Pattern of Hearing Loss from Otological Trauma due to Non-Explosive Blast Injury Caused by Slap to the Ear in Kashmiri Population

Ayaz Rehman¹, Sajad Hamid²*, Mushtaq Sangoo¹, Mymoona Akhter¹ and Shahnawaz Hamid³

¹Department of Otolaryngology, Sher-i-Kashmir Institute of Medical Sciences Medical College, Bemina, Jammu and Kashmir, India
²Department of Anatomy, Sher-i-Kashmir Institute of Medical Sciences Medical College, Bemina, Jammu and Kashmir, India
³Department of Medicine, Government Medical College, Srinagar, Jammu and Kashmir, India

Abstract

The aim of this study is to determine the pattern of hearing loss in otological trauma due to non-explosive trauma caused by slap in Kashmiri population. The study was conducted in otolaryngology clinic of a referral and a teaching tertiary care hospital Sher-i-Kashmir Institute of Medical Sciences Medical College, Bemina, Srinagar, Jammu and Kashmir, where 569 cases with non-explosive blast injury of the ear due to slap, gathered over a 3-year period, is presented. 522 Patients fulfill the inclusion criteria and 47 cases were excluded. All the selected cases underwent otological examination by clinical examination followed by otoscopic examination, PTA (Pure Tone Audiometry) and Impedance audiometry as required. Tympanic membrane perforation was identified and hearing loss was recorded. The frequency of CHL (Conductive Hearing Loss) and MHL (Mixed Hearing Loss) has been found to be 415 cases (79.5%) and 107 cases (20.5%) respectively. The severity of conductive hearing loss correlated with the size of the eardrum perforation. Male patients were more (68.008%) as compared to females (31.992%). Left ear was more commonly involved (72.16%) than right ear (28.74%). The age ranged from 10-60 years with a mean age of 26.3 years. All the patients demonstrated acute perforation of the ear drum that was confined solely to pars tensa. Anterior perforation occurred in 65 patients (12.46%) while posterior perforation occurred in 152 patients (29.12%). About 58.42% i.e. 305 of the perforations involve adjacent portion of both anterior and posterior halves of tympanic membrane. Closure of air-bone gap following healing was significant p<0.01 while recovery of BC abnormality was less favorable. The most common cause of hearing loss was due to slap by spouses (among females) and slap by security personnel (among males), followed by fight among students. So, there is the need to educate on alternative punitive measure among students and security agents, early identification, evaluation and referral of patients reduces the attendant morbidity.

Keywords: Tympanic membrane; Hearing loss; Audiogram; Blunt trauma, Pars tensa

Introduction

Trauma generally is blight on our society and it is a major cause of morbidity and mortality in any society [1]. This could be in form of assaults, road traffic injury, domestic, industrial and sports injuries. These are relatively on the increase in our society. In a 1999 study, it was found that the average personal injury in the workplace costs more than $8,000 in lost earnings [2]. Trauma patients consume more health care resources than heart and cancer patients combined, and whereas mortality from heart disease and cancer is declining, the incidence from trauma is increasing [3,4]. Non-explosive blast injury due to slap refers to otologic trauma where a blow to the ear seals the external meatus and causes a sudden increase of air pressure that strikes the tympanic membrane. Although there are few reports of non-explosive blast injury to the ear in the literature, this type of ear trauma occurs quite often and may have medicolegal implications. The aim of the study is to evaluate the incidence as well as pattern of hearing loss associated with non-explosive blast injury (due to slap) of the ear.

Trauma to the ear could be simple blunt trauma to the pinna, laceration of the pinna avulsion of part or the whole of the pinna, uncomplicated tympanic membrane perforation, dislocation of the ossicles, longitudinal and transverse fractures of the petrous temporal bone with associated loss of inner ear and facial nerve function [5-11]. Trauma to the tympanic membrane can be caused by overpressure (slap, fight, assault from security personnel’s and road traffic injury (RTI)), thermal or caustic burns, blunt or penetrating injuries such as instrumentations and barotraumas [12,13]. Overpressure is by far the most common mechanism of trauma to the tympanic membrane [12].

Traumatic perforation of the tympanic membrane may be caused by direct impact of fluids and direct pressure from outside. The aim of the study is to profile the various patterns of hearing loss due to non-explosive trauma caused by slap.

Methods

This is a Prospective study where 569 consecutive patients, were included in this study. The study was conducted in the Department of Otorhinolaryngology of Sher-i-Kashmir Institute of Medical Sciences Medical College, Bemina, Srinagar, Jammu and Kashmir, over a period of 3 years between 2009 to 2012 September. The Inclusion criteria were

1) History of slap to the ear with impairment in hearing and presented within 7 days.

2) Patients with history of trauma who also had traumatic tympanic membrane perforation as part of the presentation and presented within 7 days.

*Corresponding author: Sajad Hamid, Assistant Professor, Department of Anatomy, Sher-i-Kashmir Institute of Medical Sciences Medical College, Bemina, Jammu and Kashmir, India, Tel: 9419506978; E-mail: Drsajadrk@Rediffmail.Com

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522 Patients fulfill the inclusion criteria. The data retrieved included: Biodata, the clinical presentation, source of injury, the clinical findings and the outcome of the patients. 47 patients were excluded from the study. The Exclusion Criteria were:

1) History of Previous middle ear discharge.
2) History of Previous hearing loss.
3) Patients under 10 years of age.
4) Patients with history of explosive blast injury to the ear.

The contralateral ear of the patients was used as control.

All the selected cases underwent otological examination by clinical examination followed by otoscopy examination, PTA (Pure Tone Audiometry) and Impedance audiometry as required. Tympanic membrane perforation was identified and hearing loss was recorded. PTA was performed in an acoustically treated anechoic room. The following frequencies were tested 200 Hz, 500 Hz, 1, 2, 3, 4, 6, 8 KHz. Masking were carried out for bone conduction test at frequencies of 0.5, 1, 2 and 4 KHz in all the patients regardless of the interaural bone conduction test threshold difference. Air conduction (AC) masking was done. AC (Air conduction) threshold in the traumatized ear was ≥ 40 dB than the bone conduction threshold in contralateral normal ear. Pure tone average was determined for Air and Bone conduction at 500, 1000, 2000 and 4000 Hz. An average air–bone gap of ≥ 20 dB in the continuous frequencies of 0.5, 1, and 2 KHz were considered significant for diagnosis of Conductive Hearing Loss.

The following observations were recorded during examination and investigation:

- The males were 355 (68.008%) and females 167 (31.992%) (Table 1). The left ear was involved in 372 Patients (72.16%) and the right ear in 150 patients (28.74%) (Table 2). CHL (Conductive Hearing Loss) and MHL (Mixed Hearing Loss) has been found to be 415 cases (79.5%) and 107 cases (20.5 %) respectively (Table 3).
- All Patients demonstrated acute perforation of the ear drum that was confined solely to the pars tensa. Anterior Perforation occurred in 65 patients (12.46%) while posterior perforation occurs in 152 patients (28.74%). Anterior and posterior halves of the tympanic membrane. The prevalence of hearing loss was significantly more in injured ear than the contralateral normal ear (p<0.05) (Table 4). Closure of air-bone gap following healing was significant (p<0.05) while recovery of bone conduction abnormality was less favorable (Table 5). Majority of the slap injury were from fights (in case of females their spouses), security agents (in case of males), and students and among individuals.

**Discussion**

Trauma to TM (Tympanic membrane) can be caused by overpressure, thermal or caustic burns, blunt or penetrating injuries, and barotraumas [12,13]. Overpressure is by far the most common mechanism of trauma to the TM in our study similar to various studies elsewhere [5,12,13]. Traumatic tympanic membrane affects all age groups with a mean age of 26.3 years similar to a study from the south-eastern part of Nigeria that had a mean age of 27.6 years [13] with the highest incidence among the middle age groups from our studies similar to some study [14] but differ from other [13]. Male to female ratio was found to be 2:1 with high predominance among males (68%). This is expected, as trauma is commoner in this group of patients similar to other series [5,13,14]. Left ear were more damaged than right ear in the ratio of 2.5:1, this could be associated with the fact that most assailants were right handed and likely that most of the acts of trauma due to slap occurred with the assailant and victims facing each other making the left ear to be predominantly affected compared to the right side. Slap injuries are extremely common and can be as a result of either a hand or water slap and these injuries usually result in a triangular or linear tear of the TM from previous study [12]. These slap injuries could be a product of fight, armed robbery attack, fight with security personnel as this region has presence of huge security personnel in the world, however it was found to be common among the youths in more than 50% of cases reviewed and those in the adult were due to fight with security agents. These findings in our study are compared to a similar study in other region e.g. of Nigeria where fight with spouse was the commonest etiology recorded [13]. Slap from fights is the commonest cause of the traumatic perforation which was the commonest type of violence seen between individuals, mostly between security agents and the people and then among students. However other study found it resulting from marital conflict between wife and spouses [13]. However there is need to educate the students and security agents on other punitive measure as there is predisposition to conductive hearing loss or an imminent chronic suppurative otitis media if not properly managed. Slap was commoner among males than the females similar to other study [13]. Thus there is a need for a primary care physician to identify their limits with appropriate referral. Traumatic perforations often occur in the healthy members of the community; and generally the prognosis is excellent [6,8]. The two main factors that predispose to failure of the perforation to heal are loss of tissue and secondary infection. So, chances of secondary suppurrative otitis media were
resolved with both antibiotic impregnated topical wick ear dressing and systemic antibiotics with healing of the perforations.

Because of the risk of introducing infection, the ear should not be cleaned out. The ear must be kept dry by preventing water from entering the ear canal [6,8]. If the perforation fails to close spontaneously by 3-6 months (in the absence of secondary infection), surgical closure is indicated [6,8]. However in our study, spontaneous recovery occurs in 420 cases while as persistent perforation after conservative management was seen in 102 patients. 89 cases healed after cauterization of the margins of perforation while the rest i.e. 13 patients were subjected to myringoplasty (Table 6). On follow-up, a conservative approach was adopted and follow-up visits were scheduled at 2, 3, 6, 9, 12 weeks so as to have a uniform baseline assessment to evaluate the rate of healing at a regular 3 weekly interval.

**Conclusion**

In conclusion traumatic perforation of the tympanic membrane by slap is still common in our environment. It affects all age groups and affects male more than the females. Slap by spouses (in females) and slap by security personnel (in males) are the commonly seen, left ear is affected more than the right and sudden hearing loss is the commonest symptom of presentation. Conductive Hearing loss (CHL) in the speech frequencies was the most common form of hearing loss in this group of selected patients with non-explosive hearing impairment. Healing of perforation favoured significant recovery of the CHL (Conductive hearing loss), but recovery of sensor neural element was less favorable. Even though it is not a common injury that is under-reported, there is the need to educate the student and security agents on alternative punitive measure, early identification, evaluation and referral of patients by primary care physician who saw these patients, to reduce the attendant morbidity.

**Table 6: Pattern of recovery of cases.**

<table>
<thead>
<tr>
<th>Total patients</th>
<th>Spontaneous recovery</th>
<th>Persistent perforation after conservative management</th>
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<tbody>
<tr>
<td>522</td>
<td>420 (80.45%)</td>
<td>102 (19.55%)</td>
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<td></td>
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<td>89 (87%) healed after cauterization of the margins of perforation</td>
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<td>13 (13%) patients were subjected to myringoplasty</td>
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**References**