

Epidemiology of Trauma Patients Admitted to a Trauma Center in New Delhi, India

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ABSTRACT

Introduction: The rapid economic and automobile growth in India leads to a rapid increase in road traffic accidents (RTAs) and factors affecting it. This study evaluates the epidemiology of trauma patients' reports to the major trauma center in New Delhi, India.

Materials and methods: The 1,583 patients over 6 months reporting to the casualty of the trauma center attached to Lok Nayak Hospital, New Delhi were included in the study. The patients reporting to the outpatient department as follow-up visits were not included in the study. The data were collected with the help of a structured *pro forma*.

Results: The data depicted the RTAs as the most common cause affecting adults between 20 years and 40 years. The study reports other risk factors like alcohol intoxication and motorcycle riders. Mostly, the patients present in a semiconscious and disoriented state requiring fluid resuscitation. Abrasions and bruises in the extremities stand out as the most common injury pattern. The fractures suffered were the most common injury suffered by the patients.

Conclusion: Our study shows that RTAs and workplace injuries are the predominant causes of trauma affecting mostly the adults. This study defines the correlation of various parameters with causation and distribution of the trauma in the sample population. This study was performed to improve the understanding of the mode of trauma, severity of injuries, and outcome in our hospital, so that effective prevention and comprehensive management strategies could be made.

Clinical significance: This study signifies the fundamental study for the occurrence, distribution, and prevention of trauma in the society. The acquisition of knowledge of different patterns of trauma patients along with other descriptive factors helps to understand the causation of this disease as well as development of preventive measures. This can form the basis of hospital and regional trauma management strategies.

Keywords: Epidemiology, Injury, Polytrauma, Prevention strategies, Road-traffic accident, Trauma.

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INTRODUCTION

Trauma is a major cause of death and social problem.¹ In low- and middle-income countries, trauma accounts to 11% of all disability-adjusted life years.² Accidents are the leading cause of death in India. Due to recent technology enhancement, industrialization, rapid motorization, and unsafe driving, the risk of accidents has increased leading to significant financial loss.

To understand the epidemiology of the trauma patients being treated in our trauma center, we devised a *pro forma* to undertake an observational study. The study helps evaluate the demography of trauma patients and utilize the resources including material as well as man-power appropriately. This not only helps the hospital management to implement ergonomics but also prepares the hospital well to handle specific patients visiting to the hospital.

MATERIALS AND METHODS

The 1,604 patients who reported to the casualty of the trauma center were analyzed in the study. The patients visiting the outpatient department and follow-ups were not included in the study. It is a prospective observational study including 1,583 patients according to the inclusion criteria over 6 months from September 2019 to February 2020.

A prestructured *pro forma* was formed to collect the required data. This form was filled by the healthcare professional (doctors and nurses) in consultation with the primary doctor involved in patient care. The *pro forma* was filled on the same duty day/working shift by the concerned doctors/nurses to enhance the accuracy of the

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data entry. The *pro forma* includes the demographic details of the patient, prehospital care, mode, and pattern of injuries sustained as well as immediate management given to the trauma patients. The data were analyzed using MS Excel Sheets and SPSS 19.0.

RESULTS

The average age of patients was 33.4 years (range 2–93 years). Mostly, the younger age group reported to the trauma center. In this study, 3.9% patients were ≤10 years, 15% were between 11 years and 20 years, 33.9% were between 21 years and 30 years, 26% were between 31 years and 40 years, 12% were between 41 years and 50

years, 6% were between 51 years and 60 years, and 3% were >60 years. The adults between 20 years and 40 years suffered most of the trauma and reported to the hospital. The percentage of male gender among the study population was 76%, whereas it was 24% for the female gender.

The education status of the patients depicted that 45.9% were illiterate, 31.2% had schooling less than 10th standard, 15% were educated till graduation, and only 7.9% were postgraduate or above.

The percentage of the patients reporting to the hospital under the influence of alcohol or drugs was 36%. These data show the prevalence of the drug intoxicated population suffering the trauma requiring medical treatment in our region. Alcohol or drug intoxication increases the vulnerability toward suffering or inflicting trauma. Out of the drug or alcohol intoxicated patients, 96% were male. Among those, 90% were aged between 20 years and 40 years.

There were various modes of injury that can inflict trauma to a person. According to our study, the most common victims of the trauma were included motorcycle riders (30.7%) and car drivers or passengers (21.3%) (Table 1).

Vehicles were the most common inflicting instrument of injury, accounting for 43.7% of the cases followed by heavy objects like lathi (rod), hammer, etc., contributing to 20.5% of the cases. Sharp instruments including knife, glass, etc., were found to be involved in 15.6% of the cases. Physical assault accounts for 9.2% of the injuries inflicted on the victim, whereas others were involved in 13.3% of the cases (Fig. 1).

Table 1: Mode of trauma and number (%) of patients

Mode of trauma	
Victims	
Type of victims	N (%)
Pedestrian	125 (7.9)
Bicycle rider	279 (17.6)
Rickshaw passenger	179 (11.3)
Auto-rickshaw passenger	128 (8)
Motorcycle riders	486 (30.7)
Car driver or passenger	337 (21.3)
Bus/truck passenger	48 (3)
Others	30 (1.9)

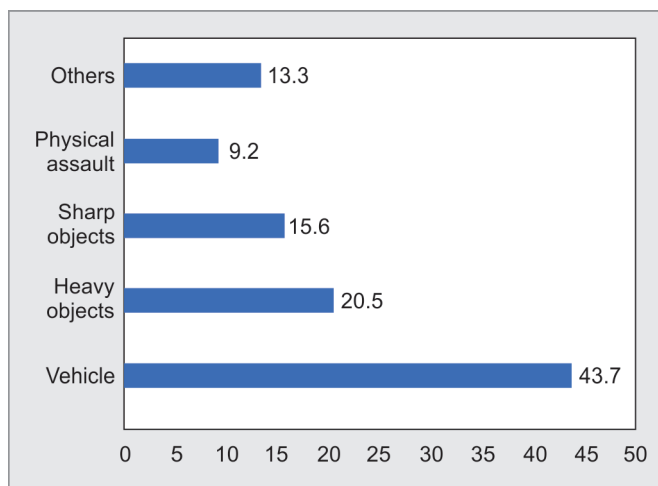


Fig. 1: Distribution of inflicting instrument

Duration since injury varies from 30 minutes to 7 days with the average time of 19.6 hours. The median time was 3.2 hours. The variation in the duration since injury is because the center being a referral hospital and caters a vast area. Around 72% of the patients reported directly to this trauma center, whereas the rest visited initially some other hospital.

The place of injury most commonly involved in the study group was the road. This was expected to find as road traffic accidents (RTAs) were the most common mode of injuries.

The condition of the patient at presentation to the hospital is very important for the prognosis of the patients. The consciousness and orientation of the patients were considered. Most patients presented with semiconscious and disoriented state (34.2%). Whereas 25.6% of the patients presented in an unconscious state in the hospital. Only 10.6% of the patients were brought dead to the hospital and the rest 29.6% of the patients were conscious (Fig. 2). This distribution of cases was affected by the mode of injury and transportation of the patients.

Hemodynamic stability is an important prognostic factor. In this study, 47.2% of the cases required no fluid resuscitation, whereas 52.8% patients required fluid resuscitation. Out of these 823 patients, 9.8% required additional inotropic medications, whereas 15.1% required cardiopulmonary resuscitation (CPCR) (Fig. 3).

The presence of bleeding was assessed in all patients. 37.2% of the patients presented with active bleeding. The type of injury sustained influenced the active bleeding. Whereas the presence of laceration, open wounds, mangled extremities, and penetrating trauma were associated with active bleeding, blunt trauma, and minor injuries were not associated with the same.

The pattern of injury sustained by the patient was the most important factor in deciding the management and prognosis of the patient. The most common pattern of injury sustained was abrasions and bruises, seen in 38.5% of the cases (Table 2). Bruises and abrasions did not depict the severity of the injury. This is further confirmed by the need of fluid resuscitation in 42.6% of the cases sustaining abrasion or bruises only. In 44.3% patients, abrasions or bruises were inflicted on extremities, whereas 23.6% were on abdomen, 18.3% on face and neck, 4% on back, and 3% on head. The laceration was the second most common injury pattern sustained by the patients reporting to our center. We have specifically kept

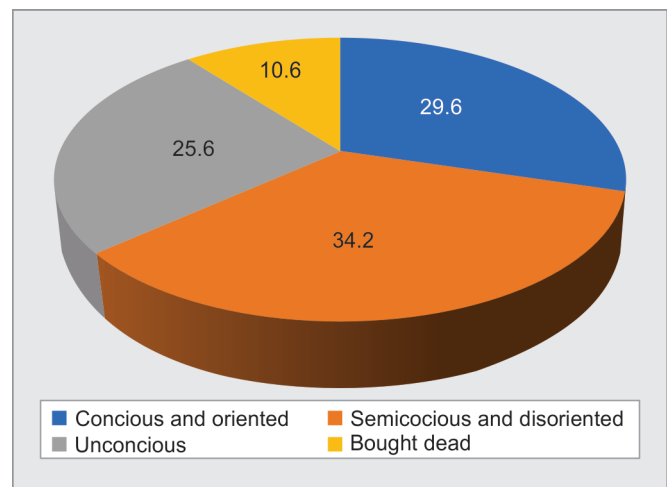


Fig. 2: Condition of the patients at presentation in the trauma center

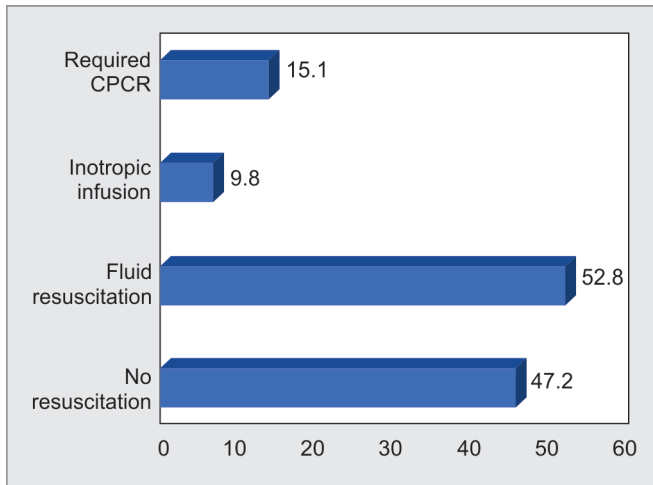


Fig. 3: Fluid management in the patients

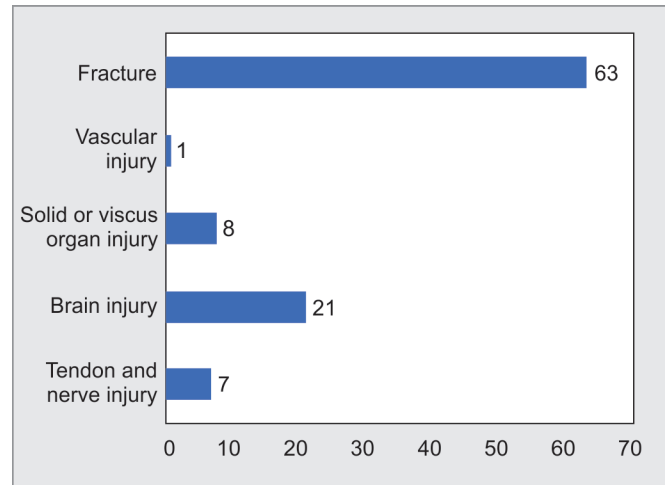


Fig. 4: Distribution of type of radiologically proven injuries

Table 2: Distribution of type of injury suffered by the patients

Type of injury	Head (%)	Extremities (%)	Abdomen (%)	Chest (%)	Face and neck (%)	Back (%)
Abrasions and bruises (38.5%)	3	44.3	23.6	3	18.3	4
Lacerations (36.4%)	24.3	54	12.2	2	6.1	1.4
Stab or penetrating wounds (11.6%)	5.5	11.3	56.3	19.2	4.5	3.2
Mangled extremities (13.5%)	14.6	13.5	6.5	4.2	3.8	1.6

penetration wounds or stab wound separately from lacerations as their management protocol is different.

The part of the body involved guides the management of the patient. Being a trauma center, most of the patients reporting had limb injuries accounting for 42% of the patients. Whereas 17% had head injuries, 11% had pelvis trauma, 11% had abdomen injuries, 7% had back injuries, 7% had face and neck injuries, and 4% had chest injuries. Around 44% of the patients had more than one body part involved. The pattern of injury sustained along with the body part involved were also used to assess the need of fluid resuscitation.

Out of the total patients reporting to the center, 64% had radiologically proven injuries. Out of which 56% were involving limbs, 12% involving head, 11% involving chest, 9% involving abdomen and spine, respectively, 3% involving face and neck. Only 36% patients had injuries that could not be proven radiologically. Out of these, 53% of such patients had abrasion and bruises, 39% patients had lacerations, and only 8% had stab or penetrating injuries.

Fractures were the most common (63%) injury type suffered by the patients, followed by brain injury (21%) and solid/viscus organ injury (8%) (Fig. 4).

Various treatment modalities were instituted for different patients in the center. Broadly categorizing the management, 11.8% of the patients were treated conservatively with medications and if required dressing only. The majority (64%) of such patients suffered abrasions and bruises and 36% patients had soft tissue injuries.

Orthopedics plaster of Paris (POP) slabs or casts were given to 43.5% of the patients reporting to the trauma center. Out of which 89% have fractures and rest had soft tissue injuries or sprains.

DISCUSSION

Intersectoral efforts and activities are essential for injury prevention strategies. It requires cooperation of various departments including hospitals, police, road transport, engineering, media, health education, and others. A trauma care system encompassing prehospital (emergency), hospital (acute care), and posthospital (rehabilitation services) care is an essential component of preventive and control strategies. Preventive strategies should be made on the basis of these epidemiological trends. This was emphasized by the Mbanjumucyo et al.,³ in the study performed in a Tertiary Hospital in Rwanda. The study by Curtis et al.,⁴ in Australia and New Zealand depicted the value of understanding the epidemiological of trauma for improving the trauma management system and preventive strategies.

The study reflects that the younger population (≤ 30 years) in New Delhi are involved in more accidents and trauma accounting for 53% of the total patients. This is consistent with other studies which also show that injuries occur in more productive age group and they are more vulnerable to injury.^{5,6} The study by Fararoei et al.,⁷ showed 24–44 years of age as the most vulnerable group to suffered accidents including RTAs, falls, etc. This may be due to more opportunities provided to the young adults for such incidents including driving vehicles, using trauma inflicting instruments, involving in quarrels or assaults, etc. The male population is more vulnerable to accidents and trauma owing to more opportunities like workplace injuries, driving vehicles, physical assaults, alcoholism, etc. A higher rate of accidents in men has also been reported by other studies from several countries.⁸ The effect of alcohol can blur the mental judgement as well as vision of the person, which can be a victim or inflicting person in a trauma case.

The study by Wui et al.,⁹ reported fall as the leading cause of injury in the elderly population and RTA in the younger age group.

Most of the patients reported to the hospital were illiterate or had schooling less than 10th standard. This shows the understanding level of the patients regarding the disease or trauma they suffered and the further course of the management. The lower level of illiteracy makes it difficult to comprehend the course of treatment and compliance to it. Traffic education is equally important to all road users. Some of the most common accidents can be avoided by teaching our drivers and pedestrians about the dire consequences that can result from even small mistakes. The study by Negussie et al.,¹⁰ emphasized the need for education in children and adults to prevent injuries/accidents.

The study depicts that motorcycle riders are at highest risk for suffering the trauma. This result was in concordance with the study by Stoica et al.,¹¹ depicting the more severity of traumatic lesions suffered by motorcycle collision. This is because of the inherent instability in two-wheelers, high-speed driving of motorcycles, and least safety features. There is a plethora of studies that have established the protective role of helmets in motorcycle and bicycle riders^{12,13} but this estimation was beyond the scope of this study. Second in the list was car passengers owing to high-speed driving and increased number of four-wheeler in the region. But due to inherent stable design with four wheels and various safety features, it is less prone to cause injury to the passenger. Out of the total victims of trauma, 44% of the victims reported to our trauma center were either pedestrian or riding on bicycles, rickshaw, or auto-rickshaw. These numbers are decreasing in area adjoining our hospital because of economic upliftment of the society and increasing purchasing power. Victims suffering injuries in buses or trucks are rare. They generally occur in the presence of high-velocity trauma leading to overturning of buses or trucks.

The data depict cars as the most common mode (38.2%) of inflicting injuries to the victims. Whereas 15.9% suffered injuries from the bicycle (9.3%) and auto-rickshaw (6.6%). Only 8% of the victims got injured by themselves and 11.8% by others, including physical assaults or fights with others. This owes to the large number of cars in the region along with poor and rash driving skills. This was followed by motorcycles and bicycles. Buses or trucks were involved in high-velocity injuries leading to polytrauma or death of the patients. The alcohol intoxication was found in decreasing order in car, bus or truck, and motorcycle drivers. This could also be a risk factor for increased involvement in trauma cases.

This depicts RTAs as the most common (43.7%) mode of inflicting injuries. The increasing number of vehicles and congestion along with the fast lifestyle in the region might be the cause of the increasing numbers. The study by Sogut et al.,¹⁴ concluded motor vehicle accidents and falls from the heights as the most common causes of trauma. The study by Byun et al.,¹⁵ found blunt trauma as the main cause of trauma in Korea. Trauma by heavy objects like hammer, brick, etc., was the second most common (20.5%) cause. This depicts the workplace injuries sustained during handling of such objects and misuse of heavy objects in inflicting trauma to the victims. Sharp instruments like knife, glass, etc., can cause injuries especially at workplace involving such sharp objects or used intentionally to inflict injuries. The other inflicting instruments included animals or fall on ground, etc.

Roads were the most commonplace of injury, accounting for 47% of the cases. Second in line was the workplace injuries accounting for 34% of the patients. Injuries at home accounted

for 17% of the injuries, whereas other places including pilgrimage places, neighborhood, etc., for 2% of the cases. The RTAs and workplace injuries constitute the major share of the trauma patient burden reporting to the trauma center. The place of injury had relation with the type of inflicting instrument, mode of transportation, accompanied person, and type of injuries sustained by the patient. Road traffic accident patients were generally accompanied by police or unknown people. The mode of transportation in such cases involved police control room (PCR) vans/ambulances or three- to four-wheeler.

In most of the cases (35.4%), the patient was transported via three- to four-wheeler. 9.3% of the patients came walking to the hospital and 22.4% were transported in two-wheeler. The most serious patients were transported in ambulances or four-wheeler. Whereas patients sustaining minor injuries were transported in two-wheeler or by themselves. The patients sustaining spine injuries or open fractures were mostly transported in ambulances or four-wheeler.

The type of injury sustained had impact over the need of fluid resuscitation. Severely injured patients with lacerations, blunt trauma abdomen, head injuries, and mangled extremities required more medical support and fluid resuscitation. The elderly patients between age group of 40 years and above required more of fluid resuscitation. The study by Rastogi et al.,¹⁶ depicted blunt injuries that were more common than penetrating injuries. The alcohol or drug intoxication increased the requirement of the fluid resuscitation. The ill condition of the patient at presentation required fluid resuscitation. All patients presenting in semiconscious or unconscious condition were given fluid resuscitation. Further response to the resuscitation was assessed and need for inotropes and CPR was decided. The study by Roy et al.,¹⁷ showed airway management, fluid resuscitation, hemorrhage control, and surgical decision-making protocols as opportunities for improvement.

In the study, 13.5% of the patients suffered trauma leading to mangled extremities. 72.8% of such patients were motorcycle riders or passengers, whereas 11.2% were pedestrians, 12.6% were car passengers, and 3.4% were bus or truck passengers. The victims sustained such high-velocity trauma from bus or truck in 62.6% of cases, whereas accident with car occurred in 29.4% cases. In 8.6% cases, the injuries were sustained by patient himself. All such patients had workplace injury. All mangled extremity patients required fluid resuscitation, 30% of which required CPR at presentation, and 42.8% required inotropic medications. Active bleeding was present in all such cases. The duration since injury varied from 5 hours to 4 days. All these patients had limb injuries with fractures, whereas 32.6% of such patients had brain injury, 22.4% patients had associated solid or viscus organ injury. All these patients required operative management.

Out of the total patients reporting to the center, 64% had radiologically proven injuries. Out of which 56% were involving limbs, 12% involving head, 11% involving chest, 9% involving abdomen and spine, respectively, 3% involving face and neck. Fractures of the bones were the most common radiologically proven injury suffered by the patients in our center. Similar results were seen in the study by Manwana et al.,¹⁸ in Botswana. Only 36% patient patients had injuries that could not be proven radiologically. The study showed 53% of such patients had abrasion and bruises, 39% patients had lacerations only, and 8% had stab or penetrating injuries. In a study performed in United Kingdom, which found that

majority of the injuries sustained involved the upper parts of the body including head, face, neck, and thorax.¹⁹

Operative intervention was sort in 24.2% of the patients. Out of which 86% were operated for orthopedic management, 6% for neurosurgical management, 6% for abdominal injuries, and the rest for chest trauma.

LIMITATION OF THE STUDY

- The study was performed at only one center in a specified area for specified period in New Delhi. This can cause bias owing to the epidemiology of people living in that area.
- More multicentric studies for longer duration are required to assess epidemiology of trauma patients in New Delhi.
- Only patients visiting to emergency department for the first time were included in the study. Outpatient department visits were not included in the study.

CONCLUSION

Our study shows that RTAs and workplace injuries are the predominant causes of trauma affecting mostly the adults. This study defines the correlation of various parameters with causation and distribution of the trauma in the sample population. This study could assist in raising the profile of RTAs as a public health problem that needs to be addressed as a preventable cause of mortality and morbidity, and planning appropriate interventions for this major challenge. This study was performed to improve the understanding of the mode of trauma, severity of injuries, and outcome in our hospital, so that effective prevention and comprehensive management strategies could be made.

CLINICAL SIGNIFICANCE

This study signifies the fundamental study for the occurrence, distribution, and prevention of trauma in the society. The acquisition of knowledge of different patterns of trauma patients along with other descriptive factors helps to understand the causation of this disease as well as development of preventive measures. It forms the basis of a trauma registry, with prospective enrolment of patients for constant improvements in trauma care. The emphasis should be to develop a national policy and strategies for injury prevention and control with a major thrust on reduction of RTIs, work-related injuries, and violence.

The study was ethically conducted following the Declaration of Helsinki.

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