

# To Determine the Association of Otorhinolaryngological Trauma in Head Injured Patients in Relation to Cause of Injury

Dr. Divya Sundaesan<sup>1</sup>, Dr. Bhadravathi Ganesh Prakash<sup>2</sup>, Dr. Vishwanath Sahukar Eshwarappa<sup>3\*</sup>

<sup>1</sup> Senior Resident, Department of Head and Neck Surgical Oncology, Malabar Cancer Centre, Thalassery.

<sup>2</sup> Professor (Ret.), Department of ENT, JSS Medical College, Mysore.

<sup>3\*</sup> Assistant Professor, Department of Neurosurgery, Vydehi Institute of Medical Sciences and Research Centre, Bengaluru. (Corresponding Author)

Received: 20th Feb, 2026 | Revised: 4th Mar, 2026 | Accepted: 25th Mar, 2026 | Available Online: 10th Apr, 2026

## ABSTRACT

The devastating consequences of head injury have been recorded since ancient times. Early neurosurgical records were primarily observational, with very few suggestions for treatment. Despite centuries of investigation and the development of new and better intensive care, we still have not discovered effective therapies that can be applied after the injury to reverse most pathologic aspects of traumatic brain injury (TBI).

**Material and Methods:** Source of Data: This study was conducted at JSS Hospital, Mysore, in the Otorhinolaryngology, Emergency Medicine, Neurosurgery, and Oral Maxillofacial departments. The study population included patients of all age groups and sex who were diagnosed to have head injuries.

**Results:** Out of the 287 head injured patients studied, 173 patients had an associated otorhinolaryngological injury, either as otologic trauma, rhinologic trauma, trauma to the facial region, paranasal sinuses, or the throat. These amounted to 60.3% of total head injured cases. Some of the cases had a combination of injuries. The remaining 114 cases (39.7%) had no ENT trauma.

**Conclusion:** From the present study of "Association of Otorhinolaryngological Trauma in Patients with Head Injury", the following conclusions can be drawn: 60.3% of head injured patients in this study were found to have an associated trauma in the otorhinolaryngological region.

**Keywords:** Head and neck, Otorhinolaryngology, Head injury, Trauma.

**How to cite this article:** Sundaesan D, Prakash BG, Eshwarappa VS. To Determine the Association of Otorhinolaryngological Trauma in Head Injured Patients in Relation to Cause of Injury. *Int J Drug Deliv Technol.* 2026;16(4):613-620. DOI: 10.25258/ijddt.16.4.67

**Source of support:** Nil.

**Conflict of interest:** The authors declare no conflict of interest.

## INTRODUCTION

The devastating consequences of head injury have been recorded since ancient times. Early neurosurgical records were primarily observational, with very few suggestions for treatment. Despite centuries of investigation and the development of new and better intensive care, we still have not discovered effective therapies that can be applied after the injury to reverse most pathologic aspects of traumatic brain injury (TBI).

In 1996, Congress approved the Traumatic Brain Injury Act (Public Law 104-166), which charged the Centers for Disease Control and Prevention (CDC) with "determining the incidence and prevalence of traumatic brain injury in all age groups in the general population of the United States."<sup>1</sup>

Head injury demands a broad definition. Head

consists of the skull, scalp, meninges, blood vessels along with the brain and its parts.

Trauma is an external source of energy, such as mechanical force causing a physical injury to any tissue. Brain injury is considered as a subgroup of head injury and is clinically assessed based on Glasgow coma scale.

A head injury is any trauma that leads to injury of the scalp, skull, or brain. The injuries can range from a minor bump on the skull to serious brain injury.

# To Determine The Association Of Otorhinolaryngological Trauma In Head Injured Patients In Relation To Cause Of Injury

Field (1976) Trauma which caused some risk of damage to the brain. Used ICD-9 rubrics.  
 Anderson and McLaurin (1980) Trauma to the brain or spinal cord. Here, trauma refers to physical injury to living tissue caused by an external force.  
 Jennett and MacMillan (1981) Patients with a history of a blow to the head or with altered consciousness after a relevant injury or with a scalp or forehead laceration, or who had an X-ray examination.  
 Klauber et al. (1981) Patients whose head injury resulted in skull fracture, unconsciousness, amnesia, neurological deficit or seizure.  
 Selecki et al. (1981) Injuries to the brain or skull  
 Kraus et al. (1984) Physical damage to, or functional impairment of, the cranial contents from acute mechanical exchange, excluding birth trauma.  
 Jagger et al. (1984) Documented head injury with loss of consciousness, post-traumatic amnesia or skull fracture.  
 Brookes et al. (1990) Any injury to the scalp including swelling, abrasion or contusion as well as laceration; or a well authenticated history of a blow to the head; or any patient in whom a skull X-ray was performed immediately following trauma, and patients who had clinical evidence of a fracture at the base of the skull.

**Table 1- Definitions of head injury: Courtesy:**  
 Head Injury 2Ed: Pathophysiology & Management By  
 P Reilly, R Bullock

Head injury is classified as either closed or open (penetrating).

- Closed head injury means a hard blow to the head from striking an object, but the object does not break the skull.
- Open, or penetrating, head injury means a hit with an object that broke the skull and entered the brain.

Common causes of head injury include road traffic accidents, falls, physical assault, and accidents at home, work, outdoors, or at sports.

Some head injuries result in prolonged or irreversible brain damage. This can occur as a result of bleeding inside the brain or forces that damage the brain directly. The Ear, Nose, Throat and Face regions are the areas that are almost always injured in head trauma. Trauma to these regions very often leads to mortality or high morbidity rates with varying amount of physical and functional damage. The need for this study is to find out the association of otorhinolaryngological trauma in patients with head injury in order to provide an early intervention to reduce the morbidity.

## MATERIAL AND METHODS

**SOURCE OF DATA:** This study was conducted at JSS HOSPITAL, MYSORE, in the Otorhinolaryngology Emergency medicine, neurosurgery, and oral maxillofacial departments. The study population will be patients of all age groups and sex who are diagnosed to have head injuries.

**SAMPLE SIZE:** Assuming ENT trauma to be associated with 25% of head injured patients, relative precision of 20%, the sample size calculated is 287. By the formula:  $(3.84 \times 9q) / d^2$

Where:  $d$  □ relative precision  
 $p$  □ expected proportion  
 $q$  □  $1-p$

## STUDY TYPE

It is a descriptive hospital based study.

## INCLUSION CRITERIA

- 1) All patients presenting with head injuries to the otorhinolaryngology, emergency medicine, neuro surgery, oral maxillofacial surgery departments, who consent for the study.
- 2) All unconscious patients will also be included in the study if the relative consents.

## EXCLUSION CRITERIA

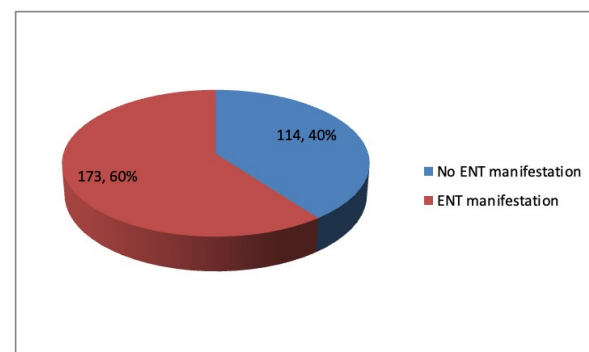
- 1) Patients who give history of previous head trauma. (In order to avoid the matter of ambiguity, about the fact whether the present otorhinolaryngological injury is a result of the present head injury or a sequelae of the older head injury).
- 2) Patients or relative (in case the patient is unconscious) who do not consent.

## RESULTS

A total of 287 head injured patients were included in this study.

**TABLE 8: Tabulation of all the head injured cases according to the presence or absence of ENT injury.**

ENT INJURY	No. OF CASES	PERCENTAGE OF TOTAL HEAD INJURED CASES
ABSENT	114	39.7
PRESENT	173	60.3



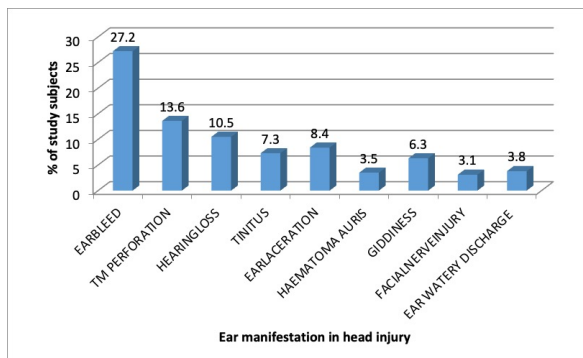
**GRAPH 1: Pie chart of percentage of head injured patients with/ without ENT injury**

Out of the 287 head injured patients studied 173 patients had an associated otorhinolaryngological injury, either as otologic trauma, rhinologic trauma, trauma to the facial region, paranasal sinuses or the throat. These amounted to 60.3% of total head injured cases. Some of the cases had a combination of injuries. The remaining 114 cases (39.7%) had no ENT trauma.

**TABLE 9: Tabulation of the head injured cases with otologic trauma by type of injury.**

**To Determine The Association Of Otorhinolaryngological Trauma In Head Injured Patients In Relation To Cause Of Injury**

EAR INJURY	No. OF CASES	PERCENTAGE OF TOTAL HEAD INJURED CASES	PERCENTAGE OF PATIENTS WITH ENT INJURY
EAR BLEED	78	27.2	45.1
TM PERFORATION	39	13.6	22.5
HEARING LOSS	30	10.5	17.3
TINNITUS	21	7.3	12.1
EAR LACERATION	24	8.4	13.9
HAEMATOMA AURIS	10	3.5	5.8
GIDDINESS	18	6.3	10.4
FACIAL NERVE INJURY	9	3.1	5.2
WATERY DISCHARGE FROM EAR	11	3.8	6.4



**GRAPH 2: Graph of head injured cases with otologic trauma by type of injury**

From the analysis of otological trauma associated with the head injury, it has been observed from this study that a total of 97 cases had different otologic trauma associated, out of which some patients had a combination of different otologic injuries.

Ear bleed was observed in 78 cases which amounted to 27.2% of total head injury cases.

Out of these cases 39 had a traumatic tympanic membrane perforation, i.e., 13.6% of total head injured cases.

Of all the head injured patients, 10.5% i.e., 30 patients complained of hearing loss.

21 patients, (7.3%) complained of tinnitus. 12 out of these cases had tympanic membrane perforations, 17 of these cases had ear bleed, remaining 4 cases had clinical evidence of hemotympanum. These cases of hemotympanum had temporal bone fractures involving mastoid and tympanic part. 15 patients with tinnitus had longitudinal fracture of petrous part of temporal bone, 6 cases had transverse fracture of petrous part of temporal bone.

18 patients (6.3%) complained of giddiness. 9 cases of giddiness had longitudinal fractures of temporal bone, with fractures of mastoid and tympanic part of temporal bone. 4 cases of giddiness were found to have a otic capsule involving transverse fractures of the temporal bone, of these 2 had associated CSF leak. 2 patients had an associated facial nerve palsy. 4 patients were diagnosed with post traumatic BPPV, as they did not have cochlear complaints, their PTA was normal, and positional test were positive. 8 cases of giddiness had associated tinnitus, with fractures not involving the otic capsule. These were diagnosed as labyrinthine concussion.

Patients with the above three complaints were further evaluated with audiometry where possible.

24 patients presented with lacerations in the pinna. This amounted to 8.4% of the total head injured patients. They were all managed surgically.

10 (3.5%) patients had Hematoma auris, which were all managed surgically.

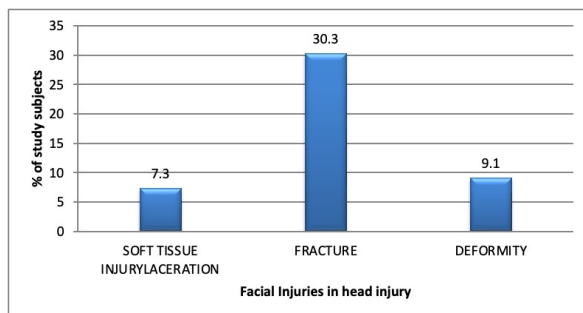
9 (3.1%) patients had facial nerve weakness that was ipsilateral, lower motor neuron type, all of them had significant improvement with medical management.

Watery discharge from the ear was noticed in 11 patients. These amounted to 3.8% of cases. All these cases were medically managed successfully by medical line of treatment with acetazolamide.

**TABLE 10: Tabulation of head injured cases with facial injuries**

**To Determine The Association Of Otorhinolaryngological Trauma In Head Injured Patients In Relation To Cause Of Injury**

FACIAL INJURIES	No. OF CASES	% OF TOTAL HEAD INURED CASES	% OF CASES WITH ENT INJURY
SOFT TISSUE INJURY/ LACERATION	21	7.3	12.1
FRACTURE	87	30.3	50.3
DEFORMITY	26	9.1	15.0



**GRAPH 3: Head injured cases with facial injuries**

A total of 86 patients out of the 287 head injured patients had sustained facial injury.

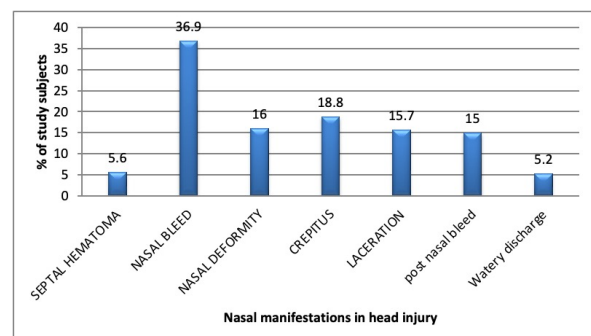
21 cases had facial soft tissue injury in the form of hematoma or lacerations. This amounts to 7.3% of cases.

Clinically evident facial fractures were observed in 87 patients, i.e., 30.3% of total head injured cases.

Facial deformity was seen in 26 patients, i.e., 9.1% of total head injured patients.

**TABLE 11: Tabulation of head injured cases with nasal injury**

NASAL INJURY	No OF CAS ES	PERCENTA GE OF TOTAL HEAD INURED CASES	PERCENTA GE OF CASES WITH ENT INJURY
SEPTAL HEMATOM A	16	5.6	9.2
NASAL BLEED	106	36.9	61.3
NASAL DEFORMIT Y	46	16.0	26.6
CREPITUS	54	18.8	31.2
LACERATI ON	45	15.7	26.0
POST NASAL BLEED	43	15.0	24.9
WATERY DISCHARG E FROM NOSE	15	5.2	8.7



**GRAPH 4: Head injured cases with nasal injury**

Out of the 287 head injured patients examined 113 patients had trauma to the nose.

Looking at this in more detail:

- Septal hematoma was observed to be present in 16 patients, (5.6%). All of these patients underwent immediate aspiration or incision and drainage with or without drain placement.
- Anterior nasal bleed was observed in 106 patients, this amounts to 36.9% of total head injured patients examined. All these patients were evaluated thoroughly for the cause of bleed and managed either medically or surgically according to the severity of the bleed.
- Post nasal bleed was observed in 43 patients i.e., 15% of all head injured cases. After evaluating

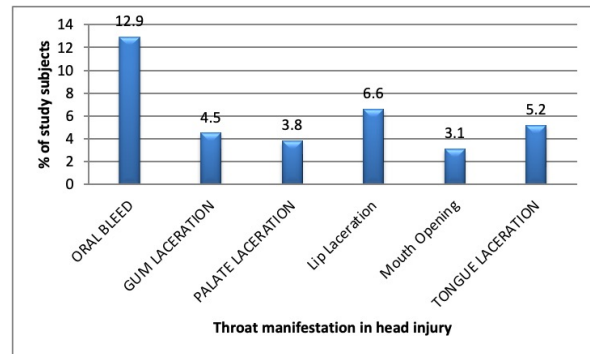
## To Determine The Association Of Otorhinolaryngological Trauma In Head Injured Patients In Relation To Cause Of Injury

them for the cause of bleed and underlying fractures, and severity of bleed, they were managed either medically or by postnasal packing where required.

- Nasal deformity was noticed in 46 patients, 16% of total head injured patients.
- Clinical evidence of nasal bone fracture in the form of nasal crepitus was observed in 54 patients, amounting to 18.8% of total head injured patients. Such patients who complained of nasal deformity and had clinical and radiological evidence of displaced nasal and septal fractures were taken up for fracture reduction within the onset of oedema or after the oedema subsided.
- Nasal lacerations were noted in 45 patients of head injury that amounted to 15.7%. All these patients underwent careful clinical and radiological evaluation for underlying fractures and underwent suturing or debridement and suturing.
- Watery nasal discharge was noted in 5.2% of patients with head injury, i.e., 15 patients. The fluid was sent for CSF biochemical analysis. The patients were evaluated with CT PNS to find out the site and size of leak. A trial of medical management was given to all the patients and they all recovered with it.

**TABLE 12: Tabulation of head injured cases with oral cavity and throat injury:**

THROAT INJURY	No OF CAS ES	PERCENTA GE OF TOTAL HEAD INURED CASES	PERCENTA GE OF CASES WITH ENT INJURY
ORAL BLEED	37	12.9	21.4
GUM LACERATI ON	13	4.5	7.5
PALATE LACERATI ON	11	3.8	6.4
LIP LACERATI ON	19	6.6	11.0
MOUTH OPENING	9	3.1	5.2
TONGUE LACERATI ON	15	5.2	8.7



**GRAPH 5: Head injured cases with oral cavity and throat injury**

Out of the 287 cases of head injured patients examined 52 patients had associated injury in the oral cavity and throat region.

Oral bleed was observed in 37 cases i.e., 12.9% of head injured cases. These cases were evaluated for the site of bleed. And the injury was repaired. In case post nasal bleed was the source then it was managed appropriately.

Gum lacerations were seen in 13 cases (4.5%). They were repaired.

Palatal lacerations were present in 11 cases, i.e. (3.8%). When present they were evaluated for the presence of underlying fracture of the hard palate.

Lip lacerations were observed in 19 patients that consisted of 6.6% of head injured cases.

Restricted mouth opening was noted in 9 cases, (3.1% of total cases). These were further evaluated for the cause of restricted mouth opening, temporomandibular joint injuries, mandibular fractures, malocclusion, and associated facial fractures.

Tongue lacerations were observed in 5.2 % of all head injured cases i.e., 15 cases. All of them were sutured.

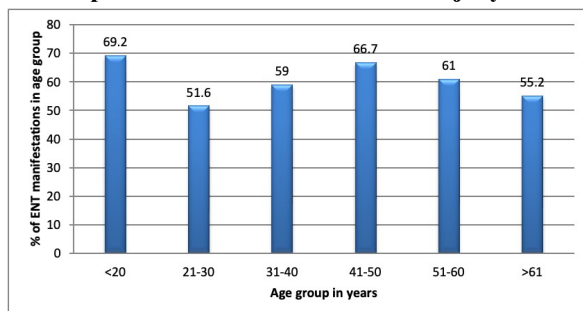
**TABLE 13: Age-wise distribution of head injured patients with or without ENT injury.**

**To Determine The Association Of Otorhinolaryngological Trauma In Head Injured Patients In Relation To Cause Of Injury**

AGE	ENT MANIFESTATIONS			
	No ENT INJURY		ENT INJURY PRESENT	
	n	%	n	%
<20	16	30.8	36	69.2
21-30	30	48.4	32	51.6
31-40	25	41.0	36	59.0
41-50	14	33.3	28	66.7
51-60	16	39.0	25	61.0
>61	13	44.8	16	55.2

P=0.5, chi-square test

**GRAPH 6: Age-wise distribution of head injured patients with or without ENT injury**



On analyzing with the chi-square test for the level of significance of association of ENT injury with head injury with respect to age of the patients: The null hypothesis that there is no association between the age of patients and the presence or absence of ENT injury is accepted, as the P value is more than 0.05.

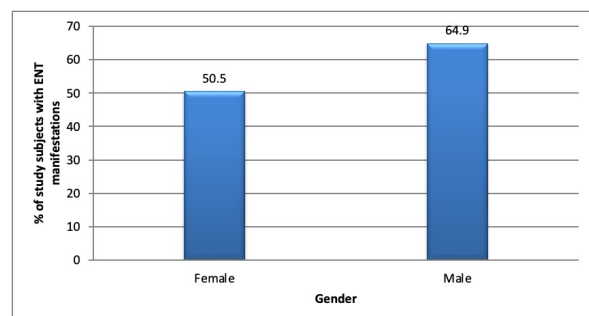
Hence concluding that there is no association between age of patient and presence or absence of ENT injury according to our study.

However, based on the percentages calculated, it is observed that a maximum of 69.2% of patients injured in the age group less than 20 years had associated ENT injury.

**TABLE 14: Gender wise distribution of head injured patients with or without ENT injury.**

GENDER	ENT INJURY			
	ABSENT		PRESENT	
	No of cases	Percentage	No. of cases	Percentage
Female	46	49.5	47	50.5
Male	68	35.1	126	64.9

P=0.02, chi-square test



**GRAPH 7: Gender wise distribution of head injured patients with or without ENT injury**

On analyzing the association of gender with the presence or absence of ENT injury in head injured patients, with chi-square testing of the null hypothesis that: There is no association of gender with the presence or absence of ENT injury in head injured patients, we found that the P value of 0.02 is lesser than 0.05.

Hence the null hypothesis is rejected, leading to the conclusion that there is significant association between the gender of the head injured patient and the presence or absence of ENT injury.

Further, from this tabulation we can see that males are more predisposed (64.9% of males sustaining head injury have an associated ENT trauma) to sustain an associated ENT injury along with their head injury.

**DISCUSSION**

The present study entitled as **“ASSOCIATION OF OTORHINOLARYNGOLOGICAL TRAUMA IN PATIENTS WITH HEAD INJURY”** aims at finding out the association of Otorhinolaryngological trauma in patients with head injury admitted at JSS Hospital, Mysore.

With this objective, 287 head injured patients were examined within 48 hours of admission, to identify the presence of associated ENT trauma. It was found that 60.3% of total head injured cases had an associated ENT trauma. This finding is slightly higher than that found in the study done in Nigeria in 2010 by

## To Determine The Association Of Otorhinolaryngological Trauma In Head Injured Patients In Relation To Cause Of Injury

Mandubueze and others where by the prevalence of ORL trauma was 41.1%.<sup>2</sup> The increase of this prevalence can be related to an increase in economic and social human activities which predispose them to different kinds of accidents, example road traffic accidents and falls.

This study also aimed to determine the association of otorhinolaryngological trauma in head injured patients by age and sex.

In this study of 287 head injured patients it is observed that there is no association between age of patient and presence or absence ENT injury. However, it is observed that a maximum of 69.2% of patients injured in the age group less than 20 years had associated ENT injury. Closely followed by patients between 40 to 50 years, in which 66.7% of head injured patients had an associated ENT trauma. This is accordance with the findings in study by Hashim et al in Malaysia which majority of the injured were around 20 years of age.<sup>3</sup> A study by Basheeth N et al quoted the mean age of injured at around 26 years.<sup>4</sup>

On analyzing the association of ENT trauma in head injured patients with the gender, it was observed that there is significant association between the gender of the head injured patient and the presence or absence of ENT injury.

Males were found to be more predisposed to sustain ENT trauma along with the head injury as 64.9% of head injured males had an associated ENT trauma in contrast to 50.5% of head injured females who had associated ENT trauma. This finding is in accordance with study of Biering-Sørensen M et al which quotes males constituting 55.5% and females constituting 45.5% of ENT trauma cases.<sup>5</sup> Carvalho TB et al quoted male to female ratio of 4:1 in faciomaxillary trauma.<sup>6</sup> Bener A et al, study of epidemiology of head and neck trauma quoted males were involved in 85.9% cases.<sup>7</sup>

The higher association of males with ENT trauma can be attributed to the higher level of outdoor activity and hence higher predisposition for high velocity trauma, by RTA.

In this study, it is observed that association of otorhinolaryngological trauma in head injured patients had no relation to cause of injury. However it is observed that 66.7% of patients that sustained head injury due to assault had an associated ENT injury. 63.1% of patients who sustained head injury by RTA – that did not involve collision with other motor vehicles, sustained an associated ENT injury. Whereas only 57.6% of patients those sustained head injury by RTA-

that involved collision with other motor vehicles, had an associated ENT trauma.

This is in accordance with the findings of the study by Carvalho TB et al, that state that the most prevalent cause for facial trauma was interpersonal violence followed by RTA.<sup>6</sup> A study by Gassner et al, on major mechanisms of craniofacial trauma revealed that, in 38% cases it was activity of daily life, 31% sports, 12% violence, in 12% traffic accidents, in 5% work accidents and in 2% other causes.<sup>8</sup>

The slightly higher occurrence of ENT injury among patients who sustained head injury due to assault could be attributed to the fact that the force applied in assault is almost always localized over a narrow targeted area.

On further analysis of the otological trauma in this study it is found that 27.2% of head injured cases had ear bleed, 8.4% of cases had pinna lacerations. As per a study by ChavaanRP et al of the ENT manifestation in head injured patients, ear bleeding due to injuries to external auditory canal and pinna was 72.9%.<sup>9</sup>

The patients with ear pinna lacerations underwent suturing under strict aseptic precautions.

Patients with hematoma auris underwent incision and drainage and placement of corrugated drain in few patients, followed by placement of pressure bandage. Tympanic membrane perforations were seen in 13.6% of patients, these values are almost close to those in the study by Chavaan RP et al (13.51%).<sup>9</sup> These patients were instructed to keep their ear dry and follow up to check for spontaneous closure of the perforations.

10.5% of patients in the present study had hearing loss, this is lesser than that recorded in the study by Chavaan RP et al, which is 69.28%.<sup>9</sup> Another study by Griffith found hearing loss in 56% of head injured patients.<sup>10</sup>

Tinnitus was complained by 7.3% of cases in this study, constituting 21 patients. 12 out of these cases had tympanic membrane perforations, 17 of these cases had ear bleed, and remaining 4 cases had clinical evidence of hemotympanum. These cases of hemotympanum had temporal bone fractures involving mastoid and tympanic part. 15 patients with tinnitus had longitudinal fracture involving the petrous part of temporal bone, 6 cases had transverse fracture of petrous part of temporal bone.

In the study by ChavaanRP tinnitus was present in 3% of patients.<sup>9</sup> This is contrary to Griffiths who found no tinnitus during his study of incidence of auditory and vestibular concussion in 84 patients.<sup>10</sup>

## To Determine The Association Of Otorhinolaryngological Trauma In Head Injured Patients In Relation To Cause Of Injury

18 patients(6.3%) complained of giddiness. 9 cases of giddiness had longitudinal fractures involving petrous part of temporal bone, with fractures of mastoid and tympanic part of temporal bone. 4 cases of giddiness were found to have a otic capsule involving transverse fractures of the petrous part of temporal bone, of these 2 had associated CSF leak. 2 patients had an associated facial nerve palsy. 4 patients were diagnosed with posttraumatic BPPV, as they did not have cochlear complaints, their PTA was normal, and positional test were positive. 8 cases of giddiness had associated tinnitus, with fractures not involving the otic capsule. These were diagnosed as labyrinthine concussion.

In study by ChavaanRP et al vertigo was seen in 9% patients, which is almost close to the value of 6.3% seen in this study.<sup>9</sup>

Facial nerve injury were seen in 3.1% of cases comprising of 9 cases out of total head injured patients. 4 of these were immediate and 5 were observed one to 2 days after the head injury. This was same as that observed by Chavaan et al, who observed facial palsy in 3% of head injured patients in their series.

CSF otorrhea was observed in 3.8% of cases. This is similar to other studies like Proctor et al which found CSF otorrhea in 3.50% of cases,<sup>11</sup> and S.C. Pandhi et al who found CSF otorrhea in 1.79% of cases.<sup>12</sup>

### **CONCLUSION**

This study demonstrates that injuries involving the ear, nose, and throat are frequently encountered in patients with head trauma, with more than half of the study population showing such associations. While statistical significance was not established for age or mechanism of injury, a greater tendency toward ENT involvement was observed in younger individuals and in cases of assault. A higher proportion of male patients were affected compared to females. Among the different subsites, otological injuries were most commonly encountered, with ear bleeding being the predominant presenting feature, and longitudinal, otic capsule-sparing temporal bone fractures occurring more often than other fracture types. Nasal trauma frequently manifested as epistaxis and external deformity, with nasal bone fractures being the most common, often in conjunction with anterior skull base injuries and cerebrospinal fluid leaks. Injuries to the oral cavity and oropharynx were mainly characterized by bleeding and

soft tissue lacerations, whereas facial trauma was notable for a substantial incidence of underlying fractures, particularly involving the midface.

Overall, the findings emphasize the need for careful and routine otorhinolaryngological assessment in patients with head injury. Early recognition and timely management of these injuries can play a crucial role in reducing associated complications and improving patient outcomes, highlighting the value of an integrated, multidisciplinary approach in trauma care.

### **References**

- 1.Faul M, Xu L, Wald MM, and Coronado VG: Traumatic Brain Injury in the United States: Emergency Department Visits, Hospitalizations and Deaths, 2002-2006. Atlanta: Centers for Disease Control and Prevention, National Center for Injury Prevention and Control, 2010
- 2.Madubueze CC, Chukwu CO, Omoke NI, Oyakhilome OP. Head and neck injuries as seen in a Nigerian teaching hospital. *Ozo CInt Orthop*. 2010.
- 3.Hashim H, Iqbal S. Motorcycle accident is the main cause of maxillofacial injuries in the Penang Mainland, Malaysia. 2011;27:19-22
- 4.Basheeth N, Donnelly M, David S, Munish S. *Laryngoscope*. 2015 Dec;125(12):2677-84. doi: 1002/lary.25358. Epub 2015 May 9.
- 5.Biering-Sørensen M. *Ugeskr Laeger*. 1990 Mar 12;152(11):739-43.
6. Carvalho TB, Cancian LR,et al. *Braz J Otorhinolaryngol*. 2010 Sep-Oct;76(5):565-74.
7. Bener A et al. *Int Emerg Nurs*. 2009 Jan;17(1):52-9. doi: 10.1016/j.ienj.2008.07.007. Epub 2008 Sep 12.
- 8.Gassner R, Tuli T et al. *J Craniomaxillofac Surg*. 2003 Feb;31(1):51-61.
9. Chavaan RP et al. ENT manifestations in head injury patients. *Odisha journal of otorhinolaryngology and HNS*, Vol-7, Issue -1, Jan-June-2013.
10. Griffiths MV. The incidence of auditory and vestibular concussion following minor head injury. *J Laryngol Otol*1979;93:253-65.
11. Proctor B, Gurdjian ES, Webster JE. The ear in head trauma. *Laryngoscope* 1956; 66:16-59
12. Pandhi SC, Mehra YN. Post-mortem temporal bone changes in head injury. *Indian Journal of otolaryngology* 1981; 33:135-7.