



Study of Thoraco-Abdominal Injuries in Conjunction with Road Traffic Accident Cases Brought for Medico-Legal Autopsy

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ABSTRACT

Background: Road traffic accidents (RTAs) are a major public health concern worldwide, claiming around 1.19 million lives annually. Thoraco-abdominal injuries are frequently encountered in RTA victims and can lead to fatal outcomes if not promptly addressed.

Aim & Objectives: This study aimed to investigate the prevalence, patterns, and severity of thoraco-abdominal injuries in road traffic incident cases brought for medico-legal autopsy to the mortuary of JMCH, Jorhat. Specifically, it sought to determine the frequency and distribution of these injuries, assess their association with pre-hospital care, evaluate the effectiveness of medical interventions in reducing mortality, and correlate autopsy findings with observed injury characteristics.

Methods: This retrospective observational study analyzed thoraco-abdominal injuries in RTA cases undergoing medico-legal autopsy at the mortuary of Jorhat Medical College & Hospital. Data on demographic information, injury characteristics, pre-hospital care, medical interventions, and autopsy findings were retrieved from medico-legal records.

Results: Between January 1, 2023, and December 31, 2023, 753 cases were analyzed, revealing 158 RTA-related fatalities (38.6% of cases). The highest incidence of fatalities was observed in the 31-40 age group (17 cases), with males predominating (65.5%). Isolated thoracic injuries were more common, with lung injuries being the most frequent (52.4% of cases), followed by rib fractures (78.6%). Liver (96.7%) and spleen (59%) injuries were predominant in the abdomen.

Conclusion: Thoraco-abdominal injuries in RTAs are significant, emphasizing the need for accurate determination of injury nature and extent in medico-legal autopsies to improve understanding and management of these injuries.

Keywords: Medico-legal autopsy, Road traffic accidents, Thoraco-abdominal injuries.

INTRODUCTION

Road traffic accidents (RTAs) have emerged as a major public health problem worldwide. Around 1.19 million individuals lose their lives annually due to road traffic accidents. These accidents are the primary cause of death among children and young adults aged 5–29 years. Despite low- and middle-income countries having approximately 60% of the world's vehicles, they account for 92% of the world's road traffic fatalities. Vulnerable road users, such as pedestrians, cyclists, and motorcyclists, comprise more than half of all road traffic deaths.¹ India has a dubious distinction of having the highest number of road accident deaths in the world. In the calendar year 2022, India witnessed a total of 461,312 road accidents, resulting in the loss of 168,491 lives and injuries to 443,366 individuals. On average, this translates to 1,264 accidents and 462 deaths every day, or 53 accidents and 19 deaths every hour across the country. Out of this Assam witnessed 2994 fatalities which was 2% of the national share.²

Thoraco-abdominal injuries are commonly encountered in victims of RTAs and often lead to fatal outcomes if not addressed promptly. The thorax and abdomen house many vital organs like heart, lungs, liver, spleen and intestines which are vulnerable to trauma during road

accidents. Blunt force impact or penetrating injuries in these regions can cause life-threatening hemorrhage, organ rupture or evisceration.³ Accurate determination of the nature, extent and cause of thoraco-abdominal injuries assumes great importance in medico-legal autopsies of deceased RTA victims. However, there is paucity of research exploring patterns of thoraco-abdominal injuries in the context of RTAs from the Northeast region of India. The current study aims to bridge this knowledge gap by conducting a retrospective analysis of medico-legal autopsy findings of RTA cases reported to a tertiary care hospital in Assam over a period of one year.

Aims and objectives:

Aim: To investigate the prevalence and patterns of thoraco-abdominal injuries in road traffic incident cases brought for medico-legal autopsy to the mortuary of JMCH, Jorhat.

Objectives:

- To determine the frequency and distribution of thoraco-abdominal injuries among RTA victims.
- To assess the severity and types of thoraco-abdominal injuries sustained in RTAs.



- To examine the association between pre-hospital care and the severity of thoraco-abdominal injuries.
- To evaluate the effectiveness of medical interventions in reducing mortality related to thoraco-abdominal injuries.
- To correlate autopsy findings with the external and internal injury characteristics observed in RTA victims.

MATERIALS AND METHODS

Study Design: This study employed a retrospective observational design to analyze thoraco-abdominal injuries in RTA cases undergoing medico-legal autopsy.

Study Setting: The study was conducted at the mortuary of Jorhat Medical College & Hospital, Department of Forensic Medicine after obtaining clearance from Institutional Ethics Committee.

Study Period: The study was conducted over a period of one year, commencing from January 1, 2023, and December 31, 2023.

Sample Population: The study population will include all RTA cases brought to the mortuary during the study period, wherein medico-legal autopsies were performed.

Inclusion Criteria:

- Road Traffic Accident cases brought for medico-legal autopsy to the mortuary of Jorhat Medical College & Hospital.
- Cases with available relevant data including demographic information, injury characteristics, pre-hospital care, medical interventions, and autopsy findings.

Exclusion Criteria:

- Non-road traffic incident cases (e.g., deaths due to other causes such as natural causes, homicides, or suicides).
- Decomposed cases.

Data Collection:

a. Retrospective Data Retrieval: Relevant data pertaining to RTA cases, including demographic information, injury characteristics, pre-hospital care, medical interventions, and autopsy findings were retrieved from medico-legal records.

b. Autopsy Examination: Detailed autopsy examinations of the deceased individuals conducted by qualified Forensic Medicine experts to ascertain the presence, nature, and extent of thoraco-abdominal injuries.

Data Analysis:

Analysis of the data was performed using MS Excel, where calculations were applied to determine percentages and extract insights from the dataset.

RESULTS

Table 1 and figure 1 shows that a total of 158 road traffic accident (RTA) cases were analyzed, of which 61 (38.6%) involved thoraco-abdominal injuries. This indicates that thoraco-abdominal injuries constitute a significant proportion of the injuries sustained in RTAs, highlighting the critical nature of such injuries and the need for focused preventive measures and medical interventions to address them effectively.

Table 1: Total number of thoraco-abdominal cases out of the total RTA cases

Total number of RTA cases	Thoraco-abdominal injury cases	%
158	61	38.6%

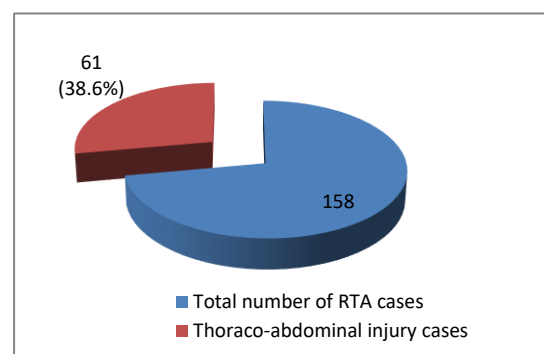


Figure 1: Showing total number of thoraco-abdominal cases out of the total RTA cases

Table 2: Age and sex wise distribution of victims

Age groups in year	Male	Female	Total	Percentage
1-10	1	2	3	4.9%
11-20	2	2	4	6.5%
21-30	7	3	10	16.3%
31-40	12	5	17	27.8%
41-50	6	3	9	14.7%
51-60	5	3	8	13.1%
61-70	3	2	5	8.1%
71-80	3	1	4	6.5%
81-90	1	0	1	1.6%

Table 2 depicts the peak incidence was seen in the age group of 31-40 years with 17 cases (27.8%) followed by 21-30 years with 10 cases (16.3%). For males, the highest number of cases is in the 31-40 age group with 12 cases, followed by the 21-30 age group with 7 cases. For females, the highest number of cases is also in the 31-40 age group with 5 cases.



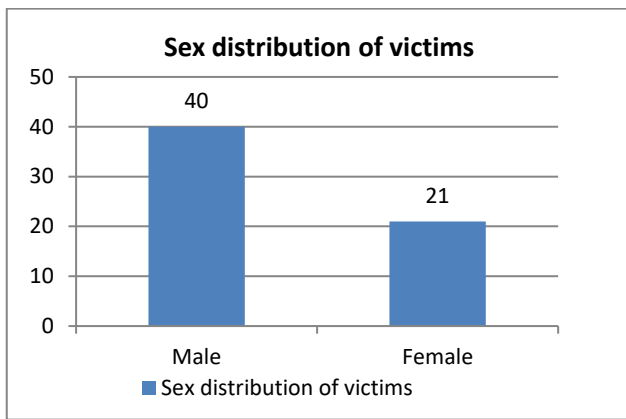


Figure 2: Sex distribution of victims of thoraco-abdominal injuries

Figure 2 illustrates the sex distribution of victims in the study, showing that out of the total cases, 40 were male and 21 were female. This indicates a higher incidence of male victims compared to female victims, with males constituting approximately 65.6% of the cases. This trend reflects a common pattern observed in road traffic accidents where male victims typically outnumber females, possibly due to greater exposure to risk factors associated with driving and traffic incidents.

Table 3: Survival period and region - wise involvement

Survival period	Thorax	Abdomen	Thorax & abdomen	Total	%
Brought dead	0	0	1	1	1.63%
2 to 6 hours	6	4	2	12	19.67%
6 to 12 hours	8	6	5	19	31.14%
12 to 24 hours	10	9	6	25	40.98%
More than 1 day	3	1	0	4	6.55%
Total	27	20	14	61	100%

Table 3 states the highest number of cases occurred within the 12 to 24-hour timeframe, totaling 25 cases (40.98%), followed by 6 to 12 hours with 19 cases (31.14%). Isolated thoracic injuries exhibited the highest number of cases across all timeframes, totaling 27 cases, while the isolated abdominal injuries had 20 cases in total.

Table 4 shows that the lung was found to be the most commonly involved organ, with 32 cases, representing 52.4% of all cases. Ribs were the most frequently involved skeletal structure, with 48 cases (78.6%). Clavicle involvement was seen in 14 cases (22.9%). Heart, bronchus, major vessels show fewer cases or no involvement at all while trachea, esophagus, thoracic vertebra show minimal involvement, with 1-2 cases each,

indicating a relatively lower frequency of injuries to these structures compared to the lung, ribs, and clavicle.

Table 4: Involvement of thoracic organs in victims

Organ	Cases	(%)
Lung	32	52.4%
Heart	4	6.5%
Bronchus	0	0%
Trachea	1	1.6%
Esophagus	2	3.2%
Major vessels	0	0%
Ribs	48	78.6%
Sternum	8	13.1%
Clavicle	14	22.9%
Thoracic vertebra	2	3.2%

Table 5: Distribution of organ injuries within the thoracic region of victims

Organ	Contusion	Laceration	Total	(%)
Right lung	32	28	60	98.3%
Left lung	16	12	28	46.6%
Heart	8	0	8	13.1%
Bronchus	0	0	0	0%
Trachea	0	1	1	1.6%
Esophagus	0	2	2	3.2%

Table 5 depicts that the right lung experienced the highest number of injuries, with a total of 60 cases, constituting 98.3% of all reported thoraco-abdominal injuries. Among these, 32 cases were contusions, and 28 cases were lacerations. The left lung, in comparison, had 28 reported injuries, representing 46.6% of total injuries. Within the left lung, there were 16 cases of contusions and 12 cases of lacerations. The heart had 8 reported injuries, all of which were contusions, making up 13.1% of the total injuries. There were no reported injuries in the bronchus. The trachea had 1 reported injury, which was a laceration, accounting for 1.6% of the total injuries. The esophagus had 2 reported injuries, both of which were lacerations, comprising 3.2% of the total injuries. Overall, the right lung was the most commonly injured organ, followed by the left lung and the heart.

Table 6: Distribution of organ injuries within the abdominal region of victims

Organ	Contusion	Laceration	Total	(%)
Liver	23	36	59	96.7%
Spleen	16	20	36	59%
Stomach	3	1	4	6.5%
Small Intestine	2	1	3	4.9%
Large Intestine	0	1	1	1.6%
Kidney	3	1	4	6.5%

Table 6 demonstrates that the liver experienced the highest number of injuries, with 59 cases in total, comprising 96.7% of all reported thoraco-abdominal injuries. Among these, 23 cases were contusions and 36 cases were lacerations. The spleen followed closely, with 36 cases of injury, making up 59% of the total injuries. Within the spleen, there were 16 cases of contusions and 20 cases of lacerations. The stomach and the kidneys each accounted for 4 cases of injury, representing 6.5% of the total injuries for each organ. The small intestine had 3 reported injuries (4.9%), consisting of 2 contusions and 1 laceration. The large intestine had the lowest number of reported injuries, with 1 case of laceration, contributing to 1.6% of the total injuries. Overall, the liver and spleen were the most commonly injured organs, primarily due to both contusions and lacerations.

DISCUSSION

Between January 1, 2023, and December 31, 2023, a comprehensive autopsy analysis of 753 cases revealed 158 fatalities attributed to Road Traffic Accidents (RTA), representing 38.6% of cases. This discussion elaborates on our findings and compares them with existing literature to highlight similarities, differences, and contextual insights.

Age Distribution: Our study found that the highest incidence of fatalities occurred in the 31-40 age group (17 cases, 10.7%), followed by the 21-30 age group (10 cases, 6.3%). This aligns with the results of Rakshitha et al.,⁴ who reported that most RTA fatalities were within the 21-40 age range. Similarly, Gushinge et al.⁵ observed a high incidence in individuals aged 30-50 years. The current findings also align with that of Abymon et al.⁶ and Shetty et al.⁷. These findings suggest that people in their 30s and 40s are particularly vulnerable to RTAs, potentially due to increased mobility and risk-taking behaviors associated with work and social activities.

In contrast, Kalara et al.⁸ noted a slightly younger peak age range, which might indicate regional differences or varying demographic profiles of the studied populations. Maurice et al.⁹ presented a broader age range of 14-56 years, with a mean age of 28.4 years, suggesting a wider age distribution in some regions or among specific accident types.

Gender Distribution: Males constituted 65.5% of fatalities in our study, which aligns with the consistent trend observed in the literature where males are predominantly affected. Hanumantha et al.¹⁰ reported a notably higher male-to-female ratio of 11.5:1, while Meera et al.¹¹ found a ratio of 3.8:1. Saini et al.¹² also documented a predominance of male victims at 85.9%. This gender disparity highlights the increased exposure of males to risk factors such as more frequent driving, involvement in high-risk occupations, and potentially riskier driving behaviors.

Our slightly lower ratio compared to some studies could reflect societal changes such as evolving gender roles, with more females participating in driving and, consequently, being exposed to similar risks.

Time of Injury: The highest number of cases in our study occurred within the 12 to 24-hour timeframe (40.98%), followed by 6 to 12 hours (31.14%). This is in contrast to Saini et al.,¹² who reported peak incidents between 6:00 and 9:00 p.m. (20.86%) and 3:00 to 6:00 p.m. (20.05%). The differences in peak times might be due to variations in reporting timeframes, local traffic patterns, or environmental factors influencing traffic flow and accident risks at different times of the day.

Rajkumar et al.¹³ indicated a morning peak for RTAs, suggesting that high traffic volume during commuting hours could contribute to higher accident rates. Such variations underscore the need for localized traffic management and safety strategies tailored to specific temporal patterns.

Injury Patterns:

Thoracic Injuries: In our study, the lung was the most commonly involved organ (52.4% of cases), consistent with findings by Hanumantha et al.,¹⁰ who reported lung involvement in 92.3% of internal thoracic injuries. Our results showed a significant incidence of rib fractures (78.6%) and clavicle injuries (22.9%), aligning with the injury patterns documented by Naik et al.¹⁴ The high frequency of right lung injuries (98.3%), involving contusions and lacerations, highlights the vulnerability of the thoracic region to severe impacts during RTAs.

Abdominal Injuries: The liver was the most affected organ in our study (96.7%), with lacerations and contusions being common. This correlates with Hanumantha et al.,¹⁰ who also found the liver to be the most commonly injured solid organ (32.6%). Maurice et al.⁹ noted a higher prevalence of spleen injuries in their study, indicating a possible variation in the nature of impacts or vehicular types involved. The involvement of the spleen (59%) in our findings, though significant, was second most prevalent after liver injuries.

Fatality Causes: Regarding the immediate causes of death, the current study emphasized the impact of thoraco-abdominal injuries on fatal outcomes, with internal organ damage being a critical factor. Meera et al.¹¹ cited hemorrhagic shock, especially when combined with head injury, as a significant cause (48.8%). Saini et al.¹² identified coma as the most common cause of death (57.18%). Our focus on the lethality of combined thoracic and abdominal injuries aligns broadly with these findings, highlighting the critical need for rapid medical intervention to address severe internal injuries in RTA victims.

CONCLUSION

The current study emphasizes the critical nature of thoraco-abdominal injuries resulting from road traffic accidents (RTAs), emphasizing an urgent need for targeted preventive measures to mitigate these injuries and fatalities. It reveals that such injuries are not only prevalent but often fatal, necessitating comprehensive interventions in traffic management and healthcare response systems. Effective prevention requires the implementation of



stricter traffic regulations, including robust laws that mandate lower speed limits, compulsory seatbelt usage, and severe penalties for violations. Enhanced driver education programs focusing on the risks of high-speed driving and the importance of adhering to traffic signals are crucial, particularly for younger drivers who are statistically at higher risk. Additionally, improved road safety measures, such as better infrastructure with clear signage, adequate lighting, and well-maintained road conditions, can reduce accident rates. The study's strength lies in its detailed analysis of injury patterns within a specific geographic and temporal context, providing valuable insights into the regional characteristics of RTAs. However, the single-center focus limits the generalizability of these findings. Future research should encompass multiple centers and diverse regions to develop a more comprehensive understanding of thoraco-abdominal injuries. This broader perspective would support the development of more effective and universally applicable prevention and intervention strategies, ultimately enhancing road safety and reducing the burden of RTAs on healthcare systems.

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