

# Intestinal Injury from Blunt Abdominal Trauma: A Study of 47 Cases

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## Abstract

**Objectives:** To determine the cause, presentation, anatomical distribution, diagnostic method, management and outcome of intestinal injuries from blunt abdominal trauma.

**Methods:** The study included 47 patients who underwent laparotomy for intestinal injuries from blunt abdominal trauma over a period of 4 years. A retrospective study was conducted and the patients were analyzed with respect to the cause, presentation, anatomical distribution, diagnostic methods, associated injuries, treatment and mortality.

**Results:** 47 patients with 62 major injuries to the bowel and mesentery due to blunt abdominal trauma were reviewed. The male to female ratio was 8.4: 1 and the average age was 34.98 years. There were 44 injuries to the small intestine including 1 duodenal injury, 11 colonic injuries and 7 injuries to the mesentery. 26 patients were injured in road traffic accidents. Out of 29 patients with intestinal perforation, free peritoneal air was present on plain abdominal and chest radiography in 23 patients. 18 patients underwent laparotomy on the basis of clinical findings alone. The

commonest injury was a perforation at the antimesenteric border of the small bowel. Treatment consisted of simple closure of the perforation, resection and anastomosis and repair followed by protective colostomy for colonic perforations. 3 (6.38%) deaths were recorded, while 8 (17.02%) patients developed major complications.

**Conclusion:** Although early recognition of intestinal injuries from blunt abdominal trauma is difficult, it is very important due to its tremendous infectious potential. Intestinal perforations are often associated with severe injuries which are probably be the determining factors in survival.

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Received: 13 Jul 2009  
Accepted: 01 Sep 2009

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Mukhopadhyay M. *OMJ*. 24, 256-259 (2009); doi:10.5001/omj.2009.52

## Introduction

Blunt abdominal trauma is a leading cause of morbidity and mortality among all age groups. Identification of serious intra-abdominal pathology is often challenging. Intestinal disruptions can be due to a variety of types of blunt trauma, with automobile being the most common aetiological agent.<sup>1,2</sup> Geill in 1899, reported an 11% incidence of major intestinal injury among the study patients sustaining blunt abdominal injury.<sup>3</sup> This figure is consistent with the 5-15% reported in other series, making the intestine the third most commonly injured organ in blunt trauma.<sup>3</sup> This report reviews experiences with blunt intestinal injuries in a teaching hospital in Kolkata, India.

## Methods

During a 4 year period, 372 patients were admitted for blunt abdominal trauma, of which 47 patients underwent laparotomy for intestinal and mesenteric injuries. A retrospective study was conducted and the patients were analyzed with respect to age, sex, cause of injury, presentation, location of injury, associated injuries, treatment, mortality and morbidity. Injuries were classified as being major or minor in nature. Major injuries were defined as 1)

perforation or transection of bowel 2) mesenteric injury resulting in ischemic bowel which required resection and 3) seromuscular injuries of the bowel wall requiring resection. Serosal tears not requiring resection and mesenteric injuries without bowel ischemia were not included in this study.

## Results

During a 4 year period, 372 patients were admitted for blunt abdominal trauma of which 83 patients required laparotomy. 47 patients (12.63%) had major injuries to the intestine and mesentery. The average age was 34.98 years. The age distribution has been shown in Table 1.

**Table 1:** Age and Sex of 47 Patients with Intestinal Injury from Blunt Abdominal Trauma

| Age (in years) | Sex                |                   | Total (%)        |
|----------------|--------------------|-------------------|------------------|
|                | Male               | Female            |                  |
| 11-20          | 2                  | -                 | 2 (4.26%)        |
| 21-30          | 9                  | -                 | 9 (19.15%)       |
| 31-40          | 21                 | 4                 | 25 (53.19%)      |
| 41-50          | 9                  | 1                 | 10 (21.28%)      |
| 51-60          | 1                  | -                 | 1 (2.13%)        |
| <b>Total</b>   | <b>42 (89.36%)</b> | <b>5 (10.64%)</b> | <b>47 (100%)</b> |

There were 42 males and 5 females, the male to female ratio being 8.4:1. Road traffic accidents accounted for 26 cases. The remaining cases resulted from miscellaneous accidents. (Table 2)

**Table 2:** Mode of Injury

| Mode of injury               | Number    | Percentage |
|------------------------------|-----------|------------|
| Road traffic accident        | 26        | 55.32      |
| Falls                        | 9         | 19.15      |
| Heavy object fell on abdomen | 5         | 10.64      |
| Hit with a blunt object      | 7         | 14.89      |
| <b>Total</b>                 | <b>47</b> | <b>100</b> |

Out of 29 patients with 34 intestinal perforations, 23 showed free peritoneal air on plain abdominal and chest radiography. Ultra sonography was suggested in 6 patients. The remaining 18 patients underwent laparotomy on the basis of clinical findings alone. In 7 patients, the initial film taken within 6 hours of injury, failed to show pneumoperitoneum which was later detected in films taken after 12 hours. In 10 patients, the injuries were missed on initial assessment and laparotomy was delayed for more than 24 hours. The mean time from admission to laparotomy was  $17.3 \pm 21.5$  hours.

There were 62 major injuries among 47 patients. There were also 44 injuries to the small intestine including 1 duodenal injury, 11 colonic injuries and 7 mesenteric injuries. In the small intestine, there were 32 perforations and 12 major seromuscular injuries. The anatomic location of the injuries is shown in Table 3.

**Table 3:** Anatomic Location of Small Intestinal Injuries

| Site                          | Number      |                |           |
|-------------------------------|-------------|----------------|-----------|
|                               | Perforation | Serosal injury | Total     |
| Duodenum                      | 1           | -              | 1         |
| Close to DJ junction          | 12          | 5              | 17        |
| Close to jejunoileal junction | 7           | 1              | 8         |
| Close terminal ileum          | 10          | 2              | 12        |
| Scattered                     | 2           | 4              | 6         |
| <b>Total</b>                  | <b>32</b>   | <b>12</b>      | <b>44</b> |

In the colon, there were 2 perforations, both in the sigmoid colon, and 9 major seromuscular injuries, 1 in the ascending colon, 4 in transverse colon and 4 in the sigmoid colon. Of the mesenteric injuries, 3 were located in the proximal jejunal mesentery, 1 in the distal jejuna mesentery, 2 in the distal ileal mesentery and 1 in the

sigmoid mesentery. A single intestinal injury was present in 33 patients, while 14 patients suffered 2 or more injuries.

Associated injuries were present in 13 (27.7%) patients, (Table 4). Intra-abdominal injuries were mainly to the liver. In this study, though splenic injury was more common in patients sustaining blunt trauma to the abdomen, the liver was mainly injured in patients with intestinal injuries. Extra-abdominal injuries were mainly to the skeletal system.

**Table 4:** Associated Injuries

| Site                    | Number of patients |
|-------------------------|--------------------|
| Intra-abdominal         |                    |
| Liver                   | 4                  |
| Pancreas                | 1                  |
| Extra-abdominal         |                    |
| Skeletal                | 5                  |
| Facio maxillary         | 2                  |
| Intra + extra abdominal |                    |
| Liver + skeletal        | 1                  |
| <b>Total</b>            | <b>13</b>          |

There were 32 perforations of the small intestine including 1 duodenal perforation. It was a grade II injury involving D<sub>4</sub>. The duodenal perforation was treated by repair of the perforation, gastrojejunostomy and a feeding jejunostomy. All the multiple perforations and 3 isolated perforations required resection and anastomosis. The rest were treated by primary closure. The major seromuscular injuries of the small intestine required resection and anastomosis. In the colon, the 2 perforations underwent primary repair. In the ascending colon, the seromuscular injuries required resection and anastomosis, in the transverse colon, resection and exteriorization were performed and those in the sigmoid colon underwent resection and anastomosis with a protective colostomy. The mesenteric injuries required resection and anastomosis.

Major complications were encountered in 8 (17.02%) patients, (Table 5).

Minor complications such as wound infection, chest infection and prolonged ileus have not been included in the table. There were 3 deaths among the 47 patients. The mortality rate was 6.38%. All the 3 patients had associated intra-abdominal organ injury. 2 died in the immediate postoperative period. The cause of the immediate postoperative deaths was severe blood loss due to associated organ injury. The third patient who subsequently developed anastomotic leakage died after 2 weeks.

**Table 5:** Major Complications

| Complications                           | No of patients | Procedure done                                    | Outcome  |
|---|----------------|---|----------|
| Anastomotic leakage                     | 2              | Laparotomy + exteriorization                      | Survived |
| Anastomotic leakage + pelvic abscess    | 2              | Laparotomy + abdominal drainage + exteriorization | Survived |
| Anastomotic leakage                     | 1              | -   | Expired  |
| Intra-abdominal abscess                 | 1              | Laparotomy + drainage                             | Survived |
| Burst abdomen + intra abdominal abscess | 2              | Laparotomy + drainage + closure                   | Survived |

## Discussion

Injury to the intra-abdominal structures can be classified into 2 primary mechanisms of injury – compression forces and deceleration forces.<sup>4</sup> Compression or concussive forces may result from direct blows or external compression against a fixed object (e.g. lap belt, spinal column). These forces may deform hollow organs and transiently increase intraluminal pressure, resulting in rupture. Deceleration forces cause stretching and linear shearing between relatively fixed and free objects. As bowel loops travel from their mesenteric attachments, thrombosis and mesenteric tears, with resultant splanchnic vessel injuries can result. Whatever the mechanism, early recognition of these lesions can be difficult. An overlooked bowel injury is very dangerous because of its tremendous infectious potential.

Annan in 1837 reported the first case of intestinal rupture secondary to blunt trauma in America.<sup>3</sup> It has been observed in earlier studies that these injuries are seen in the younger age groups and usually occur due to road traffic accidents.<sup>3,5,6</sup> The present study showed similar results.

In this study, intestinal injuries occurred in 12.63% patients with blunt abdominal trauma. This figure is consistent with the 5-15% reported in others series, making the intestine the 3<sup>rd</sup> most commonly injured abdominal organ in blunt trauma.<sup>3,7,8,9,10</sup> Most of the patients in this study presented with abdominal pain, tenderness and distension. However, the features were vague at initial examinations and became obvious only at repeated abdominal examinations. Delayed presentation or large leakage of bowel contents into the peritoneal cavity results in increased morbidity. This has also been reported in others studies.<sup>6</sup>

As with others studies, the small intestine was also the most commonly injured in the present study.<sup>2,6,11,12</sup> In this study, it was observed that the proximal jejunum and distal ileum were more prone to perforation. This has also been observed in earlier reports.<sup>13,14</sup> But some studies have not supported this view.<sup>3,15</sup> Dauterve et al. in a study of 60 patients, found that less than half of the perforations occurred in these zones.<sup>3</sup> However, according

to his study, mesenteric injuries do occur more frequently at these points. Similar results were noted in the present study. Colonic injuries occurred less frequently than small intestinal injuries. This has also been reported in others studies.<sup>2,3,5,6</sup> This is mainly due to its location and the lack of redundancy, which prevents formation of closed loops.

Diagnostic tests can be used to evaluate patients with blunt abdominal trauma. These include ultrasonography (US), diagnostic peritoneal lavage (DPL), computed tomography (CT) and diagnostic laparoscopy (DL). Ultrasonography is convenient, cheap and non-invasive. A positive test is defined as evidence of free fluid or solid organ parenchymal injury.<sup>16</sup> DPL was the diagnostic method of choice for evaluating blunt abdominal injury in the past, but recently has been often replaced by CT imaging.<sup>17</sup> DPL is an important adjunct in cases where bowel injury is suspected.<sup>18</sup> Although DPL is sensitive in identifying hemoperitoneum and associated hollow viscus injury, it has been criticized for its higher rate of non-therapeutic laparotomy.<sup>19</sup>

CT findings considered diagnostic for bowel injury are contrast extravasation and/or extraluminal air. Findings which are non-diagnostic but suggestive are; free fluid without solid organ injury, small bowel thickening and dilatation.<sup>20</sup> Peritoneal fluid with no visible solid organ injury is an important sign of bowel injury; this finding has been replicated in several studies.<sup>21,22</sup> CT diagnosis for small bowel perforation has a sensitivity of 92% and specificity of 94%.<sup>20</sup> The role of laparoscopy in blunt abdominal trauma is mainly diagnostic. In the recent years, there have been reports on therapeutics laparoscopy and repair of bowel perforations.<sup>23</sup> In hemodynamically stable patients with blunt abdominal trauma, laparoscopy safely and effectively identifies bowel injuries. Early recognition of these injuries and timely surgical treatment offers the best prognosis.<sup>24</sup>

Regarding treatment, exploratory laparotomy, drainage of septic peritoneal fluid and woundsaline lavage are very important. Prophylactic antibiotics are required.<sup>1</sup> Simple closure is usually adequate for single perforation of the small intestine, but more extensive injuries such as multiple perforations and gangrene from mesenteric injuries usually

require resection and anastomosis. Large bowel injuries particularly in the left colon may require creation of stoma.<sup>6</sup>

The mortality in this study was 6.38%. Mortality rates quoted from blunt intestinal trauma range from 10-30%.<sup>3</sup> Mortality in the present study was low, most probably due to the low rates of associated injuries as compared with others studies. Reports have shown that mortality increases with the number of associated injuries.<sup>6,9</sup>

## Conclusion

To conclude, early diagnosis and treatment are of utmost importance. The small intestine is more frequently injured than the colon and the commonest injury is a perforation in the anti mesenteric border of the small intestine. Associated injuries are often the determining factors in survival.

## Acknowledgements

The author reported no conflict of interest and no funding was received on this work.

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