

# Pattern of skull fractures and intracranial haemorrhages in cases of fatal road traffic accidents in Mangalore

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## Abstract

**Background:** Head is the most common site to be injured in road traffic accidents. Due to strike on the head the brain and its coverings are more vulnerable to blunt trauma than any other parts of the body. As head injury provides the major contribution to death, a sound practical understanding of the neuro pathology of trauma with intracranial injuries is more essential to the Forensic Pathologist. **Aim:** To evaluate the pattern of skull fractures and intracranial haemorrhages in cases of fatal road traffic accidents in Mangalore. **Material and Methods:** A retrospective study done for a period of five years on fatal head injuries due to road traffic accidents in Mangalore. A total of 286 cases were studied and the pathological features of these cases as scalp injury, pattern of skull fractures and intracranial hemorrhages and their distribution were noted. **Results:** Involvement of base of skull was seen in 167 fractures out of 286 cases. Middle cranial fossa fracture was seen in 117 cases (40.9%) followed by posterior cranial fossa in 109 cases (38.12%) and Anterior cranial fossa was involved in 84 cases (29.3%). Intra-cranial hemorrhage was seen in 255 cases (89%) out of total 286 cases. SAH was seen in 249 cases (87%) followed by SDH in 209 cases (73%). IVH was seen in 68 cases (23.8%) and EDH in 17 cases (5.9%). **Conclusion:** Proper safety guidelines to be taught right from school children, to the youth and especially drivers regarding safe driving. Promotions of safety measure like use of seat belts and helmets should be made compulsory.

**Key Word:** Fatal head injury, road traffic accident, skull fracture, intracranial haemorrhage

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## INTRODUCTION

Road traffic accidents are important causes of mortality and morbidity due to increasing number of vehicles, the risk taking behavior among general population and changes in lifestyle. The exponentially increasing number of automobile vehicles, poor adherence to traffic rules

and regulations such as maintaining lane discipline are altogether responsible for accidents. Due to high population density in Mangalore city, the road traffic density is also increasing. Head is the most common site to be injured in road traffic accidents. As head is the most prominent vulnerable exposed part of the human body by virtue of its situation and to sustain serious and fatal injuries owing to the great risk of striking the head. The dominance of head injuries in road traffic accidents is due to fact that, when the victim is pushed or knocked to the ground, he/she often takes a strike on the head and also adding to this fact, that the brain and its coverings are more vulnerable to blunt trauma than any other parts of the body. As head injury provides the major contribution to death, a sound practical understanding of the neuropathology of trauma with intracranial injuries is more essential to the Forensic Pathologist. The present study was conducted to evaluate the pattern of skull

fractures and intracranial haemorrhages in cases of fatal road traffic accidents in Mangalore.

**MATERIAL AND METHODS**

This was a record based retrospective study. The data required for the study was collected and analyzed retrospectively from all cases of road traffic accidents involving fatal head injuries subjected to autopsy at two major tertiary care hospitals, situated in Mangalore.

**Inclusion criteria**

- All cases of fatal head injuries due to road traffic accidents.

**Exclusion criteria**

- All other fatal head injury other than road traffic accidents.

A proforma was prepared accordingly to collect the data based on the deceased’s particulars, with complete external and internal examination in retrospective studies of those involved in fatal head injury cases due to road traffic accidents. The study was conducted over a period of five years were included in the study. Recorded details include name, age, sex, address, information furnished by the police in the inquest papers, postmortem reports, investigation reports if any and cause of death. The pathological features of these cases as scalp injury, pattern of skull fractures and intracranial hemorrhages and their distribution were noted. All the data obtained was kept anonymous to protect the identity of the deceased and also for confidential medico legal information.

**RESULTS**

The highest incidences of 56 cases were noticed among the age group of 20-29 years and 50-59 years respectively with male preponderance 247 (86.4%). In 286 cases of road traffic accidents, 267 cases showed some or the other injuries to face and head, the most common type of injuries were the combination of abrasions with lacerations seen in 63 (22%) of cases followed by a combination of abrasion, laceration and contusion in 51 (17.9%) cases. The most common type of injury was abrasions alone seen in 33 (11.6%) cases. In 19 (6.6%) cases had a combination of abrasions and contusions followed by a combination of abrasion and surgical scar in 18 (6.3%), followed by a combination of abrasions, lacerations, contusions and surgical scar in 9 (3%) cases. The second common type of injuries to face and head were crush injuries in 12 (4.2%) cases followed by lacerations 10 (3.5%) and contusions 8 (2.8%). Surgical scars are seen in 44 (15.3%) cases indicating patient survival for a varied period of time. Diffuse extravasations of blood in the scalp were seen in 126 cases (44.1%). Localized extravasation of blood in the

scalp was seen in occipital region in 30 cases (10.5%) followed by temporal region in 21 cases (7.3%), frontal region in 19 cases (6.6%) and parietal region in 7 cases (2.4%). The scalp contusions were seen in combination of frontal, parietal and temporal regions in 31 cases (10.8%) followed by parietal, temporal and occipital regions in 17 cases (5.9%) and frontal, temporal and occipital regions in 13 cases (4.5%). The involvement depends on the site of impact and on the side of the body on which the individual falls. On considering the type of fracture in skull vault, out of 286 cases only 172 cases (60.1%) showed skull vault fractures. Linear fracture constituted most common type of fracture accounting for about 102 cases (35.7%), next common type of fracture being comminuted fractures in 41 cases (14.4%). The combination of linear fracture with comminuted fracture in 9 cases (3.1%) followed by depressed and diastatic fracture accounting for 7 cases (2.4%) respectively and a combination of comminuted with depressed fracture in 6 cases (2.1%). The other types of fractures in skull vault like pond and gutter fractures were not recorded in the present study.

**Table 1: Type of Fracture in Vault**

Type of fracture in vault	No. of cases	Percentage
Absent	114	39.9%
Linear	102	35.7%
Linear+ Comminuted	9	3.1%
Comminuted	41	14.4%
Comminuted+ Depressed	6	2.1%
Depressed	7	2.4%
Diastatic	7	2.4%
Others	0	0%
<b>Total</b>	<b>286</b>	<b>100%</b>

On analysis of the fractures of skull based on the bone involved in the fracture, it was observed that temporal bone/s were fractured in 65 cases (22.7%) followed by parietal bone/s in 64 cases (22.3%) and frontal bone in 57 cases (20%). All bones were involved in 39 cases (13.6%) followed by occipital bone in 28 cases (9.8%) and facial bones were involved in 7 cases (2.4%).

**Table 2: Site of Fracture in Vault**

Site of fracture in vault	No. of cases (n=286 cases)	Percentage
Frontal	57	20%
Parietal	64	22.3%
Temporal	65	22.7%
Occipital	28	9.8%
All bones	39	13.6%
Facial bones	7	2.4%

Involvement of base of skull was seen in 167 fractures out of 286 cases. Middle cranial fossa fracture was seen in 117 cases (40.9%) followed by posterior cranial fossa in 109 cases (38.12%) and Anterior cranial fossa was involved in 84 cases (29.3%). Intra-cranial hemorrhage

was seen in 255 cases (89%) out of total 286 cases. SAH was seen in 249 cases (87%) followed by SDH in 209 cases (73%). IVH was seen in 68 cases (23.8%) and EDH in 17 cases (5.9%).

**Table 3: Type of Intracranial Hemorrhage**

Type of Intracranial Hemorrhages	Number of cases (n=286 cases)	Percentage
EDH	17	5.94
SDH	209	73
SAH	249	87
IVH	68	23.8

On considering the type of brain injury, the most common type of injury was cerebral oedema in 105 (36.7%) cases followed by combination of contusion, laceration and oedema seen in 43 (15%) cases. Contusion of the brain was seen in 42 (14.7%) cases followed by laceration alone in 8 (2.8%) cases. Brain had been expelled out of the cranium in 23 (8%) cases. When the sites of brain injuries were analyzed in total of 286 cases, brain injuries were present in 221 cases and whole brain was injured in 93 cases (32.5%), frontal region in 34 cases (11.9%), a combination of frontal and temporal region in 33 cases (11.5%), temporal region alone in 21 cases (7.3%), base of brain in 11 cases (3.8%), occipital region in 9 cases (3.1%) and parietal region in 6 cases (2.1%). A combination of frontal and parietal region followed by temporal and parietal region were seen in 7 cases (2.4%) each. When cause of death was analyzed, it was noted that in 244 cases (85.3%) death was due to head injury alone. In 31 cases (10.8%) death was due to multiple injuries sustained and in 11 cases (3.9%) death was attributed as instantaneous death due to crush injury sustained to the head.

## DISCUSSION

Presence of skull fractures in cases of fatal head injuries is not a rule. In this study it was observed that linear fractures were the commonest fracture, accounting for 35.7% of cases. The findings were similar to the study done in Bangalore, where they observed that fissured fracture was the most common fracture in 41% of cases. Comminuted fracture was seen in 14.4% of cases in the present study which was in contrast to the study done in Bangalore wherein they observed comminuted fracture in 30% of cases.<sup>1</sup> On considering the site of fractures in skull vault the present study showed involvement of temporal bone/s in majority of cases 22.7% followed by involvement of parietal bone/s in 22.3% cases and frontal bone in 20% cases. All bones were involved in 13.6% of cases followed by occipital bone in 9.8% cases and facial bones in 2.4% cases. Similar results were drawn from the studies done in Delhi and Jaipur, wherein temporal bone was the most commonly involved bone followed by

parietal bone/s.<sup>2,3</sup> The base of skull fractures in this study involves middle cranial fossa in most of the cases 40.9% followed by posterior cranial fossa in 38.12% cases and anterior cranial fossa in 29.3%. This study was similar to the study done in northeast Delhi, which had shown that posterior cranial fossa involvement in 40% of cases being common followed by anterior cranial fossa involvement in 20%.<sup>4</sup> The commonest intracranial hemorrhage in this study was subarachnoid hemorrhage in 87% of cases, followed by subdural hemorrhage in 73% of cases, intraventricular hemorrhage in 23.8% of cases and extra-dural hemorrhage in 5.9% of cases. The present study showed the similar findings as seen by Pillay VV.<sup>5</sup> In the present study on considering the type of brain injury, it was observed that cerebral oedema was seen in 105 cases (36.71%), followed by a combination of contusion, laceration and cerebral oedema in 43 cases (15.1%), contusion alone in 42 cases (14.7%), laceration in 8 cases (2.8%) and brain was expelled out in 23 cases (8%). This was similar to the study done in Chandigarh where the cerebral oedema was the major contributing factor towards death seen in 166 cases (45%) followed by cerebral contusions and lacerations seen in 87 cases (24%).<sup>6</sup> The present study showed the diffuse involvement of whole brain in 93 cases (32.5%) followed by frontal lobe alone in 34 cases (11.9%) and frontal and temporal lobe in 33 cases (11.5%). Similar results were observed in a study done in Bangalore, where they showed diffuse involvement of brain in 39 cases (34%) followed by frontal lobe in 24 cases.<sup>1</sup> When the cause of death was analyzed in this study, it was observed that 244 cases (85.3%) died as a result of head injury alone followed by death due to multiple injuries sustained to the body in 31 cases (10.8%) and in 11 cases death was attributed as instantaneous due to crush injury sustained to the head. There were no similar or contrasting studies to comment on this issue. There was no uniformity of findings with regard to conclusion of cause of death. In most of the cases mode of death was included along with the cause of death. Until we have uniform standards for concluding cause of death, comparison of such data may not be possible.

## CONCLUSION

Proper safety guidelines to be taught right from school children, to the youth and especially drivers regarding safe driving. Promotions of safety measure like use of seat belts and helmets should be made compulsory.

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