



RESEARCH ARTICLE

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## Detailed Study of Blunt Abdomen Trauma in a Tertiary Care Center

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### ABSTRACT

**Background:** Abdominal trauma is one of the most common causes among injuries caused mainly due to road traffic accidents. The rapid increase in motor vehicles and its aftermath has caused rapid increase in number of victims to blunt abdominal trauma. Motor vehicle accidents account for 75 to 80 % of blunt abdominal trauma.

**Aim:** To evaluate various clinical manifestations of blunt trauma abdomen, various available investigations for detection of intraperitoneal injuries, in particular, DPA, FAST and CT scan of abdomen, and to compare the efficacy of DPA and FAST in diagnosing hemoperitoneum.

**Materials and methods:** This was a prospective study where a total of 30 patients who underwent surgery for blunt abdomen trauma in Vydehi Institute of Medical Sciences and Research Centre, Bangalore were included. The clinical presentation, findings on investigation and operative findings were studied and the data was analyzed using appropriate statistical methods.

**Results:** Males (70%) were more commonly affected than females (30%), road traffic accidents were most common cause of injury. Splenic injuries (40%) were the most common injuries followed by small bowel (33.33%) and liver (33.33%). FAST was found to be more sensitive in detecting free fluid when compared to DPA. There were 2 deaths in the period of the study.

**Conclusions:** Blunt abdominal trauma is usually not obvious, hence often missed unless repeatedly looked for. Most deaths occur due to inadequate and delay in treatment of abdominal injuries. FAST is a rapid and effective method to detect free fluid in abdomen and organ injury.

### ARTICLE HISTORY

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### KEYWORDS

Abdominal trauma; Intraperitoneal injuries; Hemoperitoneum; DPA

### Introduction

Abdominal trauma is one of the most common causes among injuries caused mainly due to road traffic accidents. The rapid increase in motor vehicles and its aftermath has caused rapid increase in number of victims to blunt abdominal trauma. Motor vehicle accidents account for 75 to 80 % of blunt abdominal trauma. Blunt injury of abdomen is also a result of fall from height, assault with blunt objects, sport injuries, industrial mishaps, bomb blast and fall from riding bicycle [1]. Blunt abdominal trauma is usually not obvious. Hence, often missed, unless, repeatedly looked for. Due to the inadequate treatment of the abdominal injuries, most of the cases are fatal [2,3]. The knowledge in the management of blunt abdominal trauma has progressively increasing due to advances in diagnostics, in spite of this the morbidity and mortality remains at large. The reason for this could be due to

the interval between trauma and hospitalization, delay in diagnosis, inadequate and lack of appropriate surgical treatment, post-operative complications and associated trauma especially to head, thorax and extremities.

### Objectives of the study

1. To evaluate various clinical manifestations of blunt trauma abdomen.
2. To evaluate various available investigations for detection of intraperitoneal injuries, in particular, DPA, FAST and CT scan of abdomen.
3. To compare the efficacy of DPA and FAST in diagnosing hemoperitoneum.

### Materials and Methods

#### Source of data

The patients for this study are those who presented at Vydehi Institute Of Medical Sciences And Research

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Centre over the period of Nov 2012 to JUNE 2014 are included in the study. A minimum of 30 patients were evaluated clinically and included in the study after applying the proper inclusion and exclusion criteria [4].

### Methods of collection of data

Data was collected from the patients with their clinical history, clinical examination with appropriate investigations on those patients who were admitted. Post-operative follow up was done to note for complications. After initial resuscitation of the trauma victims, history was taken to document any associated medical problem. Routine blood and urine tests were carried out in all the patients. Documentation of patients, which included, identification, history, clinical findings, diagnostic test, operative findings, operative procedures, complications during the stay in the hospital and during subsequent follow-up period, were all recorded on a proforma specially prepared [5]. Demographic data collected included the age, sex, occupation and nature and time of accident leading to the injury.

After initial resuscitation and achieving, hemodynamic stability, all patients were subjected to careful examination, depending on the clinical findings; decision was taken for further investigations such as four-quadrant aspiration, x ray abdomen and ultrasound. The decision for further management depended on the outcome of the clinical examination and results of diagnostic tests. CT scan was done in 8 patients in our study as most of our patients were from low socio economic group, and some patients were not hemodynamically stable to be shifted for CT scan [6]. Apart from routine investigations, abdomen x ray was done in all patients. All patients under went four-quadrant aspiration. An aspiration of blood, which did not clot, was taken as positive. When the aspirate clotted, the test was taken as negative. Ultrasound of abdomen was done in 29 cases [7].

### Observations and Results

From Nov 2012 to June 2014, the total number of Blunt abdominal emergency operations was 32, out of which 2 patients were <18 yrs, hence not included in the study (Table 1). In this series, the majority of the patients belonged to 18-30 years age group, followed by 41-50 years age group (Table 2). In the 30 cases studied, 21 cases were males, and 9 females (Table 3). Road traffic accident was responsible for 86.66% of blunt abdominal trauma cases, while fall from heights accounted for 6.66% of cases and blow with blunt object was responsible for 6.66% of injuries [8].

**Table 1.** Age incidence of injuries

Age group (yrs)	No.of patients	Percentage (%)
18-30	11	36.66%

31-40	5	16.66%
41-50	9	30%
51-60	1	3.33%
61-70	3	10%
71-80	1	3.33%

**Note:** In this series, the majority of the patients belonged to 18-30 years age group, followed by 41-50 years age group.

**Table 2.** Gender incidence of injuries.

Gender	No of patients	Percentage
Male	21	70%
Female	9	30%

**Note:** In the 30 cases studied, 21 cases were males, and 9 females.

**Table 3.** Mode of injury.

Mode of injury	No.of cases	Percentage (%)
Road traffic accident	26	86.66%
Fall from height	2	6.66%
Blow to abdomen with blunt objects	2	6.66%

**Note:** Road traffic accident was responsible for 86.66% of blunt abdominal trauma cases, while fall from heights accounted for 6.66% of cases and blow with blunt object was responsible for 6.66% of injuries.

### Symptoms and signs

The following table shows the incidence of various symptoms and signs with which the 30 patients studied presented with abdominal pain (93.33%) and abdominal tenderness (80%) followed by tachycardia(70%) (Table 4).

**Table 4.** Signs and symptoms.

Symptoms and signs	No of patients
Abdominal pain	28
Abdominal guarding and rigidity	12
Abdominal tenderness	24
Pallor	06
Pulse>90/min	21
BP<90 mm of Hg systolic	04
Free fluid	05

**Note:** Majority of the patients presented with abdominal pain (93.33%) and abdominal tenderness (80%) followed by tachycardia (70%).

### Latent period

Latent period is the interval between the times of injury to the time of surgery. Majority of patients (50%) were taken for surgery between 0-5 hours of latent period (Table 5). Associated extra abdominal injuries were found in 6 cases. The common extra abdominal injuries were chest injuries including rib fractures, extremity fractures and head injuries [9].

**Table 5.** Latent period.

Hours	No of cases	Percentage
0-5	15	50%
6-10	11	36.66%
11-15	02	6.66%
16-20	01	3.33%
21-25	01	3.33%

**Note:** Majority of patients (50%) were taken for surgery between 0-5 hours of latent period.

**Table 6.** Associated injuries.

	No of cases	Percentage
Head	2	6.66%
Thoracic	1	3.33%
Orthopedic	3	10%
Soft tissue	3	10%
Combined	3	10%

**Note:** Associated extra abdominal injuries were found in 6 cases. The common extra abdominal injuries were chest injuries including rib fractures, extremity fractures and head injuries.

### Investigations

Plain X ray abdomen: Plain X ray of abdomen was done in all cases. Gas under diaphragm was found in 10 cases. The following table shows the findings detected in X ray erect abdomen and their percentage (Table 7).

**Table 7.** Plain x- ray findings.

Feature	No. of patients	Percentage
Gas under diaphragm (GUD)	10	33.33%
No abnormality detected (NAD)	20	66.66%

### Diagnostic peritoneal aspiration

Four quadrant aspirations were done in all patients, among which 8 cases. On laparotomy, they were found to have hemoperitoneum (Table 8).

**Table 8.** Diagnostic peritoneal aspiration.

Result	No. of cases	Percentage
Positive	8	26.66%

### Ct scan

CT scan was done in 8 cases, as most of the patients could not afford the investigation and few of them were not hemodynamically stable to undergo the scan [10].

### Ultrasound examination

29 patients were subjected for ultrasound examination, out of which 16 patients had scan detected solid organ injuries for which they underwent laparotomy and found to have significant injuries. In 1 patient, scan did not detect any solid organ injury but patient had splenic laceration on laparotomy [11]. 3 patients had scan detected normal solid organs with free fluid and found to have hollow viscus injury on laparotomy. Pattern of abdominal injuries detected by ultrasound in 29 patients is shown in the following table (Table 9).

**Table 9.** Organs injured.

Organ injured	No. of patients	Percentage
Liver	8	26.66%
Spleen	6	20%
Combined	1	3.33%
Free fluid without solid organ injury	3	10%

### Operative findings

In the present series, small bowel was the most commonly involved organ. (Table 10).

**Table 10.** Operative findings.

Organ injured	No. of cases	Percentage
Small bowel	10	33.33%
Spleen	12	40%
Liver	10	33.33%
Stomach	02	6.66%
Mesentery	11	36.66%
Retroperitoneum	04	13.33%
Gall bladder	01	3.33%
Pancreas	02	6.66%
Colon	01	3.33%

### Operative procedures

The following table shows the various operative procedures carried out among the patients who underwent exploratory laparotomy. Liver injuries were usually graded as I and II [12]. Out of the 10 patients with liver injury, only 6 patients underwent hepatorrhaphy with abgel packing and rest of them were treated with abgelpacking alone. Out of 12 patients with splenic injury, 9 patients underwent splenectomy, 3 patients were treated by splenorrhaphy [13]. Bowel injuries were treated with 2 layered closure, only 1 patient who had complete transaction of duodenum proximal to ampul-

la of vater required gastro-jejunostomy. Mesenteric injuries were treated by simple suturing and ligating the bleeding points (Table 11).

**Table 11.** Operative procedures

Procedure	No. of patients	Percentage
Closure of perforation	9	30%
Splenectomy	9	30%
Splenorrhaphy	3	10%
Hepatorrhaphy	6	20%
Repair of mesentery	11	36.66%
Gastro-jejunostomy	1	3.33%
Gastric perforation repair	1	3.33%

### Morbidity

The mean duration of stay of patients in the hospital ranged from 11-20 days (15 days). The range varied from 2 days to 30 days. The following table shows the duration of stay of patients with blunt abdominal trauma including those who died (Table 12).

**Table 12.** Duration of hospital stay

No. of days	No. of patients	Percentage
1-10	2	6.66%
11-20	2	80%
21-30	4	13.33%

### Mortality

2 patients died in the present study. One patient died on post-op day 5 due to pulmonary edema and sepsis, while the other person expired due to septicemia on post-op day 2. Therefore the mortality in the present study is 6.66% [14].

## Discussion

### Age incidence

The following table compares the incidence of blunt abdominal trauma in various age groups in the present series to that of the Davis et al. [16] (Table 13). It can be seen from the above table that the majority of patients belonged to less than 30 years of age group, followed by 41-50 years age group. In Davis et al study the majority of patients belonged to 21-30 years age group [15]. Therefore it can be concluded that the young and the productive age group people are the usual victims of blunt abdominal trauma (Table 14). From the above table, it can be seen that the males are the more common victims of blunt abdominal trauma, as males are involved in outdoor activities most of the times (Table 15).

**Table 13.** Comparison of age incidence with Davis et al. Series

Age group (yrs)	Present series	Davis et al.
<30	36.66%	43%
31-40	16.66%	15%
41-50	30%	13%
51-60	3.33%	6%
61-70	10%	3%
71-80	3.33%	-

**Note:** It can be seen from the above table that the majority of patients belonged to less than 30 years of age group, followed by 41-50 years age group. In Davis et al study the majority of patients belonged to 21-30 years age group. Therefore it can be concluded that the young and the productive age group people are the usual victims of blunt abdominal trauma.

**Table 14.** Comparison of gender incidence with fazili et al. Series

Gender	Present study	Fazili et al.
Male	70%	79.3%
Female	30%	20.7%

**Note:** From the above table, it can be seen that the males are the more common victims of blunt abdominal trauma, as males are involved in outdoor activities most of the times.

**Table 15.** Comparison of mode of injury with fazili et al. And khanna et al.

Mode of injury	Present study	Fazili et al.	Khanna et al.
Road traffic accident	86.66%	60.4%	57%
Fall from height	6.66%	11.2%	15%
Blow to abdomen with blunt objects	6.66%	17.4%	33%

**Note:** The above table clearly depicts that the road traffic accident is the most common mode of injury.

### Mode of injury

The above table clearly depicts that the road traffic accident is the most common mode of injury.

### Signs and symptoms

In the present study, abdominal pain was the most common presenting complaint accounting for 93.33% and abdominal tenderness was the most common sign accounting for 80% of cases. But the signs and symptoms in abdominal injuries are notoriously unreliable and are often masked by concomitant head injuries, chest injuries and pelvic fractures [17]. Significant in-

juries to the retroperitoneal structures may not manifest as signs and symptoms immediately and be totally missed even on abdominal x rays and DPA predisposing the patients to grave consequences of the missed injuries. In Davis et al. study, 43% of patients had no specific complaints and no signs or symptoms of intraabdominal injury when they first presented to the emergency room. But 44% of those patients eventually required exploratory laparotomy and 34% of patients had an intra-abdominal injury [18]. This emphasizes the importance of careful and continuing observation and repeated examination of individuals with blunt abdominal trauma (Table 16).

### Associated injuries

Associated extra abdominal injuries were found in 12 cases. The common extra abdominal injuries were extremity fractures, head injuries and chest injuries including rib fractures. The above table shows the comparison of the present study incidences of associated injuries with other studies [19].

### Investigations

Plain X ray abdomen: Plain x ray of abdomen was done in all cases. Gas under diaphragm was found in 10 cases, which accounts for 33.33% cases in the present study.

Davis et al reported that in their series, abdominal X ray was abnormal in 21% of cases; Pneumoperitoneum was detected in 6% of cases and dilated bowel loops in 6% of cases [20].

Four quadrant aspirations: In the present study all patients were subjected for four quadrant aspiration as against 44% in Davis et al study. 08 cases were found to be positive and 22 cases were negative. Out of these 22 cases, 7 cases were false negative in the present study [21]. Therefore the sensitivity of this investigation in the present study is 68.2%. Correct results (positive or negative), were determined by subsequent laparotomy, and were obtained in 86% of cases in Davis et al study [22].

Ultrasound examination: A total of 29 patients were subjected for ultrasound examination, out of which 15 patients had scan detected solid organ injuries for which they underwent laparotomy and found to have significant injuries [23]. Three patients' scan showed normal solid organs with free fluid and found to have hollow viscus injury at laparotomy [24]. Therefore ultrasound is more reliable in detecting solid organ injuries and free fluid in the abdomen. In Yoshi H et al study, the sensitivity of ultrasound in detecting injuries in blunt abdominal injury patients is about 94.6%.

**Table 16.** Comparison of associated injuries with davis et al and khanna et al series

	Present study	Davis et al.	Khanna et al.
Head	6.66%	9%	12%
Thoracic	3.33%	27%	24%
Orthopedic	10%	15%	27%
Soft tissue	10%	12%	-
Combination	10%	6%	-

**Note:** The above table shows the comparison of the present study incidences of associated injuries with other studies.

**Table 17.** Comparison of organ injuries with fazili et al , davis et al , cox et al30 and khanna et al series

Organ injured	Present series	Fazili et al.	Davis et al.	Cox et al.	Khanna et al.
Small bowel	33.33%	7.4%	8%	8%	57%
Spleen	40%	2.8%	25%	46%	26%
Liver	33.33%	4.2%	16%	33%	37%
Stomach	6.66%	1.6%	1%	7%	
Mesentery	36.66%	6.3%	4%	10%	47%
Colon	3.33%	4.7%	-	-	-
Retroperitoneum	13.33%	3.2%	-	-	-

**Note:** The above table compares the incidences of the organs involved in blunt abdominal trauma in the present study to that of the international series. As seen in these international series, spleen is the most common viscera injured even in the present series. GIT is the next commonly involved organ. Spleen was involved in 40% of cases, followed by small bowel (33.33%), and followed by liver (33.33%).

## Organwise injury

The above table compares the incidences of the organs involved in blunt abdominal trauma in the present study to that of the international series [25]. As seen in these international series, spleen is the most common viscera injured even in the present series. GIT is the next commonly involved organ [26]. Spleen was involved in 40% of cases, followed by small bowel (33.33%), and followed by liver (33.33%) [27].

## Operative procedures

In the present study closure of bowel perforation was done in 9 patients, repair of mesentery in 11 patients, splenectomy in 9 patients, splenorrhaphy in 3 patients, hepatorrhaphy in 6 patients and gastro-jejunostomy in 1 patient [28-30].

## Summary and Conclusions

This was a prospective study of 30 cases of blunt abdominal trauma. From this study, the following conclusions can be made.

1. Males are predominantly affected. It is mostly seen in the age group of 18- 30years which form the young and reproductive group. These patients are usually from lower socio economic income group.
2. Road traffic accident forms the most common mode of injury. Hence measures should be taken to prevent these accidents and care of the victims at the accident site. Well established trauma care centers should be established. Measures for early transport of the patients from the accident site to the trauma center should be undertaken.
3. A thorough and repeated clinical examination and appropriate diagnostic investigations lead to successful treatment in these patients.
4. Plain erect x ray abdomen is a valuable investigation taken for gastrointestinal injuries.
5. Ultrasound examination gives a clear picture of solid organ injury and free fluid.
6. Four quadrant aspiration is a simple and an important tool for diagnosis, but has low sensitivity.
7. The most common injured viscera in the present study is spleen followed by small bowel and liver.
8. Most of splenic injuries were treated with splenectomy. Few were managed with splenorrhaphy.
9. Liver injuries occupy the second position along with small bowel injuries and were managed by hepatorrhaphy and abgel packing.
10. Retroperitoneal hematoma was seen in a small proportion of patients associated with renal injuries. Only minor renal injuries that were encountered were treated conservatively.

11. Multiple organs were involved in most of the cases rather than an isolated organ injury.

12. Associated extra abdominal injuries like head, thoracic and orthopedic injuries were found in 12 cases in the present study. These greatly influenced the morbidity and mortality of the patients.

13. The present study showed a mortality of 6.66%.

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## Conflict of Interest Statement

The authors declare that they have no conflict of interest.

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