

Outcomes for Conservative Management of Traumatic Tympanic Membrane Perforation

Raid M. Al-Ani

University of Anbar, College of Medicine, Department of Surgery/ENT.

Abstract

Objectives: To investigate the incidence of spontaneous repair of fresh traumatic tympanic membrane perforation (TTMP) and to elucidate the risk factors which they might impair its healing process.

Patients and Methods: A cross-sectional prospective study of patients with acute TTMP was conducted in otorhinolaryngology department of AL-Ramadi Teaching Hospital in AL-Ramadi city/Iraq between May 2009 and May 2011. Detailed data matching the diagnosis of TTMP were analyzed. Clinical examination, pure tone audiogram and regular follow-up were done for all patients.

Results: Seventy-two patients (43-males, 29-females), aged 2–70 years (mean = 25.7 years) with 75 myringoruptures were studied. Three (4.2%) had bilateral TTMP, 27 (37.5%) right and 42 (58.3%) left unilateral. Out of 75 myringoruptures, 63 (84%) heal spontaneously. Spontaneous healing of traumatic TM rupture was better in patients with younger age, small sized perforation, low hearing loss at the initial pure tone audiogram assessment ($P < 0.05$). While other factors: gender of the patient, cause, side and duration of the injury does not affect the healing of TM perforation $P > 0.05$.

Conclusions: The overall percentage of spontaneous healing of fresh TTMP was 84%. Large sized perforation, old age patient and more hearing loss at the time of presentation were worse prognostic factors for healing of such rupture. Early surgical intervention of traumatic drum rupture is not indicated.

Key Words: Traumatic; Tympanic membrane; Perforation; Ramadi; Iraq.

Corresponding author: Assistant Professor Raid M. Al-Ani, FIBMS. University of Anbar, College of Medicine, Department of Surgery/ENT. Academic degree: Fellowship of Iraqi Board for Medical Specializations (FIBMS, ENT). E-mail: raedalani2003@yahoo.com, Mobile No. : 009647906145364

Introduction:

Generally trauma is blight on our country and it is an important cause of morbidity and mortality in any country¹. This could be in form of personal accident, personal assaults, road traffic accident, blast and sports injuries.

Traumatic ruptures of the ear drum are not uncommon injuries. Perforation of the tympanic membrane may be caused by changes in air pressure (blow on the ear, blast injury, Eustachian tube inflation, nitrous oxide anaesthesia and hyperbaric oxygen treatment), by fluids (syringing, caloric tests and in skin diving) or by solid objects (instrumentation attempts at foreign body removal, match sticks, hair clips and sparks of hot metal)².

Acute ear drum ruptures often occur in healthy members of the community: generally the prognosis is excellent. Small perforations are more likely to close spontaneously than large ones. Nonetheless, in the majority of traumatic perforations, the membrane usually heals and the function of the ear returns to normal. Even subtotal perforations often heal with an excellent end result². The two main factors leading to failure of the ruptures to heal are loss of tissue and secondary infection². Surgical intervention for perforation should be undertaken in the rare cases when these conditions persist greater than 6 months³.

The objectives of the study were to evaluate the overall healing rate and the factors which affect the healing process of traumatic TM perforation.

Patients and Methods:

This is a prospective study carried out in AL-Ramadi Teaching Hospital in AL-Ramadi city/Iraq from May 2009 to May 2011. The study was approved by Surgical Department, College of Medicine,

University of Anbar, and an informed consent was taken from each patient.

Ninety seven consecutive patients who suffered injuries or blow to the ear resulting in acute tympanic membrane perforations were recruited. Subjects who were included presented within 2 weeks of the injuries, and had no history of previous middle ear diseases. Twenty five patients were excluded on account of previous history of bilateral otorrhoea (4 patients) and 21 patients were lost to follow-up, so, the remaining patients 72 were enrolled in the study.

At the initial assessment, a structured interview was conducted for each patient and the following information were recorded: age, gender of patients, side of injury, duration, cause of injury, and associated symptoms. Each patient underwent a thorough ear and general physical examinations including Rinne and Weber tuning fork tests. The site and size of the TM perforations was draw by hand. The location of TM perforation was determined to be 1. anterosuperior, 2. anteroinferior, 3. posterosuperior, 4. posteroinferior when the perforation involved one quadrant of the TM or 5. central when involvement of more than one quadrant. The size of the perforation was expressed as an estimated percentage of the entire TM. For the purpose of the study, the perforations were divided into 3 types according to their size: 1. Small (<30% of the TM) 2. Moderate (30-50% of TM) and 3. Large (>50% of the TM)

The patients' hearing levels in decibel were assessed by well trained technician with a diagnostic audiometer (A 177 plus, Amplifon S.P.A., Milan, Italy) 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 thresholds were determined.

The Mean hearing loss was calculated through the pure tone average taken at 500 Hz, 1000 Hz and 2000 Hz for each site of perforations (1 to 5). While, hearing thresholds for children less than 6 years were determined with an evoked response audiometer.

A conservative management approach (avoidance of water entry to the involved ear and oral antibiotics for ten days) was adopted and follow-up visits were scheduled at 2, 4, 8, 12, 16, 20 and 24 weeks so as to have a uniform baseline assessment at 2 weeks before significant healing would have taken place, and to evaluate the rate of healing at a regular 4-weekly interval. During the follow-up visits, the tympanic membranes were re-examined. Pure tone audiometric tests were repeated following healing of the perforation. Those patients, who showed no healing after 24 weeks, subjected them for surgical repair.

Comparisons of categorical variables were conducted using the χ^2 test. All P values were calculated using 2-sided hypotheses, and the threshold for statistical significance was set at $P < 0.05$. All statistical analyses were conducted using SPSS statistical software, version 17.0.

Results:

Ninety seven consecutive patients were found to have TTMP, however, 25 were excluded because of 4 patients with previous history of bilateral otorrhoea and 21 patients were lost to follow-up, so, the remaining patients 72 were enrolled in the study. Age range 2 to 70 years with a mean age of 25.7 ± 13.70 years and median age of 25 years. Three (4.16%) of them were >50 years and majority of the patients were between 21- 50 years of age (65.29%). There are 43 (59.73%) males and 29 (40.27%) females with a male to female ratio of 1.48:1 Table 1.

Table 1: Distribution of 72 patients with TTMP according to age group and sex of patients.

Age group	Male	Female	Total
0-20	10 (45.45%)	12 (54.55%)	22 (30.55%)
21- 50	31 (65.95%)	16 (34.05%)	47 (65.29%)
> 50	2 (66.67%)	1 (33.33%)	3 (4.16%)
Total	43 (59.73%)	29 (40.27%)	72 (100%)

The TTMPs were 42 left, 27 right and 3 bilateral ears, therefore, the total perforations were 75 in the studied patients. The majority of perforations were small (80%) while the least perforations were large sized (8%). Eighty eight percent of perforations were involved only one quadrant of the tympanic membrane and the remaining perforations were involved 2 or more quadrant Table 2.

The commonest etiology recorded was from changes in air pressure, and the least by

fluids in 59 (78.68%) and 2 (2.66%) respectively Table 2 and 3.

The overall healing rate 24 weeks after the trauma was 84% (63 of 75 perforations). There was no statistically significant difference between patients with, or without spontaneous healing of tympanic membrane regarding gender of the patient, laterality, cause and duration of the injury ($P > 0.05$).

There was statistically significant difference between patients with, or without spontaneous healing of tympanic membrane

regarding age of the patient, severity of deafness, size of perforation (P>0.05)

Table 2. All TM ruptures were in the pars tensa, no attic or marginal perforations.

Table 2: Demographic characteristics of 75 TTMP.

Character	Healed TTMP (63)	Non-healed TTMP (12)	P Value
Age (years)			
<20	22 (34.94%)	0 (0%)	
21-50	40 (63.53%)	10 (83.33%)	0.11
>50	1 (1.53%)	2 (16.67%)	0.00*
Gender Male: Female	40:23 (1.74:1)	6:6 (1:1)	
Male	40 (63.5%)	6 (50%)	0.5421
Female	23 (36.5%)	6 (50%)	0.531
Hearing loss**	22-50 (27.58±7.86)	30-50 (41.5±7.67)	0.00000029*
Side			
Left	39 (61.9%)	6 (50%)	0.6093
Right	24 (38.1%)	6 (50%)	0.5921
Size			
Small	57 (90.5%)	5 (41.7%)	0.002429*
Moderate	6 (9.5%)	3 (25%)	0.5184
Large	0 (0%)	4 (33.3%)	
Cause			
Changes in air pressure	50 (79.4%)	9 (75%)	0.7884
Fluids	2 (3.1%)	0 (0%)	
Solid objects	11 (17.5%)	3 (25%)	0.7528
Duration ***			
<100	42 (66.66%)	7 (58.34%)	0.42
100-<200	9 (14.28%)	1 (8.33%)	0.20
>200	12 (19.06%)	4 (33.33%)	0.052
Site			
Isolated quadrant	60 (95.2%)	6 (50%)	0.0002564*
Multiple quadrant	3 (4.8%)	6 (50%)	0.1716

* Significant difference

** Conductive hearing loss in decibel on initial pure tone audiogram assessment

*** Duration in hours from the onset of the injury

Table 3: Causes of 75 TTMP.

Cause of perforation	N (%)
Changes in air pressure	59 (78.68%)
1. Slap	32 (42.68%)
2. Explosion	20 (26.68%)
3. Falling from height	3(4%)
4. Kicking by shoes	2 (2.66%)
5. Shouting near the ear	1 (1.33%)
6. Road traffic accident	1 (1.33%)
Fluids	2 (2.66%)
1. Syringing	1 (1.33%)
2. Benzene	1 (1.33%)
Solid objects	14(18.66%)
1. Cleaning stick	8 (10.69%)
2. Match sticks	3(4%)
3. Sparks of hot metal	1 (1.33%)
4. Hair clips	1 (1.33%)
5. Comb teeth	1 (1.33%)
Total	75 (100%)

Discussion:

Traumatic TM perforation is not uncommon ear injury with excellent rate of spontaneous reparation. 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 antibiotic) is still the most popular method.

As a result of late referral of traumatic drum ruptures to the otolaryngologist from general practitioner due to badly management of such perforations, chronic ruptures are the end result. Because there is a possibility of ear infection especially with in the first 2 weeks following fresh TM rupture, cleaning and active interventions should be avoided unless contaminating object is found

in external auditory canal or there is evidence of active discharge. 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. The perforations that do not heal spontaneously after 3-6 months can be considered for surgical repair.

Previous studies investigating spontaneous reparation of TTMP have reported prevalence ranging from 48-94%⁴⁻¹⁵. 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 the perforation and the duration of follow-up. The prevalence of spontaneous reparation noted in the present study is within the range reported in the literature.

This study showed that the effect of age on spontaneous healing of fresh TM rupture

was statistically significant (P value <0.05) which is in consistent with previous study¹².

Wound healing is faster in the young people, although, it's normal in the elderly¹⁶. The rate of wound healing was reported to be faster in young people because of higher protein turnover in such individuals.

The results also showed that large sized perforations resulted in significant non-healing perforation (P value <0.05). This agrees with other studies^{10, 12, and 15}. In an experimental study on the spontaneous repair of induced TM rupture in the rats, it was concluded that such rupture healed by means of epithelial migration arising from the annulus and the handle of malleus spreading across the margins of the rupture to cover the defect. It is conceivable that the larger the ruptures, the longer it will take the epithelial migration to cover the larger defects¹⁷.

TM plays a major role in the physiology of hearing. It has an augmentation power (14 times) to the sound waves when they reach 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 value <0.05).

In this present study, the percentage of spontaneous healing of acute TM rupture was statistically not significant regarding laterality (left versus right) or gender. Furthermore, we found that spontaneous healing was not significantly affected by time of presentation, cause of trauma (by changes in air pressure, fluids, or solid object). Early assessment 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 injury and provide enough information for diagnosis of a major perilymph leak that would warrant operation.

In the present study, all TM ruptures were in the pars tensa, no rupture in the attic or marginal regions. This is in agreement with other studies^{12, 18 & 19}.

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