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Original Research Article

ASSESSMENT OF INJURIES ASSOCIATED WITH DEATHS DUE TO ROAD TRAFFIC ACCIDENTS IN KOKRAJHAR DISTRICT

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ABSTRACT

Road traffic accidents (RTAs) are a leading cause of mortality and morbidity, particularly among young adults in the whole world. This descriptive study, conducted at the Department of Forensic Medicine, Kokrajhar Medical College & Hospital from March 2024 to September 2025, analyzed 237 autopsies of RTA victims. Males constituted 85.7% of cases, with the highest incidence in the 21–30 years age group (32.5%). Most accidents occurred between 6:00 AM and 12:00 Noon on highways and in rural areas. Motorcyclists (40.5%) were the most affected road users. Head and neck injuries were predominant both externally (36.7%) and internally (35.0%), with combined subdural and subarachnoid hemorrhages (59.1%) being most common. Head injury with intracranial hemorrhage (34.2%) was the commonest cause of death. The study underscores the need for strict enforcement of helmet laws, improved rural road safety, and timely trauma care to reduce fatalities.

Keywords: Road traffic accident, injury pattern, head injury, Forensic autopsy.

INTRODUCTION

Road traffic accidents (RTAs) are among the most significant global public health problems, contributing to substantial mortality, morbidity, and economic loss. According to the World Health Organization (WHO), road traffic injuries (RTIs) rank as the eighth leading cause of death worldwide and the foremost cause of mortality among individuals aged 15–29 years, accounting for approximately 1.35 million deaths each year and about 3,700 deaths daily.[1] Nearly half of these deaths involve vulnerable road users such as pedestrians, cyclists, and motorcyclists.[2]

Despite advances in transport systems, RTAs remain an unavoidable consequence of modernization and urbanization. The first recorded motor vehicle fatality occurred in 1896 in the United Kingdom.[3] Since then, rapid motorization, coupled with inadequate road infrastructure, poor traffic law enforcement, and human factors such as intoxication, fatigue, and inexperience, have escalated the frequency and severity of accidents. In most low and middle-income countries, 80% of global road traffic deaths occur, even though they possess only 52% of the world's registered vehicles.[1]

In India, road traffic injuries constitute a growing epidemic, accounting for nearly 12% of all deaths.[4] The socioeconomic consequences of RTAs are profound — including high out-of-pocket medical expenditures, loss of productivity, and long-term disability. Nearly 43% of RTA victims in India require hospitalization exceeding seven days, leading to significant financial and emotional burdens for families.[5]These losses extend beyond healthcare costs to encompass reduced workforce participation, school dropouts, and chronic indebtedness.[6]

From a medico-legal perspective, RTAs are of great forensic relevance. The external and internal injuries sustained by victims—abrasions, contusions, lacerations, and skeletal fractures—serve as crucial evidence for reconstructing the sequence of events in collisions. Detailed forensic examination of such injuries aids in distinguishing between driver,

passenger, and pedestrian victims, assists in identifying hit-and-run cases, and ultimately contributes to legal accountability and accident prevention.

Given the alarming rise in traffic-related fatalities, there is a compelling need for comprehensive epidemiological and forensic studies. Such analyses not only help in understanding the injury patterns and causative mechanisms but also provide a scientific basis for public health interventions and policy formulation aimed at reducing road traffic deaths. The present study is an attempt to analyze the trends, distribution, and injury characteristics in fatal road traffic accidents based on autopsy findings of the cases brought to Kokrajhar Medical College and Hospital, Kokrajhar, thereby emphasizing the critical role of forensic investigation in injury prevention and justice delivery.

MATERIALS AND METHODS

This descriptive study was performed at the Department of Forensic Medicine, Kokrajhar Medical College and Hospital over a period from March, 2024 to September, 2025. All the 237 number of victims, who were either brought dead or admitted in the hospital and died, with history of RTA and subsequently autopsied during the period were considered for the study. The key variables such as age, sex, pattern of injuries, profile of victim, time of death etc were produced from various sources such as Post mortem reports, police inquest papers and hospital records. The clinical data and cause of death were ascertained from the hospital records. Information and various other inputs relating to the time of incidence, manner of incidence, profile of victims etc of road traffic accidents gathered from the police. All these observations were later corroborated with the postmortem findings to facilitate the overall process of analysis.

RESULTS

Table 1: Age and gender wise distribution of RTA cases

Age Group (years)	Male No. (%)	Female No. (%)	Total No. (%)
0–10	5 (2.11)	2 (0.84)	7 (2.95)
11–20	28 (11.81)	3 (1.27)	31 (13.08)
21–30	66 (27.85)	11 (4.64)	77 (32.49)
31–40	47 (19.83)	6 (2.53)	53 (22.36)
41–50	33 (13.92)	5 (2.11)	38 (16.03)
51–60	14 (5.91)	4 (1.69)	18 (7.59)
61–70	6 (2.53)	3 (1.27)	9 (3.80)
>70	4 (1.69)	0 (0.00)	4 (1.69)
Total	203 (85.65)	34 (14.35)	237 (100)

Out of 237 fatal road traffic accident cases, 203 (85.7%) were males and 34 (14.3%) were females. The highest number of victims belonged to the 21–30 years age group (32.5%), followed by 31–40 years (22.4%) and 41–50 years (16.0%). The least affected age group was above 70 years (1.7%). The predominance of young adult males indicates higher exposure to occupational and behavioral risk factors such as increased mobility, speeding, and risky driving habits.

Table 2: Circumstances of occurrence of road traffic accidents

Parameter	Category	Number (%)
Time of Occurrence	6:00 AM – 12:00 Noon	119 (50.21)
Place of Occurrence	Highways and PWD Roads	156 (65.82)
Season of Occurrence	Winter	109 (46.00)
Domicile of Occurrence	Rural	196 (82.70)

Road traffic accidents most frequently occurred between 6:00 AM and 12:00 Noon, predominantly on highways and PWD roads, during the winter season, and within rural areas.

Table 3: Distribution of RTA victims based on types of road user

Category of Road User	Number	Percentage
Pedestrian	49	20.67
Bicycle	10	4.22
Motorcycle	96	40.50
Light Motor Vehicle (LMV)	35	14.77
Heavy Motor Vehicle (HMV)	47	19.84
Total	237	100

Motorcyclists constituted the largest group of road traffic accident (RTA) victims (40.50%), followed by pedestrians (20.67%) and heavy motor vehicle occupants (19.84%). This indicates that two-wheelers remain the most vulnerable road users, highlighting the need for improved road safety measures and helmet compliance.

Table 4: Distribution of RTA victims based on types of injuries sustained

Type of Injury	Number	Percentage
Abrasion + Contusion	68	28.70
Abrasion + Contusion + Laceration	57	24.05
Contusion + Laceration	42	17.72
Contusion + Laceration + Fracture	54	22.78
Contusion + Laceration + Fracture + Crush	16	6.75
Total	237	100

The majority of victims sustained multiple soft tissue injuries such as abrasions and contusions (28.70%). Combined injuries involving fractures (22.78%) and crush injuries (6.75%) reflect high-velocity impacts commonly associated with motorcycle and heavy vehicle accidents.

Table 5: Distribution of RTA victims based on body sites of external injuries

Site of External Injury	Number	Percentage
Head & Neck	87	36.70
Chest	36	15.20
Abdomen	23	9.70
Pelvis & Perineum	21	8.86
Extremities	70	29.54
Total	237	100

External injuries were predominantly located in the head and neck region (36.7%), followed by extremities (29.5%). This distribution underscores the vulnerability of the cranial region in RTAs, emphasizing the importance of protective headgear and safe driving practices.

Table 6: Distribution of RTA victims based on body sites of internal injuries

Site of Internal Injury	Number	Percentage
Head & Neck	83	35.02
Chest	29	12.24
Abdomen	61	25.74
Pelvis & Perineum	26	10.97
Extremities	38	16.03
Total	237	100

Internal injuries were most frequently observed in the head and neck region (35.02%), followed by the abdomen (25.74%). This indicates a predominance of head trauma and abdominal organ damage as major contributors to morbidity and mortality in RTAs.

Table 7: Frequency of specific types of intracranial hemorrhages

Type of Intracranial Hemorrhage	Number	Percentage
EDH only	0	0
SDH only	34	14.35
SAH only	11	4.64
ICH only	0	0
EDH + SDH	7	2.95
SDH + SAH	140	59.07
SAH + ICH	7	2.95
EDH + SDH + SAH	35	14.77
SDH + SAH + ICH	3	1.27
Total	237	100

The most common type of intracranial hemorrhage was subdural and subarachnoid combination (SDH + SAH), observed in 59.07% of cases. Pure extradural or intraparenchymal hemorrhages were rare. This reflects the high frequency of diffuse brain injury patterns due to rapid acceleration–deceleration mechanisms in vehicular impacts.

Table 8: Distribution of RTA victims based on cause of death

Cause of Death	Number	Percentage
Head Injury and Intracranial Hemorrhage	81	34.18
Shock and Hemorrhage	74	31.22
Injury to Vital Organs (Liver, Lungs, Kidneys, Spleen)	62	26.16
Septicemia	20	8.44
Total	237	100

Head injury with intracranial hemorrhage was the leading cause of death (34.18%), followed by shock and hemorrhage (31.22%). Injuries to vital organs and septicemia accounted for a smaller proportion, indicating that early management of cranio-cerebral trauma and hemorrhagic shock is crucial in improving survival rates.

DISCUSSION

The present study analyzed 237 fatal road traffic accident (RTA) cases to identify epidemiological trends and medico-legal characteristics in Kokrajhar, Assam. Road traffic injuries remain a major global public health problem, claiming approximately 1.35 million lives each year.[1,2] India contributes significantly to these figures, ranking among the countries with the highest rates of RTA-related fatalities.[6,23]

A marked male predominance (85.7%) was observed, consistent with findings from Shruthi et al,[7]Jha et al,[8] and Singh and Dhattarwal,[9] who reported male proportions ranging from 80–90%. Similar trends have been documented across other developing nations including India, likely due to male's increased outdoor activity, driving occupation, and risk-taking behaviour.[17,21] In contrast, a few studies such as McCarrol et al,[11] and Ghosh,[12] found relatively higher female involvement, attributed to urbanization and increased female mobility in metropolitan areas.

The 21–30 years age group constituted the largest share (32.5%) of fatalities, followed by 31–40 years (22.4%), which aligns with reports by DileepKumar,[13]Ranjan et al,[22] and Aggarwal et al.[14] This economically active age group is exposed to occupational and behavioral risks, making RTAs a significant socio-economic burden. However, some studies such as Sevitt,[18] and Chandra et al,[19] reported slightly higher incidence in the 30–50 years range, possibly reflecting regional differences in vehicular density and lifestyle patterns.

Half of the accidents (50.2%) occurred between 6:00 AM and 12:00 Noon, largely on highways and PWD roads (65.8%). Similar findings were observed by the Ministry of Road Transport and Highways,[6,23] and Singh,[17] who attributed this pattern to high traffic flow during daytime work hours and increased vehicular density on major connecting roads. A rural predominance (82.7%) in the present study parallels the findings of Ranjan et al,[22] and Marak et al.[24] The causes likely include poor road infrastructure, absence of safety barriers, and inadequate emergency medical services.

Contrary to these observations, Maheshwari and Mohan,[21] in Delhi reported a higher number of urban accidents, citing congested traffic and increased pedestrian exposure. Similarly, studies in Western countries (e.g., Galloway & Patel) noted a predominance of urban pedestrian crashes due to dense population and higher motorization levels.[20] This contrast underscores the influence of geographical and infrastructural variations on accident epidemiology.

In the present study, motorcyclists (40.5%) were most commonly involved, followed by pedestrians (20.7%) and heavy motor vehicle occupants (19.8%). Comparable findings were reported by Kumar et al,[5] and Marak et al,[24] reflecting India's rapid increase in two-wheeler ownership coupled with inadequate helmet compliance and poor enforcement of traffic laws.

Conversely, some Western and urban Indian studies, such as those by McCarrol et al,[11] and Maheshwari& Mohan,[21] reported pedestrians as the predominant victims. The discrepancy likely reflects regional differences in traffic composition and enforcement: while rural areas in India are dominated by two-wheelers, urban environments witness greater pedestrian vulnerability.

Soft tissue injuries, particularly abrasions and contusions (28.7%), were the most common, followed by combined fractures and lacerations (22.8%). These findings align with those of Singh,[17] and Jha et al,[8] who reported similar mixed-pattern injuries resulting from high-velocity impacts. Such combined injuries are characteristic of two-wheeler collisions and pedestrian run-overs.

The head and neck region (36.7%) was the most frequently affected site, followed by the extremities (29.5%). Internal injuries also showed head and neck predominance (35.0%), consistent with Tirpude et al,[10] and Chandra et al,[19] who documented cranio-cerebral trauma as the leading cause of death in RTA victims. In contrast, Aggarwal et al,[14] found abdominal and thoracic injuries to be more common, suggesting possible regional variations in crash dynamics or vehicle type.

The SDH + SAH combination (59.07%) was the most frequent hemorrhagic pattern observed, indicating diffuse brain injury due to acceleration–deceleration forces. Similar observations were made by Tirpudeet al.[10] and Aggarwal et al.[14] However, Singh,[17] reported a higher proportion of extradural hemorrhages, particularly in cases of direct cranial impact, highlighting that the type of impact, surface, and vehicular design may influence intracranial bleeding patterns. In this study, head injury and intracranial hemorrhage (34.2%) was the leading cause of death, followed by shock and hemorrhage (31.2%). Comparable findings have been documented by DileepKumar,[13]Marak et al,[24] and Singh,[17] reaffirming head trauma as the principal fatal factor in RTAs. However, Srivastav and Gupta,[15] reported hemorrhagic shock as the predominant cause, possibly due to the inclusion of more blunt abdominal and chest trauma cases.

The smaller proportion of septicemia-related deaths (8.4%) may represent cases where victims survived long enough to develop secondary infections, similar to findings by Ghosh,[12] and Ranjan et al.[22]

This again reflects lapses in trauma care and limited tertiary care facilities in rural areas.

CONCLUSION

The overall findings of this study corroborate the results of numerous Indian studies,[7-9,13,17,24] reaffirming that young adult males are the most vulnerable group and head injury remains the principal cause of mortality. Nevertheless, some contrasting reports,[11,15,19,21]indicate regional variation in victim profiles and injury patterns, emphasizing that local socio-economic and infrastructural factors play a decisive role in determining fatality trends.

From a preventive standpoint, the results highlight the urgent need for:

- Stringent enforcement of helmet and seatbelt laws,
- Development of safer rural road networks and improved lighting,
- Public awareness programs targeting young riders, and
- Strengthening pre-hospital trauma care and emergency referral systems.

According to WHO's recent reports,[1,2] a multidisciplinary approach involving education, engineering, enforcement, and emergency care is critical to achieving the goal of reducing RTA fatalities by 50% under the UN Decade of Action for Road Safety (2021–2030).

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