ORIGINAL ARTICLE

Epidemiological determinants and characteristics of road Traffic Accident cases admitted to KGMU, a Tertiary Care Hospital

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ABSTRACT

Background: Road traffic accidents (RTAs) represent a major public health concern, particularly in low- and middle-income countries like India, where they contribute substantially to both morbidity and mortality. **Aim and Objective:** To evaluate the epidemiological determinants, patterns of injury, and outcomes of healthcare related road traffic accidents in order to determine risk factors and recommend evidence-based prevention and management strategies. **Methodology**: A prospective observational hospital-based stdy was performed. Patients admitted due to road traffic accidents between 2019–2020 were enrolled. Data were collected within 24–48 hours of admission using a structured, pre-tested questionnaire covering socio-demographic details, vehicle type, safety measures, and injury characteristics. In cases where patients could not respond, attendants or relatives were interviewed. Data were entered into Microsoft Excel 2013 and analyzed using SPSS version 26. **Results:** Among 821 Road traffic accidents patients, 91% were males, with two-wheelers involved in 72.6% of cases. Only 6.3% used helmets/seatbelts. Mixed injuries (64.8%) predominated, and most patients were drivers (72.5%), often referred from district hospitals (43.4%). **Conclusion:** Road traffic accidents largely affect young male two-wheeler drivers with poor safety compliance. Strengthening law enforcement, road safety awareness, and trauma care at peripheral centers is crucial to reduce morbidity and mortality.

KEYWORDS

Traffic; Injury; Accidents Prevention; Trauma Center; Safety

INTRODUCTION

Road traffic accidents (RTAs) remain a major global public health challenge. Approximately 1.35 million people die each year due to RTAs, and millions more suffer non-fatal injuries leading to long-term disabilities.(1) Low- and middle-income countries, including India, account for more than 90% of these deaths compared to high-income countries.(2)

India contributes nearly 11% of global road traffic fatalities and ranks first worldwide in terms of the number of deaths from RTAs.(3) The fatality rate in India is reported to be 20 times higher than in developed nations, and vulnerable road users—particularly motorcyclists, bicyclists, and pedestrians—constitute the majority of victims.(4) Poor traffic safety laws enforcement, low compliance with helmet and seatbelt use, alcohol consumption, distracted driving, and inadequate road infrastructure are among the key risk factors contributing to this burden.(5)

Recent Indian studies continue to highlight predominance of RTAs among young, economically productive males, with two-wheelers being the most commonly involved vehicles and poor safety compliance worsening outcomes.(6,7) Despite various governmental and legislative efforts, RTAs incidence remains high. Notably, hospital-based data from North India, especially from tertiary trauma centres, remain limited. Such data are crucial to inform local road safety policies, strengthen trauma care systems, and guide preventive interventions.

Aims & Objectives

To evaluate the epidemiological determinants, patterns of injury, and outcomes of healthcare related road traffic accidents in order to determine risk factors and recommend evidence-based prevention and management strategies

MATERIAL & METHODS

Study type & study design: Prospective observational study

Study setting: Department of Trauma Surgery, King George's Medical University (KGMU), Lucknow

Study population: Road traffic accident victims

Study duration: January 2019 to December 2020

Sample size: Patients admitted to the hospital between December 2019 and November 2020 who met the predefined inclusion and exclusion criteria were enrolled in the study

Inclusion criteria:

- Patients of all age groups
- Patients admitted within 48 hours of accident
- Patients who gave informed consent

Exclusion criteria:

- Patients dead on arrival
- Patients unwilling to participate
- Patients with incomplete records

Data Collection: Data were collected within 24–48 hours of admission using a pre-tested, structured questionnaire covering socio-demographic details, vehicle type, use of safety measures, environmental conditions, injury characteristics, and referral history; for non-communicative patients, attendants or relatives were interviewed.

Operational definitions were used for clarity: an RTA was defined as any injury resulting from vehicular collision on a public road involving at least one motorized vehicle; helmet/seatbelt use referred to reported use at the time of accident; injuries were classified as blunt, penetrating, or mixed; and outcome referred to patient status at discharge. Potential confounding factors such as alcohol use, time of accident, comorbidities, weather, and referral source were considered in the analysis.

Ethical clearance & informed consent: Ethical approval was obtained from the Institutional Ethics Committee of KGMU **(Approval No.160/Ethics/R.Cell-17 Dated 22/04/2017)**, and written informed consent was secured from all participants or their legal guardians, ensuring confidentiality of data.

Data analysis: Data were entered into Microsoft Excel 2013 and analyzed using SPSS version 26.0; descriptive statistics were applied, Chi-square test was used for categorical comparisons, and Kruskal–Wallis test for non-parametric data, with a p-value <0.05 considered significant.

RESULTS

Figure-1 shows a significant male predominance, indicating that males are more frequently involved in incidents leading to hospitalization. This could be due to higher exposure to risk factors such as driving, riding motorcycles, or working in hazardous environments.

Figure1: Gender distribution of road traffic accident patients

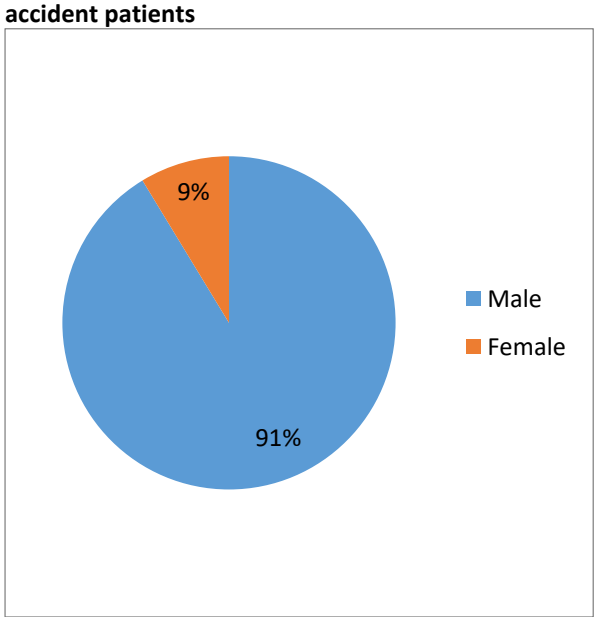
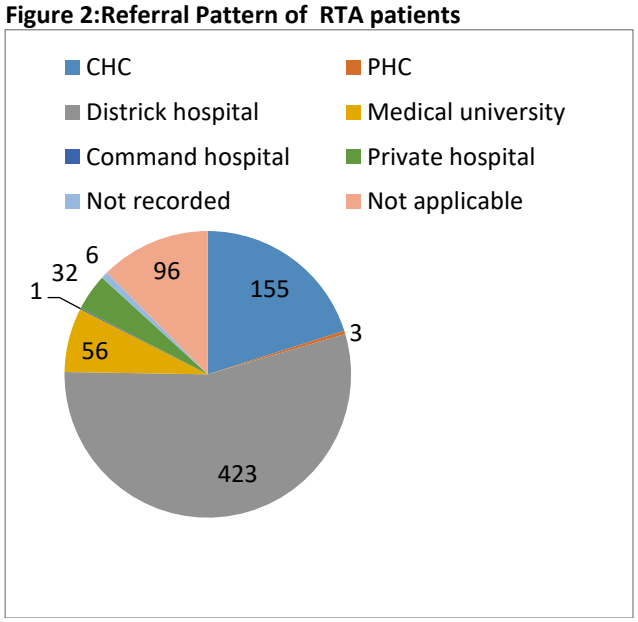


Figure 2:Referral Pattern of RTA patients



The data has been presented as N (%).

The majority of patients were referred from district hospitals, followed by community health centers (CHCs) and medical universities. A significant number of patients were categorized as "Not Applicable," which may indicate direct admissions or cases that did not require referrals. Not applicable: This category was used when the variable did not apply to the patient's context. Not recorded: This category was used when information was missing or not documented in the hospital records at the time of data collection. (Figure-2)

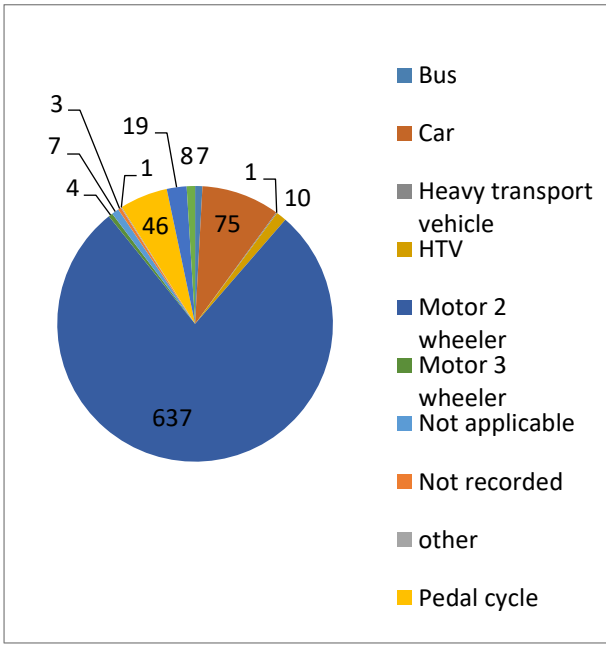
Table 1:Distribution of types of injuries among RTA patients

Dominant type	Numbers (%)
Blunt	269 (33.0%)
Mixed	528**(64.8%)**
Other	1 **(0.1%)**
Penetrating	15 (1.8%)

The data has been presented as N (%).

Mixed injuries were the most common, suggesting multiple-impact trauma, often seen in road traffic accidents. Blunt trauma was the second most frequent, possibly due to falls, vehicle collisions, or pedestrian injuries. Penetrating injuries were relatively rare, indicating a lower incidence of stab or gunshot wounds in the dataset. (Table-1)

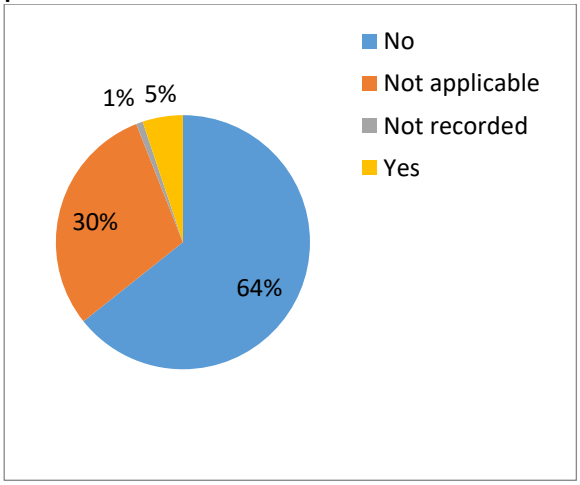
Figure 3:Type of vehicles involved in road traffic accidents



The data has been presented as N (%).

Motor 2-wheelers were the most frequently involved vehicles, reinforcing the well-known vulnerability of motorcyclists in road traffic accidents. Cars contributed significantly lower than motorcycles, but still a notable factor. Pedal cycle-related injuries indicate a risk among cyclists, possibly due to unsafe road conditions or lack of cycling infrastructure.Not applicable: This category was used when the variable did not apply to the patient's context. Not recorded: This category was used when information was missing or not documented in the hospital records at the time of data collection. (Figure-3)

Figure 4: Use of Safety Measures among RTA patients



The data has been presented as N (%).

Majority of patients did not use helmets or restraints, suggesting poor compliance with safety measures (Figure-4). This highlights an urgent need for stricter enforcement of helmet and seatbelt laws to reduce injury severity in road accidents. Not applicable: This category was used when the variable did not apply to the patient's context. Not recorded: This category was used when information was missing or not documented in the hospital records at the time of data collection.

Table 2: Role of patient at time of accident

Patient Role	Numbers (%)
Driver	558 (72.5%)
front seat passenger	45 (5.8%)
Not recorded	1**(0.1%)**
other	6**(0.8%)**
other passenger	1 (0.1%)
Pedistrian	68 (8.8%)
Pillion roder	93 (12.1%)
Rear seat passenger	42 (5.5%)
Unknown	7 (0.9%)

Drivers formed the largest group, followed by pillion riders and pedestrians, indicating that those in control of vehicles or exposed to traffic are at the highest risk. Rear seat passengers and front seat passengers had lower numbers, possibly due to seatbelt use or vehicle safety measures. Pedestrians being 8.8% of the injured population calls for better pedestrian safety measures, such as improved crossings and awareness programs. Not recorded: This category was used when information was missing or not documented in the hospital records at the time of data collection. (Table-2)

Table3:Glasgow Coma Scale (GCS) responses among RTA patients

GCS eye	
None	46 (6%)
To pressure	192 (23%)
To sound	246 (30%)
Spontaneous	333 (41%)
GCS verbal	
None	42 (5%)
Sounds	45 (5%)
Words	193 (24%)
Confused	168 (21%)
Oriented	368 (45%)
GCS Moter	
None	21 (3%)
Extension	11 (1%)
Abnormal flexion	58 (7%)
Normal flexion	88 (11%)
Localising	176 (21%)
Obet commands	463 (57%)

Table-3 presents the distribution of Glasgow Coma Scale (GCS) scores across three response categories: eye, verbal, and motor.

GCS Eye Response: Majority of patients exhibited a spontaneous eye response, indicating normal alertness; followed by response to sound, suggesting moderate impairment and response to pressure. Very few patients showed no eye-opening, indicating severe impairment.

GCS Verbal Response: Majority of patients were oriented, reflecting intact verbal function; followed by the patients who produced incomprehensible words and who were confused. An equal number of patients exhibited only sounds and had no verbal response, indicating severe neurological compromise.

GCS Motor Response: The majority obeyed commands, showing intact motor function. 21% had localized pain, 11% displayed normal flexion, and 7% had abnormal flexion. 1% showed extension, and 3% had no motor response, reflecting severe neurological impairment.

Table 4: Comparison of GCS Eye Response with Consciousness Level

GCS eye	Alert	No	Semi-conscious	Unconscious	Yes	P VALUE
Mean	3.072	3.294	3.051	2.893	3.065	0.45
Std. Deviation	0.9527	0.8852	0.9194	0.9279	0.9081	
GCS verbal						
Mean	3.934	4.059	3.971	3.911	3.857	0.86
Std. Deviation	1.216	1.391	1.126	1.254	1.167	
GCS motor						
Mean	5.176	5.294	5.170	4.964	5.234	0.51
Std. Deviation	1.251	1.359	1.181	1.264	1.169	

Table-4 examines the relationship between GCS eye response and consciousness status (alert, semi-conscious, unconscious). The mean GCS eye scores for alert patients, semi-conscious, and unconscious patients is given in the table. The p-value suggests no statistically significant difference in GCS eye response across consciousness levels. Also compares GCS verbal response across different consciousness states. The mean verbal score for alert, semi-conscious and unconscious patients is presented in the table. The p-value for this comparison suggests no statistically significant association between verbal response and consciousness level. Motor responses were compared across different levels of consciousness. The p-value generated from mean motor responses for alert, semi- conscious and unconscious patients suggests no significant difference in motor responses across consciousness levels.

DISCUSSION

This study revealed a marked predominance of male RTA victims, accounting for 91% of cases. This trend is consistent with findings from several other studies(4,8)**,** which suggest that men are more frequently involved in RTAs due to greater exposure to road travel and a higher tendency to engage in risky behaviors, such as speeding and driving under the influence **(Figure 1)**. The majority of patients were referred from district hospitals (55%), followed by community health centers (20%)

(Figure2). The heavy reliance on government hospitals for trauma care has also been highlighted in previous research(9-12)**.** This reflects the importance of improving trauma management systems at primary and secondary health facilities to ease the load on tertiary care centers.
Mixed injuries (64.8%) were the predominant type, followed by blunt trauma (33.0%) **(Table 1).** Previous studies(10,13) reported similar patterns of injury, especially among motorcyclists, and advocated for stricter road safety rules and enforcement of helmet laws. Motorized two-wheelers were responsible for 78% of RTAs **(Figure 3),** as seen in study by Hadaye et al.(12)**.** This is in line with national trends that show motorcyclists as among the most exposed road users, requiring tighter safety controls, such as the wearing of protective equipment. Yet, only 5% of patients admitted to wearing helmets or seatbelts, while 64% did not adhere to safety precautions **(Figure 4).** The same level of non-compliance, demanding increased public awareness campaigns and increased law enforcement (5-7,13)**.**

Drivers comprised the majority of victims (72.5%), pillion riders came next (12.1%), and pedestrians were the least (8.8%) **(Table 2**). The comparatively high percentage of pedestrian injury is in accordance with previous research findings (12-14)**,** which highlights the importance of improved pedestrian infrastructure and crosswalks. Testing with the Glasgow Coma Scale (GCS) revealed different extents of neurological impairment **(Table 3),** but no statistically significant difference was found between consciousness levels **(Table 4)**. These findings agree with the previous results(15) and that although GCS is still a useful tool, further clinical evaluation is required for correct prognostication.

The study has several limitations. Being a single-centre investigation, its findings may not be generalizable to other settings or healthcare institutions. The study's duration may also have been insufficient to capture seasonal variations and long-term trends in RTAs. Additionally, the lack of follow-up data limits insights into long-term recovery and outcomes. Notably, the study did not systematically assess alcohol or drug use critical risk factors for RTAs. Furthermore, the exclusion of pre-hospital fatalities may have led to an underestimation of the true severity of RTAs. Future research should aim to address these limitations through multi-center studies, longer follow-up periods, and more comprehensive data collection strategies."

CONCLUSION

This study, conducted at a tertiary care hospital in Lucknow, revealed that the majority of road traffic accident victims were young males, predominantly drivers of two-wheelers, with very poor compliance to helmet and seatbelt use. Mixed injuries were the most common presentation, and a large proportion of patients were referred from district hospitals, highlighting the dependence on higher centers for trauma management. Although neurological impairment was observed in many cases, Glasgow Coma Scale variations did not show significant differences in consciousness levels. These findings underscore the urgent need for stricter enforcement of traffic safety laws, especially helmet and seatbelt use, strengthening of trauma care facilities at primary and secondary levels, and public awareness campaigns targeting high-risk groups such as young two-wheeler riders.

RECOMMENDATION

The public health burden of road traffic accidents is very high, particularly among young male two-wheeler users who have poor safety compliance. There is a dire need for strengthening enforcement of helmet and seatbelt laws, along with targeted awareness campaigns, to reduce preventable injuries. Improvements in road infrastructure, such as exclusive lanes and safer space for pedestrians, can further minimize crash risks. The capacity improvement for trauma care should also be enhanced at district and peripheral centre by developing efficient pre-hospital and referral systems to treat early and minimize poor outcomes. Establishment of robust trauma registries and routine surveillance will facilitate evidence-based policies to reduce morbidity and mortality related to RTA.

LIMITATION OF THE STUDY

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Relevance of the Study

This study provides updated, region-specific epidemiological evidence on road traffic accidents from a major tertiary trauma center in North India, highlighting the high burden among young male two-wheeler drivers and the extremely low compliance with safety measures. It thus underlines the critical lacunae in road safety practices, pre-hospital care, and referral pathways. By documenting injury patterns, referral profiles, and neurological status using GCS, the study adds valuable data for local policymakers and health planners. It strengthens the evidence base required to devise targeted interventions aimed at enhancing trauma care, reducing RTA burden, and improving public health preparedness.

Authors Contribution

Rajeev Misra: Conceived the study, designed the methodology, supervised data collection, and reviewed the final manuscript.

Sandeep Tiwari: Contributed to study design, provided clinical expertise, validated injury classifications, contributed to interpretation of findings, and reviewed the manuscript for intellectual content.

Amar C Sharma: Data analysis, tables and figures, manuscript writing, critical revision.

Chakori Nigam: Supported data collection, ensured data accuracy, and assisted in literature review and preliminary drafting.

Surendra Bharti: Organized data acquisition, and assisted with data interpretation and result drafting.

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Nil

Conflict of Interest

There is no conflict of Interest.

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Declaration of Generative AI and AI Assisted Technologies in the Writing Process

The authors haven't used any generative AI/AI assisted technologies in the writing process

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