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# TO STUDY THE FRACTURE OF THE TEMPORAL BONE IN PATIENTS WITH TRAUMATIC HEAD INJURY: - A RETROSPECTIVE STUDY.

Neurosurgery

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## ABSTRACT

***Background:-*** fracture of the temporal bone are the lesion frequently observed in the patients with traumatic head injury associated with brain injury .The CT of high resolution allows evaluation of the fracture and complications.
***Objective:-*** evaluate patients with TBI and temporal bone fracture.
***Study design: -*** retrospective study
***Method :-*** we had evaluated 56 patients having TBI with clinical evidence and /or radiological from temporal bone fracture.
***Results :-*** Total number of cases of head injury in Amala hospital in year 2015 and 2016 was 1560 cases. The age range from 2 to 84 years. Out of those cases, 83(5.3%) had temporal bone fracture. Out of 83 cases, 64 (78.5%) were male victims and 54 (66.3%) occurred on the right side. Motor vehicle accident is the most common cause of injury 1269(81%)of patients. Petrous temporal bone fracture found in 56 (67 %) patients, Longitudinal bone fracture is the most common presentation of 39(69.7%).The clinical signs were : otorrhagia,otalgia, ottorrhea ,facial palsy ,hearing loss were commonly found.
***Conclusion:-*** Patients with TBI must be submitted to the otorhinolaryngologicalevaluation and imaging for the early diagnosis of the complications and treatment.

## KEYWORDS:

Temporal bone fracture, Head injury, Petrous

***Introduction:***
The incidence of temporal bone fracture has been reported to be as high as 30 to 70% of all cases of skull fractures in patients with head trauma.[1] the temporal bone trauma is frequently associated to severe traumatic brain injury .(1) The actual incidence of the temporal bone fracture is almost certainly higher because it has been clearly shown that many temporal bone fractures are missed on the conventional x-rays and can only be demonstrated by tomography. The clinical signs of the trauma in the temporal bone include fracture along the roof of external auditory canal, rupture of tympanic membrane with otorrhea, andottorrhagia,hemotympanum,cerebrospinal fluid leak hearing loss ,Battle's sign.

Temporal bone fracture may result in potentially serious injuries as the facial nerve, middle ear, inner ear and intracranial contents are at risk. Immediate and long term sequelae can be devastating. However, temporal bone fracture also may be undetected as patient may sometimes be asymptomatic or do not report their symptoms to the attending doctor. Trauma to the temporal bone is often overlooked in the initial evaluation and management of the patient with severe head injury.

We performed a retrospective two year review of all cases of head injury treated in our centre's Emergency Department in 2015 and 2016. We aimed to find the incidence and types of temporal bone fracture associated with the head injury, and to analyse these fractures by its gender distribution, cause of injury, otorhinolaryngological presentation, radiological findings and its outcome.

***Study design: -*** retrospective analytical study

***Method:-***The medical records of all patients with head injury admitted to the department of neurosurgery in Amala Hospital in 2015 and2016 were studied. All identified charts were reviewed for radiological confirmation of temporal bone fracture via formal radiology report. Only those charts with confirmation by official report were included in the study. Charts were then reviewed for other pertinent data related to the injury. The data was analyzed and compared with previous temporal bone fracture studies.

The inclusion criteria:- inpatients by traumatic head injury which presented clinical evidence and /or radiological CT showing temporal bone fracture submitted to the otorhinolaryngological evaluation .

Exclusion criteria:-patients of traumatic severe head injury were not submitted to the CT BRAIN having the clinical sign of temporal bone fracture .

***Results :-***
Total number of cases of head injury in Amala hospital in year 2015 and 2016 was 156ocases in the age between 3 to 84 years, and motor vehicle accident is the most common cause of the temporal bone fracture 1269(81.4%) and other causes of temporal bone fracture are fall ,indrusrial accident sports related injury and assaults are illustrated in Table I. Out of those cases, 83 (5.3%) had temporal bone fracture. Out of 83 cases, 64 (78.5%) were male victims and 54 (66.3%) occurred on the right side.Out OF THIS 83 patients 56 (70%)of patients having petrous temporal bone fracture and longitudinal fracture is the most common type of fracture presentation 39(69.4%) and other type of bone fracture illustrated in table 2.

The clinical feature of the temporal bone fracture which are illustrated in table 3 showing that patient having bleeding from the ear is the most common presentation along with the CSF in ottorhea,hearing loss ,cranial nerve palsy including facial nerve palsy and hemotympanum .Table 4 the clinical feature in the petrous temporal bone fracture showing that the longitudinal type of bone fracture having more percentage of the symptoms as compared to other type of fracture. Table 5 the radiological finding in the temporal bone fracture.

***DISCUSSION:-***
Out of 1560 cases of head injury, 83(5.30%) were radiologically diagnosed to have temporal bone fracture. It is a well known fact that a tremendous force is required to fracture a temporal bone, thus the higher incidence of temporal bone fracture here could be attributed to the severity of the force of collision in our MVA cases[3]. We found that majority of their patients were male patients and the distribution of fractures was slightly more on the right side. [4]

In this study, out of all 83 cases reported, 56(69.4%) was a petrous fracture. Petrous fracture is defined as fracture extending to the petrous apex or the otic capsule, or both. Here in this study we did not use a traditional classification of longitudinal, transverse, oblique and mixed fracture because we want to correlate clinical presentation with petrous apex involvement. However, we still divided petrous temporal bone fractures in our study into four subcategories; 39 longitudinal (69.4% of the case), 4 transverse (7%), 7 oblique (11.6%),

and 6 mixed or comminuted (11%) (Table II). The pattern of distribution of petrous temporal bone fracture found in this study is almost similar to other studies done, in which the longitudinal fracture predominates, though the percentage is different[3-6].

The commonest otorhinolaryngological clinical presentations reported were blood rhinorrhea (36.1%) and blood otorrhea (32.8%) (Table III). Majority of these symptoms occurred in petrous fracture. For petrous fracture, 18 out of 24 blood otorrhea presentations occurred in longitudinal type of fracture and none found in transverse fracture (Table IV). In their study, Kerman *et. al*[6] also stated that longitudinal temporal bone fractures are commonly associated with blood otorrhea as a presentation.

CSF leak has been reported in 11% to 45% of temporal bone fractures[4], but in our cases the reported incidence is much less at 8.2%. This under reporting could be as a result of our lack of effort to ask or look for the sign at initial presentation or in the subsequent follow-up period. Without emphasizing, the patient may tend to ignore this symptom until further complications develop. Longitudinal temporal bone fracture is the one most commonly associated with CSF leakage[7,8]. This is in correlation with the findings of our study in which all cases of CSF leak are found in longitudinal petrous temporal bone fracture.

In all cases of temporal bone fracture, it is very important to check for any hearing loss. Besides otoscopic examination, simple clinical tests that can be done at the bed side in cooperative patients are the Rinne's and Weber's test. If hearing loss occurs, patient should then be referred to the Ear, Nose and Throat doctors for full hearing assessment. In this review, only 10% (9) of the cases presented with hearing loss, with 6 of them of conductive type of hearing loss (CHL). However there was no documentation on the type of hearing loss in the rest of the cases. CHL is common in temporal bone fractures because of presence of blood in the ear, disruption of the ossicles or perforation of tympanic membrane. Transverse fractures will often cause immediate and profound sensorineural hearing loss (SNHL) since the fracture often violates the otic capsule[9]. However, no SNHL were reported in our 80 cases. In our study, there is one case of transverse temporal bone fracture but he was documented to have conductive hearing loss as well as labyrinth concussion. His pure tone audiogram (PTA) revealed moderate to severe left sided hearing loss with mild right side hearing loss. As in this case, the fracture line may have not violated the otic capsule thus, no SNHL occur. Apart from that, there is also no mixed hearing loss found in our study. Many reviewers and studies have stated that hearing loss are the commonest presentation of temporal bone fracture and we agree to it although it is not reflected in our data[3,10]. Perhaps if properly tested or documented it would have been elicited in many more patients. Clearly a prospective study with a proper assessment form will be better suited to assess this matter.

In this study, a total of 7 cases of cranial nerve (CN) palsy were documented (8.2%); 1 case of CN VI palsy and the rest of CN VII palsy. All of these cases occurred in petrous fracture (4 longitudinal and 1 oblique types). This finding is not concordance with other studies in which it revealed that half of CN VII palsy is found in transverse fracture and only a quarter in longitudinal fractures[4,5,10]. Brodie *et al*[2] with a large series of 850 cases also found their prevalence of facial nerve palsy at around the same range of ours at 7%, with a quarter of them were immediate in onset and the rest were late onset. However, all CN VII palsy reported in our study is late in onset. Out of these four patients with facial nerve palsy, two underwent facial nerve decompression with significant facial improvement afterwards. A case of CN VI palsy documented occurred in a patient with longitudinal petrous temporal bone fracture, who also had CN VII palsy and multiple skull fractures. He succumbed to death few days after the injury.

There were only five cases of haemotympanum documented; four cases in longitudinal petrous fracture and another in non-petrous fracture. Again this could be under-reported at the primary level in the casualty department. Of all the 83 cases, 42 (47.5%) have no otorhinolaryngological clinical presentation documented in the patient's record. The significant of this high percentage of asymptomatic patients is that the study found that later on in life 12% of these cases developed complications, such as hearing loss, facial nerve paralysis,otorrhea or otorhinorrhea, and life-threatening bacterial meningitis[11]. The percentage of death in our temporal bone fracture associated with head injury patients in year 2015 and 2016 is 21.3% (17 cases). Most of them died of severe head injury.

There is not much to be discussed regarding morbidity outcome of these patients. This is because most of these patients are still under follow-up at the point of this study. Those with documented conductive hearing loss (3 cases) also had improvement in hearing in the follow-up PTA. Three other cases with hearing loss have absconded from subsequent follow-up. As for haemotympanum (6cases), it resolved completely with conservative treatment. To properly study the morbidity outcome from temporal bone fracture a long term survey needs to be done and it is beyond the scope of our study.

## *CONCLUSION*

The severity of collision in our MVA cases is probably much more as evidenced by higher prevalence of temporal bone fracture. Petrous portion of the temporal bone is more commonly fractured and longitudinal type of fracture has the highest percentage. A quarter of our temporal bone fracture cases were asymptomatic thus the emphasis is that we should not rely on the clinical presentation alone as significant number of cases will be missed. SSS

**Table I: Causes of head injury**

| Causes of head injury | No of cases | Percentage |
|---|---|---|
| Motor vehicle accident (MVA) | 1269 | 81.4 % |
| Fall | 225 | 14.3 % |
| Assault | 52 | 3.3 % |
| Industrial accident | 11 | 1.5 % |
| Sports injury | 3 | 0.5 % |
| Total | 1560 | 100 % |

**Table II: Subtypes of petrous temporal bone fracture**

| Types of petrous fracture | No. of cases | Percentage |
|---|---|---|
| Longitudinal | 39 | 69.4% |
| Transverse | 4 | 7.7% |
| Oblique | 7 | 11.9% |
| Mixed/comminuted | 6 | 11% |
| Total | 56 | 100% |

**Table III: Clinical features and types of temporal bone fracture**

| Types of fracture | Total Fracture: | Petrous | Non- petrous subtype: |
|---|---|---|---|
| | n(% out of 83 cases) | subtype: n(% out of 83 cases) | n(% out of 83 cases) |
| Clinical features: CSF otorrhea | 4 (4.9%) | 4 (4.9%) | 0 |
| CSF rhinorrhea | 3 (3.3%) | 3(3.3%) | 0 |
| Blood otorrhea | 27(32.8%) | 24 (29.5%) | 3(3.3%) |
| Blood rhinorrhea | 30 (36.1%) | 24(29.5%) | 6 (6.6%) |
| Hearing loss (HL) | 9 (9.8%) | 6 (6.6%) | 3 (3.3%) |
| Conductive HL | 4 (4.9%) | 4 (4.9%) | 0 |
| Sensorineural HL | 0 | 0 | 0 |
| Mixed HL | 0 | 0 | 0 |
| Cranial nerve palsy CN VI | 1 (1.6%) | 1 (1.6%) | 0 |
| CN VII: (Early) | 0 | 0 | 0 |
| (Late) | 6 (6.6%) | 6 (6.6%) | 0 |
| Haemotympanum | 5 (8.2%) | 4 (6.6%) | 1 (1.6%) |
| Labyrinth concussion | 6 (6.6%) | 6 (6.6%) | 0 |
| | 4 (6.6%) | 0 | |

CSF=cerebrospinal fluid, CN=cranial nerve

***Table IV: Clinical features and subtypes of petrous temporal bone fracture***

| Types of petrous fracture | Longitudinal n | Transverse n | Oblique n | Mixed n |
|---|---|---|---|---|
| | (% out of 83 cases) | (% out of 83 cases) | (% out of83 cases) | (% out of 83 cases) |
| Clinical features: CSF otorrhea | 4(4.9%) | 0 | 0 | 0 |
| CSF rhinorrhea | 3(3.3%) | 0 | 0 | 0 |
| Blood otorrhea | 18(21.3%) | 0 | 2(1.6%) | 6(6.6%) |
| Blood rhinorrhea | 18(21.3%) | 2(1.6%) | 3(3.3%) | 3(3.3%) |

| | | | | |
|---|---|---|---|---|
| Hearing loss (HL) | 4(4.9%) | 2(1.6%) | 0 | 0 |
| Conductive HL | 3(3.3%) | 2(1.6%) | 0 | 0 |
| Sensorineural HL | 0 | 0 | 0 | 0 |
| Mixed HL | 0 | 0 | 0 | 0 |
| Cranial nerve palsy CN VI | 2(1.6%) | 0 | 0 | 0 |
| CN VII Early | 0 | 0 | 0 | 0 |
| Late | 4(4.9%) | 0 | 2(1.6%) | 0 |
| Haemotympanum | 6(6.6%) | 0 | 0 | 0 |
| Labyrinth concussion | 4(4.9%) | 2(1.6%) | 0 | 0 |

CSF=cerebrospinal fluid, CN=cranial nerve

**Table 5: Finding in the CT SCAN of the temporal bones**

| | n | % |
|---|---|---|
| Fracture line | 40 | 71 |
| Mastoid opacification | 14 | 25 |
| Ossicular chain luxation | 8 | 15 |
| Air in glenoid cavaity | 4 | 7 |
| Middle ear opacification | 2 | 4 |

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