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Original Article

Forensic Section

A Cross-sectional Study on the Pattern of Skull Fractures in Fatal Two-wheeler Road Traffic Accidents at a Tertiary Care Hospital in Northeastern India

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ABSTRACT

Introduction: Death due to Road Traffic Accidents (RTA) is one of the leading causes of mortality and morbidity in a developing country like India. As there is a paucity of literature on the nature and type of injuries in RTAs in the locality of Upper Assam, a retrospective study on postmortem cases of fatal two-wheeler accidents was conducted to address the magnitude of the problem.

Aim: To analyse different types of skull fractures and causes of death among two-wheeler RTAs at tertiary care Hospital in Northeast India.

Materials and Methods: The present cross-sectional study was conducted in the mortuary of Assam Medical College, Dibrugarh, Assam, India, for a period of one year from August 2020 to July 2021. The records of all RTA cases involving two-wheeler motorcycles brought for postmortem examination during this period were studied for parameters including age, gender distribution, cause of death, type of skull fracture, intracranial haemorrhage, and time of occurrence, and analysed using descriptive statistics.

Results: There were 532 fatal RTA cases recorded, out of which 292 involved two-wheelers (54.89%). Males (87.67%) outnumbered females (12.33%). The most affected age group was between 21-30 years with a total of 98 cases (33.56%), followed by 31-40 years with 68 cases (23.29%). Skull fracture was present in 103 cases (35.27%). Fissured fracture was the most common type seen in 64 cases (62.14%) followed by depressed fracture in 19 (18.45%). The most common single bone fracture was of the Temporal bone in 44 cases (42.72%), followed by frontal bone in 18 (17.48%). Coma was the most common cause of death, seen in 214 cases (73.29%), followed by haemorrhagic shock in 42 (14.38%). Subdural Haemorrhage (SDH) alone was the most common intracranial haemorrhage found in 159 cases (74.30%), followed by Extradural Haemorrhage (EDH) alone in 7 cases (3.27%).

Conclusion: Injuries to the skull and brain are the leading cause of death in RTAs. Adequate measures should be taken to prevent mortality and morbidity, achievable through strict enforcement of road safety measures, awareness among the people, and improving road infrastructure along with emergency medical services.

Keywords: Autopsy, Cause of death, Subdural haemorrhage, Time of death

INTRODUCTION

Road Traffic Accidents (RTA) are increasing at an alarming rate in developing countries like India, constituting one of the leading causes of mortality and morbidity due to trauma. Globally, approximately 1.3 million people die each year as a result of RTAs, costing most countries 3% of their gross domestic product [1]. More than half of all road traffic deaths occur among vulnerable road users such as pedestrians, cyclists, and motorcyclists. Shockingly, 93% of the world's road fatalities occur in low and middle-income countries, despite these countries having only around 60% of the world's vehicles [1]. Notably, road traffic injuries are the leading cause of death for children and young adults aged 5-29 years [1].

In India, the impact of RTAs is significant, with 1.20 lakh cases of "deaths due to negligence relating to road accidents" recorded in 2020, resulting in an average of 328 deaths per day, even during COVID-19 lockdowns. The comparative analysis of National Crime Records Bureau (NCRB) data from 2017 to 2020 shows a concerning trend, with a high number of lives lost per 100 road crashes [2]. Despite a reduction in overall road fatalities by nearly 14% from about 1.5 lakh in 2019 to 1.3 lakh in 2020 due to Coronovirus Disease-2019 (COVID-19) restrictions, indicators such as the severity of crashes and the increased share of two-wheeler occupants' deaths in total fatalities are alarming [2].

Two-wheeler deaths accounted for 38% of all road deaths in 2019, up from 35% in 2018, with a total of 58,747 deaths reported from two-wheeler crashes [3]. India, with only 1% of the world's vehicles, unfortunately, accounts for 11% of global RTA deaths, with approximately 450,000 accidents and 150,000 deaths occurring annually. This translates to 53 road accidents every hour and one death every four minutes in the country [4].

Despite these alarming statistics, there is a notable paucity of literature on the nature and type of injuries in RTAs in the locality of upper Assam. In light of the magnitude of the problem, a retrospective study on postmortem cases of fatal two-wheeler accidents was conducted with the aim to analyse various types of skull fractures and causes of death among two-wheeler RTAs in a tertiary care hospital in Northeastern India.

MATERIALS AND METHODS

The present cross-sectional study was conducted in the mortuary of Assam Medical College and Hospital, Dibrugarh, Assam, India from August 2020 to July 2021, using archival data

of postmortem cases of RTAs. All cases that occurred during this period were included in the study, following the acquisition of permission from the Institutional Ethics Committee (No. 2023/AMC/EC/1384).

Inclusion and Exclusion criteria: All RTA cases involving two-wheelers brought to the mortuary for postmortem examination during the study period were included, while deaths due to RTAs involving vehicles other than two-wheeler motorcycles and bicycles were excluded from the study.

Study Procedure

The study comprised 292 cases of fatal RTAs involving two-wheelers. Data from all cases were collected from police inquests, dead body challans, postmortem reports, and pretested proforma used for interviewing accompanying police personnel and relatives of RTA victims. The age and sex distribution of cases, the cause of death, type of skull fracture, intracranial haemorrhage (as a percentage of cases), and time of occurrence of RTA cases were studied.

STATISTICAL ANALYSIS

All data were deidentified, and the study parameters were entered into an excel sheet and analysed using descriptive statistics.

RESULTS

During the study period, a total of 1,636 autopsies were conducted, with 532 cases involving RTAs, out of which 292 cases specifically involved two-wheelers.

- The highest incidence of two-wheeler RTAs was found in the age group of 21-30 years, with a total of 98 cases (33.56%), followed by 68 cases in the age group of 31-40 years (23.29%). The lowest incidence was found in the age group of 0-10 years, with 3 cases (1.03%) [Table/Fig-1].

Age (in years)	No. of cases	Percentage (%)
0-10	3	1.03
11-20	21	7.19
21-30	98	33.56
31-40	68	23.29
41-50	55	18.84
51-60	38	13.01
61-70	9	3.08
Total	292	100

[Table/Fig-1]: Distribution of cases according to age.

- Males outnumbered females, with a total of 256 cases (87.67%) compared to 36 cases (12.33%). The male-to-female ratio was 7.11:1 [Table/Fig-2].

Gender	No. of cases	Percentage (%)
Male	256	87.67
Female	36	12.33
Total	292	100

[Table/Fig-2]: Distribution of cases according to sex.

- Death was most commonly due to coma as a result of intracranial haemorrhages in 214 cases (73.29%), followed by 42 cases of haemorrhagic shock (14.38%). Other causes of death included a combined effect of coma and haemorrhagic shock in 23 cases (7.88%), septicaemia in 5 cases (1.71%), spinal shock in 4 cases (1.37%), and crushed head in 4 cases (1.37%) [Table/Fig-3].

Cause of death	No. of cases	Percentage (%)
Coma	214	73.29
Haemorrhagic shock	42	14.38
Combined- coma and haemorrhagic shock	23	7.88
Septicaemia	5	1.71
Spinal shock	4	1.37
Crush head	4	1.37
Total	292	100

[Table/Fig-3]: Distribution of cases according to the cause of death.

- Subdural Haemorrhage (SDH) alone was the most common type of intracranial haemorrhage, found in 159 cases (74.30%), followed by Epidural Haemorrhage (EDH) in 7 cases (3.27%), and Intracerebral Haemorrhage (ICH) alone in 2 cases (0.93%) [Table/Fig-4].

Type of haemorrhage	No. of cases	Percentage (%)
SDH	159	74.30
SDH+SAH	31	14.49
EDH+SDH	12	5.61
EDH	7	3.27
EDH+SDH+SAH	2	0.93
ICH	2	0.93
SDH+SAH+ICH	1	0.47
Total	214	100

[Table/Fig-4]: Distribution of cases according to type of haemorrhages.
SDH: Subdural haemorrhage; SAH: Subarachnoid haemorrhage; EDH: Extradural haemorrhage; ICH: Intracranial haemorrhage

- The temporal bone was the most commonly involved site of skull fracture, found alone in 44 cases (42.72%), followed by the frontal bone in 18 cases (17.48%), and the parietal bone in 7 cases (6.80%) [Table/Fig-5].

Bone involved	No. of cases	Percentage (%)
Temporal	44	42.72
Frontal	18	17.48
Occipital	11	10.68
Parietal	7	6.80
Temporal+Parietal	6	5.83
Parietal+Frontal	4	3.88
Temporal+Occipital	1	0.97
Parietal+Occipital	1	0.97
Suture	8	7.77
Crush head	3	2.91
Total	103	100

[Table/Fig-5]: Skull bone involvement.

- Linear fracture was the most common type of skull fracture, found in 64 out of 103 cases (62.14%), followed by depressed fracture in 19 cases (18.45%), comminuted fracture in 12 cases (11.65%), and suture fracture in 8 cases (7.77%) [Table/Fig-6].

Type of skull fracture	No. of cases	Percentage (%)
Fissured	64	62.14
Depressed	19	18.45
Comminuted	12	11.65
Suture	8	7.77
Total	103	100

[Table/Fig-6]: Distribution of cases according to type of skull bone fracture.

- The most common time of occurrence of two-wheeler RTAs was between 12 pm and 6 pm, with a total of 134 cases (45.89%), followed by 82 cases (28.08%) between 6 pm and 12 am. A total of 64 cases (21.92%) were found between 6 am and 12 pm, and the least occurred between 12 am and 6 am, with 12 cases (4.11%) [Table/Fig-7].

Time of incidence	No. of cases	Percentage (%)
6 am-12 pm	64	21.92
12 pm-6 pm	134	45.89
6 pm-12 am	82	28.08
12 am-6 am	12	4.11
Total	292	100

[Table/Fig-7]: Time of occurrence of the cases.

DISCUSSION

The study revealed that fractures of the temporal bone were the most common, with linear fractures being the predominant type. SDH was the most frequently encountered type of haemorrhage, and the majority of fatalities resulted from coma.

Out of the 1,636 autopsies conducted during the study period, 532 cases involved RTAs, accounting for 32.52% of the total, which aligns with previous findings by Patel AP et al., [5]. Two-wheeler accidents dominated among the RTAs, with 292 cases (54.89%), consistent with the study by Kumar A et al., where 43.35% of RTA cases involved two-wheeler accidents [6].

The peak incidence of two-wheeler accidents was observed in the age group of 21-30 years, accounting for 98 cases (33.56%). This was followed by 68 cases (23.29%) in the 31-40 years age group and 55 cases (18.84%) in the 41-50 years age group, indicating that 75.68% of the total victims died during the most productive period of their lives. These findings are consistent with previous studies by Sharma RK et al., Kumar R et al., Chaturvedi Y et al., and Hasini BRC et al., [7-10].

Males comprised 256 cases (87.67%) compared to 36 cases (12.33%) in females, resulting in a male-to-female ratio of 7.11:1. These findings are similar to those of Sharma RK et al., Kumar R and Punia RK, Chaturvedi Y et al., Hasini BRC and Singh OG [7-11].

The leading cause of death in the study was coma resulting from head injury, with 214 cases (73.29%), followed by haemorrhagic shock with 42 cases (14.38%), consistent with the findings of Sharma RK et al., [7].

The most common intracranial haemorrhage observed was SDH alone (74.30%), followed by EDH alone (3.27%), in line with the findings of Hasini BRC Malik Y and Chaliha RR, Soni S et al., and Guntheti BK and Singh UP [10,12-14].

The study showed that the maximum number of road traffic incidents occurred between 12 pm and 6 pm (45.89%), contrasting with the findings of Malik Y and Chaliha RR, who reported a peak occurrence from 6 am to 9 am (25.45%) and Chary RS et al., who noted the highest number of cases (45.20%) between 6 am and 12 pm, coinciding with rush hour for students and working people [12,15]. The increased incidence of RTA cases between 12 pm and 6 pm in the present study may be attributed to the physical and mental fatigue towards the end of the workday, leading to decreased reflexes. Additionally, the earlier onset of evening in the Northeastern part of the country and fading light may contribute to increased RTAs, especially during twilight hours.

Fissured fracture was the most common type of skull fracture in the study, consistent with the findings of Malik Y and Chaliha RR, Guntheti BK and Singh UP Singha YN et al., and Hashmi ZA et al., [12,14,16,17].

The most common bone fracture was observed in the temporal bone (42.72%) in the present study, similar to the findings of Hashmi ZA et al., and Arora S and Khajuria B, but contrasting with those of Singha YN et al., and Ramteke BW et al., [16-19].

Limitation(s)

While the present study shed some light on the patterns of fracture and injury in two-wheeler accidents, it had some limitations, including the short duration of the study and the fact that it was a single-centre hospital-based study. A multicentre study might have provided more comprehensive information on the parameters studied. However, certain findings, such as the most common time of these accidents, the type of fractures, and the cause of death in the cases, may reflect the on-road behaviour of the population studied, as well as geographical factors. A more detailed study would be required to corroborate the findings of the present study.

CONCLUSION(S)

Injuries to the skull and brain are the leading causes of death in RTAs. Fissured fracture was the most common type of fracture, with the temporal bone being the most common bone involved in this study. Coma followed by haemorrhage and shock were the leading causes of death. Adequate measures should be taken to prevent mortality and morbidity, which can be achieved by strict enforcement of road safety measures, raising awareness among the people, and improving the road infrastructure along with emergency medical services.

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