

# Pattern of Injuries in Fatal Road Traffic Accidents: An Autopsy-Based Study in a Tertiary Care Hospital of Tripura

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## ABSTRACT

**Background:** Road traffic accidents (RTAs) are a leading cause of mortality worldwide, particularly in developing countries like India. This study aims to analyze the demographic profile, injury patterns, and causes of death in fatal RTA cases through autopsy-based evaluation.

**Methods:** A cross-sectional autopsy-based study was conducted at the Department of Forensic Medicine, AGMC & GBP Hospital, Tripura, from 2022 to 2025. A total of 397 medico-legal autopsy cases were included. Data were collected from inquest reports, hospital records, and autopsy findings, and analysed using SPSS.

**Results:** Most victims were males, predominantly in the 21–40 years age group. Most accidents occurred during evening hours, with hit-and-run cases being the most common. Abrasions (88.66%) and lacerations (81.11%) were the most frequent external injuries. Head injury was the leading cause of death (50.63%), followed by shock and haemorrhage (37.03%). Subarachnoid haemorrhage was the most common intracranial haemorrhage. Alcohol was detected in a significant number of cases.

**Conclusion:** RTAs predominantly affect young adult males, with head injuries being the major cause of death. Early mortality indicates severe trauma and gaps in emergency care. Strengthening trauma services, strict enforcement of traffic laws, and increasing public awareness are essential to reduce RTA-related deaths.

**Key-words:** Road traffic accident (RTA), Autopsy, Head injury, Injury pattern, Cause of death, Subarachnoid haemorrhage, Un-natural death

## INTRODUCTION

WHO defined an accident as an unexpected, unplanned occurrence that may involve injury. Traffic accident fatality is reported as “Un-natural death” under section 174 CrPC (now 194 BNSS) and in India, police conduct an inquest in the presence of two independent witnesses.

After that, the police send the dead body for a medicolegal autopsy to prove any causal relationship between the accident and death, and to determine the cause of the accident. <sup>[1]</sup> Road traffic accident (RTA) is any vehicular accident occurring on the roadway i.e., originating on, terminating on, or involving a vehicle partially on the roadway. It may include collision of an automobile with a pedestrian, or another automobile or with a non-automobile on the roadway or a fall from a moving vehicle, causing injuries or death of the involved individuals. <sup>[2]</sup>

Amongst all traffic accidents, road traffic accidents claim the largest toll of human life and tend to be world’s most serious health-related problems. As elsewhere in the

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world, the causes of road accidents are faulty vehicles, uneven roads, careless/reckless driving, speeding, drunk driving, inadequate sleep, foggy weather, alcohol and other drug effects, and many more. <sup>[3]</sup> In India, over 80,000 persons die in traffic crashes annually, over 1.2 million are seriously injured, and about 3,000,000 are turned off permanently <sup>[1]</sup>. According to the latest report to the National Crime Records Bureau, the total annual deaths due to road traffic accidents in our country have crossed 1.18 lakh. In India, the rate of RTAs is 7.5 accidents per 1000 vehicles. <sup>[6]</sup>

The pattern of injury, fatal and otherwise, varies significantly depending upon whether the victim is a vehicle occupant, a motorcyclist, a pedal cyclist or a pedestrian. <sup>[7]</sup> Various injuries may result from vehicular accidents, depending on the following factors: site of impact; direction of impact; force of impact; vehicle design; vehicle behaviour after impact (e.g., overturning); ejection of a victim; supervening factors (e.g., fire). <sup>[10]</sup>

Internal injuries may be fractures, rupture of viscera, destruction of major arteries, etc. Fatality in RTAs can be due to immediate causes like haemorrhage, injury to vital organs, vagal inhibition, neurogenic shock, embolism, etc. and late causes like infection, complications of injuries, etc. Early detection of the injury and prompt treatment are necessary to save the lives of many of these victims. <sup>[11,12]</sup> The findings of this study provide valuable insights for public and private healthcare systems in understanding the prevalence and patterns of injuries caused by road traffic accidents, thereby aiding in the formulation of effective preventive and management strategies.

## MATERIALS AND METHODS

**Study Design and Setting-** This was a descriptive, autopsy-based cross-sectional study conducted in the Department of Forensic Medicine and Toxicology at Agartala Government Medical College (AGMC) & GBP Hospital, Tripura. The institute is a tertiary care centre serving a large population and receives a significant number of medico-legal cases, including fatal road traffic accidents (RTAs). All medico-legal autopsies are conducted as per standard forensic protocols. The study was conducted over three years, from 2022 to 2025.

**Study Population and Sample Size-** The study population comprised all cases of fatal road traffic accidents brought for medico-legal autopsy to the Department of Forensic Medicine during the study period. A total of 397 cases fulfilling the inclusion criteria were included in the study.

**Inclusion Criteria-** All cases of fatal road traffic accidents subjected to medico-legal autopsy during the study period were included, irrespective of age, sex, or type of accident.

**Exclusion Criteria-** Cases with advanced decomposition, mutilated bodies, or incomplete records that could interfere with the proper assessment of injuries and cause of death were excluded from the study.

**Data Collection Procedure-** Data were collected retrospectively from multiple sources, including inquest reports conducted by investigating authorities, hospital treatment records (where available), and detailed autopsy findings. Each case was carefully reviewed to extract relevant information. Autopsies were performed following standard dissection techniques, and both external and internal examinations were carried out to document injury patterns and determine the cause of death.

**Variables Studied-** The variables analyzed in the study included demographic details such as age, sex, and domicile; circumstances related to the accident, such as type of vehicle and nature of incident (hit and run, head-on collision, etc.); pattern of external and internal injuries; and the final cause of death as determined during autopsy. Associated findings such as intracranial hemorrhage and presence of alcohol (based on toxicological analysis reports) were also studied where available.

**Statistical Analysis-** The collected data were compiled, coded, and entered into Microsoft Excel and subsequently analysed using the Statistical Package for the Social Sciences (SPSS) software (Version 20/23). Descriptive statistics, including frequencies and percentages, were calculated. Inferential statistical analysis was performed using the Chi-square test to assess associations between variables, and p-values <0.05 were considered statistically significant.

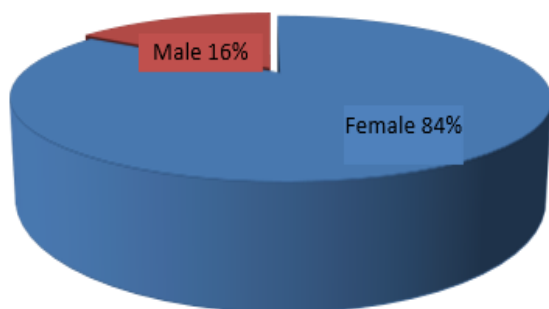
## RESULTS

Table 1 shows the age-wise distribution of the study subjects. Most victims belonged to the 21–30 years age group (25.69%), followed by the 31–40 years (20.91%) and 41–50 years (19.65%) age groups. Very few cases were observed at the extremes of age, with only 3.27% in the 0–10 years group and 7.81% in the 60+ years group. This indicates that young and middle-aged individuals are more commonly affected.

**Table 1:** Age Distribution (N=397)

Age Group (yrs)	N	Percentage (%)
0-10	13	3.27
11-20	47	11.84
21-30	102	25.69
31-40	83	20.91
41-50	78	19.65
51-60	43	10.83
>60	31	7.81

Fig. 1 shows the gender distribution of the study subjects. Most victims were females (84%), while males accounted for 16% of cases, indicating female predominance in the present study.



**Fig. 1:** Gender Distribution

Table 2 presents the distribution of cases by time of occurrence. Most accidents occurred during the evening hours (44.84%), followed by morning (33.75%) and night (21.41%). This suggests a higher incidence of RTAs during peak activity hours.

**Table 2:** Time of occurrence (N=397)

Time of Death	N	Percentage (%)
Evening (12:01 PM- 08 PM)	178	44.84
Morning (05:01 AM-12 PM)	134	33.75
Night (08:01 PM- 05 AM)	85	21.41

Table 3 shows the distribution of cases by incident type. Hit-and-run cases were the most common (51.64%), followed by head-on collisions (28.21%), collisions from behind/side (14.86%), and accidents involving stationary objects (5.29%).

**Table 3:** Nature of incident (N=397)

Nature of Incident	N	Percentage (%)
Hit and run	205	51.64
Head on collision	112	28.21
Collision from behind/side	59	14.86
Hitting stationary object	21	5.29
Total	397	100

The most common pattern of external injury among the study subjects was abrasion (88.66%), followed by laceration (81.11%) and contusion (39.29%). Fracture was found in 13.35% of the subjects, while crush injury was found in 11.34% (Table 4).

**Table 4:** Type of external injury

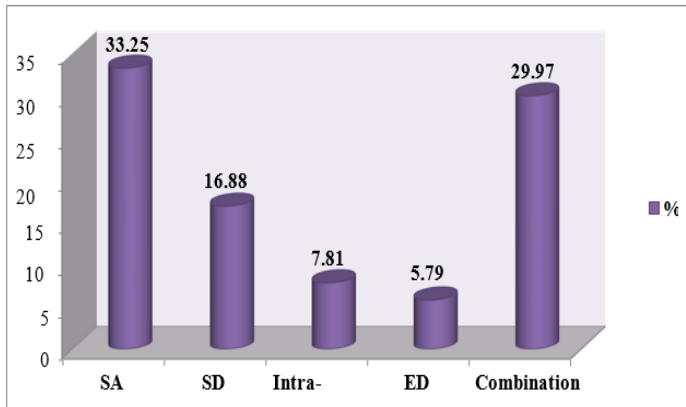
Pattern of External Injury	N	Percentage (%)
Abrasion	352	88.66
Laceration	322	81.11
Contusion	156	39.29
Fracture	53	13.35
Crush Injury	45	11.34
Incised	7	1.76

Table 5 presents the causes of death among the victims. Head injury was the leading cause (50.63%), followed by shock and haemorrhage (37.03%). Other causes included septicaemia (5.79%), haemorrhagic shock (5.54%), and spinal injury (1.01%).

**Table 5:** Profile of cause of death (N=397)

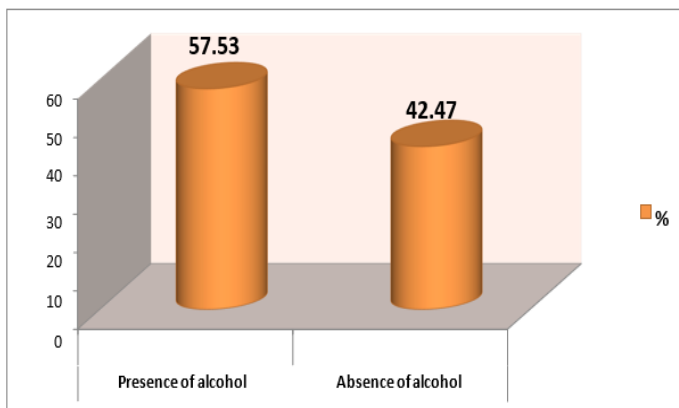
Cause of Death	N	Percentage (%)
Head Injury	201	50.63
Shock & Haemorrhage	147	37.03
Septicaemia	23	5.79
Haemorrhagic shock	22	5.54
Spinal injury	4	1.01
Total	397	100

Fig. 2 illustrates the types of intracranial haemorrhage observed. Subarachnoid haemorrhage (33.25%) was the most common, followed by subdural haemorrhage (16.88%), intracerebral haemorrhage (7.81%), extradural haemorrhage (5.79%), and combinations (29.97%).



**Fig. 2:** Type of intracranial haemorrhage

Fig. 3 depicts the presence of alcohol among the study subjects based on toxicological analysis. Alcohol was detected in 57.53% of cases, while 42.47% showed the absence of alcohol.



**Fig. 3:** Bar diagram showing associated presence of ethyl alcohol

## DISCUSSION

The present study provides valuable insights into the demographic profile, injury patterns, and causes of death in fatal road traffic accident (RTA) cases. The findings are largely consistent with previous national and international studies [10–12].

In the present study, a predominance of female victims was observed, which is contrary to most studies where males are more commonly affected due to higher outdoor exposure and risk-taking behavior [10,11]. This

variation may be attributed to regional, social, or reporting differences and warrants further investigation. Most victims belonged to the 21–30 years age group, followed by 31–40 years, indicating that young and economically productive individuals are at higher risk of fatal RTAs. Similar observations have been reported in other studies [12,13].

Regarding the timing of accidents, most occurred during the evening hours, followed by the morning and night. This could be due to increased traffic density, fatigue after work, and reduced visibility during evening hours [14].

Regarding the nature of incidents, hit-and-run cases accounted for the majority, followed by head-on collisions, reflecting poor enforcement of traffic regulations and a lack of driver accountability [15].

Analysis of injury patterns revealed that abrasions and lacerations were the most common external injuries, consistent with blunt force impact mechanisms in RTAs [10]. Head injury was identified as the leading cause of death, followed by shock and haemorrhage, which agrees with multiple studies [11,16].

Among intracranial haemorrhages, subarachnoid haemorrhage was the most frequently observed type [17]. Additionally, the presence of alcohol in a significant proportion of cases highlights its role as an important contributing factor in road traffic accidents [7,18]. The high proportion of deaths occurring within a short duration indicates the severity of trauma and possible deficiencies in pre-hospital care and emergency response systems [14,18].

## LIMITATIONS

This study has certain limitations. It is a single-center study, which may limit the generalizability of the findings. The sample size, although adequate, is relatively limited. Additionally, a lack of follow-up data limits the assessment of long-term outcomes and complications.

## CONCLUSIONS

Road traffic accidents predominantly affect the young and economically productive population, leading to significant loss of life and societal burden. Head injury remains the leading cause of death, followed by shock and haemorrhage, highlighting the critical role of timely intervention and advanced trauma care. Most deaths occurring within a short duration reflect the severity of

injuries and possible gaps in pre-hospital care and emergency response systems. These findings emphasise the urgent need to strengthen trauma care infrastructure, improve rapid transport facilities, and ensure early medical intervention. Strict enforcement of traffic regulations, promotion of helmet and seatbelt use, and public awareness regarding road safety are essential preventive measures. In the future, multicenter studies with larger sample sizes and inclusion of follow-up data are recommended to provide a more comprehensive understanding and to develop effective strategies to reduce RTA-related mortality.

### CONTRIBUTION OF AUTHORS

**Research concept-** Dr. Nirban Das.

**Research design-** Dr. Nirban Das.

**Supervision-** Dr. Jayanta Sankar Chakraborty, Dr. Pradipta Narayan Chakraborty.

**Materials-** Dr. Nirban Das.

**Data collection-** Dr. Nirban Das.

**Data analysis and interpretation** Dr. Nirban Das.

**Literature search-** Dr. Nirban Das.

**Writing article-** Dr. Nirban Das.

**Critical review-** Dr. Jayanta Sankar Chakraborty, Dr. Pradipta Narayan Chakraborty.

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**Final approval-** Dr. Jayanta Sankar Chakraborty, Dr. Pradipta Narayan Chakraborty.

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