Head Injury with Temporal Bone Fracture: One Year Review of Case Incidence, Causes, Clinical Features and Outcome

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SUMMARY

To investigate the case incidence, causes, clinical profile and outcome of temporal bone fracture complicating head trauma. A 1-year (2005) retrospective study of head injured patients presented to the Emergency Department, Hospital Tengku Ampuan Afzan, Kuantan, Pahang, Malaysia. Gender distribution, cause of injury, radiological findings and otorhinolaryngological clinical presentations were analyzed. Of 1309 patients, 61 patients were diagnosed to have temporal bone fracture (4.7%). Majority of cases were caused by motor vehicle accident (85.9%) and were predominantly male (88.5%). The right temporal bone was more frequently fractured (62.3%). Most (88.5%) were petro-mastoid fractures. Sixty-seven percent of the petrous fractures were longitudinal type. Clinical presentations mostly reported were blood rhinorrhea (36%) and blood otorrhea (32.7%). Other clinical presentations were hearing loss (9.8%), cranial nerve palsy (8.2%), cerebrospinal fluid oto-rhinorrhea (8.2%) and labyrinth concussion (6.5%). Four out of five cranial nerve palsies were facial nerve. Out of the 61 cases, 16 (26.2%) had no clinical presentation at the time of Emergency Department consultation. Thirteen (21.3%) died due to severe head injury. The case incidence of temporal bone fracture in head injured patients in our centre is 4.7%. The petro-mastoid type fracture predominates. Proper early diagnosis and management minimize complications.

KEY WORDS:
Temporal bone fracture, Head injury, Petro-mastoid

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 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. Yet, trauma to the temporal bone is often overlooked in the initial evaluation and management of the patient with severe head injury. In Malaysia, we have not yet published epidemiological and clinical data on this subject despite the overwhelming incidence of head injury most commonly associated with motor vehicle accident (MVA) in this country.

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.

We performed a retrospective one year review of all cases of head injury treated in our centre's Emergency Department in 2005. 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.

MATERIALS AND METHODS

The medical records of all patients with head injury admitted to the Hospital Tengku Ampuan Afzan (HTAA) in 2005 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.

RESULTS

Total number of cases of head injury in HTAA in year 2005 was 1309 cases, and causes of those are illustrated in Table I. Out of those cases, 61 (4.7%) had temporal bone fracture. Out of 61 cases, 54 (88.5%) were male victims and 38 (62.3%) occurred on the right side.

DISCUSSION

The incidence of head injury caused by MVA in this study was far higher at 85.9% compared to a study reported by the University of California at 75%[2]. This reflects the ever increasing problem faced by our country's authority to reduce the incidence of MVA. Also a worrying fact here is that the head injury cases in our hospital is averaging at around 110 cases per months (3-4 cases per day). Perhaps upgrading the current trauma facilities or better still building a new tertiary

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referral trauma centre may provide long term solution for management of head injury cases in our population setting.

Out of 1309 cases of head injury, 61(4.7%) were radiologically diagnosed to have temporal bone fracture. A study by University of Massachusetts from 1995 to 1997 revealed that out of 2977 patients with closed head injury, only 3% (90) sustained temporal bone fracture[3]. The percentage in our study was higher compared to their study, most probably due to the higher incidence and severity of MVA we have in our country. 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.

Our findings seem to agree with Ishman *et. al*[4] and Dahiya *et. al*[3] in terms of gender distribution and site involvement of temporal bone fracture. Their studies, like ours, found that majority of their patients were male patients and the distribution of fractures was slightly more on the right side. In Malaysia, male drivers are more than female drivers and being a right hand side drive vehicle, the right side is more exposed to lateral crashing in accident.

In this study, out of all 61 cases reported, 46(75.4%) 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; 31 longitudinal (67.4% of the case), 4 transverse (8.7%), 5 oblique (10.9%), and 6 mixed or comminuted (13%) (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, 13 out of 18 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% (6) of the cases presented with hearing loss, with 3 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 61 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 5 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 61 cases, 29 (47.5%) have no otorhinolaryngological clinical presentation documented in the patient's record. However, this could be because 13 of the 29 cases in which no clinical presentation reported died due to severe head injury. If we exclude these 13 cases, then we have 16 cases (26.2%) of temporal bone fracture without any otorhinolaryngological complaint. This number somewhat tally with other study that shows that nearly one third of temporal bone fractures may be missed by clinical diagnosis alone[11]. 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,

Table I: Causes of head injury

Causes of head injury	No of cases	Percentage
Motor vehicle accident (MVA)	1125	85.9 %
Fall	135	10.3 %
Assault	27	2.1 %
Industrial accident	20	1.5 %
Sports injury	2	0.2 %
Total	1309	100 %

Forty-six (75.4%) out of the 61 cases of temporal bone fracture involved petrous part, followed by 8 (13.1%) mastoid segment fractures. Subtypes of petrous temporal fracture are shown in Table II.

Table II: Subtypes of petrous temporal bone fracture

Types of petrous fracture	No. of cases	Percentage
Longitudinal	31	67.4%
Transverse	4	8.7%
Oblique	5	10.9%
Mixed/comminuted	6	13%
Total	46	100%

CSF oto-rhinorrhea is the predominant otorhinolaryngological feature as illustrated in Table III and Table IV

Table III: Clinical features and types of temporal bone fracture

Types of fracture	Total Fracture: n(% out of 61 cases)	Petrous subtype: n(% out of 61 cases)	Non- petrous subtype: n(% out of 61 cases)
Clinical features:			
CSF otorrhea	3 (49%)	3 (4.9%)	0
CSF rhinorrhea	2 (3.3%)	2 (3.3%)	0
Blood otorrhea	20 (32.8%)	18 (29.5%)	2 (3.3%)
Blood rhinorrhea	22 (36.1%)	18 (29.5%)	4 (6.6%)
Hearing loss (HL)	6 (9.8%)	4 (6.6%)	2 (3.3%)
Conductive HL	3 (4.9%)	3 (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)	4 (6.6%)	4 (6.6%)	0
Haemotympanum	5 (8.2%)	4 (6.6%)	1 (1.6%)
Labyrinth concussion	4 (6.6%)	4 (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 (% out of 61 cases)	Transverse n (% out of 61 cases)	Oblique n (% out of 61 cases)	Mixed n (% out of 61 cases)
Clinical features:				
CSF otorrhea	3(4.9%)	0	0	0
CSF rhinorrhea	2(3.3%)	0	0	0
Blood otorrhea	13(21.3%)	0	1(1.6%)	4(6.6%)
Blood rhinorrhea	13(21.3%)	1(1.6%)	2(3.3%)	2(3.3%)
Hearing loss (HL)	3(4.9%)	1(1.6%)	0	0
Conductive HL	2(3.3%)	1(1.6%)	0	0
Sensorineural HL	0	0	0	0
Mixed HL	0	0	0	0
Cranial nerve palsy				
CN VI	1(1.6%)	0	0	0
CN VII				
Early	0	0	0	0
Late	3(4.9%)	0	1(1.6%)	0
Haemotympanum	4(6.6%)	0	0	0
Labyrinth concussion	3(4.9%)	1(1.6%)	0	0

CSF=cerebrospinal fluid, CN=cranial nerve

Total number of cases without otorhinolaryngological presentation was 29 (47.5%). There were 13(21.3%) total number of death in 61 cases.

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 2005 is 21.3% (13 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. However, in terms of surgical intervention post injury, the two patients that underwent facial nerve decompression had significant improvement afterwards. 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 (5 cases), 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 head injury epidemiology in HTAA is consistent with findings elsewhere as MVA accounts for majority of the cause, male and right side predominance. However the severity of collision in our MVA cases is probably much more as evidenced by higher prevalence of temporal bone fracture in our head injury cases. Petrous portion of the temporal bone is more commonly fractured and longitudinal type of fracture has the highest percentage. Blood rhinorrhea and blood otorrhea are the most common presenting features documented in our cases although in many other series hearing loss is the predominant complaint. 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. This study highlights the under-documented otorhinolaryngological presentations in our emergency setting. This is understandably so as skull base injuries are frequently overlooked while treating more life threatening injuries in Emergency Departments. However, it should be remembered that temporal bone fracture can lead to serious long term morbidity and sequelae. Therefore again and again we should be reminded to thoroughly examine our patients in any circumstances we are in.

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