high incidence of domestic violence, poverty and ignorance. The incidence of TTMP is on rise globally due to interpersonal violence, industrialization and weapon misuse.³

The causes of TTMP include sudden increase in ear pressure due to slapping, blast, forceful syringing, caloric tests, faulty technique of ear cleaning or extracting FB, probing, accidents, travelling in a non-pressurized air craft or sudden fluid compression while diving.⁴ TTMP may present with sudden severe pain, hearing loss, bleeding, tinnitus, dizziness, perilymphatic fistula, and facial nerve injury. TM perforation can lead to suppurative otitis media and sensorineural hearing loss if left untreated. TTMP can be treated with a variety of different methods, including non-surgical and surgical. Various studies show spontaneous healing rate ranging from 78 to 90 percent. If spontaneous healing fails after six months, then myringoplasty or tympanoplasty may be recommended if the participant also has significant conductive hearing loss.⁵

This study is conducted to review numerous aetiologies of traumatic tympanic membrane perforation; appraise the factors concerned in healing of traumatic membrane perforation; and determine the patients who are unlikely to profit from conservative management so early surgical intervention could also be suggested

MATERIAL AND METHODS

The current study was a hospital based prospective observational study conducted at UCMS, Bhairahawa, Nepal that was approved by Institutional Review Committee with registration number UCMS/IRC/156/21 prior to the study. Both verbal and written consents were taken from the participants. All Patients that were diagnosed to have TTMP based on history of trauma to the ear, and otoscopic examination confirming tear or perforation of the TM were included in study. Patients that had previous external or middle ear disease, unconscious patients, multiple-injuries, those in whom the TM could not be assessed for any reason and those who are unable to complete minimum follow-up visit of 12 weeks post-injury were excluded.

The overall spontaneous perforation closure rates were 94-97 % in a study done by Lou ZC.7 So, taking 96 percent as estimated proportional and 0.05 of estimated error. Minimum sample size required was 59. Total sample size of 60 was taken.⁶

All the data collected from patients with traumatic tympanic membrane perforation visiting UCMS Outpatient basis (OPD) from October 2021 to March 2022 for a period of 6 months. Follow up record was collected after 12 weeks post injury. The patients were evaluated on the basis of otoscopic examination (presence of perforation, size of perforation, site of perforation, association with bleeding) and the symptoms (ear discharge/otalgia/slowly progressive deafness).

The following criteria were used to estimate the relative size of the perforations:

- Small perforation; less than one fourth of the TM (area involved is $\leq 25\%$ or one quadrant),
- Medium perforation; less than one half of the TM (area involved is 25% -50% or two quadrants)
- large perforation; more than one half of the TM (area involved is 50%-75% or more than two quadrants).

All the patients were managed with nasal tropical decongestant, antihistaminic for 1 week and paracetamol if needed. Healing status of TM was assessed 12 weeks post injury. Outcome was classified as healed TM in complete closure of perforation and persistent TM perforation in non-closure of perforation.

Data collection regarding age, sex, cause (mode of trauma) was compiled in a systematic way in preformed Proforma. All the data from cases were entered in Microsoft (MS) Excel office and then analysed by Statistical Package for Social Service (SPSS).

RESULTS

Sixty patients were enrolled in the study which included 37 (61%) male and 23 (39%) female patients with mean age of the study population being 32.28 ± 19.98 years with maximum age of 79 and minimum age of 4 years. Maximum number of cases belonged to the age group 30-40 years with frequency of 15 followed by 14 cases in age groups 21-30 years. Age groups 51-60 years showed least number of cases (2). (Table 1). Out of the 60 cases, 36 (59%) had left ear perforation whereas 24 (41 %) had right perforation. No statistical significance was noted in outcome after 12 weeks in terms of laterality ($p=0.30$). (Table 2)

The most common presentation was otalgia seen in 36 (60%) patients followed by hearing loss in 21(35%) patients. The least common symptom was vertigo complained by 2 patients (figure I). The most common cause of TM perforation was slap seen in 18 (30%) patients followed by physical assault other than slap and fall injury that comprised 16% each. Least common cause was accidental trauma seen in 1 patient. Highest healing rate after 12 weeks was seen in self-imposed trauma (3/3) followed by slap induced perforation in 17 out of 18 patients (94.5%). Three patients that had perforation following explosives did not heal by 12 weeks. (figure II)

In our study 27 (45%) patients had small perforation, 21 (35%) had medium perforation and 12(20%) had larger perforation. The healed rate after 12 weeks was highest in small perforation (97%) and least in large perforation (42%). There was statistical significance noted between size of perforation and outcome after 12 weeks. (p = 0.02). (Table 2) Out of 60 patients, TM perforation was totally closed after 12 weeks in 46 (77%) patients whereas 14 patients (23%) had persistent perforation (table 2). The perforation healing rate after 12 weeks was lowest in age group of >60 (29%) with highest at the age group of 11-20 (83%) (Table 1). The mean age of healed TM perforation and persistent perforation after 12 weeks was 28.96 years ± 16.40 SD years and 43.14 ± 26.723 years. Statistical significance noted in outcome after 12 weeks in relation to age (p = 0.0190). (Table 2)

Table 1. Age and gender wise distribution of patients with condition of TM after 3 months

Age Group	Gender		Condition of TM after 12 weeks	
	Female	Male	Healed	Perforated
<11	1	4	4	1
11-20	4	9	12	1
21-30	7	7	10	4
31-40	7	8	12	3
41-50	2	2	4	0
51-60	2	0	2	0
>60	0	7	2	5
Total	23	37	46	14

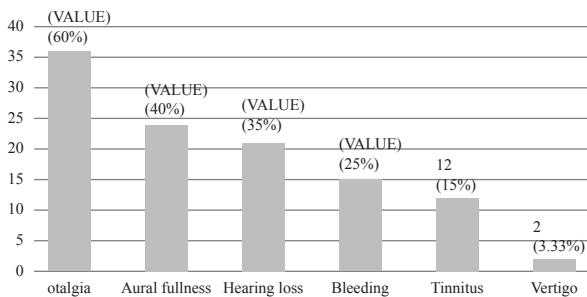


Figure 1. Frequency wise distribution of clinical presentation of patients

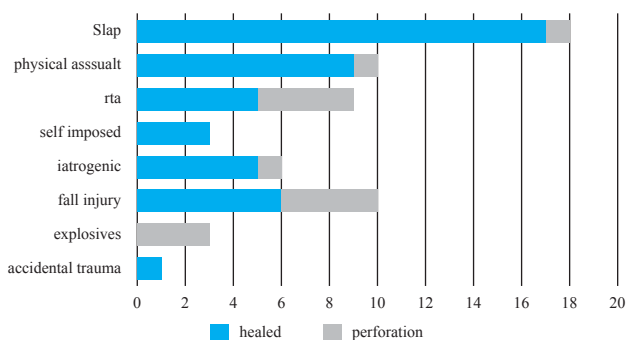


Figure 2. Aetiological profile of traumatic TM perforations with relation to condition of TM after 12 weeks

Table 2. Factors associated with outcome of traumatic perforations

Factor	Condition of TM after 12 weeks		p value	
	Healed (n=14)	Perforation (n=14)		
Age	26.28 ± 13.5	52 ± 25.11	0.0190	
Laterality	Right (n=24)	20 (83%)	4 (17%)	0.3
	Left (n=36)	26 (72%)	10 (28%)	
Size of Perforation	Small (n=27)	25 (93%)	2 (7%)	0.02
	Medium (n=21)	16 (76%)	5 (24%)	
	Large (n=12)	5 (42%)	7 (58%)	

DISCUSSION

Trauma to the ear will vary from easy to complicated cases like trauma, laceration, or avulsion of half or all of the pinna; uncomplicated tissue layer perforation; dislocation of the ossicles and longitudinal and cross fractures of the petrous temporal bone with associated loss of inner ear and facial nerve function.⁷ Typically, TM perforations can be closed by the common tympanoplasty procedure. technique with a high rate of success. Since a major proportional traumatic perforations patients tend to heal spontaneously, the risk, costs and inconveniences of operation are avoided, most of otolaryngologist consider a ‘wait and watch’ policy of management for traumatic tympanic membrane perforation.

Out of sixty patients that were enrolled in the study 61% were male and 39% were female with mean age of the study population being 32.28 ± 19.98 years which was in concordance with the result of Wani A. et al⁸ but contrasts to a study done by Sannigrahi R.⁹ Higher prevalence in male and these groups of ages in our study is expected, as trauma is more common in this age group of patients. Right ear perforation was common and seen in 59% of total studied cases This might be explained by the fact that most attackers were right-handed and that most violent acts including slaps, were likely committed by right-handed people with victim and attacker positioned such that the left ear is exposed. Although no statistical significance was noted in terms of laterality.

Otalgia was the most common symptom being observed in 60% of patients followed by hearing loss in 35% of patients. In a study done by Wani A. et al⁸ tinnitus was the most common complaint (90.90%) followed by aural fullness (87.10%) and otalgia seen in 30 % of cases. Similarly, in a study by The Sogebi OA,² common presenting symptoms were hearing loss (64.2%), tinnitus (50.9%) and ear ache (41.5%). This range of variance in presenting symptoms may be related to the severity and extent of the injuries as only 2 cases in our study presented with symptoms of vertigo.

In the current study, common causes of TM perforation were slap (30%) patients followed by physical assault other than slap and fall injury that comprises 16% each which is concordance with the study done by Wahid FI et al.⁵ TM perforation in our region usually resulted from slap injuries, which was the most common type of violence seen mostly between wife or lover and spouses as domestic violence are common in this domain. In contrary, research done by Dawood et al¹⁰ from Iraq, where explosion injuries were more prevalent

(43.5%) than slaps (24.8%) resulting to TM perforation, which could be attributed to more number of explosive blasts occurring in Iraq as it had been at war for such a long time.

In our study, smaller perforation was most common seen in 45% of cases and large perforation being least common accounting for 20% which is in concordance with the study done by Dawood MR¹⁰ but contrast to study done Wahid FI et al⁵ where medium perforation was more common. Statistical significance was noted between size of perforation and outcome after 12 weeks with smaller perforation having 97 percent healing rate.

Tympani membrane perforation was totally closed in 77% patients whereas 23% had persistent perforation after 12 weeks which is in concordance with studied done by Kristensen S et al¹¹ Other studies showed healing rate ranging between 90-94%.^{7,12,13} There are various factors influencing spontaneous healing of traumatic TM perforation like different injury types, age and sex distribution, and relationship between size of perforation, degree of hearing loss, posttraumatic aural precautions and many more. The perforation healing rate after 12 weeks was lowest in age group of >60 (29%) with highest at the age group of 11-20 (83%) in our study. The outcome would be affected in the old by the deterioration in the healing process brought on by the aging of the tissues, as well as the co-existence of specific diseases with altered microcirculation or microangiopathies, which are most common in the elderly. The healed rate after 12 weeks was highest in small perforation (97%) and least in large perforation (42%) which was statistically significant. Highest healing rate after 12 weeks was seen in self-imposed and least following explosives. Explosive's trauma was mostly associated with larger perforation compare to self-inflicted and slap injuries. There was no statistical significance note in outcome after 12 weeks in terms of gender and laterality.

CONCLUSION

Traumatic tympanic membrane perforation spontaneous healing rate was 46 (77%) after 12 weeks whereas 14 patients (23%) had persistent perforation. Some factors like age of patients size of perforation, types of traumas have significant effect on outcomes of spontaneous healing. With cautious care and strong aural precautions, the prognosis of tympanic membrane perforation spontaneous healing is favourable.

CONFLICT OF INTEREST

None

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