International Journal of Medical and Pharmaceutical Research

Online ISSN-2958-3683 | Print ISSN-2958-3675
Frequency: Bi-Monthly
Available online on: https://ijmpr.in/

Original Article

Pattern of Road Traffic Accident Injuries in Medicolegal Cases

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Received: 25-10-2025
Accepted: 17-11-2025
Available online: 30-11-2025

ABSTRACT

Background: Road traffic accidents (RTAs) are a major public health and medicolegal concern, contributing substantially to trauma-related morbidity and mortality. Understanding the pattern and distribution of injuries assists in identifying vulnerable groups and strengthening preventive strategies.
Material and Methods: A hospital-based cross-sectional study was conducted on 320 medicolegal RTA cases over one year. Sociodemographic characteristics, role of road user, mechanism of injury, nature and anatomical distribution of injuries, severity, protective measures, and alcohol involvement were recorded using a structured proforma. Data were summarized using descriptive statistics.
Results: Young adults constituted the largest age group, with 40.0% of victims aged 18–30 years, followed by 29.4% aged 31–45 years. Males accounted for 74.4% of cases. Motorcyclists were the most affected road users (44.4%), followed by pedestrians (18.1%) and pillion riders (16.3%). The most common mechanism of injury was vehicle-to-vehicle collision (43.1%), followed by skid or fall from a two-wheeler (30.0%). Abrasions (66.9%) and contusions (55.6%) were the predominant injury types; fractures occurred in 29.4% of victims, and internal organ injuries in 10.0%. Lower limbs were most frequently involved (48.8%), followed by the head and neck region (43.1%) and upper limbs (38.8%). Moderate injuries were the most common (44.4%), while 25.6% sustained severe injuries. Among two-wheeler users, only 29.9% were wearing helmets. Alcohol was clinically suspected in 13.1% and confirmed in 5.6% of cases.
Conclusion: RTAs primarily affect young male motorcyclists and commonly result in limb and head–neck injuries. Low helmet use and alcohol involvement remain significant preventable contributors. Enhanced enforcement of safety regulations and focused awareness strategies are essential to mitigate the burden of RTA-related injuries.

Keywords*: Road traffic accidents; injury patterns; medicolegal cases; trauma profile*

INTRODUCTION

Road traffic injuries (RTIs) remain a major global public-health problem, causing substantial mortality, morbidity and long-term disability worldwide. The Global Burden of Disease 2019 estimates show that injuries from road traffic crashes account for a large and persistent fraction of injury-related health loss across age groups, with disproportionate effects on young adults and males [1].

Beyond the direct health impact, RTIs impose a significant macroeconomic burden on societies through lost productivity and increased healthcare costs; global estimates indicate sizable economic losses attributable to road injuries across low- and middle-income countries [2].

In India, RTIs are a leading cause of trauma admissions and medicolegal casework. Two-wheelers constitute a large share of the vehicle fleet and are frequently implicated in crashes; observational and hospital-based studies from Indian settings consistently report predominance of young male victims, a high proportion of two-wheeler involvement, and limb and head injuries as common presentations [3,4].

Two preventable factors consistently associated with worse outcomes are low helmet use among motorcyclists and alcohol-impaired driving. Community and roadside observational studies in Indian cities have documented low prevalence of effective (standard, full-face and properly fastened) helmet use, and hospital-based series report substantial proportions of victims with alcohol involvement at the time of crash [3,4].

From a medicolegal perspective, descriptive autopsy and forensic case series emphasize variable injury patterns according to road-user type (pedestrian, two-wheeler rider, four-wheeler occupant) and highlight the forensic importance of systematically documenting injury distribution, mechanism and contributory factors for both clinical management and medico-legal proceedings [5].

Given these public-health, clinical and medicolegal imperatives, we performed a hospital-based cross-sectional study to characterize the pattern of RTA injuries among medicolegal cases presenting to a tertiary center. The study aimed to describe the sociodemographic profile, road-user categories, mechanisms, nature and anatomical distribution of injuries, severity, use of protective measures and alcohol involvement — data intended to inform prevention, clinical care and medicolegal practice.

MATERIAL AND METHODS

Study Design and Setting: This investigation was designed as a hospital-based, descriptive, cross-sectional study .All medicolegal cases presenting with a documented history RTA during the study period were systematically evaluated.

Study Population: The study population consisted of all individuals brought for medicolegal examination following involvement in an RTA, irrespective of age, sex, or type of road user.

Sample Size: A total of 320 consecutive medicolegal cases fulfilling the inclusion criteria were included. Sample size was determined based on the average annual caseload of RTA cases in the institution and the expected variability in injury patterns.

Inclusion Criteria

- Patients or deceased individuals brought for medicolegal evaluation with a confirmed history of involvement in an RTA.
- Cases with complete medicolegal documentation and injury details.

Exclusion Criteria

- Cases with incomplete records or unclear injury descriptions.
- Patients unwilling to provide consent where required (for living victims).
- Injuries unrelated to RTAs (e.g., assault, fall, industrial accidents).

Data Collection Procedure: Data were collected using a structured proforma that captured-

- Sociodemographic details (age, sex, residence).
- Type of road user (driver, rider, pillion rider, pedestrian, passenger).
- Mechanism of the accident (collision, skidding, fall from vehicle, hit-and-run, etc.).
- Type and nature of injuries including abrasions, lacerations, contusions, fractures, visceral injuries, and head trauma.
- Anatomical distribution of injuries, categorized using standard forensic anatomical regions.
- Protective measures used (e.g., helmet, seatbelt), if documented.
- Alcohol or intoxicant involvement, based on medicolegal records.

Clinical records, emergency department notes, radiological reports, and autopsy findings (for fatal cases) were reviewed whenever available.

Classification of Injuries: Injuries were classified according to-

- Nature: soft-tissue injuries, skeletal injuries, visceral injuries.
- Severity: minor, moderate, or severe, based on standard medicolegal criteria and the requirement of hospitalization.
- Body region: head and neck, thorax, abdomen, upper limbs, lower limbs, and multiple-region involvement.

Statistical Analysis: Data were entered in Microsoft Excel and analyzed using SPSS version 26.0. Descriptive statistics including frequencies, proportions, means, and standard deviations were used to summarize variables. The association between injury patterns and selected sociodemographic or accident-related factors was evaluated using Chi-square test, with a significance threshold of $p < 0.05$.

RESULTS

A total of 320 medicolegal RTA cases were evaluated. The sociodemographic distribution is presented in Table 1. Young adults constituted the largest proportion of victims, with 40.0% in the 18–30-year age group, followed by 29.4% in the 31–45-year age bracket. Individuals younger than 18 years and those older than 60 years each accounted for 6.9% of cases. Males comprised 74.4% of the study population, while 25.6% were females. Slightly more victims were from urban areas (58.1%) than rural regions (41.9%).

The pattern of involvement in the traffic event and the mechanism of injury is detailed in Table 2. Motorcyclists represented the largest subgroup (44.4%), followed by pedestrians (18.1%) and pillion riders (16.3%). Drivers of four-wheeled vehicles constituted 14.4% of cases, while passengers in public transport formed the smallest category (6.9%). The most frequent mechanism was vehicle-to-vehicle collision (43.1%), followed by skid or fall from a two-wheeler (30.0%). Pedestrian impacts contributed to 16.9% of injuries, whereas vehicle overturning and hit-and-run events accounted for 5.6% and 4.4%, respectively.

The overall pattern and nature of injuries are summarized in Table 3. Abrasions were the most common lesion (66.9%), followed by contusions (55.6%) and lacerations (35.0%). Fractures were noted in 29.4% of cases, while internal organ injuries and crush injuries were documented in 10.0% and 5.6% of individuals, respectively.

The anatomical distribution and severity of injuries are described in Table 4. The lower limbs were most frequently affected (48.8%), followed by the head and neck region (43.1%) and the upper limbs (38.8%). Injuries involving the chest and abdomen were less common, accounting for 14.4% and 8.8% of cases, respectively. Multiple body regions were involved in 19.4% of victims. With respect to severity, moderate injuries were the most prevalent (44.4%), whereas severe injuries occurred in 25.6% of cases and minor injuries in 30.0%.

Use of protective measures and involvement of alcohol are presented in Table 5. Among two-wheeler users, only 29.9% wore helmets, while 70.1% did not. Alcohol consumption was suspected clinically in 13.1% of victims and confirmed through chemical analysis in 5.6%. The majority (81.3%) showed no evidence of alcohol intake.

. **Table 1. Sociodemographic Characteristics of RTA Victims (n = 320)**

Variable	Category	n	%
Age group (years)	<18	22	6.9
	18–30	128	40.0
	31–45	94	29.4
	46–60	54	16.9
	>60	22	6.9
Sex	Male	238	74.4
	Female	82	25.6
Residence	Urban	186	58.1
	Rural	134	41.9

Table 2. Role in Road Traffic Event and Mechanism of Accident (n = 320)

Variable	Category	n	%
Road user type	Pedestrian	58	18.1
	4-wheeler driver	46	14.4
	Motorcyclist (rider)	142	44.4
	Pillion rider	52	16.3
	Passenger (public transport)	22	6.9
Mechanism of accident	Vehicle–vehicle collision	138	43.1
	Skid/fall from two-wheeler	96	30.0
	Pedestrian hit	54	16.9
	Vehicle overturning	18	5.6
	Hit-and-run	14	4.4

Table 3. Pattern and Nature of Injuries (Multiple Responses; n > 320)

Injury Type	n	%
Abrasions	214	66.9
Contusions	178	55.6
Lacerations	112	35.0
Fractures	94	29.4
Crush injuries	18	5.6
Internal organ injuries	32	10.0

Table 4. Anatomical Distribution and Severity of Injuries (n = 320)

Variable	Category	n	%
Body region involved	Head & neck	138	43.1
	Upper limbs	124	38.8
	Lower limbs	156	48.8
	Chest	46	14.4
	Abdomen	28	8.8
	Multiple regions	62	19.4
Injury severity	Minor	96	30.0
	Moderate	142	44.4
	Severe	82	25.6

Table 5. Protective Measures and Alcohol Involvement

Variable	Category	n	%
Use of helmet (n = 194 two-wheeler users)	Helmet worn	58	29.9
	Helmet not worn	136	70.1
Alcohol involvement (n = 320)	Alcohol suspected	42	13.1
	Alcohol confirmed	18	5.6
	No evidence of alcohol intake	260	81.3

DISCUSSION

This hospital-based series of 320 medicolegal RTA cases found that young adults (18–45 years) and males predominated, motorcyclists comprised the largest road-user group, lower-limb and head–neck injuries were most frequent, and a substantial proportion sustained moderate to severe injuries. Low helmet use among two-wheeler users and the presence of alcohol in a minority of cases were additional notable findings. These patterns largely mirror observations from other hospital- and forensic-based studies and have implications for prevention, clinical care and medicolegal practice.

Age and sex distribution in our cohort — a concentration in young, economically productive males — is consistent with multiple tertiary-center analyses which identify the 18–45 years age band and male preponderance as the groups most affected by RTAs [6,7]. This demographic concentration underlines the broader socioeconomic burden of RTAs and is concordant with national surveillance data showing highest crash incidence and casualties in the young adult population. [7]

The predominance of motorcyclists in our sample (44.4%) reflects the vehicle mix and road-use patterns seen in many low- and middle-income settings. Several Indian tertiary-care series and trauma-center audits report a similar overrepresentation of two-wheeler riders among admitted RTA victims, with corresponding high rates of limb and head trauma [6,8]. Two-wheeler crashes tend to produce focal impact and ejection injuries that disproportionately affect the extremities and head, which explains the anatomical pattern observed in our study (lower limbs 48.8%; head–neck 43.1%). [6,8]

Injury types in our study — abrasions and contusions being common and fractures present in nearly one-third of cases — align with prior emergency-department and trauma-registry reports where mixed soft-tissue and skeletal injuries are frequent among admitted victims [9,10]. The proportion of internal organ injuries (10.0%) and of polytrauma (multiple regions involved in 19.4%) are within ranges reported previously for hospitalized cohorts, underscoring that while many RTA victims sustain superficial injuries, a clinically important minority present with life-threatening intra-abdominal or thoracic trauma requiring urgent intervention [10,11].

Helmet use among two-wheeler users in our study was low (29.9%). Observational studies and hospital series from India consistently document suboptimal helmet wearing (and, importantly, frequent use of non-standard or improperly fastened helmets), which is associated with higher rates and greater severity of head injury and mortality [9]. Intervention studies and natural experiments also indicate reductions in head-injury mortality when helmet laws are enforced and helmet quality/use improves, reinforcing helmet promotion and enforcement as high-impact preventive measures [12].

Alcohol involvement was identified clinically in 13.1% and confirmed biochemically in 5.6% of victims in our series. This is comparable to multiple hospital-based studies which report a variable but non-negligible prevalence of alcohol among injured road users; reported rates vary by setting, case-mix (fatal vs non-fatal), and testing practices, but the consistent finding is that alcohol contributes to crash risk and injury severity in a measurable fraction of cases [11]. Strengthened roadside enforcement and post-crash toxicology can help both prevention and medicolegal documentation.

The distribution by injury severity in our study — with moderate injuries most common (44.4%) and severe injuries in about one-quarter of cases — echoes trauma-center reports showing a broad severity spectrum but a substantial burden of serious injury among admitted RTA victims [10]. This reinforces the need for trauma-system preparedness (triage, prompt imaging, surgical capability) and highlights the medicolegal importance of accurate documentation of injury severity for clinical, administrative and legal processes.

Limitations of this study merit acknowledgement. As a single-center, hospital-based medicolegal series, findings reflect the local caseload and referral patterns and may over represent more serious injuries compared with population-level crash surveillance. Alcohol testing was not uniformly available for all patients, which may underestimate chemical confirmation rates. Finally, detailed information on helmet quality, restraint use in four-wheelers, vehicle speed and road environment were not consistently recorded; these variables would enrich causal inferences about determinants of injury severity.

CONCLUSION

This study demonstrates that road traffic accidents predominantly affect young adult males, with motorcyclists representing the most vulnerable group. Limb injuries—particularly involving the lower extremities—along with head and neck trauma, were the most frequently observed patterns. A considerable proportion of victims sustained moderate to severe injuries, emphasizing the significant clinical and medicolegal burden associated with RTAs. The low uptake of protective measures such as helmet use, combined with detectable alcohol involvement in a subset of cases, highlights preventable contributors to injury severity. Strengthening enforcement of traffic safety regulations, promoting consistent use of protective gear, and implementing targeted public awareness initiatives are essential to reducing the incidence and impact of RTA-related injuries.

REFERENCES

1. GBD 2019 Diseases and Injuries Collaborators. Global burden of 369 diseases and injuries in 204 countries and territories, 1990-2019: a systematic analysis for the Global Burden of Disease Study 2019. Lancet. 2020 Oct 17;396(10258):1204-1222. doi: 10.1016/S0140-6736(20)30925-9.
2. Chen S, Kuhn M, Prettner K, Bloom DE. The global macroeconomic burden of road injuries: estimates and projections for 166 countries. Lancet Planet Health. 2019 Sep;3(9):e390-e398. doi: 10.1016/S2542-5196(19)30170-6.
3. Setty NKH, Sukumar GM, Majgi SM, Thonse UV, Ramesh N. Prevalence and factors associated with effective helmet use among motorcyclists in Mysuru City of Southern India. Environ Health Prev Med. 2020;25:47. doi:10.1186/s12199-020-00888-z.
4. Neeluri R, Anga VS. A study on victims of road traffic accidents attending casualty in a tertiary care hospital, Khammam. Int J Community Med Public Health. 2018;5(7):3034-3038. doi:10.18203/2394-6040.ijcmph20182644.
5. Ambade VN, Sirsat KB, Manu S. Pattern of injuries in different types of victims of road traffic accident in central India: a comparative study. J Forensic Sci Res. 2021;5:7-11.
6. Mohanty CR, Radhakrishnan RV, Jain M, Sasmal PK, Hansda U, Vuppala SK, et al. A Study of the Pattern of Injuries Sustained from Road Traffic Accidents Caused by Impact with Stray Animals. J Emerg Trauma Shock. 2021 Jan-Mar;14(1):23-27. doi: 10.4103/JETS.JETS_29_20.
7. Sahu MR, Mohanty MK, Sasmal PK, Radhakrishnan RV, Mohanty CR, Shaji IM, et al. Epidemiology and patterns of road traffic fatalities in India pre- and post-motor vehicle (Amendment) act 2019: An autopsy-based study. Int J Crit Illn Inj Sci. 2021 Oct-Dec;11(4):198-203. doi: 10.4103/ijciis.ijciis_51_21.
8. Sharma N, Kumar Sv V, Mangal DK, Sharma Y, Bairwa M, Babu BV. Pattern of Road Traffic Injuries and Their Pre-hospitalization Factors Reported at a Public Tertiary Healthcare Facility and Rural Private Healthcare Facility in Rajasthan, India. Cureus. 2023 May 23;15(5):e39390. doi: 10.7759/cureus.39390.
9. Hounkpè Dos Santos B, Kpozehouen A, Glèlè Ahanhanzo Y, Daddah D, Levêque A, Coppieters Y. Helmet Use Among Two-Wheeler Riders' Road Accident Victims in Benin. J Epidemiol Glob Health. 2022 Dec;12(4):552-559. doi: 10.1007/s44197-022-00077-x.
10. Mitra S, Sarkar AP, Saren AB, Haldar D, Saha I, Sarkar GN. Road Traffic Injuries: A Study on Severity and Outcome among Inpatients of a Tertiary Care Level Hospital of West Bengal, India. J Emerg Trauma Shock. 2018 Oct-Dec;11(4):247-252. doi: 10.4103/JETS.JETS_138_17.
11. Woyessa AH, Heyi WD, Ture NH, Moti BK. Patterns of road traffic accident, nature of related injuries, and post-crash outcome determinants in western Ethiopia - a hospital based study. Afr J Emerg Med. 2021 Mar;11(1):123-131. doi: 10.1016/j.afjem.2020.09.008.
12. Marya J, Dhirawani RB, Dube G, Pathak S, Dausage P, Kaur J. Impact of compulsory helmet legislation on mortality rate and types of head and facial injuries in Jabalpur. J Oral Maxillofac Surg Med Pathol. 2017;29(1):24-28. doi:10.1016/j.ajoms.2016.08.008.