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MANAGEMENT OF ACUTE TRAUMATIC TYMPANIC MEMBRANE PERFORATION WITH MEDICATED GELFOAM PLUG

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ABSTRACT

Background: Traumatic tympanic membrane perforation is quite common and is traditionally treated by observation approach.
Aim: To evaluate the role of medicated gelfoam plug in healing of acute traumatic tympanic membrane perforation.
Methods: A prospective study was conducted in seventy eight consecutive patients of acute traumatic tympanic membrane perforation. Margins of perforation were reposited in original position with suction tip or sickle knife and medicated gelfoam plug was put over it to act as scaffolding.
Results: There were seventy eight subjects in age groups of 16-55 years, 50 being males and 28 females. Slap & sports injuries were common etiological factors. Hearing loss 64(82.05%) and tinnitus 15(19.23%) were commonest presenting symptoms. Mean pre and post-operative conductive hearing loss was 19.5 dB (8-40) and 7.28dB respectively. Two refractory cases underwent type-1 cartilage tympanoplasty. Overall success rate was 97.43.
Conclusion: Medicated gelfoam plug a simple, quick and very economical procedure gives excellent results (97.43%).

KEYWORDS

Gelfoam, Tympanic membrane, Traumatic perforation, Tympanoplasty.

Introduction

Traumatic perforation of tympanic membrane is not an uncommon clinical entity which causes little morbidity; however, it affects quality of life because of associated psychological trauma. The incidence of traumatic perforation is on the increase due to prevalence of violence in the society and an increase in traffic accidents1. Tympanic membrane perforation can also result from self-cleaning of the ear, domestic violence, and sports injuries especially contact sports. It is sometimes associated with injury to the ossicular chain and even the inner ear. Trauma could be simple laceration of pinna, avulsion of part or whole of pinna, uncomplicated tympanic membrane perforation, dislocation of ossicules, longitudinal & transverse fracture of the petrous temporal bone which is sometimes associated with severe hearing loss and facial nerve paralysis2. Traumatic perforation has definite impact on quality of life of the individual as it is likely to interfere with occupational and recreational activities.

Tympanic membrane is an important anatomical structure of sound conduction as its vibratory character is necessary for sound transmission in humans as well as animals. Trauma to the tympanic membrane and middle ear cleft is caused by slap, fight, assault with various objects or weapons, road traffic accident, thermal or caustic burns, blunt or penetrating injuries like instrumentations and barotrauma3. Slap on the face or pinna is very common in Indian society as it may be inflicted by parents, teachers and spouses with or without any reason. Traumatic perforation of tympanic membrane may also be caused by direct impact of fluids i.e. diving and direct air pressure from outside like blasts. It usually heals spontaneously in three weeks to three months, however, some cases present with persistent unhealed perforation4. Impediment to spontaneous healing includes putting of ear drops, oil and water entering in the ear during taking bath or swimming. Unhealed perforation may get infected, hearing loss persists and rarely there may be development of cholesteatoma due to migration of epithelium5. Acute traumatic tympanic membrane perforation usually have good prognosis even without treatment. We evaluated the role of medicated gelfoam plug in healing of acute traumatic tympanic membrane perforation.

Material and methods

The present prospective study was conducted in seventy eight consecutive patients of either sex in the age group of 16- 55 years suffering from acute traumatic central tympanic membrane perforation irrespective of the mode of trauma. Patients less than 16 years and above 55 years of age were excluded from the study. This was chosen because a person less than 16 years was deemed to be too young to undergo repair under topical anesthesia and more than 55 years were not included to exclude any associated presbycusis hearing loss and possibility of expected age related delayed healing. All subjects who underwent any ear surgery in the past, middle ear infections and perforation caused by blast injuries were also excluded from the study. Preoperatively routine investigations like tuning fork tests, X ray mastoids to exclude any fracture, Hb, BT, CT, and complete urine examination were carried out. Pure tone audiometry was performed in each case and average air bone gap of each patient was calculated preoperatively and postoperatively at the frequency of 500, 1000 and 2000Hz.This also excluded any preoperative sensorineural hearing loss. Three hours fasting was ensured. Premedication with pentazocin 30 mg, promethazine 25 mg and atropine 0.4 mg intramuscular was given half an hour prior to operative procedure. All patients were operated under topical anesthesia after written informed consent.

Ear to be operated was kept up and sterile tight cotton plug was put in the external auditory canal to avoid any sensorineural hearing loss due to seepage of antiseptic in the middle and inner ear. The area was cleaned with povidone iodine and methylated spirit and draped ensuring complete asepsis. At this point sterile cotton plug was removed. Topical anesthesia (xylocaine 4%) was instilled in the external auditory canal at least 20 minutes prior to surgery. Under microscope margins of perforation visualized (Fig-1).

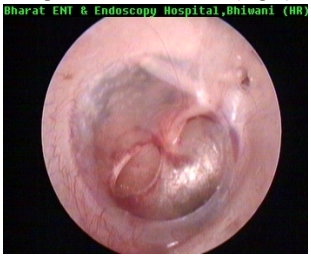

Fig-1. Right side traumatic tympanic perforation in postero inferior quadrant.

The rolled in or rolled out margins were reposited and approximated in their original position either by suction tip or sickle knife. Gelfoam plug soaked with oflaxcin antibiotic ear drop was put over the reposited margin of the tympanic perforation (Fig-2). A small piece of cotton soaked with framycetin ointment was inserted into external auditory canal.

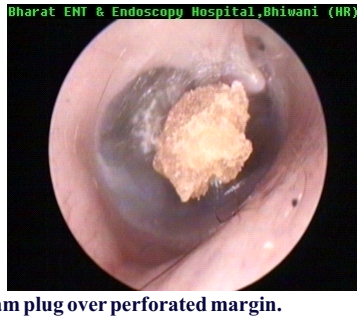

Fig-2. Gelfoam plug over perforated margin.

Post operatively moxifloxacin 400mg OD, levocetrizine 5mg OD and tablet diclofenac50mg SOS for 10 days. Patient was discharged on the same day. Cotton pack was removed after 7 days and gelfoam plug was inspected on tympanic membrane and patients were followed up weekly for four weeks. The gelfoam plug was found absorbed spontaneously in most of the cases and healed tympanic membrane was observed (Fig-3).

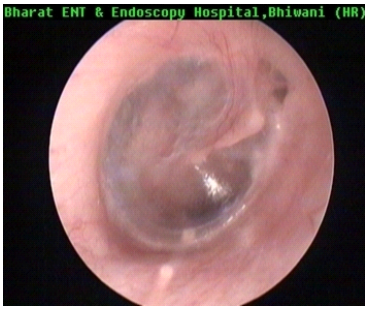

Fig-3. Right side complete healed tympanic membrane after 21 days.

Pure tone audiometry (PTA) was also done at the same time. Statistical analysis preoperative and postoperative hearing results was calculated on pure tone audiometry and analyzed statistically using students't' test.

Results

A total number of seventy eight patients with acute traumatic tympanic membrane perforation were treated. The dry central perforation varied in size from 1- 5mm. These subjects were divided into various age groups e.g. 16-25 years age group had 32(41.02%) patients, 23 (29.48%) males and 9 (11.53%) females; age group 26-35 years had 23 (29.48%) patients, 15 (19.23%) males and 8 (11.28%) females; age group 36-45 years had 17 (21.79%) patients, 10 (12.82%) males and 7 (8.97%) females. In age group of 46-55 years there were 6 patients (7.69%) 2 being (2.56%) males and 4 (5.13%) females. Most common mode of trauma was slap injury i.e. 28 subjects. Other causes of mode of trauma are depicted in table-1.

Table- 1 Etiological factors in traumatic tympanic membrane perforation.

Sr.No	Types of trauma	Frequency	Total	
		Male	Female	
1	Slap	15	13	28
2	Ear cleaning with ball pen	02	00	02
3	Self ear cleaning injury with other objects	01	03	04
4	Road side accidents	10	03	13
5	Falling	06	05	11
6	Sports injuries	15	03	18
7	Water filled balloon	02	00	02

Majority of the patients (64%) had associated hearing loss, 15 % tinnitus, 10 % dizziness, 8% bleeding ear and 3% had pain in the ear. In our study left tympanic membrane was found more commonly affected i.e. 68 % as compared to 32% on right side. There was no case of bilateral tympanic perforation. There were various grades of perforation depending on the numbers of quadrants affected (table-2). Margins of tympanic perforation were raised in 21 (26.92%), inverted 48 (61.54%) and everted 9 in (11.54%) subjects.

Table-2Grades of Traumatic Membrane Perforation

Sr. No	Grades	Quadrants involved	No of cases	Percentage
1	I Involvement of one quadrant 42 cases	Postero- inferior	23	29.48
		Antero- inferior	12	15.39
		Postero- superior	07	8.97
2	II Involvement of two quadrants 25 cases	Postero- inferior and postero-superior	18	23.07
		Posterio-inferior and anterio- inferior	07	8.97
3	III Involvement of three quadrants	Antero-inferior, postero-inferior and postero-superior	11	14.3
4	IV Involvement of four quadrants	-	00	00

The mean preoperative hearing loss was 19.5dB (range 8-40) whereas postoperative loss was 7.28 dB (range 4- 14). There was no postoperative complication like CSOM. However, two cases did not heal. After expectant wait of three months, type-1 cartilage tympanoplasty was done which was successful in both the cases which were initially of grade-3 perforation.

DISCUSSION:

Gelfoam is a sterile compressed sponge which was initially used as haemostatic for application over bleeding surfaces6. It is water-insoluble, off-white, non-elastic, porous and pliable material prepared from purified porcine skin. Niklasson & Tano employed gelfoam plug for repair of small tympanic perforation and reported that this is easy, fast, outpatient office procedure and is better alternative to the fat plug technique7. Use of gelfoam in the middle ear has been debated; Hellstrom et al even reported that gelfoam increased fibrosis and bone formation in rat models8. However, gelfoam has been used routinely as stabilizing material in tympanoplasty and reported to increase the connective tissue regeneration which has a positive effect in healing of tympanic membrane[7].

In the present study mean age of subjects was 28.06 years (ranges 16-55). Lindeman et al reported a mean age of 24.1 years, whereas Berger et al reported mean age of 21.7 years in their series which is almost comparable with the present series 11,12.Maximum patients i.e. 32 (41.07%) in the present series were in the age group of 16-25 years, out of which 23(29.48%) were males. Similarly Hempel et al reported a high prevalence in males1, whereas Olowookere et al observed a high incidence of traumatic perforation in young and active females [10].

The most common observed etiology for traumatic tympanic membrane perforation was slap injury 28(35.89%), followed by sports injury 18(23.07%) and road side accidents 13(16.66%). It may be due to the fact that slap is an easy and natural way for self-defense and punishment. At the place of study boxing is very popular sport which results in lots of tympanic membrane trauma. During last few decades increasing number of road side accidents due to high speed and overcrowding of roads has also been reported as important etiological factor. We also had 13 cases due to traffic accidents. It is natural tendency of human beings that if there is itching in the ear, one tries to scratch the ear with easily available object like ball pen, key, hairpins, match stick, spectacle and cotton buds which results in tympanic perforation [1,2,9] as was also observed in six of our cases. At the place of study Holi is famous color festival of Hindus during its ceremony a few people play with water filled balloons which was also responsible for tympanic membrane perforation in two cases. Lou et al reported that most common high pressure trauma to tympanic membrane and middle ear is due to slap which was also observed in 28 cases in the present series. Other reported causes include instrumentation, self-cleaning, road traffic injury, foreign body and sometimes explosion[13]. Majority of tympanic perforation (68%)were present on the left side whereas right side was involved in 32% cases, which is consistent with earlier study in which left ear drum was affected in 66%, right ear drum in 34% cases and no bilateral perforation3. We also didn't observe a single case of bilateral perforation.

Tympanic membrane perforation in the present study was of grade-I in 42(53.84%), grade- II in 25(32.03%), grade-III, 11(14.13%) cases and no case of grade-IV. Sarojamma et al also reported that 28(56%) cases were grade-I, 19 (38%) of grade-II, 3(6%) of grade-III and none of grade-IV3. The size of perforation in grade-I was small, grade-II medium and grade -III large mostly involving lower half of tympanic membrane. However, as the intensity of pressure due to trauma increases, it leads on to damage to any or even all the quadrants of the tympanic membrane. Postero- inferior quadrant of tympanic membrane was found more commonly affected as compared to other quadrants in the present study. It is due to the fact that posteroinferior quadrant of tympanic membrane is placed more laterally and is nearest to the trauma or pressure[11]. During the process of trauma the pressure wave travels along the posterior canal wall and strikes to the posteroinferior quadrant first causing perforation at this site as compared to other quadrants. The presentation of margin in acute traumatic tympanic membrane perforation was inverted 48(61.54%), raised 21(26.92%) and everted in 9(11.54%) in the present series. Sarojamma et al reported raised margin in 66%, inverted margin in 26% and everted margin in 8%3.

Chief complains of patients was hearing impairment, tinnitus, dizziness, ear bleeding and earache. Earlier workers have also reported hearing loss, tinnitus, dizziness, ear bleeding and earache as main complaints in their series of tympanic membrane perforation[3, 14]. We observed a mean conductive hearing loss of 19.5dB (8-40). Mehta et al observed a conductive loss of 10-20 dB in their series[15]. However, Sarojmma et al observed a higher conductive loss of 26-35 dB in their series.

The mean spontaneous healing time for acute traumatic tympanic membrane perforation reported in literatures is 34.78 days (range 21-75 days)3. The overall healing rate achieved in various studies is 75% and 94.8%3,12. We used medicated gelfoam plug after reposition of perforated margin of tympanic membrane. Majority of perforations 58(74.35%) healed within 16 days, 12(15.38%) healed within 20 days and 6(7.07) healed in 27 days. Overall success rate of tympanic membrane healing with gelfoam plug was 97.43%, however, reported success rate of spontaneous healing without gelfoam plug is much less[16]. Post- operative audiological analysis showed 7.28 (4-14) dB loss which was negligible and mean hearing gain was statistically significant ($p<0.05$). Persistent small to medium tympanic perforation after trauma are due to secondary infection of middle ear which should be controlled by antibiotics and early tympanoplasty as was the case in two of our patients who had grade 3 perforations which healed in one month.

Gelfoam plug was used over the reposited margin of acute traumatic membrane perforation which is very simple, quick, and easy to perform procedure, is economical and better alternative as compared to just wait & watch. It is more efficient than fat plug tympanoplasty[17]. Gelfoam helps in holding the perforated margins in apposition which results in early healing of perforation in double quick time just like clean sharp surgical wound, with better audiological outcome.

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