

## Pattern and injury severity score in thoraco-abdominal trauma: A cross-sectional study in medicolegal autopsy cases

Abdul Raof MP<sup>1,\*</sup>, Th. Meera Devi<sup>2</sup>, Soibam Neha<sup>3</sup>, Deepen Chhetri<sup>4</sup>

<sup>1,3,4</sup>Post Graduate Trainee, <sup>2</sup>Professor and Head, Dept. of Forensic Medicine, Regional Institute of Medical Sciences, Imphal, Manipur, India

**\*Corresponding Author: Abdul Raof MP**

Email: raofbaimbbs@gmail.com

### Abstract

Thoracoabdominal injury in various forms is one of the major causes of mortality in majority of the cases brought for medicolegal autopsies. The study aims at assessing the pattern of thoracoabdominal injuries in medicolegal autopsy cases and to correlate injury severity score (ISS) with survival period in these cases. It was observed that thoracoabdominal trauma cases accounted for 77 of the total 350 cases of medicolegal autopsies. The most commonly involved age group was >30-40 years (31%) and the commonest causative agent of thoracoabdominal trauma was road traffic accidents (71.4%) followed by firearm injury (19.4%). Majority of the road traffic accidents occurred on highways (85.4%) and the commonest offending vehicles were cars (36.3%). Majority of the victims in road traffic accidents were pedestrians (47.2%). The most common thoracic organ involved was the lung (30%) and ribs were fractured in 32.5% of the cases. Haemorrhagic shock with head injury was the cause of death in 50.7% of cases. The mean survival period of the victims was 2.56+/-5.4 hours (range 0 to 36). Victims with low ISS survived longer than victims with high ISS, and the mean ISS was 38+/- 13 (range 17 to 66). Some of the deaths in the present study were preventable if there was adequate transportation facility for these victims of trauma and presence of the well-equipped trauma centres near the highways.

**Keywords:** Medicolegal autopsies, Thoraco-abdominal injuries, Injury Severity Score (ISS).

### Introduction

The thoraco-abdominal region is vulnerable to various forms of mechanical trauma like road traffic accidents, fall from height, assaults, penetrating trauma and injuries involving this region have always been considered very serious. Road traffic accidents have always been a leading cause of blunt trauma throughout the world. At the same time, blunt weapons are some of the most easily available weapons during an unanticipated fight or assault. In India, one of the most common causes of blunt abdominal trauma is road traffic accident and blunt abdominal trauma is one of the leading causes of mortality among trauma victims.<sup>1</sup> On the other hand, penetrating wounds may be produced by a cutting or stabbing instrument, by a firearm, or by a fall on a sharp projecting point.<sup>2</sup> Interestingly, firearm fatalities are common in this part of India with an incidence of 6.11 firearm deaths per 1,00,000 population.<sup>3</sup> In present times, it is acknowledged that data collection, characterization and documentation of injuries form a cornerstone in prevention and management of trauma. The present study would provide us with the clues, injury severity score, general overviews of types, severity, incidence, prevalence and other characteristics of injuries in thoracoabdominal trauma. Hence, the present work was designed to study the pattern of thoraco-abdominal injuries with regard to the pattern of these injuries, and period of survival with special reference to Injury Severity Score (ISS) in fatal mechanical trauma cases brought for medico-legal autopsy.

### Materials and Methods

This cross-sectional study was carried out in the Department of Forensic Medicine of a tertiary care teaching institute in Imphal after approval from the Research Ethics

Board, during the period from September 2016 to August 2018. Seventy seven (77) cases of mechanical trauma with thoraco-abdominal injuries with or without injuries to other parts of the body, brought for medico-legal autopsies were included in the study. Cases of unknown causes of death and decomposed bodies were excluded from the study. Detailed autopsy examinations were conducted, and for the establishment of injury severity score (ISS), the injuries were ranked on a scale of 1 to 6 as per AIS (Abbreviated Injury Scale) as follows:<sup>4</sup>

AIS Score	Injury
1	Minor
2	Moderate
3	Serious
4	Severe
5	Critical
6	Maximum (Untreatable)

Each injury was assigned an Abbreviated Injury Scale (AIS) score and allocated to one of six body region viz.

1. Head and neck - including cervical spine, spinal cord, skull and brain
2. Face - including the facial skeleton, nose, mouth, eyes and ears
3. Chest – include injuries to all internal chest cavity organs, diaphragm, thoracic spine and rib cage.
4. Abdomen or pelvic contents – internal abdominal organs, pelvis and lumbar spine
5. Extremities or pelvic girdle – include all sprains, fractures, amputations and dislocations
6. External (skin)-include all contusions, abrasions and lacerations independent of their location.

The ISS is the sum of the squares of the highest AIS severity scores from the three most severely injured body regions and ranges from 1-75. An ISS of 75 is assigned to any one with AIS of 6, as all the AIS 6 injuries are inherently fatal. The findings of the study were recorded and statistically analysed and exposed as percentage mean and proportion.

## Results

Thoracoabdominal trauma constituted 22% of all the cases of mechanical trauma brought for autopsy (Fig. 1). The most commonly involved age group was >30-40 years comprising 31%, followed by the age group of >20-30 years (24.5%). The majority of the victims were males, the male: female ratio being 4:1 (Table 1). The commonest causative agent of thoraco-abdominal trauma was road traffic accidents (71.4%) followed by firearm injury (19.4%) as

shown in table 2. It is evident from table 3 that majority of the road traffic accidents occurred on highways (85.4%). The commonest offending vehicles were cars (36.3%) and trucks (29%). The commonest victims in road traffic accidents were pedestrians (47.2%) as shown in table 4.

Thoracic injuries were associated with head injury in 45.4% of the cases (Fig. 2). The most common thoracic organ involved was the lung (30%) as shown in Fig. 3 and ribs were fractured in 32.5% of the cases (Fig. 4). Haemorrhagic shock with head injury was the cause of death in 50.7% of cases (Fig. 5). A few cases (15.6%) died on the way to the hospital, while 49.35% died in the hospital and 35% died on the spot (Table 5). The mean survival period of the victims was  $2.56 \pm 5.4$  hours (range 0 to 36). The maximum number of cases had ISS of 21-40. Victims with low ISS survived longer than victims with high ISS. The mean ISS was  $38 \pm 13$  (range 17 to 66) (Table 6)

**Table 1: Showing the age and sex distribution**

S. No	Age group in years	Males		Females		Total	PC (%)
		No	%	No	%		
1	<10	0	0	0	0	0	0
2	>10-20	4	5.2	1	1.3	5	6.4
3	>20-30	15	19.4	4	5.2	19	24.5
4	>30-40	22	28.5	2	2.6	24	31
5	>40-50	11	14.3	4	5.2	15	19.4
6	>50-60	3	3.9	3	3.9	6	7.7
7	>60-70	2	2.6	2	2.6	4	5.1
8	>70	4	5.2	0	0	4	5.1
Total		61	79.2	16	20.8	77	100

**Table 2: Showing the causative agents of thoracoabdominal trauma**

S. No	Type of trauma	Numbers	Percentage (%)
1	Road traffic accident	55	71.4
2	Fire arm	15	19.4
3	Fall from height	5	6.5
4	Bomb blast	1	1.3
5	Injury by sharp weapon	1	1.3
Total		77	100

**Table 3: Showing the place of occurrence of road traffic accidents**

Place of occurrence	No of cases	Percentage (%)
National highway	30	54.5
State highway	17	30.9
Inter village road	8	14.5
Total	55	100

**Table 4: Showing the offending vehicles and victims of road traffic accidents**

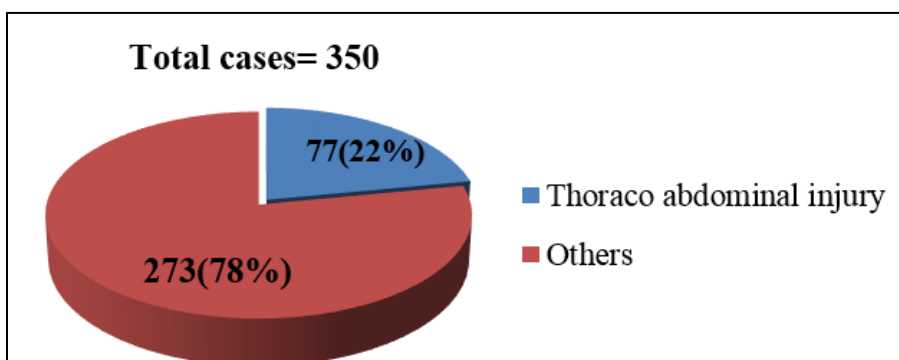
Type of victim	Offending vehicles					Total	Percentage (%)
	Car	Heavy vehicle (truck)	Bike	Auto rickshaw	Self		
Pedestrian	9	9	6	2	0	26	47.2
Motorcyclist	4	2	1	2	2	11	20
Pillion rider	5	2	1	0	0	8	14.5
Car occupant	0	2	0	1	3	6	10.9
Heavy vehicle occupant	0	0	0	0	1	1	1.8
Auto rickshaw occupant	2	1	0	0	0	3	5.4
Total	20 (36.3%)	16 (29%)	8 (14.5%)	5 (9.1%)	6 (11%)	55	100

**Table 5: Showing the place of death**

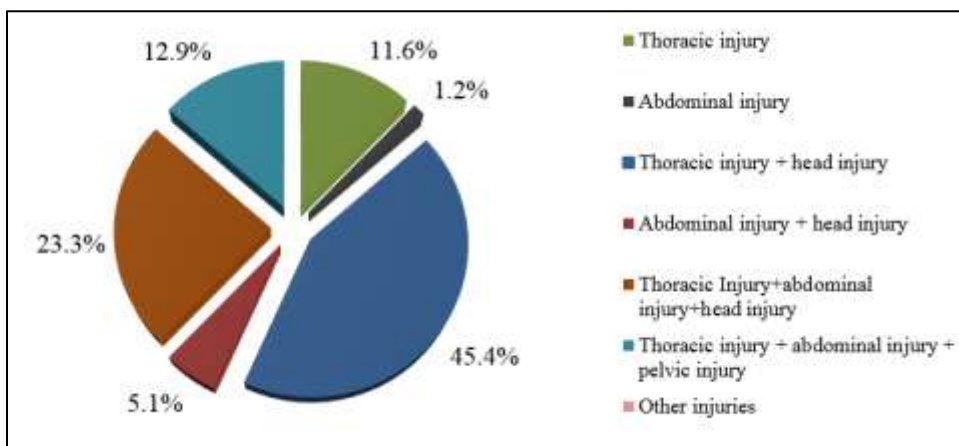
Place of death	No. of cases	Percentage (%)
Hospital	38	49.35
Spot	27	35
On the way to hospital	12	15.6
Total	77	100

**Table 6: Showing injury severity score (ISS) in relation to survival period**

S. No	ISS	Survival Period							Total	r=-0.418
		Spot	<1hr	1-<2hr	2-<6hr	6-<12hr	12-<24hr	24-<48hrs		
1	0-10	0	0	0	0	0	0	0	0	
2	11-20	0	0	1	0	0	2	0	3	
3	21-30	1	2	3	11	0	3	1	21	
4	31-40	6	5	4	6	1	0	0	22	
5	41-50	6	4	1	2	0	0	0	13	
6	51-60	9	2	0	0	0	0	0	11	
7	61-70	4	0	1	1	0	0	0	6	
8	71-75	1	0	0	0	0	0	0	1	
Total		27 (35%)	13 (16.8%)	10 (12.9%)	20 (25.9%)	1 (1.3%)	5 (6.6%)	1 (1.3%)	77	



**Fig. 1: Showing the total number of thoracoabdominal trauma cases**



**Fig. 2: Showing associated trauma of other sites in thoracoabdominal injury cases**

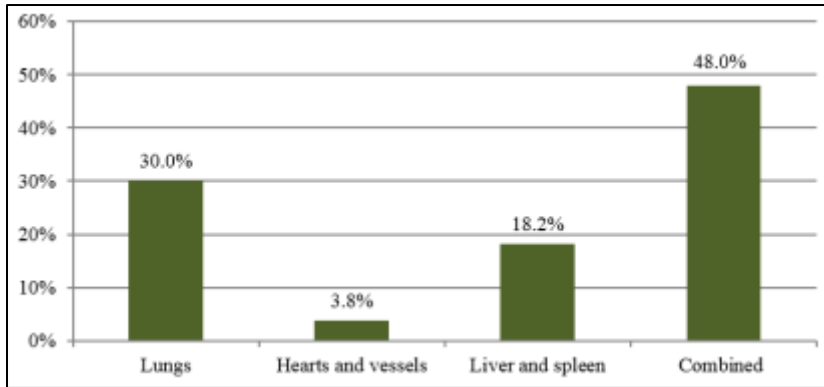


Fig. 3: Showing the distribution of thoracoabdominal organ injuries

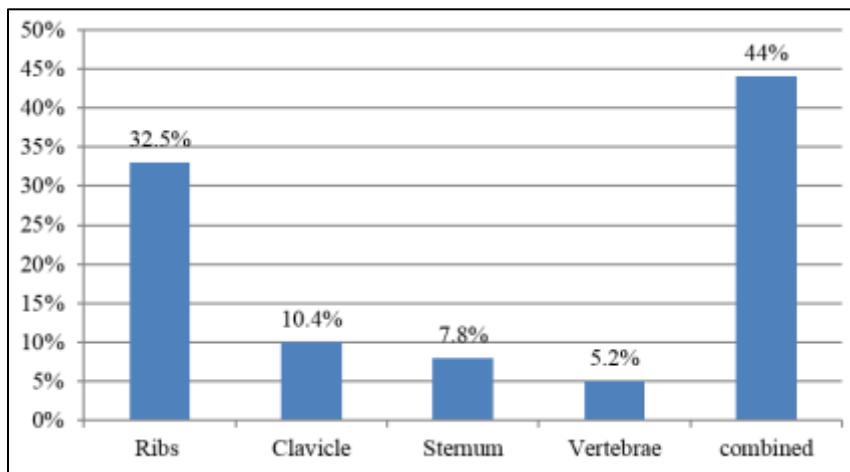


Fig. 4: Showing distribution of cases according to bony structure involved

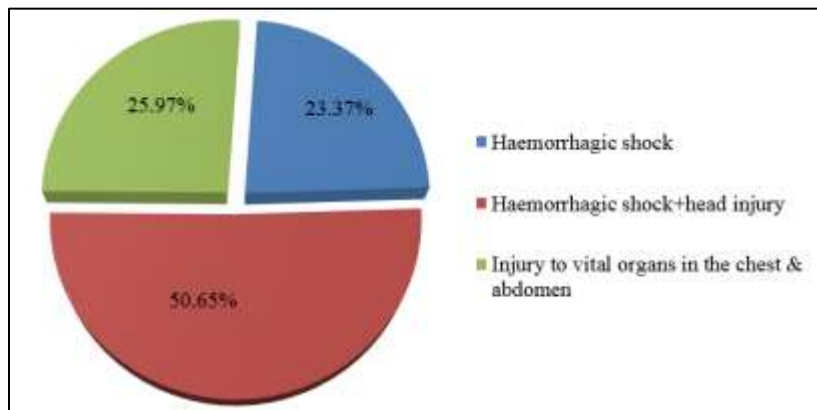


Fig. 5: Showing the causes of death

**Discussion**

In this study, the peak incidence of thoracoabdominal trauma was observed in the age group >30-40 years, comprising 31% of the cases. Similar findings were observed by Prajapati et al<sup>5</sup> and Srivastava et al.<sup>6</sup>

There were considerable number of road traffic accident cases and fire arm cases in the age group of >30-40 years in this study, and it indicates that people in these most productive and active phase of life are more vulnerable to

such forms of trauma as they tend remain outdoors and get themselves involved in hazardous tasks to earn their wages.

Majority of the cases were males, constituting 79% of the total, the male: female ratio being 4:1. This male preponderance is consistent with the study observed by Reddy et al.<sup>2</sup> Prajapati et al<sup>5</sup> and Kumar et al.<sup>7</sup> The reason for this male dominance maybe due to the fact that males are more exposed to the unforeseen hazards of roads during travelling and also for the reasons cited above.

As observed by Chandra et al,<sup>8</sup> Bergvist et al<sup>9</sup> and Abbasi et al,<sup>10</sup> in this study also road traffic accidents were

the most common cause of thoracoabdominal trauma. This finding could be due to poor maintenance of roads and automobiles, lack of proper traffic planning, violation of traffic rules by drivers and use of intoxicants while driving. On the other hand, the second commonest cause of thoracoabdominal injuries in this study was the firearm, which may be due to the prevailing law and order situation in the state.

The commonest offending vehicles were the cars (36.3%), followed by heavy vehicles (29%) and pedestrians were the most common victims followed by motor cyclists in the present study. Similar findings were observed by Nikolic et al<sup>11</sup> and Rautji et al,<sup>12</sup> where pedestrians were the most common victims. Abbasi et al<sup>11</sup> also observed cars to be the most common offending vehicle (22.1%), which is in accordance with this study. Further, the reason for high number of pedestrian victims could be due to carelessness on the part of the pedestrian while crossing roads, not using footpaths, etc.

Luby et al<sup>13</sup> observed that motorcyclists were the commonest victims after pedestrians (46%) which may be compared with findings of the present study. This finding can be explained by fact that most of the motorcyclists are usually youngsters and care free riders who usually ride without proper safety measures, with a tendency to over speeding, negligence and intoxication.

In this study, most of the thoracoabdominal injuries due to road traffic accidents occurred on the national and state highways i.e. 47(85.4%) and followed by inter village road 8(14.5%). Similarly, Kumar et al<sup>14</sup> also observed that most of the thoracoabdominal injuries occurred due to road traffic accident and they occurred on highways (52%) followed by city road (28.2%). This can be explained by the congested and poorly maintained highways in this part of the country.

In a study conducted by Kumar et al,<sup>14</sup> combination of chest and head constituted 34.4% of total injuries, and chest alone sustained maximum injuries i.e.16.7%. Similar findings were observed in the present study. This pattern of injury could be due to the fact that head and chest are the most exposed and vulnerable parts in road traffic accidents and in case of homicidal injury, assailants target vital organs like brain, heart and lungs which are situated in these body parts.

In our study, it was observed that most common thoracoabdominal organ injured was the lung (30%) and the commonest bones fractured were the ribs (32.5%). Similar findings were observed in a study conducted by Kumar et al,<sup>7</sup> Kumar et al<sup>14</sup> and Lema et al,<sup>15</sup> who observed that ribs were the most common bones fractured and lungs were the most common organs injured in thoracoabdominal trauma. This can be explained by the fact that rib cage acts as a protective mechanism in trauma involving the thoracic region, and fracture ribs are often associated with lung trauma.

In the present study, we found that the commonest cause of death was shock and hemorrhage with head injury (50.7%) followed by injury to vital organs (head, lungs and vessels) i.e. 25.97%. In accordance with our finding, Segers

et al<sup>16</sup> and Vock et al<sup>17</sup> also observed hemorrhagic shock combined with head injury to be the cause of death in majority of the cases.

Majority of the victims of the thoracoabdominal injury cases in our study i.e., 38 (49.4%) died in the hospital, while 12 (15.6%) cases died on the way to the hospital and 27 (35%) died on the spot. Nikolic et al<sup>11</sup> and Sahdev et al<sup>18</sup> observed that most of the injured persons survived for some time and expired in hospitals and also opined that if victims were brought early and were provided advance medical treatment, they would have survived. Thus, autopsy of the injured person who survived in trauma reveals most frequent injury complications, clinical diagnosis and preventable deaths.

The mean period of survival of the victims in our study was 2.56 +/- 5.4hrs. It was also found that victims with low ISS had longer survival period compared to those with high ISS score. Maximum spot death victims had ISS of 51-60 range. Victims who survived more than 24 hours had ISS of 21-30 range. A weak negative correlation between survival period and ISS value in our sample was noted (coefficient of linear correlation,  $r=-0.418$ ) i.e., ISS score is inversely proportional to the period of survival. More victims with high ISS have less or zero survival period and victims with less ISS have longer survival period. Similar negative correlations between survival periods and ISS values were observed by Srivastava et al<sup>6</sup> ( $r=-0.472$ ) and Nikolic et al<sup>11</sup>( $r=-0.458$ ). However, the overall survival of a victim depends on effective emergency medical system like prompt and correct diagnosis, immediate intervention, etc.

## Conclusion

It may be concluded from the present study that the commonest cause of thoraco-abdominal trauma in this part of the country is road traffic accident followed by firearm injuries. Victims with low ISS had longer survival period compared to those with higher ISS and most of the victims died on the way to hospitals, which may attributed to the lack of emergency medical services in the highways in this part of the country.

**Conflict of Interest:** None.

**Acknowledgement:** None.

**Source of Funding:** None.

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**How to cite this article:** Raof Abdul MP, Devi Th. M, Neha S, Chhetri D. Pattern and injury severity score in thoraco-abdominal trauma: A cross-sectional study in medicolegal autopsy cases. *Indian J Forensic Community Med* 2019;6(1):18-23.