

ORIGINAL ARTICLE

Pattern of Limb Injuries in Road Traffic Accident: A Cross-Sectional Study in a Tertiary Health Care Centre in North East India

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Abstract:

According to World Health Organization, road traffic accident claims 1.2 million deaths annually and causes up to 50 million non-fatal injuries. A limb injury is any injury to a limb, either a leg or arm, or to the toes and fingers. Limb injuries include broken bones (cracked or fractured bones, eg. a broken arm), dislocations (when a bone has been moved or dislodged, eg. a dislocated shoulder), sprains (injuries to ligaments, eg. a sprained ankle), strains (injuries to muscles, eg. a strained thigh), nail injuries (injuries to toenails and fingernails, eg., a stubbed toe), and bruises (colored marks caused by bleeding under the skin due to an impact). A cross-sectional study was conducted in the mortuary of a tertiary health care centre in North-East India. The study was done from September 2019 to August 2021. All road traffic accident cases which were brought for medico legal autopsy were included. From the present study, it was found that maximum number of victims was due to two-wheeler accidents and most of the fatalities occurred after reaching hospital, mostly due to lack of prompt aid for the victim and less trauma center in the region. Injuries mostly seen are abrasion and a few cases of fracture. The cause of death is injury to major vessels involved in the fracture causing shock and hemorrhage. It is also observed that multiple limb injuries and limb injuries associated with fracture could be fatal which is significant ($p < .001$).

Keywords: Road traffic accident; Limb injuries; Two wheeler accident; Abrasion; Fracture; Fatality.

Introduction:

Road traffic accident can be defined as an event that occurs on a way or street open to public traffic; resulting in one or more persons being injured or killed, where at least one moving vehicle is involved.¹ According to World Health Organization, road traffic accident claims 1.2 million deaths annually and causes up to 50 million non-fatal injuries. The injuries caused by road traffic accidents (RTAs) become a major public health problem worldwide and a major cause of morbidity and mortality with temporary or permanent disability.

A limb injury is any injury to a limb, either a leg or arm, or to the toes and fingers. Limb injuries include broken bones (cracked or fractured bones, eg. a broken arm), dislocations (when a bone has been moved or dislodged, eg. a dislocated shoulder), sprains (injuries to ligaments, eg. a sprained ankle), strains (injuries to muscles, eg. a strained thigh), nail injuries (injuries to toenails and fingernails, eg. a stubbed toe), and bruises (colored marks caused by bleeding under the skin due to an impact).²

More than 1.17 million people die in traffic accidents around the world every year, and 65% involve pedestrians. Meanwhile, 85% of pedestrian casualties include lower limb injuries, a much higher figure compared to motorized vehicle occupants. Lower limb injuries are the most common in pedestrian casualty.³

The present work is designed to study the pattern of limb injuries to understand the circumstances and mechanism of causation of these injuries in Road traffic accident.

Materials and Methods:

A cross-sectional study was conducted in the mortuary of a tertiary health care centre in North-East India. The study was done from September 2019 to August 2021. All road traffic accident cases which were brought to the mortuary for medico legal autopsy were included in the study.

Cases with limb injuries with or without injury to other part of the body were included. Cases with unknown cause of death and decomposed bodies were excluded.

The Sample size was calculated as follows :

a) Prior information:

- P: Prevalence rate of limb injuries = 15.8% (from a study by Shamim m⁴)

b) Assumption:

- 95% degree of precision
- Z (critical value at 5% level of significance) = 1.96
- L (allowable error) = 7

c) Formula:

$$N = \frac{Z^2 P (1-P)}{L^2}; \text{ where N is the required sample size.}$$

$$= \frac{1.96^2 \times 0.158 \times (1-0.158)}{7^2}$$

$$\approx 105$$

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Henceforth, adequate sample size for the proposed study is found to be around 105 road traffic accident cases with limb injuries. Study variables consisted of independent variables as age, sex, religion, address, caste, education, socioeconomic status and dependent variables as the patterns of upper limb injuries and lower limb injuries viz. abrasion, laceration, fracture, contusion, offending vehicles, type of victims, survival period, time and place of occurrence, etc.

Procedure and data collection: After giving brief introduction about our study, informed consent was taken from the relatives. The particulars of victim were recorded and a detailed history pertaining to nature of incident and time and place of occurrence was obtained from the police records and relatives of the victims. Information regarding the vehicle involved, road on which accident occurred, victim as pillion or driver or pedestrian, history pertaining to survival time after sustaining injury was obtained from relatives or accompanying persons or police and also from hospital records, if any.

1. Post mortem examination: a) External examination: Examination of wearing apparels: noting the tears, stains, tyre marks, foreign bodies etc., and other external findings like cyanosis, congestion, jaundice, post-mortem changes and recording of the injuries in detail- type, location, size, age of wound etc.

b) Internal examination: All the three body cavities i.e., the cranial, thoracic and abdominal cavities were opened and explored as done in routine post-mortem examination. The cavities and their contents were examined systematically and internal organ injuries and injuries of the limbs were thoroughly assessed and recorded.

To maintain confidentiality of the deceased, name etc was not used on the proforma. After obtaining all the required details and complete postmortem, finding was entered in the proforma.

Statistical analysis: The present study is carried out in the department of Forensic Medicine and Toxicology of a tertiary health care centre in North-East India. It is based on a primary sample of 105 road traffic accident cases with limb injuries that were brought to the mortuary. The type of study is cross sectional study and it was done during stipulated study period of two calendar years starting from August 2019 to July 2021. Autopsy reports and related information, so collected, were first transferred to Microsoft Excel worksheet and then to SPSS (Statistical Package for Social Sciences) data document. Then after thorough scrutiny and checking of the data, statistical analysis was performed by using IBM: SPSS Statistics Version 21.

All the categorical variables considered, were again described as number of cases and percentages. To establish association between the categorical variables with the type of injuries, χ^2 -test is applied, and interpretation is made accordingly. All comparisons are two-sided and the P-values of <0.05 , <0.01 , and <0.001 were taken as the cut off values for significance, highly significant and very highly significant respectively.

Ethical issue: Ethical approval from the Research Ethical Board (REB), of the institute was obtained. Informed written consent

was obtained from the deceased's party. Code was used during collection of data to maintain confidentiality. The data obtained was kept in the department of Forensic Medicine and Toxicology of the institute. The access to the data was restricted to the investigator and the guides. The study was self-sponsored study and there was no conflict of interest.

Results:

A total one hundred and five cases of fatal road traffic accident with limb injuries were studied during the study period in the mortuary of the tertiary health care centre of North East India during the period of September 2019 to August 2021.

In the present sample of 105 road traffic accident cases with limb injuries, there are 83 males and 22 females with 79.0% and 21.0% respectively. It shows that male has more number of road traffic accident than that of his counterpart female.

Among the cases of road traffic accident, highest number of victims were observed among the age of 31-40 years which accounted for 24.8%; and lowest number of victims of about 1.9% were observed among the age group of 0-10 years.

Meitei maintains highest percentage (86.7) which is followed by Manipuri Muslim (8.6) and Manipuri Tribal (4.8%) respectively.

There are only two categories of socio-economic status viz., low class, and middle class; and the former has lower number of cases (14.3%) in the present sample while compared with the latter (85.7%).

Autumn (34.3%) is the season during which most road traffic accidents took place as against the lowest in spring season (16.2%).

Maximum number of victims was due to two-wheeler accident which accounted for 52.4% of which 38 (69.09%) fatalities were riders. Further, pedestrian was observed to be the next major fatalities of road traffic accident cases which account for 30.5% and by four-wheeler about 17.1% in which majority about 12 (66.67%) fatalities were among drivers.

Most of the fatalities occurred after reaching hospital which accounted for 84.8% and the least number of fatalities which is 1% occurred at home after taking primary treatment and sent home.

Most of the road traffic accident cases, 74.3% survived for a period of 1-24 hours before they succumb to their injuries. Further it is observed that 1 case survived for more than 1 week but unfortunately, he succumbed to his injuries.

Maximum fatalities were due to injuries to vital organs associated with shock and hemorrhages which accounts for 90.5% of cases and 9.5% of fatalities were due to injuries to the limb associated with shock and hemorrhages.

Injury-wise analysis: For analysis convenience, all the combination of multiple injuries are clubbed under the one caption of multiple injuries, and therefore in the following section, there are five categories i.e., fracture, abrasion, contusion, laceration, and multiple injuries considered as type of injuries as shown in Table 1. As mentioned elsewhere, in order to establish association between all the parameters, taken into

Table 1. Type of injuries a distribution of road traffic accident according to brief history.

Parameters	Type of injuries							x ² -value	df	P-value
		Fracture 8 (7.6%)	Abrasion 46 (43.8%)	Contusion 17 (16.2%)	Laceration 4 (3.8%)	Multiple injuries 30 (28.6%)	Total 105 (100.0%)			
Brief history	Two wheeler	4 (7.3%)	24 (43.6%)	11 (20.0%)	2 (3.6%)	14 (25.5%)	55 (100.0%)	3.340	8	.911
	Four wheeler	1 (5.6%)	8 (44.4%)	2 (11.1%)	-	7 (38.9%)	18 (100.0%)			
	Pedestrian	3 (9.4%)	14 (43.8%)	4 (12.5%)	2 (6.2%)	9 (28.1%)	32 (100.0%)			

Table 2. Type of injuries distribution of road traffic accident according to survival period.

x²-value; df: degree of freedom; P-value: probability due to chance factor

Parameters	Type of injuries							x ² -value	df	P-value
		Fracture 8 (7.6%)	Abrasion 46 (43.8%)	Contusion 17 (16.2%)	Laceration 4 (3.8%)	Multiple injuries 30 (28.6%)	Total 105 (100.0%)			
Survival period	On the spot	1 (6.2%)	4 (25.0%)	2 (12.5%)	2 (12.5%)	7 (43.8%)	16 (100.0%)	18.412	16	.300
	Within 1hr	1 (11.1%)	2 (22.2%)	0	0	6 (66.7%)	9 (100.0%)			
	1-24hr	6 (7.7%)	38 (48.7%)	15 (19.2%)	2 (2.6%)	17 (21.8%)	78 (100.0%)			
	>1week	0	1(100.0%)	0	0	0	1(100.0%)			
	Unknown	0	1(100.0%)	0	0	0	1(100.0%)			

Table 3. Type of injuries a wise distribution of road traffic accident according to cause of death.

Parameters	Type of injuries							x ² -value	df	P-value
		Fracture 8 (7.6%)	Abrasion 46 (43.8%)	Contusion 17 (16.2%)	Laceration 4 (3.8%)	Multiple injuries 30 (28.6%)	Total 105 (100.0%)			
Cause of death	Injury to limb	4 (40.0%)	-	-	1 (10.0%)	5 (50.0%)	10 (100.0%)	31.595	8	<.001
	Shock and haemorrhage	1 (1.9%)	29 (55.8%)	7 (13.5%)	-	15 (28.8%)	52 (100.0%)			
	Injury to vital organs	3 (7.0%)	17 (39.5%)	10 (23.3%)	3(7.0%)	10 (23.3%)	43 (100.0%)			

account, with the type of injuries, c²-test is applied, and interpretation is made accordingly.

It may be observed from the table-1 that brief history has no significant association with the type of injuries. This statement is supported by the corresponding insignificant P-value which is more than 0.05, the significant level adopted. However the findings further reveal that on the records of brief history within the fracture, pedestrian and four wheeler are found the highest and the lowest respectively; within the abrasion, four wheeler and two wheeler, the highest and the lowest; within the contusion, four wheeler and two wheeler, the highest and the lowest; within laceration, no case of four wheeler found while pedestrian is found the highest followed by two wheeler. Within the case of multiple injuries, four wheeler and pedestrian are noticed the highest and the lowest respectively.

It is observed that, in most of the fatalities, there are five categories of survival periods which can be considered for analysis purposes. This is shown in table 2. They are on the spot, within 1hr, 1-24hr, >1 week, and unknown. After applying the test one may infer that survival period has not much relationship with the happening of road traffic accident. This proclamation is based on the insignificant² value i.e., p=0.300.

In order to ascertain the relationship of cause of death with the type of injuries, table-3 has been introduced along with test value. Again, from the table it may be observed that cause of death has a very highly significant association with the type of injuries as evident by p<0.001.

Discussion:

In this study, most of the victims were males, there are 83 males

and 22 females with 79.0% and 21.0% respectively. Study conducted by Murarka KI et al.,⁵ Nilambar J et al.,⁶ Mehrdad M et al.⁷ have also similar to our study. It shows that male has more number of road traffic accident than that of his counterpart female. Predominance of male explained that male are more prone to lead a more active life, more exposed to traffic accidents and trauma, etc.

Majority of the victim were in the age range of 31-40 years with highest percentage (24.8%) and lowest incidence (1.9%) was seen in the age range of 45 - 50 years which is similar to studies conducted by Chaurasia AK et al.,⁸ Nilambar J et al.,⁶ Mehrdad M et al.⁷ The highest in the age group 31-40 years could be due to fact that this is the most active phase of life

In case of the caste of victims, Meiteis constituted the highest percentage (86.7%) which is followed by Manipuri Muslim (8.6%) and Manipuri Tribal (4.8%). This is due to fact that Meiteis are the majority group in the study population which is in agreement with the findings of Bhuyan PJ and Ahmed F,⁹ which state that the dominant community in a study population constitutes the highest percentage of the cases.

Most of the victims belong to the middle socioeconomic group (85.7%) and the remaining 14.3% belongs to the low socioeconomic group. On socio-educational front, this can be interpreted as to the affordability of the people to maintain the vehicle. This is in agreement with Reddy A et al.¹⁰

Autumn (34.3%) is the season during which most road traffic accidents took place as against the lowest in spring season (16.2%). Our finding is in contrast with finding of Singh H et al.,¹¹ Singh PK et al.¹² where winter was common season for RTA.

In case of survival period, there was a lone case that did not know the period. 1% of the cases survived for more than 1 week followed by those who survived for 1-24 hrs (74.3%). This is again followed by those who survived for 1 hour (8.6%) and death on the spot was 15.2%. Our finding is similar with Chaurasia S et al.¹³ where most of the victim (30%) died within 12-24 hour whereas finding of Singh H et al.¹¹ showed that 39.5% deaths occurred within 1hr which is different from our finding.

In case of vehicle involved, maximum cases were caused by two-wheeler accidents (52.4%) and next was the pedestrian (30.5%) followed by four-wheeler (17.1%) which is similar with the findings of Bhuyan PJ et al.⁹ This could be due to fact that two wheelers are the most commonly used means of transport in Manipur.

In terms of type of victims, rider of two wheeler was found to be of highest percentage (69.09%), followed by driver of four wheeler (66.67%), occupant of four wheeler (33.3%), pillion rider (30.9%), and pedestrians (30.5%). This finding is similar to study conducted by Mishra S et al.¹⁴ and Navali AM et al.¹⁵ This could be due to the casual attitude of two wheeler riders to traffic rules.

It is observed from our study (table-10) that type of victim has no significant association with the type of injuries. This statement is supported by the corresponding insignificant p-value which is more than 0.05, the significant level adopted. However, from the table it is observed that abrasion is the most common type of injury seen in all type of victims with the highest of 24 cases is seen in two wheeler followed by 14 cases in pedestrian and 8 cases in four wheeler road traffic accident. Further, among the various type of injuries sustained by two wheeler victims, laceration is the least which is seen in 2 cases, while fracture is seen in 1 case which is the least type of injury seen in four wheeler victims, whereas among pedestrian the least type of injury is laceration which is seen in 2 cases. In contrast to the study by George AS et al.¹⁶ where Pillion riders were injured more often in collisions between two and four wheelers.

Our finding is similar with study by Jhakar JK et al.¹⁷ and slightly different from the work done by Mishra S et al.¹⁴ which found that common injuries were laceration & fracture (30%).

Regarding the cause of death, injury only to the limb with shock and hemorrhages was the cause of death in 9.5% of the cases and in the remaining 49.5% of the cases the cause death was due to shock and hemorrhage and 41% due to injury to vital organs. This is significant finding as the p value is < .001. This finding is different from previous workers^{18,19} where limb injury alone has never been reported as the sole cause of death.

Regarding association of limb injury with the cause of death, out of 10 cases showing fatal limb injuries, the cases showed multiple limb injuries (50%) followed by fracture (40%) and laceration 1%. This proves that even if the limb is involved in vehicular accident, it could be fatal if there is multiple limb injuries or if there is fracture involved. This finding has not been seen in studies done by previous workers.

In this study, cases were taken which were brought to Regional

Institute of Medical Sciences, so our finding may not be representative of all the fatal two road traffic accident with limb injuries happening in the state.

Conclusion:

From the present study, it is found that maximum number of victims was due to two-wheeler accidents and it is observed that most of the fatalities occurred after reaching Hospital, mostly due to lack of prompt aid for the victim and less trauma center in the region. In our study, injury mostly seen on the victims is abrasion and a few cases of fracture. The cause of death is due to injury to major vessels involved in the fracture causing shock and hemorrhage. From our study, it is observed that multiple limb injuries and limb injuries associated with fracture could be fatal which is significant ($p < .001$). The result of this study enables a health care provider to predict fracture and site of injury. Strict enforcement of road safety regulations and improving emergency medical services may prevent untimely deaths and disabilities caused by RTAs. Awareness campaigns concerning safety rules can be targeted at the high-risk groups with emphasis on improvement of the roads. The fact that the economically productive age-group was mostly involved should prompt an urgent public policy response with special reference to education, engineering, environment, and emergency care of road accident victims.

Ethical Clearance: Taken

Conflict of Interest: Nil

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