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Brief Report

TRAUMATIC PERFORATION OF THE TYMPANIC MEMBRANE: A REVIEW OF 80 CASES

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Abstract—Background: Traumatic perforation of the tympanic membrane (TPTM) is often encountered in primary care or in the emergency department (ED). Several therapeutic interventions have been described, but conservative follow-up until spontaneous complete recovery is the most common choice. **Objective:** Our goal was to analyze the trauma mechanism, perforation characteristics, and outcome of patients with TPTM. **Methods:** The study included patients examined in the ED of a tertiary, university-affiliated medical center because of TPTM between 2012 and 2016. Their medical records were retrospectively reviewed for demographics, trauma mechanism, clinical characteristics, and outcome. A phone survey was performed to obtain the missing information of all the patients who did not continue their follow-up in our outpatient clinic. **Results:** We reviewed the histories of 80 patients with a mean age of 26.7 ± 14.6 years (20 children; 25%). TPTM was caused by blunt trauma in 45 patients (56%) and penetrating trauma in 35 patients (44%). Thirty-five patients (44%) completed their follow-up in the hospital outpatient clinic, with a mean duration of 6.2 weeks. Twenty-five patients (38%) completed their follow-up in a community-based otolaryngology clinic, 6 patients (9%) chose not to complete their follow-up, and 14 patients were lost to follow-up. Of the 60 patients who completed follow-up, 56 patients recovered spontaneously, 3 patients underwent successful tympanoplasty, and 1 patient was referred to surgery

but was lost to follow-up. All children healed spontaneously. **Conclusion:** TPTM was more common in young males with main mechanisms of blunt trauma (an assault) or cleaning the ear canal. All children demonstrated complete spontaneous recovery. © 2017 Elsevier Inc. All rights reserved.

Keywords—myringoplasty; perforation; Q-Tip injury; tympanic membrane; tympanoplasty

INTRODUCTION

Traumatic perforation of the tympanic membrane (TPTM) is often encountered in primary otolaryngology clinics or in the emergency department (ED). Most patients are in their third to fourth decade of life (1,2). Various causes have been reported, such as blunt trauma inducing overpressure, which is the most common mechanism, penetrating trauma with either a cotton swab (so called “Q-tip injury”) or other sharp objects, barotrauma, and blast injuries (1–4).

TPTM may be accompanied by a conductive hearing loss that correlates with the perforation size, but rarely exceeds 30 dB. Other common comorbidities that might be associated with TPTM are ossicular chain injury, late cholesteatoma formation, sensorineural hearing loss, tinnitus, and vertigo. Secondary infection of the middle ear may also occur (1).

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The best management for TPTM is still controversial (5). Some authors recommend water precautions alone, with an overall success rate of spontaneous healing (without surgical intervention) of up to 95%, depending on the size of the perforation (6,7). In the case in which the perforation fails to close spontaneously within 3 to 6 months, and in the absence of secondary infection, myringoplasty is indicated, with a success rate of up to 90% (7,8). Various nonsurgical manipulations have been offered in order to improve the spontaneous healing rate, such as placing a paper patch over the edges of the perforation or application of fibroblast growth factor that may facilitate proliferation of fibroblasts and accelerate the perforation closure (6).

The goal of the current study was to analyze the trauma mechanism, perforation characteristics, and clinical outcome of patients with TPTM.

METHODS

This is a retrospective chart review of all patients who attended the ED in our tertiary, university-affiliated medical center because of TPTM between August 2012 and August 2016. Demographic data, mechanism of injury, characteristics of the perforation, treatment, and follow-up examinations were retrieved from the medical charts. Audiometric testing was not routinely performed and the data were not sufficient to be examined or discussed.

All patients were examined and diagnosed by an otolaryngologist in the ED, with follow-up performed in the ear, nose, and throat outpatient clinic. A telephone survey was performed to obtain the missing information regarding the status of the tympanic membrane (TM) perforation in patients who did not continue their follow-up in our outpatient clinic. Patients who suffered from TM perforation before the traumatic event were excluded. The study was approved by the Sheba Medical Center's Institutional Review Board. Informed consent was obtained from all study participants.

Statistical Analysis

The mean and standard deviation of each measurement were determined. Student's *t*-test was used to analyze the difference in duration from the traumatic event until full recovery, and the chi-squared test was applied to compare overall differences in perforation characteristics.

RESULTS

Eighty patients with TPTM who presented to the ED were included, of which 61 were males (76%). The mean age of the total study group was 26.7 ± 14.6 years of age (range 3–74 years). Twenty patients (25%) were <18 years of age (mean age 11.3 years). The mean duration of follow-up

was 6.2 ± 5.4 weeks (median 5 weeks; range 0–27 weeks). Most patients suffered from TPTM caused by assault ($n = 40$ [50%]) or Q-tip injury ($n = 32$ [40%]). Five patients (6.25%) were injured by other types of trauma, including a direct hit from the water while diving ($n = 3$), playing ball ($n = 1$), and motor vehicle accident (MVA; $n = 1$). Three patients (3.75%) suffered from iatrogenic injury while having a cerumen plug removed by an otolaryngologist ($n = 2$) or while fitting a hearing aid ($n = 1$). Ossicular chain interruption was noted in only 1 patient who was involved in a MVA. Three patients had bilateral perforations (1 assault and 2 Q-tip injuries).

The perforation was characterized as central in 68 patients (93%), marginal in 5 patients (7%), and unknown in 7 patients. Fifty-nine perforations (74%) were defined as small ($\leq 25\%$ of the surface area of the TM), 12 (15%) were defined as large, and 9 (11%) were not defined. The location of the perforation was described regarding the malleus handle and the umbo with 30 cases of anterior perforation (37.5%), 25 posterior (31.25%), and 5 inferior (6.25%). There were some trends in the location of the perforation according to the mechanism of trauma: blunt trauma, causing overpressure, resulted mainly in anterior perforations (64%) and no inferior perforations, while Q-tip injuries resulted mainly in posterior perforations (50%) followed by anterior (29.2%) and inferior (20.8%) perforations.

Follow-up was conducted either in the outpatient clinic ($n = 35$, 44%) or by a community-based otolaryngologist ($n = 25$, 31%). Six patients (7.5%) did not complete their follow-up and the outcome of the perforation was unavailable, even with completion of the telephone survey. Fourteen patients (17.5%) were lost to follow-up.

Spontaneous closure of the TMTP was noted in 56 of 60 (93%) patients for whom follow-up was completed. All children recovered spontaneously. The mean duration until closure of the perforation was 5.17 ± 3.04 weeks. Four patients (7%) in whom a perforation was still noted after a 6-month period were recommended for tympanoplasty.

Since only 4 patients did not heal spontaneously, we found no correlation between demographic data, trauma mechanism, or perforation characteristics and the rate of TM recovery. However, a few trends could be retrieved from reviewing the data of patients who completed follow-up ($n = 60$): all patients but the 1 post-MVA, with TPTM caused by blunt trauma, recovered spontaneously. All anterior perforations healed spontaneously ($n = 21$). Whether the perforation was small or large did not significantly change the rate of spontaneous closure (95.6% vs. 90.9%, respectively) nor the duration of time until recovery (5.8 ± 3.4 vs. 7.9 ± 5.2 weeks, respectively).

A silk-paper patch placed over the perforation edges at the time of the first examination in the ED was used in 29 patients (36%). Most of these perforations were defined as small ($n = 25$) and central ($n = 27$), with no difference

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