

Pattern of Injuries in Fatal Road Traffic Accident – A Cross-Sectional Study

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Abstract

Aim: To assess the pattern of injuries in fatal road traffic accidents.

Material & Methods: The present cross-sectional study was conducted at the Department of Forensic Medicine & Toxicology after due approval from the ethical committee for a period of 1 year. 80 deceased dying due to fatal RTA autopsied at the mortuary of were recruited in the study. Data was collected from medico-legal case register, inquest reports, hospital bed tickets, history from eyewitnesses, relatives, friends of deceased & investigating police officer, photographs of the site of incident were obtained from the investigating officer & photographs also obtained during post mortem examination.

Results: There was male dominance with maximum subjects were from age group of 21-30 years. Most common profile among the study subjects was rider of 2 wheeler. Most common pattern of external injury among the study subjects was abrasion (87.5%) followed by laceration (81.25%) & contusion (37.5%). Fracture was found in 13.35% of the subjects while crush injury in 11.34%. The body region most commonly affected was extremities (95%), followed by head & neck including face (88.75%) & chest (28.75%). Most common cause of death was head injury (51.25%) followed by shock & haemorrhage (36.25%).

Conclusion: For a developing nation like India, traffic accidents are a regrettable financial burden. Male residents of HMV between the ages of 21 & 30 were the most frequent RTA victims. The most frequent injuries were contusions, abrasions, & lacerations. Most often, injuries occurred to the extremities. One known serious health issue that kills & disables people in this nation is head injuries from RTAs. It is imperative that the relevant authorities act quickly & appropriately to protect this vulnerable population by lowering the number of brain injuries linked to RTAs.

Keywords: Mortality, RTA, Head Injury, Chest Injury.

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Introduction

Any vehicle collision that starts on the road, ends on the road, or involves a vehicle partially on the road is referred to as a road traffic accident (RTA). It could entail a car colliding with a pedestrian, another car, or a non-automobile on the road, or it could involve a car falling from a moving vehicle & injuring or killing the people involved [1]. One of the leading causes of death worldwide is traffic accidents. The most common cause of mortality in automobile accidents is known to be head injuries. India's growing population density has had a noticeable effect on the country's road traffic density, which has led to an increase in traffic accidents. Road traffic accidents are the leading cause of fatalities worldwide & are often associated

with the most severe health issues. Road accidents are caused by a variety of factors, including defective vehicles, uneven roads, reckless or irresponsible driving, speeding, intoxicated driving, lack of sleep, foggy weather, the effects of alcohol & other drugs, & many more. [2]

According to the 2015 Global Status Report on Road Safety, 1.25 million road traffic deaths occur annually worldwide, which is a plateau. Road traffic density is rising in India, one of the world's fastest-developing countries with a dense population. [3] More life years are lost in road accidents in India than in cardiovascular diseases for people over the age of four. Every year in India, road accidents claim the lives of over 80,000 people, critically injure over

1.2 million, & leave over 3,000,000 people permanently disabled [4,5]. The National Crime Reports Bureau's most recent study states that more than 1.18 lakh people die each year in our nation as a result of traffic accidents. In India, there are 7.5 RTA accidents for every 1000 vehicles [6]. Road traffic injuries are predicted to become the fifth most common cause of mortality by 2030 if present trends continue. About 90% of these fatalities take place in low- & middle-income nations, where the rate of traffic fatalities is higher than in high-income nations. Depending on whether the victim is a pedestrian, a motorcyclist, a pedal bicycle, or a car occupant, the pattern of injuries, whether fatal or not, differs considerably [7].

Vehicle design, hit site, impact direction, impact force, post-impact vehicle behavior (e.g., overturning), victim ejection, & intervening circumstances (e.g., fire) can all result in various types of injuries in auto accidents. [8]. Internal injuries can include major artery damage, visceral rupture, & fractures. Both immediate reasons, such as hemorrhage, damage to vital organs, vagal inhibition, neurogenic shock, embolism, etc., & late causes, such as infection, injury sequelae, etc., can result in death in RTAs. For many of these individuals, life-saving measures include early injury discovery & timely treatment [9].

Although morbidity does not account for these social dimensions of the issue, road traffic accidents not only damage primary victims but also many secondary victims in the form of family members & relatives who suffer financially, psychologically, & socially [10]. Particularly in hit-&-run situations, a thorough & in-depth analysis of the injuries can aid in the reconstruction of the event & assist the investigating officer in identifying & prosecuting the accident's perpetrator. Furthermore, research on the various injury types linked to fatal outcomes aids in the implementation of policies aimed at reducing the number of people killed in traffic accidents. Therefore, the goal of the current study was to evaluate the injury trends in fatal traffic accidents.

Material & Methods

The present cross-sectional study was conducted at the Department of Forensic Medicine & Toxicology after due approval from the ethical committee for a period of 1 year. All deceased dying due to fatal RTA autopsied at the mortuary or were recruited in the study. During the study period; we were able to recruit 80 patients.

Inclusion Criteria: All confirmed cases of death due to road traffic accidents.

Exclusion Criteria:

- Body with advanced stage of decomposition.
- Death due to railway accidents.
- Doubtful history.

Study Tools: Measuring tape, magnifying glass, surgical blade with metallic handle, sterile disposable gloves, rib shear, enterotome, scissors, forcep, electric autopsy saw, chisel, hammer, brain knife, viscera preserving jar, formalin, needle with suturing material, DSLR Camera.

Procedure of Data Collection:

1. All the cases were selected consecutively during the study period when they were presented with the above-mentioned inclusion & exclusion criteria.
2. The data was collected from:
 - (a) Medico-legal case register, inquest reports, hospital bed tickets,
 - (b) History from eyewitnesses, relatives, friends of deceased & Investigating Police Officer,
 - (c) Photographs of the site of incident were obtained from the Investigating officer.
 - (d) Photographs also obtained during postmortem examination.
3. Consent for collecting the required data was taken from the legally authorized persons.
4. Predesigned proforma was used to record the relevant information from the victims.

Data was collected & subjected to statistical analysis.

Statistical Analysis

Data so collected was tabulated in an excel sheet, under the guidance of statistician. The frequency of the measurements per group was used for statistical analysis (SPSS 24.00 for windows; SPSS inc, Chicago, USA).

Results

Out of 80 subjects; males & females comprised of 83.75% & 16.25% of the subjects respectively. Maximum subjects were from age group of 21-30 year (26.25%) followed by 31-40 year (20%) while minimum subjects were from age group of 0-10 year (3.75%). Season of death viz. winter (Dec-Mar), monsoon (Aug-Nov) & summer (Apr-Jul) was revealed in 51.25%, 35% & 13.75% of the subjects respectively (table 1).

Table 1: Demographic profile among the study subjects

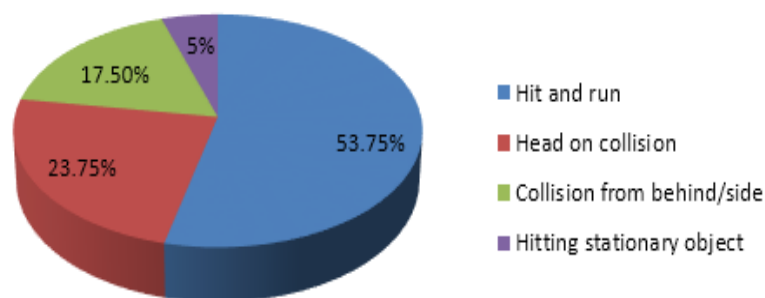
Gender	N=80	%
Male	67	83.75
Female	13	16.25
Age Group (in years)		
0-10	3	3.75
11-20	9	11.25
21-30	21	26.25
31-40	16	20
41-50	15	18.75
51-60	9	11.25
>60	7	8.75
Season of Death		
Winter (Dec-Mar)	41	51.25
Monsoon (Aug-Nov)	28	35
Summer (Apr-Jul)	11	13.75
Time of Death		
Evening (12:01 PM- 08 PM)	37	46.25
Morning (05:01 AM-12 PM)	29	36.25
Night (08:01 PM- 05 AM)	14	17.5

Fatal road traffic accidents were happened mostly on city roads (50%) followed by highway (38.75%). Majority of the victims who died due to road traffic injuries were two-wheeler occupants (68.75%) followed by light motor vehicle (26.25%) & heavy motor vehicle (5%) as shown in table 2.

Table 2: Type of roads

Types of Roads	N=80	Percentage (%)
Highway	31	38.75
City roads	40	50
Other Roads	9	11.25
Type of vehicle		
2 wheelers	55	68.75
Light motor vehicle	21	26.25
Heavy motor vehicle	4	5

Hit & run cases were revealed in 53.75% of the cases while head on collision & collision from behind/side was reported among 23.75% & 17.50% of the subjects respectively (graph 1).

**Graph 1: Nature of incident**

Profile of victims viz. pedestrian, rider of 2 wheeler, pillion rider 2 wheeler, driver of 4 wheeler & above & passenger of 4 wheeler & above was reported among 25.44%, 39.80%, 22.17%, 9.07% & 3.53% of the subjects respectively. Hence most common profile among the study subjects was rider of 2 wheeler (table 3).

Table 3: Profile of victims

Profile	N=80	Percentage (%)
Pedestrian	20	25
Rider of 2 wheeler	33	41.25
Pillion rider 2 wheeler	17	21.25
Driver of 4 wheeler & above	8	10
Passenger of 4 wheeler & above	2	2.5

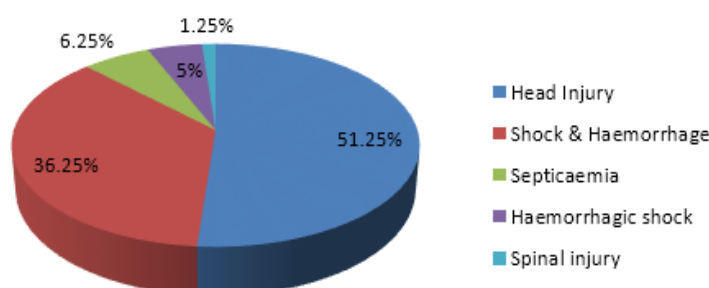
Most common pattern of external injury among the study subjects was abrasion (87.5%) followed by laceration (81.25%) & contusion (37.5%). Fracture was found in 13.35% of the subjects while crush injury in 11.34%. The body region most commonly affected was extremities (95%), followed by head & neck including face (88.75%) & chest (28.75%).

Table 4: Type & pattern of external injury along with bone fracture distribution

Pattern of External Injury	N=80	Percentage (%)
Abrasion	70	87.5
Laceration	65	81.25
Contusion	30	37.5
Fracture	14	17.5
Crush Injury	9	11.25
Incised	1	1.25
External & Internal Injuries		
Extremities	76	95
Head & Neck including face	71	88.75
Chest	23	28.75
Back	10	12.5
Abdomen	8	10
Pelvis	4	5
Neck	2	2.5
Pattern of bone fracture		
Skull	38	47.5
Ribs	47	58.75
Vertebrae	5	6.25
Pelvic Bone	9	11.25
Long Bone	26	32.5

Most common cause of death was head injury (51.25%) followed by shock & haemorrhage (36.25%) as shown in graph 2.

Cause of Death



Graph 2: Profile of cause of death

Discussion

Developing successful preventive measures requires an understanding of the trends in injuries that result

in fatalities in traffic accidents. Targeted measures aimed at reducing road traffic mortality can be informed by identifying the types of injuries, victim demographics, & accident circumstances, including vehicle types & road conditions. The current study's objective was to examine the injury trends in fatal traffic accidents.

In this investigation, male dominance was noted. According to international data, men are more likely than women to be involved in traffic accidents. This is probably because men are more likely to be drivers, passengers, or pedestrians. Additionally, men's propensity for reckless, negligent driving or riding & breaking traffic laws, as well as our Indian social structure, which places a higher priority on men taking care of the home & going to work.

The literature has extensive documentation of this masculine domination. Similar male prevalence was also noted by Kumar et al. [11], who found that 76% of the victims were men. This gender disparity is sometimes attributed to men's greater exposure to traffic situations, whether as drivers, pedestrians, or passengers. This is corroborated by a Singh et al. [12] study, which demonstrates that men are more prone to drive recklessly, including speeding & drinking, which adds to their increased representation in RTA data. Similar male dominance was also shown by Rinki Srivastava et al. [13] in their study, which showed that men made up 77% of the overall victims while women made up only 23%.

Minimum participants were from the age range of 0–10 years, while maximum subjects were from the age group of 21–30 years, followed by 31–40 years. These results are in line with a number of research (Kumar et al., [11]; Rinki Srivastava et al., [13] that show younger & middle-aged persons are most at risk from RTAs because they are more mobile & frequently utilize cars for social & professional purposes. Furthermore, according to WHO data, RTAs are the world's biggest cause of mortality for those between the ages of 15 & 29. [14]

In this survey, the majority of fatal traffic incidents occurred on city roads, followed by highways. High-speed traffic, more vehicles, & more frequent long-distance travel all increase the chance of crashes, which may be the reason for the high number of accidents on state & federal roadways. The higher frequency of accidents on roads, especially state & national highways, where cars go faster & there is a greater chance of fatal collisions, was also noted in a research by Sharma et al. [15]. Accident rates on these roads are further increased by bad road conditions, inadequate signage, & inadequate lighting. In their respective investigations, Rinki Srivastava et al. [13] & Rakshitha B.M et al. [16] found similar results.

In the current study, the greatest number of deaths occurred during the winter months of December

through March & in the evening (12:01 pm to 08 pm). In their study, Rakshitha B.M. et al.¹⁶ found that 35% of all observed incidents of traffic accidents happened in the evening, between 6 p.m. & 12 a.m., followed by afternoon (29%), morning (17%), night (12%), & unknown 7%. The current study is comparable to this. However, they discovered that the highest rates of traffic accidents occurred in April (13.67%) & June (13.67%), with January (10.25%) & March (10.25%) coming in close behind. The current analysis discovered that the majority of traffic incidents happened between 6 & 12 p.m. A study by Farooqui et al [17], Dsouza et al [18], Marak et al [19], Swarnkar et al [20], Neeluri et al [21], Raja et al [22] & Sonawane et al [23], also produced comparable findings.

This high proportion of evening to midnight fatalities is caused by a number of factors, including inadequate lane lines, poor road lighting, a lack of retroreflective signage, & driver behavior such as excessive speeding, inattentive driving, & drunk driving.

Among the study participants, two-wheeler riders were the most prevalent profile, followed by pedestrians. The distribution emphasizes the high danger that vulnerable road users, including walkers, incur because they are less protected than car occupants. In a similar vein, Rakshitha B.M. et al. [16] discovered that, of all road user categories, motorcycle riders had the highest fatality rate, accounting for 70 cases (59.82%), followed by pedestrians with 30 cases (25.64%). A significant percentage of pedestrian fatalities (30%) was also recorded by Sharma et al.¹⁵, who attributed this to a lack of suitable pedestrian infrastructure in many urban & rural locations. Our results contrast with those of Farooqui et al. [17] & Marak et al [19], who found that pedestrians were the most frequent casualties. These findings were comparable to those of studies conducted by Swarnkar et al [20], Neeluri et al [21], & Sonawane et al. [23].

The study participants' most frequent exterior damage pattern was abrasion, which was followed by laceration & contusion (39.29%). 13.35% of the individuals had a fracture, while 11.34% had a crush injury. These results are in line with the trends reported in research by Pathak et al. [24], which found that bone fractures were the most common injury in RTAs, followed by soft tissue injuries such as abrasions & contusions. These wounds are a reflection of the high-energy trauma received in traffic accidents, especially those that happen at high speeds. According to Rinki Srivastava et al. [13], the most frequent external injury types were abrasions (70%) & lacerations (55%), with 72% of victims suffering from contusions (bruising).

The extremities were the body part most frequently impacted, followed by the head & neck, which

includes the face & chest. According to a study by Rinki Srivastava et al. [13], 66% of the victims had thoraco-abdominal injuries, with 36% of cases involving the thorax (chest), 8% involving the abdomen, & 22% involving both regions. According to Nzegwu et al. [25], injuries to the chest & abdomen were frequent in high-impact RTAs, resulting in serious internal damage & a substantial contribution to the death rate. Involvement of the lower limbs, which is frequently observed in pedestrians & motorcyclists, further demonstrates the significant stress these groups experience in accidents [26].

The most frequent fractures in the current investigation were to the skull & ribs. Due to the tremendous energy transfer during collisions, especially frontal & side-impact collisions, these injuries are frequent in RTAs. In 6.55% of the cases, a thoracic vertebral fracture was seen. Long bone fractures occurred in 34.76% of cases, while pelvic bone fractures occurred in 10.83% of cases. The most frequent fracture found in a research by Rakshitha B.M et al [16] was a thorax fracture, which occurred in 45 instances (38.46%), followed by a skull fracture in 43 cases (36.75%), a lower limb fracture (21.36%), an upper limb fracture (13.67), a pelvic fracture (3.418%), & a spine fracture (0.854%). This aligns with the current research. In 52% of the cases, ribs were cracked, according to Rinki Srivastava et al. [13]. Rib fractures indicate significant chest trauma, which frequently results in consequences including internal bleeding & pneumothorax. Patel et al. [26] report that 60% of cases had skull fractures, with linear fractures accounting for the majority (43.33%).

Head injuries were the leading cause of mortality, followed by shock & hemorrhage. This suggests that the most common causes of death in traffic accidents are either severe blood loss or traumatic brain injuries, both of which have high fatality rates if left untreated. These results are in line with research by Patel et al. [26], which demonstrated that the two main causes of death in RTAs are cerebral bleeding & head trauma. 60% of cases had skull fractures, with linear fractures accounting for the majority (43.33%). A significant percentage of RTA fatalities are caused by skull fractures, which are frequently deadly, especially when they are connected to bleeding. These findings are consistent with those of Sharma et al. [15], who found that the leading causes of death in RTAs are traumatic brain damage & bleeding.

Improving survival rates in these situations requires prompt medical attention, such as addressing brain injuries & stopping bleeding.

Limitations

During this investigation, we ran into a few restrictions. The results may not apply to various

forms of trauma in patients with varying degrees of injury severity & prognosis because we only included individuals who passed away following traffic accidents. Additionally, because there was no emergency medical system in place during the study period, precise information about prehospital events, transportation time, & initial medical care such as fluid resuscitation & cervical collars was not recorded for analysis.

Conclusion

For a developing nation like India, traffic accidents are a regrettable financial burden. Male residents of HMV between the ages of 21 & 30 were the most frequent RTA victims. The most frequent injuries were contusions, abrasions, & lacerations. Most often, injuries occurred to the extremities. One known serious health issue that kills & disables people in this nation is head injuries from RTAs. It is imperative that the relevant authorities act quickly & appropriately to protect this vulnerable population by lowering the number of brain injuries linked to RTAs.

To improve the quality of early hospital care of traumatized patients & to reduce the mortality & morbidity of traffic crashes, authorities must implement policies to increase public education against high-risk behavior driving, especially among young men, offer periodic training courses for emergency unit medical staff, especially for surgical residents & interns, based on the Advanced Trauma Life Support (ATLS) principles, train them in the interpretation of radiological images & CT scans of the head & neck, equip emergency units with modern & adequate imaging settings, & perform educational mortality reports in accordance with medico-legal autopsy examinations.

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