

# A Pattern of Abdominal Organs Injuries in Blunt Trauma and Their Outcome

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## ABSTRACT

**Aim:** To found out pattern of abdominal organ injuries in blunt trauma and their outcome.

**Study design:** Prospective study

**Duration and place of study:** Accident and Emergency department of Mayo Hospital, Lahore from June 2011-Dec 2012

**Methods:** The study was conducted on 70 patients with blunt trauma to abdomen. Primary survey of the patients constituted A,B,C,D and Es approach of trauma care and identification of life threatening conditions and their immediate management. In secondary survey, a detailed history of trauma patient, a thorough physical examination and related investigations were carried out to identify abdominal injuries and associated injuries from head to toe. The postoperative care of the patient was provided up to maximum to reduce morbidity. The postoperative complications developed in postoperative period were managed properly. Patients were discharged when they were stable. Colostomy patients were explained about colostomy care and later on, reversal of colostomy. All patients were followed up to 2 week, 4 week, 8 week intervals for at least first 2 months after discharge.

**Results:** Out of seventy, 60 (86%) were males and 10 (14%) females with mean age of 26 years. The age ranged from 12 to 60 years. The most frequent age group was 21-30 in both male and female. 66 patients were explored for blunt trauma to abdomen. All were found to be positive. Mean number of organs injured in each patient was 3.2. Small bowel was the most commonly injured organ in 18 patients, having 30 (55.6%) injuries in this study. After this, splenic injuries were the commonest solid organ injury, i.e., 30% in 16 patients. Pancreas and colon were less commonly injured solid and hollow organ respectively

**Conclusion:** Blunt abdominal trauma could be reduced by preventing the use of old motor vehicles, strict compliance of traffic rules and urgent repair of damaged roads.

**Keywords:** Blunt abdominal trauma, organ injury,

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## INTRODUCTION

Blunt trauma to abdomen is due to road traffic accident (75%) followed by blows (14%) and falls (10%)<sup>1</sup>. Solid organ injury is more common in blunt trauma to abdomen because the energy of deceleration and compression, fractures the capsule and parenchyma of these relatively incompressible organs<sup>2,3</sup>.

A patient presenting in the emergency has a unique presentation and set of injuries, despite a mechanism of injury similar to that of previous patients. These patterns of injury and the alterations which occur in them are influenced by age of the victim, gender, anatomical factors (e.g. rupture of small bowel nears its points of fixation) and mechanism of injury. Excessive alcohol ingestion also modifies patient's response to and recovery from trauma. Knowledge of the patterns of injury helps

the surgeon in rapid diagnosis of injuries without the need of special investigation<sup>2</sup>.

In abdominal trauma, there are two types of forces during impact. First, changes in speed (acceleration or deceleration) create shear strain and second, deformity changes (stretch or compression) create tensile strain<sup>4</sup>.

Shear strain injuries are produced when viscera accelerate at a rate out of proportion to the points of attachment, e.g. the kidney, small intestine, large intestine and spleen are all vulnerable to these types of injuries. Similarly, with deceleration, the liver may continue to travel relative to ligamentum teres, generating shear forces that transect or lacerate the hepatic parenchyma. In general, blunt trauma more commonly affects the right hepatic lobe<sup>5</sup>.

Tensile strain injuries are created by direct compression. In abdomen, organs are injured by compression between a frontal impact and the vertebral column, e.g. pancreas, liver, spleen and occasionally the kidneys are injured in this way. Both

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shear and tensile injuries help to predict patterns of injury for specific type of blunt abdominal trauma.

**PATIENTS AND METHODS**

This was a prospective study of seventy patients with blunt trauma to abdomen, who presented in Accident and Emergency department of Mayo Hospital, Lahore from June 2011-Dec 2012.

Patient’s selection criteria was as follows.

- 1- Patients above 12 years of age of either sex with blunt trauma to abdomen were included in study.
- 2- Patients of blunt abdominal injury with or without external imprint mark of injury on abdomen were also part of this study.
- 3- Patients of abdominal trauma who survived more than 48 hours postoperatively or after trauma were also studied.
- 4- The patients below 12 years of age of both sex and those who expired during resuscitation or at the operation table were excluded from the study.

The initial assessment and, if required, resuscitation were started in the above selected patients. Primary survey of the patients constituted A,B,C,D and Es approach of trauma care and identification of life threatening conditions and their immediate management. In secondary survey, a detailed history of trauma patient, a thorough physical examination and related investigations were carried out to identify abdominal injuries and associated injuries from head to toe.

A complete neurological examination of a trauma patient was also carried during the secondary survey. After secondary survey, patients with abdominal trauma were re-evaluated for initiation of definitive treatment. This included conservative treatment (4 patients) and operative management (66 patients).

The postoperative care of the patient was provided up to maximum to reduce morbidity. The postoperative complications developed in postoperative period were managed properly. Patients were discharged when they were stable. Colostomy patients were explained about colostomy care and later on, reversal of colostomy. All patients were followed up to 2 week, 4 week, 8 week intervals for at least first 2 months after discharge.

**RESULTS**

Table 1: Seventy patients were included in this study. Out of seventy, 60 (86%) were males and 10 (14%) females with mean age of 26 years. The age ranged from 12 to 60 years. The most frequent age group was 21-30 in both genders.

Table 2: The road traffic accident was the commonest mode of injury. It included 52 (74.3%) patients. Fall from height and blows to abdomen were less common mechanism of trauma and they consisted of 10 (14.3%) and 8(11.4%) patients, respectively.

Table 1: Age and sex distribution

| Age (years) | =n | Male | Female |
|-------------|----|------|--------|
| 12-20       | 22 | 19   | 3      |
| 21-30       | 31 | 28   | 3      |
| 31-40       | 9  | 7    | 2      |
| 41-50       | 6  | 5    | 1      |
| 51-60       | 2  | 1    | 1      |

Table 2: Mechanism of injury

| Mode of injury   | =n | %age |
|------------------|----|------|
| RTA              | 52 | 74.3 |
| Fall from height | 10 | 14.3 |
| Blows            | 8  | 11.3 |

Table 3: Pattern of abdominal organ injury in blunt trauma

| Pattern   | No. of injuries | =n | %age |
|---|-----------------|----|------|
| <b>Liver</b>  |                 |    |      |
| Grade I   | 2               | 14 | 12.9 |
| Grade II  | 8               |    |      |
| Grade III   | 4               |    |      |
| <b>Spleen</b>                                       |                 |    |      |
| Grade III   | 2               | 16 | 14.8 |
| Grade IV  | 8               |    |      |
| Grade V   | 6               |    |      |
| <b>Kidney</b>                                       |                 |    |      |
| Grade V   | 4               | 4  | 3.7  |
| <b>Pancreas</b>                                     |                 |    |      |
| Grade II  | 2               | 2  | 1.8  |
| <b>Small bowel jejunum ileum</b>                    |                 |    |      |
| Grade II  | 10              | 18 | 27.7 |
| Grade IV  | 4               |    |      |
| Grade V   | 4               |    |      |
| Grade II  | 6               |    |      |
| Grade V   | 6               |    |      |
| <b>Colon</b>  |                 |    |      |
| Grade II  | 2               | 2  | 1.8  |
| <b>Rectum</b>                                       |                 |    |      |
| Grade II  | 2               | 2  | 1.8  |
| <b>Vessels IVC (suprarenal) MA (Ileal branches)</b> |                 |    |      |
| Grade IV  | 2               | 4  | 3.7  |
| Grade I   | 2               |    |      |
| <b>Retroperitoneal hematomas</b>                    |                 |    |      |
| Zone I  | 4               | 20 | 18.5 |
| Zone II   | 6               |    |      |
| Zone III  | 10              |    |      |
| <b>Urinary bladder</b>                              |                 |    |      |
| Grade III   | 2               | 2  | 1.8  |
| <b>Urethra (membranous)</b>                         |                 |    |      |
| Grade IV  | 2               | 2  | 1.8  |
| <b>Diaphragm (left dome)</b>                        |                 |    |      |
| Grade III   | 2               | 2  | 1.8  |

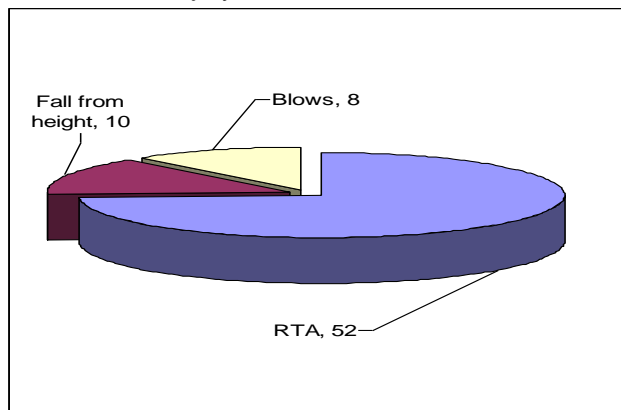
Table 4. Associated Injuries (Extra-abdominal)

| Organ injury | =n | %age |
|--------------|----|------|
| Radius       | 1  | 1.4  |
| Ulna         | 1  | 1.4  |
| Radius/Ulna  | 1  | 1.4  |
| Humerus      | 1  | 1.4  |
| Femur        | 2  | 2.9  |
| Tibia/Fibula | 2  | 2.9  |
| Ribs         | 5  | 7.1  |
| Head injury  | 1  | 1.4  |
| Spinal cord  | 3  | 4.3  |

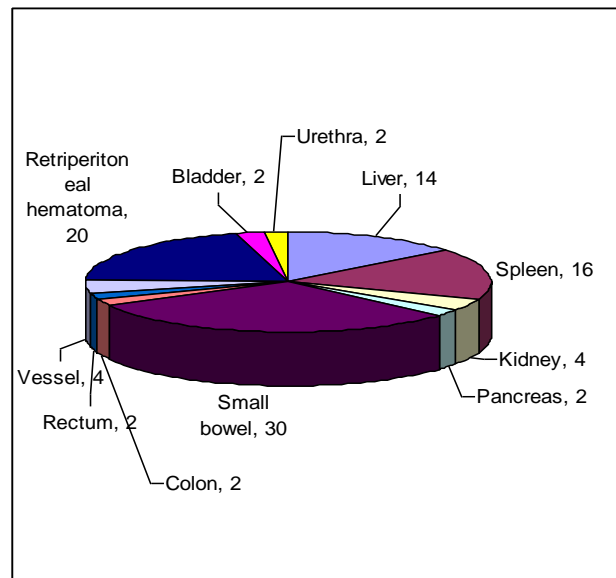
Table 5: Postoperative complications

| Complications                                | =n | %age  | Management                                     |
|--|----|-------|--|
| Respiratory tract infection                  | 20 | 28.6% | Conservative                                   |
| Wound infection                              | 5  | 7.1%  | Drainage and dressings                         |
| Intest obstruction (adhesive bowel)          | 2  | 2.9%  | Conservative 1<br>Exp. laparotomy 1            |
| Pneumothorax                                 | 1  | 1.4%  | Tube thoracostomy                              |
| Hemothorax (missed injury)                   | 1  | 1.4%  | Tube thoracostomy                              |
| Jaundice                                     | 1  | 1.4%  | Conservative                                   |
| Urinary tract infection                      | 1  | 1.4%  | Conservative                                   |
| Necrotizing fasciitis (lower abdominal wall) | 1  | 1.4%  | Extensive debridement and antibiotic cover     |
| Burst abdomen                                | 1  | 1.4%  | Re-exploration and closure with tension suture |
| Pancreatic fistula                           | 1  | 1.4%  | Conservative                                   |
| Deep venous thrombosis                       | 1  | 1.4%  | Conservative                                   |

Mechanism of injury



Pattern of abdominal organ injuries



**Table 3:** Out of seventy patients 66 patients were explored for blunt trauma to abdomen. All were found to be positive. Total number of abdominal organs injured were 108. Mean number of organs injured in each patient was 3.2. Small bowel was the most commonly injured organ in 18 patients, having 30 (55.6%) injuries in this study. Jejunal injuries were present mostly at proximal part while ileal injuries were present mostly at the distal part of small gut. After this, splenic injuries were the commonest solid organ injury, i.e., 30% in 16 patients. Pancreas and colon were less commonly injured solid and hollow organ respectively in this study. Incidence of solid viscera injury was (63%) and hollow viscera injury was (62.8%). It is almost equal in this study.

**Table 4:** Incidence of associated injuries in this study of blunt abdominal organ was 17(24%). The common extra-abdominal injuries were chest and spinal cord injuries i.e., 5(7.1%) and 3(4.3%) respectively. They aggravated the morbidity of patients and prolonged their recovery.

**Table 5:** The postoperative morbidity was observed in 35(50%) patients. Common complications were respiratory tract infection in 20(28.6%) cases, and wound infection in 5(7.1%) patients. Fifty percent patients left the hospital without complications.

**DISCUSSION**

In this prospective study of blunt abdominal trauma, the predominance of young males has been observed as they are the most mobile population of our society. The male to female ratio is found to be 6:1. Similar report is present in other series of trauma

victims<sup>6,7</sup>. Regarding social setup in Pakistan, females are more protected.

Trauma series from Western society shows a male to female ratio of 3:1 which probably is due to the more outdoor life pursued by female making them more vulnerable<sup>8</sup>. If the person is the sole earning member of the family, it may impose a socioeconomic burden to the family and the society.

The most common mode of blunt trauma to abdomen in our study was road traffic accident (74.3%). It was followed by fall from height (14.3%) and blows to abdomen were 11.3%. According to Weiner and Barrett in civilians, blunt trauma is caused primarily by road traffic accidents (75%) and falls (10%). Similarly, in other studies, road traffic accident is also the commonest mechanism of injury as compared to falls and blows to abdomen<sup>3,9,10</sup>.

The incidence of blunt trauma to abdomen particularly road traffic accident has increased due to more vehicles on road day by day and violation of traffic rules by drivers.

In the present study, small bowel injury after blunt trauma was maximum, i.e. 55.6%. This is similar to study done by Najfi et al, in which small bowel was more frequently injured, i.e. 51.1%. However in a study from Vancouver General Hospital, Canada, an increase in the incidence of small bowel injuries was associated with the use of seat belts. We cannot explain our finding on this basis because use of seat belts is less frequent in our country<sup>11</sup>.

The portion of small bowel which is the most often injured is that which happens to occupy midline position at the moment of impact against the spine in steering wheel or seatbelt injury.<sup>12</sup> Other less common sites of damage are the first portion of the jejunum and the terminal ileum, where the intestine is fixed. This pattern of injury of small bowel was present in our study.

The spleen is the most common solid organ to be injured in blunt abdominal trauma<sup>3,8,10,13,14,5</sup>. In the present study spleen was also the commonest solid organ injured in blunt abdominal trauma, resulting in 30% splenic injuries of moderate to severe grade in 16 patients. In other studies like Najfi et al and Ghazanfar et al, splenic injuries are 10(18.5%) and 15 (23%) respectively. Their results differ from our study due to difference in number of patients present in each study. In one recent study, splenectomy rate was 22.8%, while in present study it was 30%. It increases with higher grade of splenic injury<sup>16</sup>.

The liver was the second most commonly injured solid organ after blunt trauma in this study. This is similar to the results of Ghazanfar et al, Najfi et al and Khan et al. Blunt trauma to right half of the abdomen and chest was responsible for 22% hepatic

injuries in 14 cases in present study. But in literature, hepatic injury incidence reported is 16.5% (9), 9% (6), and 22.7% (15) respectively<sup>3,10,17</sup>. This difference in results from present study may be due to variable number of patients in each series.

In present study, pattern of solid viscera damage was observed as spleen (30%), followed by liver (22%) and kidney (7.4%). But in other study, this pattern is deviated such that liver (36%), followed by the spleen (32%) and kidney (24%)<sup>18,19</sup>. This difference is perhaps due to the variation in number of patients and mode of injury to the different solid organs in these series.

Retroperitoneal hematoma is a common complication of pelvic and spine fractures and injuries to retroperitoneal viscera and an uncommon isolated manifestation of blunt abdominal trauma.<sup>12</sup>

Retroperitoneal hematomas regularly develop around injuries to the pancreas and duodenum. In present study, twenty patients (37%) had retroperitoneal hematomas after blunt trauma to abdomen. They were mostly not explored except for a few cases of paraduodenal hematoma and pericolic hematoma (not associated with pelvic hematoma). No injury was found in these cases.

In a series of blunt abdominal trauma by Najfi et al, three patients (5.5%) had retroperitoneal hematomas which were not explored. By report of Davis et al, about fifty percent cases of retroperitoneal hematomas after blunt trauma were not explored and drained. Thus a selective approach is used to open retroperitoneal hematoma due to blunt trauma depending upon site and size of hematoma.

In this study the procedures used for management of blunt abdominal injuries were good, applicable and cost effective. The complications which were observed during the study, resulted due to factors like severity of grade of abdominal organ injured, shock, missed injury<sup>20</sup> multisystem injury, colonic injury, multiple transfusions, prolonged surgery (>2 hours), extensive small bowel contamination. These factors are responsible for morbidity due to infectious complications. This may prolong hospital stay of trauma patients<sup>21,22</sup>. Moreover, pre-existing lung disease and chronic smoking and prolong use of nasogastric tube caused respiratory tract infection.

## CONCLUSIONS

Important facts about blunt abdominal trauma have been drawn as;

- Mostly the young male patients are the victims of this trauma

- Road traffic accident is the most common mode of injury in blunt trauma
- The chest injury is the commonest associated extra-abdominal injury
- The most commonly injured organ in the study is the small intestine, but the spleen is the most frequently damaged solid viscus
- Respiratory tract infections and wound infections are frequently observed morbidity due to reasons mentioned above.

## RECOMMENDATIONS

- 1- Road traffic accidents could be reduced by preventing the use of old motor vehicles, strict compliance of traffic rules and urgent repair of damaged roads
- 2- The laws governing the avoidance of alcohol use while driving, limiting speed of motor vehicle and wearing of different restraints, i.e. safety belts, helmets etc. must be implemented by highway authority
- 3- Different public awareness programs regarding trauma as a health problem, its prevention and management must be shown on media

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