Original Article

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OTOLOGICAL TRAUMA: AN EXPERIENCE AT CMH PESHAWER

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ABSTRACT

Objective: To study the pattern of otological trauma sustained by troops serving in Operation AI Mezan.

Design: A cross sectional study.

Place and Duration: Department of ENT CMH Peshawar. Data collected from hospital admission and discharge register and ENT OPD register from December 2008 to September 2010.

Patients and Methods: Data of all patients of otological trauma was recorded. Nature of otological injuries was recorded along with relevant investigations and the data was studied.

Results: Tympanic membrane damage is the most common otological injury observed among cases of ear trauma.

Conclusion: All patients of blast trauma should have otological assessment and audiometry.

Keywords: Hearing loss, Otological trauma, Tympanic membrane perforation.

INTRODUCTION

Otological trauma is a wide entity and can be conveniently divided anatomically into external ear, middle ear and inner ear variety. Apart from external ear injuries the other two types are always seen as combined injuries. Mode of otological injuries is either direct impact or blast injuries[1,2]. Middle and inner ear damage is more common with blast injuries[3]. Blast injuries are different from noise induced hearing loss as given in the classification by Horrocks which is the internationally followed classification of otological blast injuries'.

Blast injuries of the ear can be classified into report trauma and blast trauma. Report trauma is due to small arms fire and stimuli are multiple and short lived, sensory neural hearing loss is usually temporary at 4 Kilo Hertz and middle ear damage is seen less often. Blast trauma is caused by positive pressure of blast wave with a single long acting stimulus with permanent sensory neural hearing loss and extensive damage to middle ear conduction mechanism[1].

Tympanic membrane and middle ear injuries are more commonly seen with blast trauma. Tympanic membrane is liable to rupture even with pressures of 5 psi (pound per square inch) and 50% rupture at 15 psi. Incudo-malleolar joint disruption is the most common type of ossicular chain injury. Cholesteatoma may occur in up to 12% of traumatic tympanic membrane perforation due to implantation of fragments of keratinized squamous epithelium into the middle ear cleft[1].

It is essential to document otological trauma as soon as it occurs, so as to perform a detailed examination and document the type of otological trauma. Most of the referrals to the ENT department are weeks later when the patient complains of reduced hearing.

PATIENTS AND METHODS

Data of all soldiers of otological trauma presenting from December 2008 to September 2010 was collected by consulting the "Admission and Discharge Register of the Hospital" and cross checking it with "Daily War Causality Report" and tabulated. Nature of otological injuries sustained was recorded by dividing them anatomically into external, middle and inner ear. Patients with tympanic membrane perforation and pure conductive hearing loss were included in middle ear damage, whereas patients with mixed, pure sensory neural hearing loss and vertigo fell under inner ear damage. Tympanic membrane damage was classified as grade 1 perforation which was taken as a pinpoint or linear tear with less than 25% involvement of tympanic membrane surface area, grade 2 involved 25%

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to 50%, and grade 3 more than 50% of the tympanic membrane.

Among the relevant investigations Pure Tone Audiometry was done for all patients complaining of hearing loss, and tympanometry was carried out in individuals with complaints of hearing loss with intact tympanic membrane. Hearing loss was considered present if average of hearing threshold in speech frequencies (500 Hertz, 1000 Hertz, 2000 Hertz and 4000 Hertz) in either ear was more than 30 decibel. Data was entered in SPSS version 15 for statistical analysis. Descriptive statistics were used to describe the data.

RESULTS

Among the casualties evacuated to CMH Peshawer during the study period a total of 135 serving soldiers were treated for otological trauma. Fifty seven (42.2%) soldiers had demage to both ears bringing the total number of ears studied to 192. These included those having otological injuries as a result of direct small arms fire and blast injuries. Median time from day of injury to audiometry was 14.02 days. Minimum time from injury to audiometry was 1 day and maximum time was 76 days.

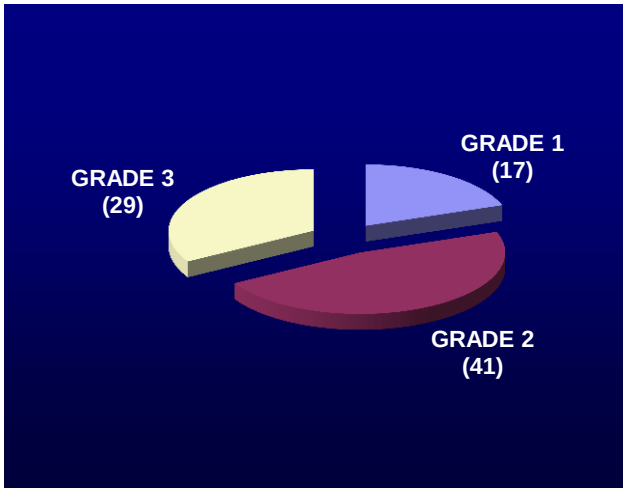

Fig. 1: Grades of tympanic membrane tears.

Location of otological trauma is shown in table 1. Pure Tone Audiometry (PTA) was performed on all 135 cases with 76 (56.3%) cases of conductive hearing loss and 18 (13.3%) of patients with pure sensory neural hearing loss, and 27 (20%) cases had mixed deafness. Fourteen (10.4%) cases had normal hearing. Grades of tympanic membrane damage are shown in figure 1.

DISCUSSION

External ear injuries account for 9% of ear trauma as quoted by Owens[4] and as less as 1% as quoted by Chait[5]. The external ear injury includes shrapnel injury to pinna and any injury caused by blast trauma.

Among middle ear damage most common pathology was tympanic membrane perforation in our study and accounted for 61.5 % of ear traumas as compared to 44 % by Chandler et al[6], 89.2% in Second World War by Chait et al[5], 73% in U.S troops in Somalia as quoted by Mabry[7] and 57% by U.S troops in Iraq as quoted by Gondusky[8]. Seventeen patients i.e. 19.5% with tympanic membrane injury had grade 1, 41 (47%) had grade 2, and 29 (33.5%) had grade 3 perforations. On follow up 33% of patients had spontaneous closure of tympanic membrane defect and all of them with grade 1 tear, 67% of cases went on to develop suppurative otitis media which was managed conservatively. Middle ear is a closed gas containing space and pressures as low as 5 psi can rupture the tympanic membrane, with higher pressures even ossicular chain can be damaged. Ossicular chain damage was reported in 22 (18.6%) cases confirmed on otomicroscopy. Nine cases had ossicular chain dislocation with intact tympanic membrane

Table: Location of otological trauma (n=192)

	External Ear		Middle ear			Inner ear	
	Pinna	Pinna & EAC	T.M rupture	T.M rupture with ossicular chain damage	Ossicular chain damage without T.M rupture	Sensory neural hearing loss	Vertigo
Number of cases	10 (34%)	19 (66%)	87 (73.7%)	22 (18.6%)	9 (7.66%)	18(40%)	27(60%)
Total	**29(15.1%)**		**118(61.4%)**			**45(23.4%)**	

- EAC : External Auditory Canal
- T.M : Tympanic Membrane

confirmed by otomicroscopy and tympanometry.

Hearing loss as confirmed by PTA was found in 89% of otological trauma with 76 cases of conductive hearing loss, 18 with pure sensory neural and 27 with mixed deafness. Inner ear damage starts as damage to outer hair cells at basal turns and proceeding to apical turns of cochlea and later on involvement of inner hair cells. Damage to inner hair cells usually leads to permanent hearing loss. Amber et al[9] reported hearing pathologies in 55% of cases. Roth et al[10] have given a figure of 74 % sensory neural or mixed hearing loss and 60% tinnitus in their study. Brennan[11] reported that 22% of battle traumas in Iraqi war had hearing loss. Similarly Chandler et al[6] have given a figure of 30% to 55% hearing loss among survivors of blast trauma. The patients of pure sensory neural hearing loss were given a short course of steroids for seven days which showed improvement in only 10 % of cases. Vertigo after blast trauma is reported by majority of the patients either as a transient phenomenon which lasts for few seconds to long term type of vertigo which persists for weeks to months[12]. Most patients of transient vertigo do not report it to the audiologist as by the time they are being examined it has subsided or the patient is under labyrinthine sedatives[13]. Origin of vertigo after blast trauma as postulated by studying live animal models is due to bleeding in perilymph spaces. As perilymph is confluent with cerebrospinal fluid, the above mentioned pathology may be a form of subarachnoid haematoma/ haemorrhage[14,15]. There is also increasing evidence that bleeding in perilymph space, secondary injury including vasospasm, transient ischemia, and microcirculatory dysfunction lead to delayed sensory neural hearing loss[15].

Furthermore the impact of explosions in confined spaces like vehicles and buildings is yet to be studied extensively because vehicles may limit the shrapnel injury but the effect of blast waves can be enhanced thereby causing more damage as stated by Leibovici[16].

Hearing protection system are currently available which range from over the ear protectors to specially designed helmets covering the ears, and may help to prevent or lessen otological trauma. Traditional hearing protectors dampen all kinds of sounds there by being ineffective as verbal commands play a vital role in modern battlefield. Recently a protection system devised by Rascal Acoustics has been introduced in the British army which has shown to lessen the impact of otological trauma by attenuating only the sounds of speech frequencies and dampening any sound which has a pressure effect above 4.5 psi[1].

CONCLUSION

Tympanic membrane rupture among blast trauma victims is a common finding, with majority of cases having damage to less than 50% surface area of the tympanic membrane.

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