Original Article

An Autopsy Based Epidemiological Study of Abdominal Injuries in a South India Population

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Abstract

Background: Trauma to the abdomen is a major cause of mortality in India. It is important clinically because abdominal injury poses difficulty in diagnosis and has lethal potential if not immediately treated.

Methodology: This autopsy-based study was aimed at finding the nature and pattern of injuries in the abdomen region. After autopsy examinations of 134 trauma cases involving abdominal injuries, the epidemiological data was compiled and analysed.

Results: Most victims belonged to the age group of 21–40 years (44%), and males outnumbered females in the ratio of 9:1.Road traffic and railway accidents together (77%) accounted for most abdominal injuries. Common intra-abdominal organs injured were liver, spleen, intestines, and kidneys. Liver sustained lacerations (69%) more than contusions (11%). The most frequent associated injuries involved the head (35%), chest, limbs, and spine.

Conclusion: This study concluded that road accidents were the main cause of abdominal trauma, and males in the working age group (21–50 years) were the most affected. Most of the injured persons died on the spot, and hemorrhagic shock (47%), followed by head injury, were the main causes of death. These findings reiterate that efforts could be made to decrease these preventable forms of deaths by creating public awareness about safety measures, both on the road and at workplaces. The fact that many of the injured persons died on the spot highlighted the urgent need for better pre-hospital trauma care and appropriate actions by policymakers.

Keywords: Trauma; Abdominal injuries; Road traffic accidents (RTA); Spot death.

Introduction

Trauma remains the most common cause of death for all individuals between the ages of 1 and 44 years and is the third most common cause of death regardless of age. (1) The abdomen is the largest cavity in the body, which is not protected by any

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bony cage, thus prone to both blunt and penetrative force injuries. Stabbing of the abdomen may lead to the opening of large blood vessels, leading to profuse bleeding. Protrusion of abdominal organs, especially the bowel, out through the wound may be seen in cases of penetrative injury to the abdomen. [2]

Injuries to the chest wall are often associated with significant injury to the liver, and the liver is the second most injured organ in penetrating abdominal trauma. The liver and spleen may bleed extensively, causing a hemoperitoneum. Among patients with blunt injuries, motor vehicle collision is the most common injury mechanism.[3] Around 168491 lives were lost on Indian roads in 2022—an all-time high.[4] Extensive bruising of the gut and its vascular mesentery may occur while the intestines are particularly vulnerable to transection from being compressed against the spine. Ruptures of the liver and spleen are common lesions following serious abdominal trauma, such as a fall from a height or a crush injury, as in traffic impacts. The most common fatal sequel to intra-abdominal trauma is hemorrhage from any of the contained organs.[5]

Injuries to the abdomen are not always isolated but often associated with injuries to other parts, and their involvement may be overlooked. Accurate determination of the nature, extent and cause of abdominal injuries assumes great importance in medico-legal autopsies of RTA victims. However, there is paucity of studies focussing on abdominal injuries in the context of RTAs and other forms of trauma in South India. The present study aimed to bridge this knowledge gap by conducting an autopsy-based analysis of trauma cases reported to a tertiary care hospital. This study tried to analyze the pattern and nature of abdominal injuries, and the findings could serve to extend our knowledge in trauma pathology.

Materials and Methods

Study design & sample size: This was a prospective observational study of 18 months conducted in a teaching hospital in South India during 2014-2016, involving 134 cases with abdominal and other concomitant injuries undergoing autopsy.

Inclusion criteria: All trauma-related deaths subjected to autopsy and found to have abdominal and other associated injuries.

Exclusion criteria: All cases without any involvement of the thoraco-abdominal region, decomposed bodies and burn cases. Cases where trauma type could not be precisely established were also left out.

Data collection and analysis: Relevant information regarding the circumstances of trauma and the course of death was obtained from friends, relatives, and police sources. The details were noted in a pro forma prepared for the study, and data was analyzed using descriptive statistics, where calculations were applied to determine percentages. A formal approval from the Institutions' Ethics Committee (IEC) was taken prior to starting the study.

Results

The profile of injuries obtained from our study are presented in the form of tables below.

Table 1: Genderwise and age group wise distribution of victims (n-134)

Sex	**Numbers**	**Percentage**
Male	121	90.3%
Female	13	9.7%
Total	134	100%
Age Group in years	**Total number of victims**	**Percentage**
0 – 19	13	9.7%
20 – 29	32	23.8%
30 – 39	29	21.7%
40 – 49	24	17.9%
50 – 59	17	12.7%
60 – 69	12	8.9%
70 – 79 & over	7	5.2%
Total	134	100%

Of the 134 autopsied abdominal trauma cases considered, 90% were male, and most belonged to the age group of 21–40 years (n = 61, 45.5%).

Table 2: Mode of abdominal injuries(n-134)

Mode of injuries	Number of cases	Percentage
Road Traffic Accidents (RTA)	89	66.4%
Railway injuries	15	11.2%
Assault by sharp force(Stab/Firearm)	11	8.2%
Fall from height, Fall over sharp object	7	5.3%
Assault by blunt force	03	2.2%
Others (ex. Wall collapse, Bull gore, industrial injury)	09	6.7%

RTAs were the most common cause of chest trauma (66%), followed by railway injuries (11.2%) and assault cases (8.2%), including both sharp and blunt force injuries.

Table 3: Period of survival after trauma(n-134)

Period of survival	Number of cases	Percentage
Spot death (and <1 hour)	73	54.5%
During transport & hospitalized (1- 24 hours)	29	21.6%
In hospital deaths (1-7 days)	25	18.7%
After 7 days	7	5.2%

Table 3 shows the distribution of abdominal trauma in relation to the period of survival of victims. More than half of the victims were found spot dead or immediately within an hour (54%), and 22% died within 24 hours of trauma, after hospitalization.

Table 4: Profile of external and internal injuries to abdomen (n-134)

External injuries	Total number of cases	Percentage
Abrasions	97	72%
Contusions	59	44%
Lacerations	24	18%
Internal injuries		
to liver	107	79%
to spleen	53	39%
to abdominal wall & diaphragm	34	25%
to peritoneum	25	19%
to stomach (n-10) & intestines (n-19)	29	14%

Table 5: Type and distribution of abdominal injuries (n-134)

Type of injury	No. of cases	Percentage
Liver lacerations (n-91) & contusions	102	76.1%
Spleen lacerations (n-43) and contusions	47	35.1%
Kidney lacerations and contusions	17	12.7%
Stomach rupture & contusions	16	12%
Intestine rupture & contusions	15	11.2%
Liver & Spleen ruptures	11	8.2%
Pancreas rupture and contusions	07	5.2%
Lumbar vertebral / pelvic injuries	21	15.6%
Miscellaneous- Liver stab wound (n-2), mesentery, bladder injury etc	8	5.9%

Tables 4 and 5 illustrate the location and type of external and internal injuries in relation to abdomen. Abrasion (72%) was the most common type of external injury, followed by contusion (44%) while major internal injuries noted were lacerations of the liver (67%) and spleen (32%).

Table 6: Other injuries in association with abdominal injuries (n-134)

Associated Injuries	Number of cases	Percentage
Head & neck	61	45.5%
Thorax	93	69.4%
Limb fractures	39	29.1%
Vertebral injuries	15	11.2%
Pelvis structures	17	12.7%
Abdomen alone	4	2.9%

The most frequent associated injuries involved the head (45%), chest (69%), limbs (long bone # in 29% cases), and spine, while injuries limited to the abdomen region alone were found in 4 cases.

Table 7: Types of RTA victims in the study sample. (n=91)

Type of victim	Total cases (n-91)	Percentage
Pedestrian	27	29.6%
2-Wheeler riders	21	23.1%
2-Wheeler pillion riders.	10	10.9%
3-Wheeler occupants (Auto, Tractor)	09	9.9%
4-wheeler occupants (Cars, Truck, Lorry, Tanker)	17	18.6%
Others	07	8.5%

Among the road users, pedestrians comprised the greatest number of victims, involving 29% of cases, followed by two-wheeler riders (23%), and pillion riders (11%).

Table 8: Causes of death in the study sample.(n-134)

Cause of death	Number of cases	Percentage
Hemorrhagic shock	63	47.1%
Trauma to head	35	26.2%
Trauma to spine	7	5.2%
Thoracic-abdominal injury (combined)	11	8.2%
Abdominal injury (alone)	4	2.9%
Peritonitis & Septicemia	3	2.2%
Miscellaneous (traumatic asphyxia, multiple injuries etc)	11	8.2%

In our study sample, we observed that the main cause of death was hemorrhagic shock (47%), followed by, trauma to the head (26%), trauma to the spine(5.2%), and multiple injuries (8%).

Fig 1. Firearm Injury

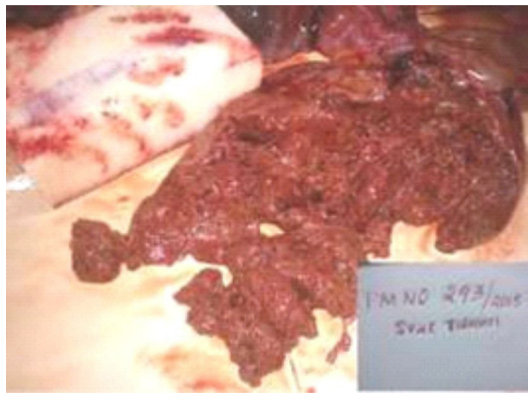

Fig 2. Rupture of liver

Fig 3. Lacerations of liver

Fig 4. Contusions of liver

Discussion

Injuries to the abdomen are mostly accidental and occasionally homicidal, due to the accessible anatomical nature of the abdomen region. As abdominal injury is a diagnostic black box, expedient diagnosis and treatment of intra-abdominal injuries are essential to prevent morbidity and death. The present study focussed on the epidemiologic aspects of thoraco-abdominal trauma and related variables.

Table 1 depicted that 89% of victims were malein our study, and peak incidence was noticed in the age group of 21–40 years (45.5%). The male preponderance of victims was in accordance with studies. [6,7], as men are more exposed to the outside hazards of the modern world. In a study on the profile of RTA victims in Jammu, [8] males constituted 86%of the total number. The most vulnerable age groups are between 21-30 and 30-40 years, which was quite similar to studies [9, 10] explained by the fact that persons in these age groups tend to take risks, thereby subjecting themselves to the danger of accidents.

Table 2 showed that injury due to RTA (n-91, 68%) outnumbered the other modes, followed by assault cases at 8%, which was consistent with studies. [9, 11] Our study partially agrees with a study [12] which found out that RTA (48%) was the most common cause, followed by fall (32%) and stab injury (18%). As persome studies, [7,13] RTA accounted for nearly 70% of cases, followed by falls from height and assaults accounting for 14% and 09% of cases, respectively. The high number of RTAs can be attributed to a lack of road safety sense and ignoring traffic rules. Bad road conditions, speeding, poor visibility, not using helmets, consuming alcohol, and using phones while driving have contributed to the occurrences of RTAs in India.

Table 3 showed that, more than half of the victims died on the spot, which is in accordance with the studies [8,13] and 22% of victims died later, but within 24 hours of hospitalization, while 18% died in subsequent 7 days. Out of total 73 cases of spot death in our study, most victims died due to the injury to the head, thorax, and abdomen region, followed by polytrauma. A few studies [10,12] found that most victims passed away within 1-6 hours of the incident. However, the incidence of spot deaths was mere 19% in a study.[14] In a 2-year study by Gushinge,[15] about 48 victims died on the spot or were brought dead to hospitals, while another 48 victims succumbed within 6 hours of admission. These findings highlight the necessity of basic life support ambulances and quick transfer to the hospital. The fatal outcomes in those who survived for a while but eventually died in due course, emphasize the need of robust pre-hospital emergency care services in the country.

As per tables 4 & 5, internal injuries were more common than external injuries. The study identified abrasions (72%), and contusions (44%), as the most prevalent external injuries on the abdomen, which is comparable to a study by Abymon [16]. The liver (79%) and the spleen (39%) were the most injured intra-abdominal organs, followed by the intestines (14%) and kidneys (12%). Liver sustained more lacerations (67%) than contusions. These findings stood in accordance with many studies [6-7, 9-12], where the liver and intestines were found to be more involved than the spleen.

Bordoni[17] reported proportionally more hepatic and splenic lesions in blunt traumas than in the penetrating trauma. Although the most injured abdominal organ in penetrating trauma was the liver, they found predominantly more lesions in the intestines, stomach, and blood vessels of individuals of penetrating trauma. Interestingly, Naik[13] found liver injury (35% cases) as the commonest, followed by the intestine's (31%), while Khan[14] found that the second most common abdominal organ to be injured, after the liver, was the kidney in a study on fatal RTAs. Hemorrhage is more common with parenchymatous injury where death has occurred, and contusion of the liver was seen in more cases than laceration, as per Sugadha.[18]

An abdominal injury may be associated with extra abdominal injuries, and frequently, the abdominal wall usually escapes gross injury by transmitting the force of violence to more resistant organs inside the abdominal cavity. In our study (table 6), the most frequently associated injuries involved the head (45%), chest (69%), limbs (29%), and spine (15%). This picture varied significantly with the findings of Naik[13] which revealed no association in 47% of cases and association with the head (7%), chest (17%), limb

(11%), and multiple injuries (18%).Blunt abdominal injuries were most associated with thoracic and head injuries in a Qatar trauma canterstudy[19] on 1036 patients of abdominal trauma. The common associated extra-abdominal injuries included chest (35%), musculoskeletal (32%), and head injury (24%). These results are generally consistent with our focus on the lethality of combined thoracic and abdominal injuries, emphasizing the urgent need for prompt medical attention to treat serious internal injuries in RTA victims.

Among the road users (table 7), pedestrians comprised the greatest number of victims, involving 29% of cases in our study, followed by two-wheeler riders (23%), and pillion riders (10%). This composition was consistent with the studies [11-14] which is understandable as most of the road users are pedestrians, thus exposed to a higher risk of accidents and injuries. However, a study done in Manipal [9] on RTAs stated that most of the victims were two-wheeler occupants (35%), followed by pedestrians (23%). Panchal(12) found that bike riders (38.5%) constituted the maximum number of cases, followed by pillion riders (31.8%) rather than pedestrians. The causes of accidents could be defects in motor vehicle condition and bad road conditions, coupled with drivers' fault in many cases. Road safety measures like wearing seat belts by passengers in motor vehicles, using certified helmets by 2-wheeler riders driving at safe speed, and obeying the traffic rules by pedestrians, will avoid accidents and resultant injuries. Driving under the influence of alcohol and using mobile phones, which can distract while driving, should be avoided. Robust pre-hospital care and preventive measures symbiotically help mitigate these kinds of injuries and fatalities.

Due to the soft and yielding nature of the abdominal wall, the application of even a heavy force may not cause any external wound on the abdominal wall, but the transmitted force may cause some serious internal wound. Subcapsular tears produce intrahepatic hematoma, which may eventually rupture into the peritoneal cavity, causing death hours or days after the injury. [15] The current study focused on the impact of abdominal injuries on fatal outcomes in relation to the immediate causes of death, where internal organ damage was identified as a critical factor.

Our study aligned with many studies [2, 7-12, 16-18] in revealing that the primary causes of death were hemorrhagic shock (47%) and head injury (26%), more so when the individual died within a few hours. This could be explained by the fact that thoracoabdominal trauma frequently accompanies head injuries in high impact accidents or falls from height. However, Abymon [16] reported that among RTAs, head injury (47%) was the commoner cause of death, followed by thoraco-abdominal injury (20%). Abdominal injury alone had caused death in 3% of cases, mainly due to rupture of splenic or hepatic hematomas, causing torrential internal bleeding. Cases of peritonitis (3%) and septicemia combined with trivial head injury showed delayed death.

Conclusion

Abdominal injuries constitute a prime factor in increasing the amount of morbidity and mortality in trauma cases. As per our study, the most likely person to experience abdominal trauma is a healthy young adult male in an age range of 21–40 years. The most frequently observed causes of abdomen trauma were RTA and railway accidents, followed by assault. The main cause of death was haemorrhagic shock due to multiple injuries followed by head injury.

A thorough and meticulous examination should bedonein all trauma and accident cases as many of them show fatalvisceral organ damage without external injury. Our study finding that many of the injured persons died on the spot highlighted the urgent need for better pre-hospital trauma care and appropriate actions by policymakers. It reiterates that efforts could be made to decrease these preventable forms of deaths by creating public awareness about safety norms and preventive measures.

Given that spot fatalities and death rates within one hour of experiencing trauma, were considerably higher, it is crucial to begin pre-hospital care and primary resuscitation as soon as possible during the first hour of trauma, rightly called the "golden hour of trauma." The first 60 minutes post-trauma which is the most crucial period that determines the patient's outcome has been termed the "golden hour."[20]

The stakeholders may benefit from this study in identifying the vulnerable population to trauma, and educating them on various elements of safety. The existing trauma services at primary and secondary levels of healthcare may be improved and enhanced so that many lives can be saved.

Conflict of Interest: Nil.

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Ethical clearance: Approved from the Institutional Research Ethics committee, wide letter dated November 26, 2014.

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