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# EVALUATION OF HEARING CHANGES IN PATIENTS WITH TEMPORAL BONE AND ASSOCIATED ORTHOPAEDIC TRAUMA FOLLOWING ROAD TRAFFIC ACCIDENTS

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## ABSTRACT

**Background:** Road traffic accidents are a major cause of craniofacial trauma worldwide and commonly result in temporal bone injuries. Damage to the temporal bone can affect the auditory apparatus, leading to varying degrees of hearing impairment. In patients with associated orthopaedic trauma, early otological assessment is often delayed because priority is given to life-saving management. Identification of hearing deficits in such patients is important for rehabilitation and long-term quality of life.

**Aim:** To evaluate hearing changes in patients with temporal bone injury associated with orthopaedic trauma following road traffic accidents.

**Materials and Methods:** This prospective observational study was conducted in a tertiary care teaching hospital over a period of 18 months. A total of 96 patients with temporal bone trauma and associated orthopaedic injuries following road traffic accidents were included. Detailed clinical examination, radiological evaluation, otoscopic findings, and pure tone audiometry were performed in all eligible patients. Hearing loss was categorized into conductive, sensorineural, and mixed types. Statistical analysis was performed using SPSS version 25.0.

**Results:** Among the 96 patients studied, the majority were males (70.8%) and belonged to the 21–40 years age group (55.2%). Longitudinal temporal bone fractures were the most common fracture type (57.3%). The majority of patients demonstrated conductive hearing impairment, while sensorineural and mixed deficits were seen less frequently. A significant association was found between fracture type and pattern of hearing impairment (p=0.002).

**Conclusion:** Hearing impairment is a frequent consequence of temporal bone trauma associated with orthopaedic injuries after road traffic accidents. Conductive hearing loss was the predominant finding, especially in longitudinal fractures, whereas transverse fractures were associated with more severe sensorineural deficits. Early diagnosis and multidisciplinary management may help improve hearing outcomes and overall rehabilitation.

**Keywords:** Temporal bone fracture, hearing loss, road traffic accidents, orthopaedic trauma, pure tone audiometry, conductive hearing loss

## INTRODUCTION

Road traffic accidents continue to be a major global health concern and contribute significantly to trauma-related morbidity and mortality, particularly in developing countries.[1] High-velocity injuries frequently involve the craniofacial region and may result in fractures of the temporal bone. Temporal bone injuries are clinically important because the bone contains delicate auditory and vestibular structures that are highly vulnerable to trauma.[2] Hearing loss is one of the most common complications following temporal bone fractures. The mechanism of hearing impairment varies depending on the severity and direction of injury. Conductive hearing loss may occur due to tympanic membrane perforation, ossicular chain disruption, or hemotympanum, whereas sensorineural hearing loss usually results from cochlear injury, labyrinthine concussion, or vestibulocochlear nerve damage.[3] Temporal bone fractures are commonly classified as longitudinal, transverse, or mixed fractures based on the orientation of the fracture line. Longitudinal fractures account for the majority of cases and are usually associated with conductive hearing deficits. In contrast, transverse fractures are less common but often produce sensorineural hearing loss and vestibular symptoms because of otic capsule involvement.[4] Patients sustaining temporal bone trauma frequently present with associated orthopaedic injuries due to the high-energy impact involved in road traffic accidents. Fractures of long bones, pelvis, and spine are often encountered simultaneously, making early otological evaluation difficult during the acute trauma period.[5] Failure to identify hearing impairment during the early trauma period can negatively influence recovery, communication, and quality of life. Modern trauma care emphasizes early multidisciplinary assessment for improving patient outcomes. Pure tone audiometry and high-resolution computed tomography play a crucial role in identifying the type and extent of hearing loss in temporal bone injuries.[6] Despite increasing

incidence of trauma cases, limited Indian studies have comprehensively evaluated hearing changes in patients with temporal bone fractures associated with orthopaedic trauma.

The present study was therefore undertaken to assess the pattern of hearing changes in patients with temporal bone trauma and associated orthopaedic injuries following road traffic accidents.

## MATERIALS AND METHODS

This prospective observational study was conducted in the Department of Otorhinolaryngology in association with the Department of Orthopaedics and Trauma Centre of a tertiary care teaching hospital over a period of 18 months. The study included a total of 96 patients who sustained temporal bone trauma along with associated orthopaedic injuries following road traffic accidents. All enrolled patients underwent systematic clinical assessment along with ENT and radiological evaluation.

### Inclusion Criteria

- Patients aged 18 years and above.
- Patients with temporal bone trauma following road traffic accidents.
- Presence of associated orthopaedic injuries confirmed clinically or radiologically.
- Patients medically stable for audiological evaluation.
- Patients willing to provide informed consent.

### Exclusion Criteria

- History of chronic hearing impairment.
- Chronic suppurative otitis media.
- Congenital ear abnormalities.
- Penetrating cranial injuries.
- Patients unable to undergo audiological assessment.
- Patients unwilling to participate.

### Methodology

After obtaining institutional ethical clearance and informed consent, all patients fulfilling the inclusion criteria were enrolled. Demographic details, mechanism of injury, associated orthopaedic trauma, and neurological findings were documented.

Detailed ENT examination including otoscopic evaluation was performed. High-resolution computed tomography of the temporal bone was obtained to identify fracture type and extent of injury.

Pure tone audiometry was carried out once patients became clinically stable. Hearing loss was categorized according to WHO classification into:

- Conductive hearing loss (CHL)
- Sensorineural hearing loss (SNHL)
- Mixed hearing loss (MHL)

**Statistical Analysis**

Data were entered into Microsoft Excel and analyzed using SPSS version 25.0. Quantitative variables were expressed as mean ± standard deviation, while qualitative variables were represented using frequencies and percentages. Chi-square test was used to assess association between categorical variables. A p-value less than 0.05 was considered statistically significant.

**RESULTS**

A total of 96 patients with temporal bone trauma associated with orthopaedic injuries following road traffic accidents were evaluated during the study period. Detailed demographic analysis, fracture characteristics, and audiological assessment were performed in all patients. The observed clinical findings and distribution of hearing loss patterns are summarized in the following tables and figures.

**Table 1: Demographic Characteristics of Study Participants (n=96)**

| Variable | | Number | Percentage (%) |
|---|---|---|---|
| Age in Years | 18–20 | 15 | 15.6% |
| | 21–40 | 53 | 55.2% |
| | 41–60 | 21 | 21.9% |
| | >60 | 7 | 7.3% |
| Gender | Male | 68 | 70.8% |
| | Female | 28 | 29.2% |

The majority of patients belonged to the young adult age group of 21–40 years, reflecting greater exposure of this population to road traffic accidents. Higher incidence among males may be related to greater occupational travel and road exposure. (Table 1)

**Table 2: Distribution of Temporal Bone Fracture Types**

| Fracture Type | Number | Percentage (%) |
|---|---|---|
| Longitudinal | 55 | 57.3% |

| | | |
|---|---|---|
| Transverse | 24 | 25% |
| Mixed/Complex | 17 | 17.7% |

Longitudinal fractures represented the most commonly encountered fracture pattern in the present study, while mixed fractures were comparatively less frequent. (Table 2)

**Table 3: Pattern of Hearing Loss among Study Participants**

| Type of Hearing Loss | Number | Percentage (%) |
|---|---|---|
| Conductive Hearing Loss | 40 | 41.7% |
| Sensorineural Hearing Loss | 31 | 32.3% |
| Mixed Hearing Loss | 15 | 15.6% |
| Normal Hearing | 10 | 10.4% |

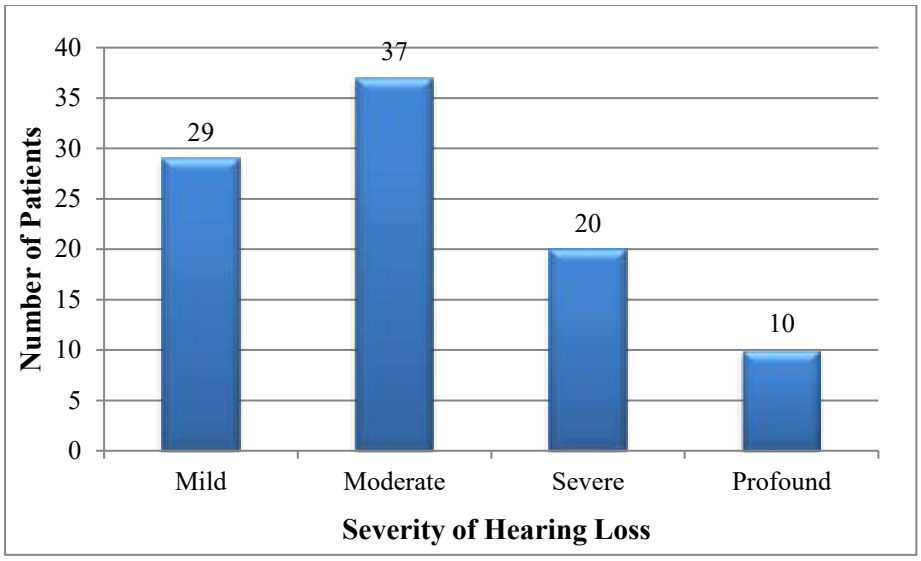
Conductive hearing loss was the most frequent hearing abnormality observed following temporal bone trauma. Sensorineural deficits were also observed in a considerable number of patients. (Table 3)

**Table 4: Association between Temporal Bone Fracture Type and Hearing Loss**

| Fracture Type | CHL | SNHL | MHL | Normal | p-value |
|---|---|---|---|---|---|
| Longitudinal | 31 | 11 | 8 | 5 | 0.002 |
| Transverse | 5 | 14 | 3 | 2 | |
| Mixed | 4 | 6 | 4 | 3 | |

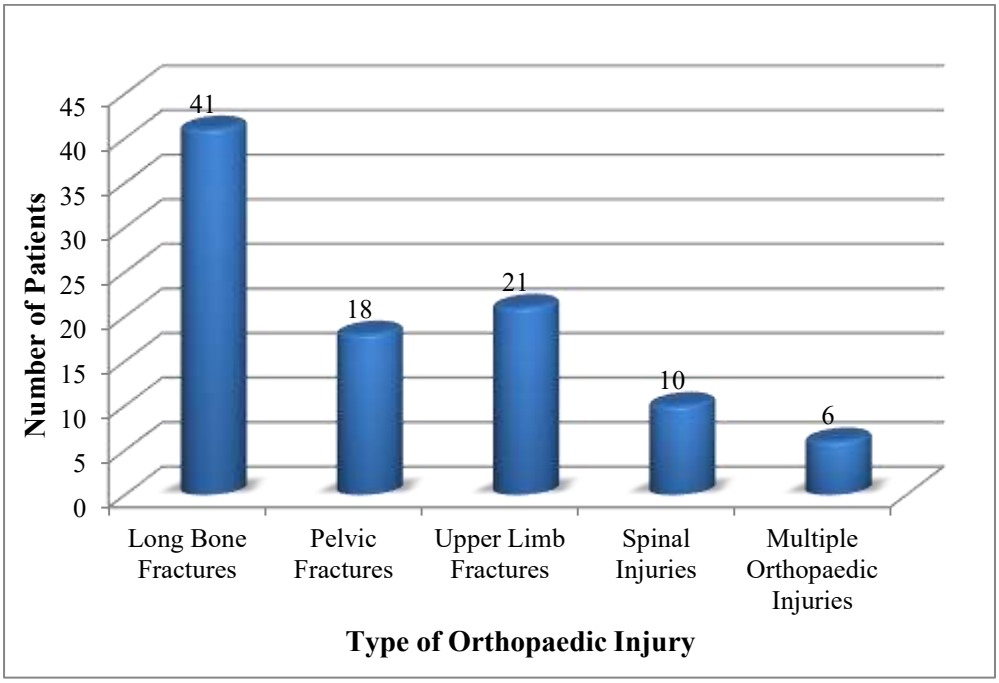
Longitudinal fractures were predominantly associated with conductive hearing loss, whereas transverse fractures showed a greater tendency toward sensorineural hearing impairment. The association between fracture type and hearing pattern was statistically significant. (Table 4)

**Figure 1: Severity of Hearing Loss among Patients with Temporal Bone Trauma**




Moderate hearing loss was the most commonly observed severity category among patients included in the study. Severe and profound hearing deficits were more commonly seen in patients with transverse temporal bone fractures. (Figure 1)

**Figure 2: Distribution of Associated Orthopaedic Injuries**




Long bone fractures were the most common associated orthopaedic injury among patients sustaining temporal bone trauma following road traffic accidents.

**DISCUSSION**

High-velocity road traffic accidents commonly produce craniofacial trauma involving the temporal bone. In the present study, young adult males constituted the majority of affected individuals. Similar findings have been reported in previous trauma studies, where males in the economically productive age group were more commonly involved in vehicular accidents.[7]

The present study demonstrated that conductive hearing loss was the most common auditory abnormality following temporal bone trauma. The predominance of conductive deficits could be explained by middle ear involvement such as hemotympanum and ossicular disruption.[8] Conductive deficits are often reversible with conservative treatment or surgical intervention depending on the severity of middle ear damage.

Sensorineural hearing loss was more frequently associated with transverse fractures in our study. This observation is consistent with reports suggesting that transverse fractures commonly involve the otic capsule and cochlear structures, thereby producing permanent auditory deficits.[9] Cochlear concussion and vestibulocochlear nerve injury may contribute significantly to this pattern of hearing impairment.

A statistically significant relationship was observed between fracture orientation and type of hearing loss. Longitudinal fractures were predominantly associated with conductive hearing deficits, whereas transverse fractures were linked to sensorineural loss. Similar associations have been described in earlier otological trauma studies.[10]

Associated orthopaedic trauma was present in all patients included in the study. Polytrauma patients often require emergency stabilization before detailed otological examination can be performed. Consequently, subtle hearing deficits may remain unnoticed during the acute phase of management.[11] Early identification of hearing impairment is important because untreated deficits can adversely affect rehabilitation and social functioning.

The present study highlights the importance of routine audiological assessment in all patients with temporal bone injuries following road traffic accidents. Pure tone audiometry and HRCT temporal bone imaging remain valuable diagnostic tools for identifying the severity and mechanism of hearing loss.[12]

One limitation of the present study was the relatively short follow-up duration, which limited long-term evaluation of hearing recovery. Further multicentric studies with larger sample sizes are recommended.

**CONCLUSION**

Temporal bone trauma associated with orthopaedic injuries following road traffic accidents is commonly associated with hearing impairment. Conductive hearing loss was the predominant finding, particularly in patients with longitudinal fractures, whereas transverse fractures were more frequently associated with sensorineural deficits.

Early audiological assessment and multidisciplinary management are important for timely diagnosis and improved rehabilitation. Routine hearing evaluation should be considered in all patients with temporal bone trauma associated with polytrauma to facilitate better functional recovery and quality of life.

## REFERENCES

1. World Health Organization. Global status report on road safety 2018. Geneva: World Health Organization; 2018.
2. Shih RY, Burns J, Ajam AA, Broderick DF, Chakraborty S, Corey AS, et al. ACR Appropriateness Criteria® Head Trauma: 2021 update. J Am Coll Radiol. 2021;18(5 Suppl):S13-S36.
3. Brodie HA, Thompson TC. Management of complications from temporal bone fractures. Otolaryngol Clin North Am. 2016;49(2):447-455.
4. Ishman SL, Friedland DR. Temporal bone fractures: traditional classification and clinical relevance. Laryngoscope. 2018;128(10):2383-2392.
5. Sharma B, Gupta AK, Deb P, Sood N, Kaur P. Pattern of craniofacial trauma in road traffic accidents and associated injuries. Indian J Otolaryngol Head Neck Surg. 2019;71(Suppl 2):1201-1208.
6. Wick CC, Nalavenkata S, Dziegielewski PT, et al. Contemporary management of temporal bone trauma. Otol Neurotol. 2020;41(9):e1132-e1140.
7. Hoffer ME, Balough BJ, Gottshall KR. Posttraumatic balance disorders. Int Tinnitus J. 2017;21(1):20-26.
8. Deshmukh KA, Patil CY, Kulkarni AA, et al. Evaluation and outcomes of hearing loss in temporal bone fractures: a prospective study. Cureus. 2023;15(6):e39872.
9. Diaz RC, Cervenka B, Brodie HA. Treatment strategies for hearing loss after temporal bone trauma. Curr Opin Otolaryngol Head Neck Surg. 2019;27(5):330-336.

10. Ishman SL, Friedland DR. Temporal bone fractures in adults: evaluation and management. Otolaryngol Clin North Am. 2018;51(6):1059-1070.
11. Lou ZC, Tang YM, Yang J, et al. Clinical characteristics and treatment outcomes in traumatic temporal bone fractures. Acta Otolaryngol. 2021;141(3):247-253.
12. Dahiya R, Keller JD, Litofsky NS, Bankey PE, Bonassar LJ, Megerian CA. Temporal bone fractures: otic capsule sparing versus otic capsule violating injuries. J Trauma Acute Care Surg. 2019;87(2):376-382.