

# Evaluation of Spontaneous Healing of Traumatic Tympanic Membrane Perforation

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## Abstract

Traumatic tympanic membrane (TM) perforation has long been a challenge to the otologist, the objective of this study was to evaluate the prevalence of spontaneous healing of traumatic TM perforation and the factors influenced this healing process. This was a hospital based prospective study performed in the Department of ear, nose and throat (ENT), Al-Fallujah Teaching Hospital, Al-Anbar, Iraq, from August 2011 to April 2013, during this period 60 patients diagnosed having traumatic perforation of TM (62TM) due to bilateral affection in two patients. All those patients treated conservatively with systemic antibiotics, avoidance of let water in the ear and follow up for three months. The commonest cause of perforation was slap injuries (29%), perforation by solid objects (25.8%), explosion (16.1%), fall from height (12.9%), road traffic accident (9.7%), syringing (4.85%) and swimming (1.6%). The healing rate of perforated TM after three months of follows up was 82.3% (51 of 62 TM). There was no statistically significance difference between patients with, or without spontaneous healing of TM regarding the gender of the patient, laterality and causes of the injury ( $p>0.05$ ). There was statistically significant difference between patients with, or without spontaneous healing of TM regarding age of the patient, severity of deafness, size of perforation ( $p<0.05$ ). From this study we concluded that the chances of spontaneous healing of traumatic TM perforation were very high, so that, early surgical intervention of traumatic TM perforation is not indicated.

**Keywords:** Traumatic; Tympanic membrane; Perforation; Spontaneous healing

## Introduction

The tympanic membrane (TM) is an important component of sound conduction as its vibratory characteristic is necessary for sound transmission in human beings [1]. Traumatic perforations of TM are not uncommon injuries. Rupture of the TM may be caused by changes in the air pressure (blow on the ear, blast injury, Eustachian tube inflation, nitrous oxide anesthesia and hyperbaric oxygen treatment), by fluids (syringing, caloric tests and in diving) or by solid objects (instrumentation attempts at foreign body removal, match sticks, hair clips and sparks of hot metal) [2]. Traumatic perforations often occur in healthy members of the community: generally the prognosis is excellent. Most of traumatic tympanic membrane perforations usually spontaneously heal and returns to normal membrane function. However, small perforations are more likely to close spontaneously than large ones [2]. The two main factors leading to failure of the perforations to heal are loss of tissue and secondary infection [3]. Surgical intervention for perforation should be undertaken in the rare cases when these conditions persist greater than six months [3].

The aim of the study was to evaluate the prevalence of spontaneous healing of traumatic TM perforation and the factors influenced this healing process.

## Materials and Methods

This was a hospital based prospective study performed in the Department of ear, nose and throat (ENT), Al-Fallujah Teaching Hospital from August 2011 to April 2013. This study was approved by ethics committee of the hospital and informed consent had been taken from each patient, during this period 65 patients diagnosed having TM traumatic perforation for different reasons. Patients who were included in the study were who presented within two weeks of the injuries, and had no history of external or middle ear diseases. Five patients were lost during follow up so the remaining patients were 60 patients. Assessment of the patients had been done by taking history included: age, gender of the patient, duration, cause of injury. Each patient underwent ear, nose, throat and general examinations including tuning fork tests (Rinne and

Weber tests), more details recorded regarding TM perforation regarding the site, size and draw of the affected TM was done. The site classified as anterosuperior, anteroinferior, posterosuperior, posteroinferior and central (if involved more than one quadrant). The size of the TM perforations were divided into three categories: small; if the size was less than 30% of the total size of TM, moderate; if the size 30-50% of TM and large if the size more than 50%. Pure tone audiometry (PTA) was performed to all the patients involved in the study at frequencies 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz and 8000 Hz respectively in an acoustically treated sound proof room. Air and bone conduction threshold were determined. The mean hearing loss was calculated through the pure tone average taken at 500 Hz, 1000 Hz and 2000 Hz.

The treatment policies build up upon conservative management of the perforation. All the patients were treated with oral antibiotics for ten days, avoidance of let water in the ear and follow up scheduled at every two weeks visit for up to three months. During each follow up visit, the TM was re-evaluated and PTA was repeated. Those patients who showed no chance for healing spontaneously or conservatively after three months, they were referred for surgical repair of the perforation.

## Results

The total number of the patients with traumatic TM perforations was 60 patients, they ranged from seven year to above 60 years old, and the mean age with standard deviation was 22 years  $\pm$  2.2 years.

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They were 38 patients' males and 22 patients were females with male to female ratio of 1.7:1 as shown in table 1.

Traumatic TM perforations happened in 39 patients on the left side, 19 patients on the right side and two patients with bilateral TM perforations, so that the total perforations were 62 in the studied patients.

The majority of the perforations were small in size which constituted 44 (71%), moderate sized perforation happened in 13 (21%) and large perforations in 5 (8%).

The aetiology of traumatic TM perforation showed in Table 2, in order of frequency, the commonest cause was slap injuries (29%), perforation by solid objects (25.8%), explosion (16.1%), fall from height (12.9%), road traffic accident (9.7%), syringing (4.85%) and due to swimming (1.6%).

The healing rate of perforated TM after three months of follows up was 82.3% (51 of 62 TM). There was no statistically significance difference between patients with, or without spontaneous healing of TM regarding the gender of the patient, laterality and causes of the injury ( $p > 0.05$ ). There was statistically significant difference between patients with, or without spontaneous healing of TM regarding age of the patient, severity of deafness, size of perforation ( $p < 0.05$ ) as shown in Table 3.

## Discussion

Traumatic perforations often occur in the healthy members of the community; and generally the prognosis is excellent [2,4]. The two main factors that predispose to failure of the perforation to heal are loss of tissue and secondary infection [5]. A great number of these perforations heal spontaneously, especially those caused by acute trauma, while others remain open and have to be closed surgically. Controversies are still excited regarding the best way to handling such problem. Anyhow conservative management (watchful technique with avoidance of water enters to the ear and prophylactic antibiotics) is still the most popular method. Aural drops containing antibiotics were of no benefit in the absence of active infection and may well aid introducing opportunistic microorganisms resulting in persistence of perforation.

Age ( years )	Male	Female	Total (%)
7 - 10	2	0	2(3.3)
11 - 20	6	3	9(15)
21 - 30	11	7	18(30)
31 - 40	10	8	18(30)
41 - 50	5	4	9(15)
51 -> 60	4	0	4(6.7)
Total	38	22	60(100)

Table 1: Age and Sex Distribution.

Aetiology of traumatic TM perforation	Number	Percentage
<b>Changes in air pressure</b>	42	67.7
Slap	18	29
Explosion	10	16.1
Fall from height	8	12.9
Road traffic accident	6	9.7
<b>Fluids</b>	4	6.45
Syringing	3	4.85
Swimming and diving	1	1.6
<b>Solid objects</b>	16	25.8
<b>Total</b>	62	100

Table 2. Shows the aetiology of traumatic tympanic membrane perforation (no.62 TM).

Character	Healed TM (no.51)	Non healed TM (no.11)	P value
<b>Age (years)</b>			
<20	10	1	P<0.05
21-40	32	4	
>40	7	6	
<b>Sex</b>			
Male	31	7	
Female	18	4	
<b>Hearing loss</b>			
Mild (20-30decibel)	37	4	P<0.05
Moderate (31-50decibel)	14	7	
<b>Side</b>			
Left	34	7	
Right	17	4	
<b>Size</b>			
Small	39	5	P<0.05
Moderate	9	4	
Large	3	2	
<b>Causes</b>			
Changes in air pressure	36	6	
Changed in fluid pressure	4	0	
Solid objects	11	5	

Table 3. Shows the prevalence of spontaneous healing of tympanic membrane and related demographic factors.

The perforations that do not heal spontaneously after 3-6 months can be considered for surgical repair.

Previous studies investigating spontaneous repair of traumatic TM perforation have reported prevalence ranging from 48-94% [6-16]. The variability in these studies may be attributed to differences in the age of the patient, patient population, place of the study (clinic versus institution), causes of perforation and the duration of follow up. The prevalence of spontaneous repair noted in the present study is within the range reported in the literatures.

This study showed that the effect of the age on spontaneous healing of TM rupture was statistically significant ( $p < 0.05$ ) which is consistent with previous study [14]. Wound healing is faster in young people, although, it is normal in elderly [17]. The rate of healing was reported to be faster in young people because of higher protein turnover in such individuals.

Perforation of the tympanic membrane causes a conductive hearing loss that can range from negligible to 50 dB [18]. The results also showed that large sized perforations resulted in significant non healing perforation ( $p < 0.05$ ). This agrees with other studies [12,14]. TM plays a major role in physiology of hearing, it has an augmentation power (14 times) to the sound waves when they reach the oval window, so when the perforation is larger; the conductive type of deafness is greater. Our study showed that the healing of fresh TM rupture was affected by severity of deafness ( $p < 0.05$ )

In this study, the percentage of spontaneous healing of traumatic TM perforation was not significant regarding laterality (left versus right) or gender. Furthermore, we found that spontaneous healing was not significantly affected by cause of trauma. Early assessments of the patient at the time of injury with close follow up can be helpful in prevention of ear infection, avoidance of complications which might occur with such injuries.

## Conclusion

From this study we concluded that the chances of spontaneous healing of traumatic TM perforation were very high, so that, early surgical intervention of traumatic TM perforation is not indicated.

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## References

1. Gacek RR, Gacek MR (2003) Anatomy of the Auditory and Vestibular Systems. In Ballenger's Otorhinolaryngology Head and Neck Surgery Volume 1. Sixteenth edition. Edited by: James B Snow Jr, John Jacob Ballenger. DC Becker Inc, Ontario 1-5.
2. Toner JG, Kerr AG (1997) Ear Trauma. In Scott-Brown's Otolaryngology. Volume 3: Otolology 6th edition. Edited by: Booth JB, Kerr, Advisory AG, Groves J. Butterworths Meinemann, London 1-3.
3. Grant JR, Arganbright J, Friedland DR (2008) Outcomes for conservative management of traumatic conductive hearing loss. Otol Neurotol 29: 344-349.
4. Ijaduola GTA (1986) The Principles of Management of Deafness. Nig Med Pract 12: 19-25.
5. Afolabi OA, Aremu SK, Alabi BS, Segun-Busari S (2009) Traumatic tympanic membrane perforation: an aetiological profile. BMC Res Notes 2: 232.
6. Kristensen S, Juul A, Gammelgaard NP, Rasmussen OR (1989) Traumatic tympanic membrane perforations: complications and management. Ear Nose Throat J 68: 503-516.
7. Lindeman P, Edström S, Granström G, Jacobsson S, von Sydow C, et al. (1987) Acute traumatic tympanic membrane perforations. Cover or observe? Arch Otolaryngol Head Neck Surg 113: 1285-1287.
8. Marvakili SA, Baradaranfar MH, Karimi GH, Labibi M (2007) Assessment of spontaneous healing rate of traumatic tympanic membrane perforation and three months follow up; Yazdi Forensic Medicine. Tahrn University Medical Journal May 65: 57-61.
9. Kristensen S (1992) Spontaneous healing of traumatic tympanic membrane perforations in man: a century of experience. J Laryngol Otol 106: 1037-1050.
10. Yamazaki K, Ishijima K, Sato H (2010) [A clinical study of traumatic tympanic membrane perforation]. Nihon Jibiinkoka Gakkai Kaiho 113: 679-686.
11. Ritenour AE, Wickley A, Ritenour JS, Kriete BR, Blackbourne LH, et al. (2008) Tympanic membrane perforation and hearing loss from blast overpressure in Operation Enduring Freedom and Operation Iraqi Freedom wounded. J Trauma 64: S174-178.
12. Spremo S, Spiric S, Spiric P (1998) [Therapeutic approach in blast injuries of the ear]. Srp Arh Celok Lek 126: 171-176.
13. Amadasun JE (2002) An observational study of the management of traumatic tympanic membrane perforations. J Laryngol Otol 116: 181-184.
14. Orji FT, Agu CC (2008) Determinants of spontaneous healing in traumatic perforations of the tympanic membrane. Clin Otolaryngol 33: 420-426.
15. Lou ZC, Hu YX, Tang YM (2011) Prognosis and outcome of the tympanic membrane flap at traumatic tympanic membrane perforation edge. ORL J Otorhinolaryngol Relat Spec 73: 212-218.
16. Lou ZC, He JG (2011) A randomised controlled trial comparing spontaneous healing, gelfoam patching and edge-approximation plus gelfoam patching in traumatic tympanic membrane perforation with inverted or everted edges. Clin Otolaryngol 36: 221-226.
17. Talbot IC. Factors influencing wound repair. In Walter and Israel General Pathology, Chapter 6, Nuttall G., Smith G & Cutler F, (eds), 1996, pp.177-178. Churchill Livingstone, Edinburg.
18. Gulya AJ, Glasscock ME. Shambaugh surgery of the ear, (5<sup>th</sup>edn) BC Decker Inc, Spain, 2003 Glasscock pp 400-420.