

Pattern of Skull Fractures in Fatal Craniocerebral Injury Cases

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Abstract

Background: In this modern era of scientific development and industrial progress, craniocerebral trauma is the leading cause of morbidity, mortality and achieved status as a 'global health epidemic'. Skull fracture is an important component of craniocerebral injury. Fracture pattern, type, extent, and position are important in assessing the sustained injury. The skull fractures, offer varying diagnostic and medico-legal problems to the medical jurists as well as to the clinicians. So in present study more emphasis was given on study of skull fractures. *Materials & Methods:* A prospective cross sectional study was carried out during period from 1st June 2011 to 15th October 2012 in the department of FMT of Rural Medical College, Loni. In present study 100 fatal cases of craniocerebral injury were studied. During medicolegal post-mortem examination, detailed external as well as internal examination was conducted in each case and injuries were examined in details. Skull fracture was noted in terms of type, location, number, extension & associated complications. In this way collected data was analysed & presented in this paper. *Results:* In the present study we found skull fractures in 71 cases out of 100 cases. Linear type of skull fracture was found in 40 cases. In 34 (47.88%) cases both the vault as well as base were involved. In case of vault fracture, occipital bone was commonest location (8 cases). It was noted that the commonest site of basal fractures was the combination of anterior, middle and posterior cranial fossa accounted for 15 cases. *Conclusions:* Majority of fatal cases of head injury shows skull fracture. Combined involvement of vault and base was seen in most of the cases. Linear fracture was the commonest type of fracture observed. In vault fracture, occipital region was commonly involved & fronto-parieto-temporal. In base fracture, combination of anterior, middle & posterior cranial fossa was the commonest combination observed.

Keywords: Craniocerebral Injury; Skull Fracture; Medicolegal Problem.

Introduction

In this modern era of scientific development and industrial progress, craniocerebral trauma is the leading cause of morbidity, mortality and achieved status as a 'global health epidemic'. Vehicular accidents, fall from height & assault are common modes of head injuries. Other modes are

occupational head injuries, industrial accidents, head injuries sustained in natural calamities like earthquakes and building collapses, sports and recreational activities. Out of these, head injuries due to vehicular accidents supervene [1].

There are three main components of head scalp, skull & brain. The term craniocerebral injuries can be used to describe the presence of skull & brain injury [2]. National Advisory Neurological Disease and Stroke Council has defined craniocerebral injury as "a morbid state resulting from gross or subtle structural changes in the scalp, skull and / or the contents of the skull, produced by mechanical forces" [3].

A skull fracture indicates that substantial force has been applied to the head and is likely to have damaged the cranial contents [4]. Fractures may be caused by direct or indirect violence. Direct injuries

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Received on 20.03.2017, Accepted on 07.04.2017

may be caused by: 1. Compression as by midwifery forceps or crushing of the head under the wheel of a vehicle. 2. An object in motion striking the head, e.g. bullets 3. Head in motion striking an object as in falls. Indirect injury of the skull occurs from a fall on the feet or buttocks. There is no relation between the damage to the brain & linear fractures of skull. Skull fractures can occur without any significant or detectable brain injury or any impairment of consciousness. Conversely fatal brain injury may occur without fracture of skull [5].

Skull fractures are useful in Forensic Pathology as they can often indicate the position & nature of the head injury [6]. The causative forces & fracture pattern, type, extent, and position are important in assessing the sustained injury [7]. The skull fractures, especially by blunt force offer varying diagnostic and medico-legal problems to the medical jurists as well as to the clinicians [8]. So in present study more emphasis was given on study of skull fractures in relation to its incidence, type, location, pattern of vault & base fractures.

Material & Method

In present study 100 fatal cases of craniocerebral injury were studied, which were sent to the mortuary of Rural Medical College, Loni for medico-legal post-mortem examination. Preliminary data related to

name, age, sex, address, brought by whom, date and time of incidence, date and time of admission, treatment given, date and time of death were noted. A detailed external as well as internal examination was conducted in each case and injuries were examined in details. More stress was given on head dissection. Head was dissected layer by layer. Scalp & under scalp area was examined for any injury. Skull fracture was noted in terms of type, location, number, extension & associated complications. Meninges were examined for haemorrhage. Then Brain matter examined for injury. In the last details of fracture of base of skull was noted by stripping the dura matter. In this way collected data was analyzed & presented in this paper.

Observation & Result

Incidence of Skull Fracture

Out of 100 fatal cases of head injury, we found skull fractures in 71 cases & in remaining 29 cases we did not find any skull fractures.

Location of Skull Fractures

We found skull fractures in 71 cases. Out of these cases, in 34 (47.88%) cases both the vault as well as base were involved, whereas 33.80% cases showed fractures of vault only. In 18.30% cases fractures of

Table 1: Incidence of Skull Fracture

Type of Case	No. of Cases (%)
Cases with Fracture of Skull	71 (71)
Cases without Fracture of Skull	29 (29)
Total	100 (100)

Table 2: Distribution of Cases according to the location of Skull Fractures

Type of Case	No. of Cases (%)
Cases of Vault Fracture	24(33.80)
Cases of Base Fracture	13(18.30)
Case of Vault and Base Fracture	34(47.88)
Total	71(100)

Table 3: Distribution according to the Type of Fracture of Skull

Type of Fracture	No. of Fracture (%)
Linear	40 (56.33)
Comminuted	20(28.16)
Depressed	1(1.40)
Separation of Sutures	1(1.40)
Depressed-Comminuted	2(2.81)
Depressed-Linear	3(4.22)
Comminuted-Linear	2(2.81)
Linear-Suture separation	1(1.40)
Linear-Depressed-Suture separation	1(1.40)
Total	71(100)

only base of skull was observed.

Types of Skull Fracture

In present study we found linear type of skull fracture in 40 cases, comminuted fracture in 20 cases, depressed fracture in 1 case & suture separation in 1 case. We also found various combinations of above mentioned types. Combination of depressed fracture and linear fracture was seen in 3 cases. Combination of linear fracture & sutural separation was seen in 1 case. Combination of comminuted fracture & linear fracture was noted in 2 cases. Combination of depressed fracture & comminuted fracture was noted

in 2 cases. Unique combination of linear fracture, depressed fracture & sutural separation was seen in 1 case.

Vault Fractures

If vault of skull is considered, its fracture was noted in 58 cases. Out of which, 7 cases shows frontal bone involvement. Occipital bone involvement was noted in 8 cases. In 5 cases temporal bone was involved. 3 cases shows parietal bone involvement. In rest of the cases simultaneous involvement of vault bones were seen.

Table 4: Distribution of Cases according to the Site of Fractures of Skull Vault

Site of Fracture Bone	No. of Cases (%)
Frontal	7(12.06)
Parietal	3(5.17)
Temporal	5(8.62)
Occipital	8(13.79)
Fronto-Parietal	2(3.44)
Fronto-Temporal	3(5.17)
Parieto-Temporal	5(8.62)
Parieto-Occipital	3(5.17)
Temporo-Occipital	1(1.72)
Fronto-Parieto-Temporal	9(15.51)
Fronto-Parieto-Occipital	2(3.44)
Parieto-Temporo-Occipital	2(3.44)
Whole Vault	8(13.79)
Total	58(100)

Base Fracture

In present study, base of skull was fractured in 47 cases. The commonest site of basal fractures was the combination of anterior, middle and posterior cranial fossa accounted for 15 cases, followed by anterior

cranial fossa fractures in 13 cases, combination of anterior and middle cranial fossa fractures in 7 cases, posterior cranial fossa fractures in 5 cases, middle cranial fossa fractures in 4 cases and combination of middle and posterior cranial fossa fractures in 3 cases.

Table 5: Distribution of Cases according to the Site of Fractures of Skull Base

Site of Fracture	No. of Cases (%)
Anterior Cranial Fossa	13(27.65)
Middle Cranial Fossa	4(8.51)
Posterior Cranial Fossa	5(10.63)
Anterior Cranial Fossa + Middle Cranial Fossa	7(14.89)
Middle Cranial Fossa + Posterior Cranial Fossa	3(6.38)
All Three Fossae Fracture	15(31.91)
Total	47(100)

Discussion

In this study 71% fatal cases of craniocerebral injury showed fractures of skull in various forms; while 29% fatal craniocerebral injury cases did not reveal any fracture (Table 1). Fracture of skull indicates an impression of severe injury and the impact occurred with considerable force. Agarwal SS et al [9] showed that nearly 75% (72 cases) had

fractures of the skull. Chattopadhyay S and Tripathi C [10] found that multiple cranial bones were involved in 56 (76.7%) of cases. Similar findings were also noted by Tandle RM and Keoliya AN [11].

In the present study, 71% cases had skull fractures, of which 47.88% had fracture of vault and base, whereas 33.80% cases showed fractures of vault only and 18.30% cases showed fractures of base only (Table 2). In majority of fatal head injury cases, there

were combinations of fracture of vault and basal fracture, explained by the fact that, the fracture commences at the region of maximum impact, usually on the vault of the skull and radiate mainly in the direction of force, downwards the skull base. It was suggestive that injuries are caused due to heavy forceful impact and commonly seen in vehicular accidents. In a study done by Devadiga KV and Jain SP [12], 12 cases had fracture of vault as well as of the base of skull, 8 cases had fracture of vault and 6 cases had basal fracture of skull. The study of Davidson A and Wilky JS [13] showed maximum incidence of combination of fracture of vault and base. Findings of the present study are not consistent with the studies of Tirpude BH et al [14] & Kohli A and Banerjee KK [15].

In present study we found linear type of skull fracture in 40 cases, comminuted fracture in 20 cases, depressed fracture in 1 case & suture separation in 1 case. We also found various combinations of above mentioned types (Table 3). Linear fractures are likely to be caused by a forcible contact with a broad resisting surface like the ground. Tandle RM and Keoliya AN [11] showed in their study that linear fracture was the commonest type. The study of Agarwal SS et al [9] revealed that nearly 75% (72 cases) had fractures of the skull, commonly being fissure fractures. Similar findings were also noted by Patel DJ and Agnihotram G [16] & Menon A et al [17].

If vault of skull is considered, its fracture was noted in 58 cases. Out of which, 8 cases shows occipital bone involvement followed by frontal bone (7 cases), temporal bone (5 cases), parietal bone (3 cases). In rest of the cases simultaneous involvement of vault bones were seen (Table 4). These findings are not consistent with the study of Akang EEU et al [18], in which commonest site of skull fracture was frontal bone (12.4%), followed by temporal bone (9.4%). Our study is also contradicts with the study of Behera C et al [19] (commonest involvement of parietal bone in 32.91% cases) & Khan MK et al [20] (temporal bone was the commonest site).

In the present study, commonest site of basal fractures was the combination of anterior, middle and posterior cranial fossa accounted for 31.91% cases, followed by anterior cranial fossa fractures in 27.65% cases, combination of anterior and middle cranial fossa fractures in 14.89% cases, posterior cranial fossa fractures in 10.63% cases, middle cranial fossa fractures in 8.51% cases and combination of middle and posterior cranial fossa fractures in 6.38% cases (Table 5). In most of the cases, fractures of the base of skull are the extension of fracture of vault. The study of Chattopadhyay S

and Tripathi C [8] showed that middle cranial fossa was the most vulnerable to mechanical injury (38.35%, N=28). The study of Tirpude BH et al [14] indicates that among basal fractures, middle cranial fossa was found in 25.9% cases (commonest site). Other authors like Khan MK et al [20], Parmar P et al [21] & Manish K et al [22] also found that middle cranial fossa was commonly fractured.

Conclusion

- Majority of fatal cases of head injury shows skull fracture.
- Combined involvement of vault and base was seen in most of the cases.
- Linear fracture was the commonest type of fracture observed.
- In vault fracture, occipital region was commonly involved & fronto-parieto-temporal combination was the commonest combination observed.
- In base fracture, combination of anterior, middle & posterior cranial fossa was the commonest combination observed.

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