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Original Research Article

Evaluation of intestinal injuries from blunt abdominal trauma

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ABSTRACT

Background: To Evaluate the cause, presentation, anatomical extent, diagnostic method, management and outcome of intestinal injuries from blunt abdominal injuries.
Methods: The study included 40 patients who underwent laparotomy for intestinal injuries from blunt abdominal trauma over a period of 1 year. A retrospective study was conducted, and the patients were evaluated with respect to the cause, presentation, anatomical distribution, diagnostic methods, associated injuries, treatment and mortality.
Results: 40 patients with 58 major injuries to the bowel and mesentery due to blunt abdominal trauma were reviewed. The male to female ratio was 9: 1 and the average age was 32.51 years. There were 38 injuries to the small intestine including 1 duodenal injury, 13 colonic injuries and 6 isolated injuries to the mesentery. Out of 29 patients with intestinal perforation, free peritoneal air was present on plain abdominal and chest radiography in 23 patients. The commonest injury was a perforation at the antimesenteric border of the small bowel. Treatment consisted of laparotomy followed by simple closure of the perforation, resection and anastomosis and repair followed by protective colostomy for colonic perforations. 3 (7.56%) deaths were recorded, while 6 (15%) patients developed major complications.
Conclusions: Bowel and mesenteric injuries may be significant and require immediate surgery or may be nonsignificant and permit nonsurgical treatment. Although early recognition of intestinal injuries from blunt abdominal trauma is difficult only by clinical assessment, nevertheless important to establish the right diagnosis due to its high infective potential. Intestinal perforations are often found accompanying other severe intra-peritoneal injuries which probably, are the determining factors in morbidity and mortality hence the main emphasis lying on early detection of the injuries and reducing the time from admission to the surgery thus playing a role in the reduction of mortality and morbidity associated with intestinal injuries following blunt trauma abdomen.

Keywords: Blunt trauma to abdomen, Intestinal injuries, Mesenteric injuries

INTRODUCTION

Blunt abdominal injury is a like a surgeons Pandora's box, deciding for or against a surgical intervention in the form of a laparotomy. Delay in the initiation of treatment or surgical intervention can be catastrophic. Clinical and laboratory means commonly used in diagnosing the condition are seldom accurate, and difference in the presenting complaints and signs as time progresses needs to be always kept in mind as they are of help when positive. When the same are negative most often they raise questions on their reliability. Any part of the intestine can be injured, but gastric injuries are the rarest of them. An individualistic approach for each patient is the need of the hour to reduce the unusually high morbidity and mortality associated with the abdominal trauma and its sequel.

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 etiological agent.[1] Geill in 1899, reported an 11% incidence of major intestinal injury among the study patients sustaining blunt abdominal injury.[2]

This figure is consistent with the 5-15% reported in other series, making the intestine the third most commonly injured organ in blunt trauma.[2] This report reviews experiences with blunt intestinal injuries following abdominal trauma.

METHODS

In a 1-year period, 124 patients were admitted for blunt abdominal trauma, of which 40 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

- Intestinal injury from blunt abdominal trauma-perforation or transection of bowel
- Mesenteric injury resulting in ischemic bowel which required resection
- Seromuscular injuries of the bowel wall requiring resection.

RESULTS

During a 10 months period, 124 patients were admitted for blunt abdominal trauma of which 67 patients required laparotomy. 40 patients (32.25%) had significant major intestinal and mesenteric injuries. The average age was 32.51 years and the age distribution are illustrated in the table below.

Table 1: Age and sex distribution.

Age (years)	Sex (male)	Sex (female)	Total (%)
11-20	2	0	5
21-30	6	0	15
31-40	20	2	55
41-50	7	1	20
51-60	1	1	5
Total	36 (90%)	4 (10%)	100

In the study there were 36 males and 4 females and the Male to female ratio was 9:1. The most common cause of a major intestinal and mesenteric injury was found to be road traffic accidents (RTA) causing 57.5% of the total injuries observed.

Amongst 32 intestinal perforations, 19 showed free peritoneal air on plain abdominal and chest radiography. Ultra-sonography was suggested in 6 patients. The remaining 10 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 12-24 hours. The mean time from admission to laparotomy was 17.4±2.5 hours.

Table 2: Mechanism of injury.

Mode of injury	Total number	%
RTA	23	57.5
Fall from height	7	17.52
Hit by blunt object	3	7.5
Heavy object falling on abdomen	5	12.5
Others	2	5

Table 3: Anatomic locations of injuries in the small intestine.

Sites	Small intestinal injuries		
	Perforation	Serosal injury	Total
Duodenum	1	0	1
Duodenojejunal	4	7	11
jejuno-ileum	21	2	23
Close to IC junction	3	2	5
Scattered	3	1	4
Total	32	12	44

In the small intestine, there were 32 perforations and 12 major seromuscular injuries. The anatomic location of the injuries is shown in the table above.

There were 58 major injuries among 40 patients. There were also 38 injuries to the small intestine including 1 duodenal injury, 3 colonic injuries and 6 mesenteric injuries.

In the colon, there were 3 perforations, both in the sigmoid colon, and 7 major seromuscular injuries, 4 in transverse colon and 3 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.

Associated injuries were present in 17 (42.5%) patients. Intra-abdominal injuries were mainly to the liver and spleen. In this study, though splenic injury was more common in patients sustaining blunt trauma to the abdomen. Extra-abdominal injuries were mainly to the skeletal system (17.64%).

Table 4: Associated injuries.

Associate injuries	Total
Intra-abdominal	
Liver	4
Spleen	8
others	1
Extra-abdominal	
Skeletal system	3
Facio-maxillary	1

There were 32 perforations of the small intestine including 1 duodenal perforation, involving D4. The duodenal perforation was treated by repair of the perforation, gastrojejunostomy and a feeding jejunostomy. All the multiple perforations required resection and anastomosis. The rest were treated by primary closure. The major sero muscular injuries of the small intestine required resection and anastomosis. In the colon, the 2 sigmoid perforations underwent drainage and right transverse colostomy. In the ascending colon, the seromuscular injuries required resection and anastomosis.

Table 5: Major complications.

Complications	Number	Procedure done	Outcome
Anastomotic leakage	3	laparotomy + exteriorization	survived 2 death 1
Intra-abdominal collections / abscess	7	laparotomy + abdominal drainage	survived 5 deaths 2
Burst abdomen/wound dehiscence	3	secondary closure	survived 3
Pelvic abscess	2	laparotomy + abdominal drainage	survived 2
Total	15		survived 13 deaths 3

Major complications encountered during the period of study are shown in the above Table, intraabdominal collections or abscess being the commonest of them all at 46.66%, the patient underwent revision laparotomy and drainage. Significant bowel injury was defined as either a complete tear of the bowel wall or an incomplete tear that involves the serosa and that extends to but does not involve the mucosa. Nonsignificant bowel injuries include a hematoma and a tear limited to the serosa. Significant mesenteric injuries include active mesenteric bleeding, disruption of the mesentery, and mesenteric injury associated with bowel ischemia. An isolated mesenteric hematoma was considered non-significant.

DISCUSSION

Bowel and mesenteric injuries are detected in 5% of blunt abdominal trauma patients at laparotomy and are the third most common type of injury from blunt trauma to abdominal organs.[3-6] Injury to the intra-abdominal structures can occur primarily due to 2 mechanisms of injury-compression forces and deceleration forces.[7] 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. Direct force may crush the gastrointestinal tract; rapid deceleration may produce shearing force between fixed and mobile portions of the tract; and a sudden increase in intraluminal pressure may result in bursting injuries.[8] An overlooked bowel injury is very dangerous because of its propensity to progress to general peritonitis and eventual sepsis.

The common sites of blunt trauma injury in the small bowel are the proximal jejunum, near the ligament of Treitz, and the distal ileum, near the ileocecal valve. In these regions, mobile and fixed portions of the gut are continuous and therefore are susceptible to shearing forces.[9]

Delayed diagnosis of bowel and mesenteric injuries results in increased morbidity and mortality, usually because of haemorrhage or peritonitis that leads to sepsis.[10-12] Although abdominal pain from peritoneal irritation may be a clinical manifestation of bowel and mesenteric blunt trauma injuries,

this symptom is nonspecific, in addition, it might not be present when the patient is initially evaluated. Furthermore, if the patient has concomitant head and spinal cord trauma, which make abdominal assessment difficult, the results of a physical examination may not be reliable. The use of results of clinical assessment as the sole indication for surgery has led to a negative laparotomy rate as high as 40%.[13] Patients in whom abdominal injury is suspected can be evaluated with various diagnostic tests, including peritoneal lavage, ultrasonography (US), and computed tomography (CT).

Diagnostic peritoneal lavage has a sensitivity greater than 90% for the detection of hemoperitoneum, but it is not specific and not reliable for the assessment of

retroperitoneal injuries.[14-17] In addition, like any invasive procedure, diagnostic peritoneal lavage carries some risks. Bowel perforation may be missed at lavage in up to 10% of cases in which the diagnostic procedure is performed soon after blunting abdominal trauma has occurred.[18] Diagnostic peritoneal lavage performed before CT may compromise the interpretation of the CT study, since fluid and air may be present within the peritoneal cavity as a result of lavage.

Focused assessment with US in the trauma setting has a sensitivity of 86% and specificity of 98% for the detection of free intra-abdominal fluid, but it is nonspecific with regard to organ injury. Multidetector CT is more sensitive and specific than diagnostic peritoneal lavage, abdominal US, and clinical examination for the diagnosis of bowel and mesenteric injuries, and it has become the diagnostic test of choice for the evaluation of blunt abdominal trauma in hemodynamically stable patients.[17,19] The results of various studies show sensitivities of 69%-95% and specificities of 94%-100% for the diagnosis of bowel and mesenteric injuries with CT.[20-23] The use of multidetector CT for evaluation of blunt abdominal trauma helps significantly reduce the amount of time required to perform the examination and the number and severity of motion artefacts and helps improve blood vessel opacification and solid organ enhancement.[14]

Numerous CT signs of bowel and mesenteric injuries secondary to blunt abdominal trauma have been described in the literature. The main goal in evaluating these signs is to distinguish significant bowel and mesenteric injuries that require surgical intervention from those that can be managed non-surgically. CT findings considered diagnostic for bowel injury are contrast extravasation and/or extraluminal air. Findings which are nondiagnostic but suggestive are; free fluid without solid organ injury, small bowel thickening and dilatation. Peritoneal fluid with no visible solid organ injury is an important sign of bowel injury; this finding has been replicated in several studies.[20-22]

In this study, intestinal injuries occurred in 12.63% patients with blunt abdominal trauma. This figure is consistent with the 5-15% reported in other series, making the intestine the 3rd most commonly injured abdominal organ in blunt trauma.[24-27] Most of the patients in this study presented with abdominal pain, tenderness and distension. As with other studies, the small intestine was also the most commonly injured in the present study.[28,29] 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, but some studies have not supported this view.[30,31] Colonic injuries occurred less frequently than small intestinal injuries. This has also been reported in other studies This is mainly due to its location and the lack of redundancy, which prevents formation of closed loops.[4,6-8]

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.[32] Regarding treatment, exploratory laparotomy, drainage of septic peritoneal fluid and wound saline lavage are very important. Prophylactic antibiotics are required.[1] 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.[4] The mortality in this study was 6.38%. Mortality rates quoted from blunt intestinal trauma range from 1030%.[3] Reports have shown that mortality increases with the number of associated injuries.[32-34]

CONCLUSION

Bowel and mesenteric injuries may be significant and require immediate surgery or may be non-significant and permit nonsurgical treatment. Although early recognition of intestinal injuries from blunt abdominal trauma is difficult only by clinical assessment, nevertheless important to establish the right diagnosis due to its high infective potential. Intestinal perforations are often found accompanying other severe intra-peritoneal injuries which probably, are the determining factors in morbidity and mortality hence the main emphasis lying on early detection of the injuries and reducing the time from admission to the surgery thus playing a role in the reduction of mortality and morbidity associated with intestinal injuries following blunt trauma abdomen.

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REFERENCES

1. Munns J, Richardson M, Hewett P. A review of intestinal injury from blunt abdominal trauma. ANZ J Surg. 1995;65(12):857-60.
2. Dauterive AH, Flancbaum L, Cox EF. Blunt intestinal trauma. A modern-day review. Ann Surg. 1985;201(2):198-203.
3. Peitzman AB, Arnold SA, Boone DC. Trauma manual. Pittsburgh. 1994;93.
4. Buck GC, Dalton ML, Neely WA. Diagnostic laparotomy for abdominal trauma. A university hospital experience. The American Surgeon. 1986;52(1):41-3.
5. Dauterive AH, Flancbaum L, Cox EF. Blunt intestinal trauma. A modern-day review. Annals of Surgery. 1985;201(2):198.
6. Cox EF. Blunt abdominal trauma. A 5-year analysis of 870 patients requiring celiotomy. Annals of Surgery. 1984;199(4):467.

7. Salomone JA, Salomone JP, Keim SM. Abdominal trauma, blunt. E-Medicine. Back to cited text. 2009;(9).
8. Hughes TM, Elton C. The pathophysiology and management of bowel and mesenteric injuries due to blunt trauma. Injury. 2002;33(4):295-302.
9. Hawkins AE, Mirvis SE. Evaluation of bowel and mesenteric injury: role of multidetector CT. Abdominal Imaging. 2003;28(4):505-14.
10. Roman E, Silva VS, Lucas C. Management of blunt duodenal injury. Surg Gynecol Obstet. 1971;132:7-14.
11. Snyder WH, Weigelt JA, Watkins WL, Bietz DS. The surgical management of duodenal trauma: precepts based on a review of 247 cases. Archives of Surgery. 1980;115(4):422-9.
12. Lucas CE, Ledgerwood AM. Factors influencing outcome after duodenal injury. J Trauma. 1975;15: 839-46.
13. Drost TF, Rosemurgy AS, Kearney RE, Roberts P. Diagnostic peritoneal lavage: limited indications due to evolving concepts in trauma care. Am Surg. 1991;57:126-8.
14. Talton DS, Craig MH, Hauser CJ, Poole GV. Major gastroenteric injuries from blunt trauma. Am Surg. 1995;61:69-73.
15. Wisner DH, Chun Y, Blaisdell FW. Blunt intestinal injury: keys to diagnosis and treatment. Arch Surg. 1990;125:1319-23.
16. Munns J, Richardson M, Hewett P. A review of intestinal injury from blunt abdominal trauma. Aust N Z J Surg. 1995;65:857-60.
17. Soderstrom CA, DuPriest Jr RW, Cowley RA. Pitfalls of peritoneal lavage in blunt abdominal trauma. Surg Gynecol Obst. 1980;151(4):513-8.
18. Fang JF, Chen JC, Lin BC. Cell count ratio: new criterion of diagnostic peritoneal lavage for detection of hollow organ perforation. J Trauma. 1998;45:540-4.
19. Malhotra AK, Fabian TC, Katsis SB, Gavant ML, Croce MA. Blunt bowel and mesenteric injuries: the role of screening computed tomography. J Trauma. 2000;48:991-8.
20. Donohue JH, Federle MP, Griffiths BG, Trunkey DD. Computed tomography in the diagnosis of blunt intestinal and mesenteric injuries. J Trauma. 1987;27:11-7
21. Hagiwara A, Yukioka T, Satou M. Early diagnosis of small intestinal rupture from blunt abdominal trauma using computed tomography: significance of the streaky density within the mesentery. J Trauma. 1995;38:630-3.
22. Sivit CJ, Eichelberger MR, Taylor GA. CT in children with rupture of the bowel caused by blunt trauma: diagnosis efficacy and comparison with hypoperfusion complex. AJR Am J Roentgenol. 1994;163:1195-8.
23. Mirvis SE, Gens DR, Shanmuganathan K. Rupture of the bowel after blunt abdominal trauma: diagnosis with CT. AJR Am J Roentgenol. 1992;159:1217-21.
24. Davis JJ, Cohn I, Nance FC. Diagnosis and management of blunt abdominal trauma. Ann Surg. 1976;183(6):672-8.
25. Orloff MJ, Charters AC. Injuries of the small bowel and mesentery and retroperitoneal hematoma. Surg Clin North Am. 1972;52(3):729-34.
26. Divincenti FC, Rives JD, Laborde EJ, Flimeing ID, Cohn is. Blunt abdominal trauma. J Trauma Acute Care Surgery. 1968;8(6):1004-13.
27. Hunt KE, Garrison RN, Fry DE. Perforating injuries of the gastrointestinal tract following blunt abdominal trauma. Am Surg. 1980;46(2):100-4.
28. Kane NM, Francis IR, Burney RE, Wheatley MJ, Ellis JH, Korobkin M. Traumatic Pneumoperitoneum: Implications of Computed Tomography Diagnosis. Investigative Radiology. 1991;26(6):574-8.
29. Grosfeld JL, Rescorla FJ, West KW, Vane DW. Gastrointestinal injuries in childhood: analysis of 53 patients. J Pediatr Surg. 1989;24(6):580-3.
30. Bosworth BM. Perforation of the small intestine from non-penetrating abdominal trauma. Am J Surg. 1948;76(5):472-82.
31. Geoghegan T, Brush BE. The mechanism of intestinal perforation from nonpenetrating abdominal trauma. Arch Surg. 1956;73:455-64.
32. Mathonnet M, Peyrou P, Gainant A, Bouvier S, Cubertafond P. Role of laparoscopy in blunt perforations of the small bowel. Surg Endosc. 2003;17(4):641-5.
33. Ameh EA, Nmadu PT. Gastrointestinal injuries from blunt abdominal trauma in children. East Afr Med J. 2004;81(4):194-7.
34. Davis JJ, Cohn I, Nance FC. Diagnosis and management of blunt abdominal trauma. Ann Surg. 1976;183(6):672-8.

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