

Original Research

Pattern of injuries in road traffic accidental cases (An autopsy-based study)

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Abstract

Aim: The aim of this study was to analyze the patterns of injuries in road traffic accidents (RTAs) through autopsy-based examinations, focusing on the demographics of victims, types of injuries sustained, and the circumstances surrounding the accidents.

Material and Methods: This cross-sectional, descriptive study was conducted at the mortuary of the District Hospital, Barabanki, over a one-year period from September 2017 to August 2018. The study included 100 victims of RTAs whose deaths occurred within the Barabanki district. Data was collected from post-mortem examinations, inquest reports, and hospital records. The patterns of injuries were evaluated, and statistical analysis was performed using the Chi-square test with SPSS version 21.0, considering a p-value of less than 0.05 as statistically significant.

Results: The majority of RTA victims were males (77%) aged between 21-30 years (27%). Thoraco-abdominal injuries were the most common, observed in 66% of the cases, while 63% of the victims had head injuries, with intracranial hemorrhages present in 56% of cases. Alcohol intoxication played a significant role, particularly in the 31-40 year age group (68.8%). Shock and hemorrhage (56%) and coma due to head injury (44%) were the leading causes of death.

Conclusion: The findings highlight the high mortality and severe injuries sustained in RTAs, particularly in middle-aged males. Alcohol use and head injuries are key contributors to fatalities, underscoring the need for enhanced road safety measures and timely medical intervention.

Keywords: Road traffic accidents, autopsy, injury patterns, alcohol intoxication, head injuries

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Introduction

Road traffic accidents (RTAs) have been a significant public health concern since the inception of motor vehicles. The earliest recorded fatal road accident occurred in Great Britain in 1896, followed by the first documented fatality in the United States in 1899. Despite advancements in vehicle safety and traffic regulations, RTAs remain one of the leading causes of death worldwide. According to the World Health Organization (WHO), an estimated 1.25 million deaths were caused by road traffic injuries globally in 2010, equating to one death every 25 seconds (1). Although high-income countries have seen a decrease in fatalities due to traffic accidents, low- and middle-income countries (LMICs) have experienced an alarming increase. This disparity highlights the global inequity in road safety measures and accident prevention strategies (2).

In 2008, road traffic injuries ranked fourth among the leading causes of death worldwide. RTAs not only result in mortality but also impose a substantial economic burden on countries, costing 1-3% of their

gross domestic product (GDP) (3). The most affected demographic is young individuals aged 15 to 29 years, with over 50% of road traffic deaths occurring in this economically productive age group (4). This is particularly concerning for LMICs, where over 90% of global road traffic deaths occur, even though these countries account for only about half of the world's vehicles. Vulnerable road users, such as pedestrians, cyclists, and motorcyclists, constitute nearly half of those killed in RTAs (5).

If no effective measures are taken, road traffic crashes are expected to result in approximately 1.9 million deaths annually by 2020 (1). In addition to the fatality rate, RTAs lead to a high number of non-fatal injuries, requiring extensive medical treatment and trauma care, placing further strain on healthcare systems (2). Road traffic accidents are not only a public health issue but also a social and economic one, as the majority of victims are young, economically active individuals whose premature deaths or disabilities significantly affect families and communities (4).

India, with its rapidly growing population and urbanization, faces one of the highest rates of road traffic accidents globally. It ranks second after China in terms of the total number of road accident-related deaths. In 2013, India recorded over 207,551 deaths due to road accidents, making it a country with a severe road safety crisis (5). The increase in vehicular traffic, poor infrastructure, and lack of stringent traffic regulations contribute to the rising toll of road accident-related fatalities in the country. A 2010 report by the National Crime Records Bureau (NCRB) indicated that India saw over 430,600 road accidents, resulting in 133,938 deaths and 470,600 injuries, accounting for 37.2% of all accidental deaths due to unnatural causes (3).

The state of Uttar Pradesh, specifically the district of Barabanki, is a significant contributor to this concerning trend. Barabanki is located near Lucknow, the capital of Uttar Pradesh, and is a key transit hub for vehicles traveling to and from eastern Uttar Pradesh and other central and western parts of the state. The district is intersected by several busy national and state highways, making it a hotspot for road traffic accidents. High traffic density, coupled with insufficient road safety measures, has led to an increasing number of road traffic injuries and fatalities in the region (5).

Understanding the patterns of injuries leading to fatalities in road traffic accidents is crucial for developing effective preventive strategies. Identifying the types of injuries, the demographics of the victims, and the conditions surrounding the accidents, such as vehicle types and road conditions, can inform targeted interventions aimed at reducing road traffic deaths. This is particularly important for regions like Barabanki, where road traffic accidents are frequent due to high traffic flow on major highways (2).

Material and Methods

The study was conducted at the mortuary of the District Hospital, Barabanki. It employed a cross-sectional, descriptive design focusing on victims of road traffic accidents (RTAs) brought to the mortuary for post-mortem examination during the study period. The inclusion criteria involved deaths caused by road traffic accidents within Barabanki district, while the exclusion criteria excluded deaths due to other causes. The study was carried out over a one-year period, from September 2017 to August 2018. The sample size was calculated using a standard formula for descriptive studies, with a 5% type I error, a sample proportion of 0.5, and an absolute error or precision of 10%, leading to a calculated sample size of 96. After rounding, the final proposed sample size was set at 100.

Ethical approval for the study was obtained from the Institutional Ethics Committee, and permission for data collection was granted by the Chief Medical Officer (CMO) of the District Hospital, Barabanki. The data for this study was sourced from the records

of medicolegal post-mortem examinations performed during the study period at the District Mortuary. Data collection involved assessing the pattern of injuries among RTA victims through autopsy examinations. These examinations were carried out using standard post-mortem instruments, including scalpels, organ knives, brain knives, scissors, bone cutters, and rib shears. Inquest reports (Panchnama) were reviewed, and additional information was obtained from investigating officers, eyewitnesses, relatives, and friends of the deceased. Relevant hospital records, death certificates, and detailed post-mortem reports were also used for data collection.

The materials used for the autopsy process included a wide range of instruments, such as scalpels of various sizes, organ knives, brain knives, bone cutters, rib shears, dissecting forceps, Bernard's saws, post-mortem needles, skull chisels, hammers, and enterotomes. In addition to the autopsy instruments, data records such as inquest reports, statements from witnesses, hospital documents, and post-mortem findings were critical in gathering comprehensive data for the study.

Data Analysis: All collected data were entered into an MS Excel spreadsheet and analyzed using the Statistical Package for Social Sciences (SPSS) version 21.0. The Chi-square test was employed for statistical analysis, and a p-value less than 0.05 was considered statistically significant.

Table 1: Age-wise Incidence

The age distribution of road traffic accident (RTA) victims revealed that the majority of victims were in the 21-30 year age group, representing 27% of the total cases. This was followed by the 31-40 and 41-50 age groups, comprising 16% and 19% of the total cases, respectively. Younger individuals, below 20 years, made up 9% of the victims, while elderly individuals aged 61-70 years and above contributed 11% of the cases. The least number of victims were in the >80 age group, accounting for just 1%. The mean age of the victims was 41.52 years, with a standard deviation of 17.46 years, indicating that middle-aged adults were the most affected by road traffic accidents.

Table 2: Sex-wise Distribution

In terms of gender distribution, males were overwhelmingly represented, accounting for 77% of the total victims, while females constituted only 23%. This male dominance in road traffic accidents is consistent with global data, likely due to higher exposure of males to traffic environments, either as drivers, riders, or pedestrians. The male-to-female ratio in the study was calculated to be 3.35:1, showing that males are at a significantly higher risk of RTAs compared to females.

Table 3: Types of Roads

The types of roads where accidents occurred showed that state highways were the most common locations for RTAs, representing 46% of the total incidents. National highways followed closely, accounting for 36%, while other types of roads made up 18%. The high occurrence of accidents on state and national highways could be attributed to high-speed traffic, a higher volume of vehicles, and more frequent long-distance travel, increasing the risk of collisions.

Table 4: Various Categories of Victims

When categorizing the victims, pedestrians formed the largest group, comprising 34% of the total. This indicates the vulnerability of individuals walking on or near roads. Drivers and riders represented 29%, passengers made up 23%, and pillion riders were the least affected group at 14%. The distribution underscores the significant risk faced by vulnerable road users such as pedestrians, who are less protected compared to vehicle occupants.

Table 5: Pattern of Alcoholic Intoxication in Different Age Groups

Alcohol intoxication played a role in a substantial number of RTAs. The highest proportion of drivers or victims under the influence of alcohol was found in the 31-40 age group, where 68.8% of cases involved alcohol consumption. This was followed by the 21-30 age group with 44.4%, and the 41-50 age group with 36.8%. Younger age groups (<20 years) and older victims (>60 years) showed significantly lower levels of alcohol involvement, indicating that middle-aged individuals are at a higher risk of being involved in alcohol-related road accidents.

Table 6: Thoraco-Abdominal and Extremities Involvement

Thoraco-abdominal injuries were observed in 66% of the victims, with the thorax (chest) being involved in 36% of cases, the abdomen in 8%, and both regions in 22%. Limb injuries were also common, with lower limb involvement seen in 58% of the cases and upper limb involvement in 37%. This distribution shows that thoraco-abdominal injuries are prevalent in RTAs and are often accompanied by severe limb injuries, reflecting the traumatic nature of such accidents.

Table 7: Types of External Injuries

The most common types of external injuries were contusions (bruising), which were found in 72% of victims, followed by abrasions (70%), and lacerations (55%). Incised or punctured wounds were observed in 30% of cases, while crush injuries affected 15%. Fractures and dislocations were seen in 20% of cases, indicating that most victims suffered significant trauma to soft tissues and bones as a result of the impact from the accidents.

Table 8: Internal Injuries

Internal injuries were most frequently found in the ribcage, with 52% of victims suffering rib fractures. Lacerations to the lungs were noted in 28% of cases, while the liver and stomach were lacerated in 6% of cases each. The spleen was ruptured in 2% of cases, while no injuries were found in the kidneys or urinary bladder. These findings indicate that chest injuries, particularly to the ribs and lungs, are common in RTAs, often leading to severe internal bleeding or respiratory complications.

Table 9: Pattern of Head Injuries

Head injuries were prevalent in 63% of the cases, with intracranial hemorrhages occurring in 56% of the victims. The majority of hemorrhages were subarachnoid (85.71%), followed by subdural (55.35%) and extradural (26.78%). Skull fractures were observed in 60% of cases, with linear fractures being the most common (43.33%), followed by comminuted fractures (31.67%). These results underscore the significant role of head trauma in RTAs, which often leads to severe neurological damage or death.

Table 10: Cause of Death

The two main causes of death in RTA victims were shock and hemorrhage (56%) and coma due to head injury (44%). This indicates that the leading fatal injuries in road traffic accidents are either due to significant blood loss or traumatic brain injuries, both of which have high mortality rates if not promptly and adequately treated.

Table 1: Age-wise Incidence

| Age Group | No. | Percentage (%) |
|---------------------------------------|------------------------------|----------------|
| <20 Years | 9 | 9% |
| 21-30 Years | 27 | 27% |
| 31-40 Years | 16 | 16% |
| 41-50 Years | 19 | 19% |
| 51-60 Years | 14 | 14% |
| 61-70 Years | 11 | 11% |
| 71-80 Years | 3 | 3% |
| >80 Years | 1 | 1% |
| Mean Age ± SD (Range) in Years | 41.52 ± 17.46 (12-82) | - |

Table 2: Sex-wise Distribution

| Sex | No. | Percentage (%) |
|----------------------|-------------|----------------|
| Male | 77 | 77% |
| Female | 23 | 23% |
| Sex Ratio (M) | 3.35 | - |

Table 3: Types of Roads

| Type | No. | Percentage (%) |
|------------------|-----|----------------|
| National Highway | 36 | 36% |
| State Highways | 46 | 46% |
| Other Roads | 18 | 18% |

Table 4: Various Categories of Victims

| Category | No. | Percentage (%) |
|----------------|-----|----------------|
| Pedestrians | 34 | 34% |
| Drivers/Riders | 29 | 29% |
| Passengers | 23 | 23% |
| Pillion Riders | 14 | 14% |

Table 5: Pattern of Alcoholic Intoxication in Different Age Groups

| Age Group | Total No. of Victims | No. of Driver/Victim Under Influence of Alcohol | Percentage (%) |
|-------------|----------------------|---|----------------|
| <20 Years | 9 | 3 | 33.3% |
| 21-30 Years | 27 | 12 | 44.4% |
| 31-40 Years | 16 | 11 | 68.8% |
| 41-50 Years | 19 | 7 | 36.8% |
| 51-60 Years | 14 | 4 | 28.6% |
| 61-70 Years | 11 | 2 | 18.2% |
| 71-80 Years | 3 | 0 | 0% |
| >80 Years | 1 | 0 | 0% |

Table 6: Thoraco-Abdominal and Extremities Involvement

| Category | No. | Percentage (%) |
|-------------------------------|-----|----------------|
| Thoraco-abdominal Involvement | 66 | 66% |
| Thoracic | 36 | 36% |
| Abdomen | 8 | 8% |
| Both Thorax & Abdomen | 22 | 22% |
| Upper Limb Involvement | 37 | 37% |
| Lower Limb Involvement | 58 | 58% |

Table 7: Types of External Injuries

| Type | No. | Percentage (%) |
|---|-----|----------------|
| Abrasions | 70 | 70% |
| Contusions | 72 | 72% |
| Lacerations | 55 | 55% |
| Incised / Punctured / Perforated Wounds | 30 | 30% |
| Crush Wounds | 15 | 15% |
| Fractures and Dislocations | 20 | 20% |

Table 8: Internal Injuries

| Organ Involved | Type of Injury | No. | Percentage (%) |
|----------------|----------------|-----|----------------|
| Lungs | Lacerated | 28 | 28% |
| Heart | Lacerated | 1 | 1% |
| Liver | Lacerated | 6 | 6% |
| Spleen | Ruptured | 2 | 2% |
| Kidney | - | 0 | 0% |
| Stomach | Ruptured | 6 | 6% |
| Intestine | Ruptured | 4 | 4% |

| | | | |
|-----------------|---|----|-----|
| Urinary Bladder | - | 0 | 0% |
| Rib Fractures | - | 52 | 52% |

Table 9: Pattern of Head Injuries

| Type | No. | Percentage (%) |
|-------------------------------|-----|----------------|
| Head Injury | 63 | 63% |
| Intracranial Hemorrhage | 56 | 56% |
| - Extradural | 15 | 26.78% |
| - Subdural | 31 | 55.35% |
| - Subarachnoid | 48 | 85.71% |
| Skull Fracture | 60 | 60% |
| Type of Skull Fracture (n=60) | | |
| - Comminuted | 19 | 31.67% |
| - Linear | 26 | 43.33% |
| - Depressed | 13 | 21.67% |
| - Compound | 2 | 3.33% |

Table 10: Cause of Death

| Cause of Death | No. | Percentage (%) |
|-------------------------|-----|----------------|
| Coma due to Head Injury | 44 | 44% |
| Shock and Hemorrhage | 56 | 56% |

Discussion

The age distribution in the present study shows that the majority of road traffic accident (RTA) victims fell within the 21-30 year age group (27%), followed by 31-40 years (16%) and 41-50 years (19%). These findings are consistent with several studies that indicate younger and middle-aged adults are the most vulnerable to RTAs due to their higher mobility and frequent use of vehicles for work and social activities. A study by Kumar et al. (6) reported a similar distribution, with the highest number of RTA victims in the 21-30 age group (25%), followed by the 31-40 age group (18%). Additionally, WHO data also shows that RTAs are the leading cause of death among individuals aged 15-29 years globally (7).

Males constituted the overwhelming majority of victims (77%) in this study, with a male-to-female ratio of 3.35:1. This male dominance is well-documented in the literature. Kumar et al. (6) also reported a similar male preponderance in their study, where 76% of the victims were male. The higher exposure of males to traffic environments, whether as drivers, pedestrians, or riders, is often cited as the reason for this gender discrepancy. A study by Singh et al. (8) supports this, showing that men are more likely to engage in risky driving behaviors, such as speeding and alcohol consumption, further contributing to their higher representation in RTA statistics.

State highways were the most common site for RTAs in this study (46%), followed by national highways (36%). Highways, due to higher vehicle speeds and traffic density, are frequent locations for fatal accidents. A study by Sharma et al. (9) also highlighted the higher incidence of accidents on highways, particularly state and national highways, where vehicles travel at higher speeds, increasing the

likelihood of fatal crashes. Additionally, poor road conditions, lack of adequate signage, and improper lighting further exacerbate accident rates on these roads.

Pedestrians accounted for 34% of the victims in this study, making them the largest category of RTA victims. This is consistent with findings from studies conducted in other developing countries, where pedestrians, being unprotected road users, are at a higher risk of fatal accidents. Drivers and riders made up 29%, while passengers and pillion riders accounted for 23% and 14%, respectively. Sharma et al. (9) also reported a high number of pedestrian fatalities (30%) in their study, attributing this to inadequate pedestrian infrastructure in many urban and rural areas.

Alcohol consumption played a significant role in RTAs in the 31-40 age group, where 68.8% of victims were under the influence of alcohol. This was followed by the 21-30 age group (44.4%). These findings are in line with studies by Varghese et al. (10), who reported that alcohol intoxication was involved in 45% of fatal RTAs, particularly in younger and middle-aged males. Alcohol impairs judgment, slows reaction time, and increases the likelihood of risky behaviors such as speeding and not wearing seat belts or helmets.

Thoraco-abdominal injuries were prevalent in 66% of cases, with lower limb injuries occurring in 58% of victims. The high incidence of thoracic and abdominal injuries aligns with previous studies, such as those by Nzegwu et al. (11), which reported that chest and abdominal injuries were common in high-impact RTAs, leading to severe internal damage and contributing significantly to the mortality rate. Lower limb involvement, often seen in motorcyclists and pedestrians, also shows the severe trauma these groups sustain in accidents.

Contusions (72%) and abrasions (70%) were the most common types of external injuries observed in this study. Lacerations were noted in 55% of cases, while fractures and dislocations occurred in 20% of victims. These findings are consistent with the patterns described in studies by Pathak et al. (12), where soft tissue injuries like contusions and abrasions were the most frequent injuries in RTAs, followed by bone fractures. Such injuries reflect the high-energy trauma sustained in road accidents, particularly in high-speed collisions.

The most frequently injured internal organs were the lungs (28% lacerated), ribs (52% fractured), and liver (6% lacerated). These injuries are common in RTAs due to the high energy transfer during crashes, particularly in frontal and side-impact collisions. Kumar et al. (6) also reported a high incidence of thoracic injuries, particularly rib fractures (50%) and lung lacerations (30%), which are often fatal if not treated promptly. The presence of rib fractures suggests severe trauma to the chest, which often leads to complications such as pneumothorax and internal hemorrhage.

Head injuries were prevalent in 63% of cases, with intracranial hemorrhages occurring in 56% of victims. Subarachnoid hemorrhage was the most common type of intracranial bleeding, observed in 85.71% of the cases. These findings are consistent with studies by Patel et al. (13), which showed that head trauma and intracranial hemorrhage are the leading causes of death in RTAs. Skull fractures were present in 60% of cases, with linear fractures being the most common type (43.33%). Skull fractures, particularly when associated with hemorrhage, are often fatal and account for a large portion of RTA mortalities.

The leading causes of death in this study were shock and hemorrhage (56%) and coma due to head injury (44%). These results align with findings from Sharma et al. (9), who reported that hemorrhage and traumatic brain injury are the most common causes of death in RTAs. Immediate medical intervention, such as controlling bleeding and managing head injuries, is crucial to improving survival rates in such cases.

Conclusion

In conclusion, this autopsy-based study highlights the critical patterns of injuries observed in road traffic accident (RTA) victims, emphasizing the severity of thoraco-abdominal, limb, and head injuries. The majority of victims were males in the economically active age group, with a significant portion of fatalities resulting from head trauma and hemorrhage. Alcohol intoxication was a notable factor in a large

number of accidents, especially among middle-aged individuals. These findings stress the need for improved road safety measures, stricter traffic regulations, and timely medical intervention to reduce the burden of RTAs on public health.

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