



## CONSERVATIVE TREATMENT FOR TYMPANIC MEMBRANE TRAUMATIC PERFORATION

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### ABSTRACT

**Background:** Traumatic tympanic membrane perforation (TTMP) can be treated by a variety of methods ranging from watchful waiting to surgical intervention. The best treatment strategy for TTMP is still controversial and surgical intervention can be reserved for when severe complications accompany the perforation. We aimed to determine the efficacy of conservative treatment for overpressure TTMP. **Methods:** This observational study included 32 patients with overpressure TTMP referred to the Otolaryngology Clinic of Shahid Mohammadi Hospital, Bandar Abbas, Iran, from June 20, 2017 to July 21, 2018. Their ear canal was cleaned using suction. Patients' symptoms and the perforation characteristics (shape, site, and size) were noted. Audiometry was performed for all the patients and oral cephalexin (500 mg q6h) was prescribed to prevent infection. The participants were advised to avoid using any otic drops and to use dry cotton during the day and vaselined gauze when bathing. All patients were visited weekly for 6 weeks and then every 2 weeks. Audiometry was performed again if complete healing of the tympanic membrane was observed. **Results:** Of the 32 included patients aged 10-37 years, 20 (62.5%) were male. In 15 patients (46.9%) the right and in 17 (53.1%) the left tympanic membrane was perforated. The perforation shape was triangular/round in 24 (75%), linear with <1 mm width in 2 (6.2%), and linear with  $\geq 1$  mm width in 6 (18.8%). Overall, 84.4% of the perforations were in the posterior half and 15.6% in the anterior half of the tympanic membrane. The most common symptoms were pain and bleeding (90.6%), followed by feeling of fullness (81.2%), and transient tinnitus (59.4%). The perforation shape was significantly correlated with healing duration, with the longest healing period in the triangular/round group versus the shortest in the linear <1 mm width group ( $P=0.015$ ) (Table 2). Sensorineural hearing loss was found in 6.2% of patients. An average of 25.3 dB hearing loss was observed which resolved after healing of the perforations. Spontaneous healing was observed in 100% of the patients with an average duration of  $28.58 \pm 5.28$  days. **Conclusions:** Conservative treatment of TTMP with water avoidance yielded a 100% success rate in this study.

**KEYWORDS:** tympanic membrane, perforation, conservative treatment, trauma, overpressure.

### BACKGROUND

Hearing difficulties and balance disorders can result from major trauma to the ears, especially when the inner ear is involved.<sup>[1]</sup> Overpressure is the most common mechanism for the traumatic tympanic membrane perforation (TTMP).<sup>[2]</sup> TTMP can be treated by a variety of methods ranging from watchful waiting to surgical intervention.<sup>[3]</sup> Due to the spontaneous healing in most patients, surgical intervention is not preferred in the absence of significant symptoms.<sup>[4]</sup> Surgical intervention is specifically recommended when complications occur, including severe sensorineural hearing loss, fistula, severe vertigo, and facial paralysis.<sup>[4]</sup> However, the best treatment strategy for TTMP is still controversial.<sup>[5]</sup>

Some researchers have reported a 95% success rate for watchful waiting with water precautions. Nevertheless, spontaneous healing depends on the perforation size.<sup>[6,7]</sup> The success rate of myringoplasty is up to 90% in cases of spontaneous closure failure within 3-6 months and lack of secondary infection.<sup>[7,8]</sup>

Nonsurgical active interventions have been recommended to promote spontaneous healing, such as topical application of enoxaparin, ascorbic acid, and fibroblast or epidermal growth factor, as well as placing a paper patch on the perforation edges. The growth factors can accelerate epithelialization and accelerate closure.<sup>[6,9]</sup>

The aim of the current study was to determine the efficacy of conservative treatment for overpressure TTMP.

## METHODS

### Participants

This observational study included patients with overpressure TTMP referred to the Otolaryngology Clinic of Shahid Mohammadi Hospital, Bandar Abbas, Iran, from June 20, 2017 to July 21, 2018. Patients with severe symptoms requiring surgical intervention were excluded from the study. The study received ethics approval from the Ethics Committee of Hormozgan University of Medical Sciences.

### Study design

A total of 32 patients were referred from forensics for TTMP resulting from slapping or punching. After giving informed consent to participate in the study, all patients underwent complete examination of the ear. Their ear canal was cleaned using suction. Patients' symptoms and the perforation characteristics (shape, site, and size) were noted. Audiometry was performed for all the patients and oral cephalexin (500 mg q6h) was prescribed to prevent infection. The participants were advised to avoid using any otic drops, even in the presence of bloody secretions. Also, they were advised to use dry cotton during the day and vaselized gauze when bathing. All patients were visited weekly for 6 weeks and then every 2 weeks. Audiometry was performed again if complete healing of the tympanic membrane was observed.

### Data analysis

To analyze the data, we used the Statistical Package for the Social Sciences (SPSS) software (version 25.0, Armonk, NY, IBM Corp., USA). Frequencies and percentages were used to describe qualitative variables. Mean and standard deviation were used to describe quantitative variables. The ANOVA test was used to compare healing duration by perforation shape. P-values  $\leq 0.05$  were considered statistically significant.

## RESULTS

A total of 32 patients aged 10-37 years were evaluated in this study, of whom 12 (37.5%) were female and 20

(62.5%) were male. Table 1 demonstrates the symptoms and characteristics of perforation in these patients. In 15 patients (46.9%) the right and in 17 (53.1%) the left tympanic membrane was perforated. The perforation shape was triangular/round in 24 (75%), linear with  $<1$  mm width in 2 (6.2%), and linear with  $\geq 1$  mm width in 6 (18.8%). Overall, 84.4% of the perforations were in the posterior half and 15.6% in the anterior half of the tympanic membrane. The most common symptoms were pain and bleeding (90.6%), followed by feeling of fullness (81.2%), and transient tinnitus (59.4%).

The perforation shape was significantly correlated with healing duration, with the longest healing period in the triangular/round group versus the shortest in the linear  $<1$  mm width group ( $P=0.015$ ) (Table 2).

Sensorineural hearing loss was found in 6.2% of patients. An average of 25.3 dB hearing loss was observed which resolved after healing of the perforations. Spontaneous healing was observed in 100% of the patients with an average duration of  $28.58 \pm 5.28$  days.

**Table 1: Symptoms and characteristics of perforation.**

Variables	Values
Symptoms N (%)	
Pain	29 (90.6)
Bleeding	29 (90.6)
Feeling of fullness	26 (81.2)
Transient tinnitus	19 (59.4)
Perforation shape N (%)	
Triangular/round	24 (75.0)
Linear with $<1$ mm width	2 (6.2)
Linear with $\geq 1$ mm width	6 (18.8)
Site of perforation N (%)	
Posterior half	26 (84.4)
Anterior half	4 (15.6)
Involved ear N (%)	
Right	15 (46.9)
Left	17 (53.1)

Abbreviations: N, number.

**Table 2: Healing duration by perforation shape.**

Variables	Perforation shape			P-value*
	Triangular/round	Linear ( $<1$ mm Width)	Linear 1 mm Width)	
Healing duration (weeks) mean $\pm$ SD	4.78 $\pm$ 2.20	2.16 $\pm$ 1.54	3.00 $\pm$ 1.12	0.015

Abbreviations: SD, standard deviation

\*Analyzed by the ANOVA test.

## DISCUSSION

In the current study, all cases of TTMP were due to overpressure from punching or slapping. In fact, the most

common cause of TTMP is overpressure resulting from a direct blow. There are also other mechanisms, including barotrauma, blast injury, and instrumental injury, such as perforation when removing a foreign body.<sup>[2,10]</sup> However,

Sagiv et al reported that assaults and cleaning the ear canal accounted for 90% of their cases of TTMP.<sup>[11]</sup> Lou et al attributed 50% of TTMPs to direct blows and slap injuries.<sup>[2]</sup>

In our study, the frequency of left and right ear TTMP was comparable, which is in line with the findings of Sagiv et al.<sup>[11]</sup> Nonetheless, it has been reported that traumatic perforations mainly occur in the left ear when the cause is assault. Moreover, a lower rate of spontaneous healing and large perforations have been observed in such cases.<sup>[2]</sup> Yet, all cases of our study improved spontaneously despite being caused by slapping or punching. Also, El-Daba et al reported complete healing in the conservative management arm of their study.<sup>[12]</sup>, complaints of ear buzzing persisted for the initial few weeks.

Furthermore, although the location of the perforation was mostly in the posterior half of the tympanic membrane in this study, it did not affect spontaneous healing. This is consistent with the findings of Orji et al and Kristensen et al, who demonstrated that the rate of spontaneous healing was not influenced by the site of perforation.<sup>[6,8]</sup>

The most common symptoms in our study were pain and bleeding, which affected approximately 90% of the patients with TTMP, while in the study by Wani et al the most common complaint was tinnitus followed by fullness and reduced hearing.<sup>[13]</sup> On the other hand, El-Daba et al reported hearing loss as the most common symptom, followed by pain and ear buzzing.<sup>[12]</sup> The discrepancy among these studies can be justified by the difference in site, size, and shape of perforation, as well as the causative mechanism.

An interesting finding of the current study was that, the longest healing duration was observed when the perforation shape was triangular/round, while the shortest healing period belonged to linear perforations with <1mm width. Studies have shown that the shape of perforation can affect the healing process, with irregular edges taking longer to heal or requiring approximation.<sup>[14]</sup>

## CONCLUSIONS

Conservative treatment of TTMP with water avoidance yielded a 100% success rate in this study. However, large prospective studies or randomized clinical trials with multiple arms are required to determine the superiority of this method over other strategies.

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## REFERENCES

1. Eagles K, Fralich L, Stevenson JH. Ear trauma. Clinics in sports medicine, 2013; 32: 303-16.
2. Lou Z-C, Lou Z-H, Zhang Q-P. Traumatic tympanic membrane perforations: a study of etiology and factors affecting outcome. American journal of otology, 2012; 33: 549-55.
3. Jellinge ME, Kristensen S, Larsen K. Spontaneous closure of traumatic tympanic membrane perforations: observational study. The Journal of Laryngology & Otology, 2015; 129: 950-4.
4. Smith M, Darrat I, Seidman M. Otologic complications of cotton swab use: one institution's experience. The Laryngoscope, 2012; 122: 409-11.
5. Grant JR, Arganbright J, Friedland DR. Outcomes for conservative management of traumatic conductive hearing loss. Otolaryngology & Neurotology, 2008; 29: 344-9.
6. Orji FT, Agu CC. Determinants of spontaneous healing in traumatic perforations of the tympanic membrane. Clinical Otolaryngology, 2008; 33: 420-6.
7. Lou Z, Yang J, Tang Y, Xiao J. Risk factors affecting human traumatic tympanic membrane perforation regeneration therapy using fibroblast growth factor-2. Growth Factors, 2015; 33: 410-8.
8. Kristensen S. Spontaneous healing of traumatic tympanic membrane perforations in man: a century of experience. The Journal of Laryngology & Otology, 1992; 106: 1037-50.
9. Lou ZC, Yang J, Tang Y, Fu YH. Topical application of epidermal growth factor with no scaffold material on the healing of human traumatic tympanic membrane perforations. Clinical Otolaryngology, 2016; 41: 744-9.
10. Berger G, Finkelstein Y, Harell M. Non-explosive blast injury of the ear. The Journal of Laryngology & Otology. 1994;108:395-8.
11. Sagiv D, Migirov L, Glikson E, Mansour J, Yousovich R, Wolf M, et al. Traumatic perforation of the tympanic membrane: a review of 80 cases. The Journal of Emergency Medicine. 2018;54:186-90.
12. El-Daba AE-A, Mohamed Abd El-Fatah A, Mostafa Ahmed Abo Mansora A. Comparative study between patching and conservative treatment of traumatic tympanic membrane perforation. Al-Azhar Medical Journal, 2020; 49: 379-86.
13. Wani A, Rehman A, Lateef S, Malik R, Ahmed A, Ahmad W, et al. Traumatic tympanic membrane perforation: An overview. Indian Journal of Otolaryngology, 2016; 22: 100.
14. Lou Z, Lou Z-H. Identificação e conduta nas perfurações traumáticas da membrana timpânica com bordas invertidas ou evertidas. Brazilian Journal of Otorhinolaryngology, 2019; 85: 17-23.