
Mesenteric Injuries Presentations After Blunt Abdominal Trauma

Ashraf Noureldin, MD*, Usama Lotfi, MD, MRCS**

Menoufia University Hospitals and Saad Specialsit Hospital AlKhubar Saudi Arabia *,
and Cairo University**

ABSTRACT

Injury to the bowel or mesentery during abdominal blunt trauma is rare, the exact incidence is not known, but in patients undergoing emergency laparotomy, an incidence of 5%–13% has been reported. This low incidence explains the difficult diagnosis due to the limited experience of most trauma teams with this injury. Furthermore, the identification of blunt hollow viscus injury is notoriously difficult in patients with multiple injuries in whom physical examination may be unrealistic. The purpose of this study was to review and present our experience with blunt mesenteric injury with special emphasis on the clinical presentation and pre-operative diagnosis of these challenging injuries to find a reliable method of high suspicion to reach early diagnosis. A total of 428 laparotomies were done for blunt abdominal trauma during the 7 year period from June 2003 to February 2009; 43 of whom had a mesenteric injury (10%). Their records were reviewed and the following data were collected. All patients underwent an exploratory laparotomy during which the diagnosis of mesenteric injury was confirmed. The patients were divided into two groups: the early group (n=28) who were operated on within 8 hours and the delayed group (n = 15) who were operated on at least 16 hours after the injury. 35% were missed at initial evaluation. In conclusion, mesenteric injuries are difficult to diagnose even with thorough evaluation with serial physical examination, ultrasound, DPL or CT scanning. A low threshold for exploration based on clinical suspicion is of paramount importance in order to reduce the complications following delayed treatment of these injuries.

INTRODUCTION

One of the most controversial subjects in trauma care has been the assessment and management of abdominal injuries due to blunt trauma. There has been a trend over the last four decades towards increased conservatism in the management of blunt abdominal injuries.

Injury to the bowel or mesentery during abdominal blunt trauma is rare, the exact incidence is not known, but in patients undergoing emergency laparotomy, an incidence of 5%–13% has been reported^[1-3]. This low incidence explains the difficult diagnosis due to the limited experience of most trauma teams with this injury. Furthermore, the identification of blunt hollow viscus injury is notoriously difficult in patients with multiple injuries in whom physical examination may be unrealistic. In recent years, because of marked advancements in technology, computed tomography (CT) has become the modality of choice to assess blunt abdominal injuries^[4], leading to a dramatic increase in nonoperative management of solid organ injury^[5,6]. Concomitantly, the possibility of

missed blunt bowel and mesenteric injuries (BBMIs) is theoretically increased by use of CT even if the overall incidence of missed injury is quite low and should not influence decisions concerning eligibility for nonoperative management^[7]. Patients with missed BBMI can develop sepsis, multiple organ failure, and could potentially progress to death.

The usual mechanism is direct crushing of the mesentery and bowel against the vertebral column^[8] in addition to shearing and tearing forces particularly at points of mesenteric attachment^[9]. Today the most commonly reported cause is a car crash often involving the use of seat belts^[10-12].

These injuries vary in severity from simple contusions to complete transection of the mesentery, which may result in ischemia and perforation of the bowel followed by peritonitis and abscess or fistula formation. It can also lead to stricturing of the bowel wall and late small bowel obstruction^[13], which may appear days or even months after the injury.

AIM OF THE WORK

The aim of this study was to review and present our experience with blunt mesenteric injury with special emphasis on the clinical presentation and pre-operative diagnosis of these challenging injuries to find a reliable method of high suspicion to reach early diagnosis.

PATIENTS & METHODS

The trauma database was used to select patients who had a traumatic mesenteric injury that was confirmed at laparotomy at two different hospitals in Saudi Arabia.

A total of 428 laparotomies were done for blunt abdominal trauma victims during the 7 year period from June 2003 to February 2009; 43 of whom had a mesenteric injury (10%). Their records were reviewed and the following data were collected: age, gender, mechanism and site of injury, clinical findings at presentation, associated injuries, and methods of diagnosis, operative findings, type of repair, duration of hospital stay, morbidity, and mortality.

All patients underwent an exploratory laparotomy during which the diagnosis of mesenteric injury was confirmed. Because the diagnosis of mesenteric injury was confirmed at laparotomy in all cases, the time from injury to operation was used as an estimate of the time to diagnosis.

The patients were divided into two groups: the early group ($n=28$) who were operated on within 8 hours and the delayed group ($n=15$) who were operated on at least 16 hours after the injury (Table 1). Diagnostic peritoneal lavage (DPL) was done by the "open technique" in hemodynamically unstable patients.

Ultrasound (US) was considered diagnostic if free peritoneal fluid was detected. Computed tomography (CT) was done for hemodynamically stable patients after oral and intravenous contrast medium and was interpreted by an experienced radiologist.

CT diagnosed mesenteric injury in the presence of hemoperitoneum without apparent solid organ injury, thickening of bowel wall, or mesenteric hematoma. Early exploratory laparotomy was done for hemodynamically unstable patients if either lavage or US indicated injury or if CT showed evidence of mesenteric or small bowel injury in hemodynamically stable patients.

Among patients who had a delayed diagnosis 34% (5/15) were transferred from other hospitals, some patients were discharged from other hospitals as being normal and presented to our emergency department few hours after their discharge with progressive abdominal pain, fever, hypotension and tachycardia and were found to have different degrees of small and large intestine mesenteric injury.

RESULTS

Patient's data, diagnosis time and mechanism of injury are shown in table I. The clinical findings, method of diagnosis, and the site of injury in the 43 patients with mesenteric injuries are shown in Table II and fig 1. Associated injuries were common and are shown in Table III.

The type of surgical repair, morbidity, and duration of hospital stay are shown in Table IV. The early group had a significantly shorter hospital stay than the delayed group ($p = 0.004$) and the delayed group had significantly more complications than the early group ($p < 0.0001$).

One patient was kicked by an ox horn and had a superficial cut wound on the abdominal wall which was not perforating the muscle, the patient had a muscle hematoma and a mesenteric hematoma.

The commonest CT findings were circumferentially thickened hypoattenuated wall of the intestine with consequent concentric luminal narrowing. In addition to fluid collections in the peritoneal cavity and pouches. We have no reported mortalities in our series.

Table I. Clinical details of the 43/428 patients operated on for blunt abdominal injuries (10%) who had mesenteric injuries

<i>Data are number of patients unless otherwise stated.</i>	
Mean age (years):	38
Range	14–63
Sex:	
Male	28
Female	15
Diagnosis:	
Early (median 190 min, range 3–8 h)	28
Late (median 21 h, range 12 h–3 days)	15
Mechanism of injury:	
Motor vehicle collisions	35
Fall	4
Kicked by animal	1
Hand fights	2
Sport accident	1

Table II. Findings, diagnostic methods, and type of injuries in the early and delayed diagnostic groups
Data are number of patients.

	<i>Early n= 28</i>	<i>Delayed n= 15</i>
Clinical findings		
Pulse > 120 min	23	14
Blood pressure < 90 mm hg	21	14
Fever ≥ 38 °c	5	7
Pain	24	13
Diminished bowel sounds	16	14
Bruises and ecchymosis	7	5
Methods of diagnosis		
clinically	4	6
ultrasound	1	2
Computed tomography	3	2
Diagnostic peritoneal lavage	20	5
Nature of mesenteric injury		
Small intestine		
Devascularised	19	7
Bleeding	5	4
Hematoma	6	4
Large intestine		
Devascularised	0	1
Bleeding	2	1
Hematoma	2	3

Table III. Associated injuries Data are number of Injuries

	<i>Early n= 28</i>	<i>Delayed n= 15</i>
Spleen injury	7	3
Liver injury	5	2
Kidney injury	2	0
Retro peritoneal hematoma	11	7
Small intestine perforation	2	1
Large intestine perforation	1	0
Small intestinal gangrene	2	2
Large intestinal gangrene	2	1
Head trauma	2	1
Chest trauma	4	2
Pelvic fracture	2	1
Skeletal trauma	1	1

Table IV. Type of repair and outcome in the early and delayed diagnostic groups
Data are number of patients except where otherwise stated.

	<i>Early n= 28</i>	<i>Delayed n= 15</i>
Control and primary repair	9	5
Control and resection	16	9
Hematoma evacuation	3	1
Morbidity		
Wound infection	3	5
Small bowel obstruction	0	1
Sepsis	0	2
Systemic manifestation	1	2
Length of hospital stay (day's range)	13 (5-19)	23 (12-39)

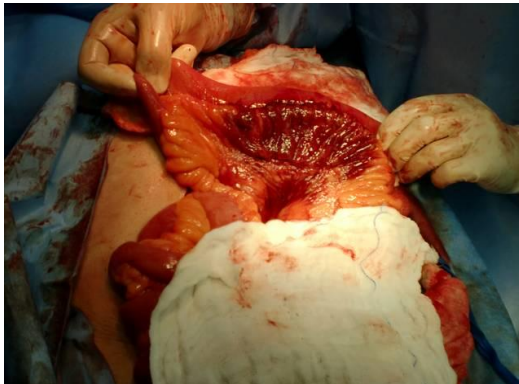


Fig. 1: A transversely lying hematoma of small bowel mesentery in a polytrauma patient with haemodynamic instability, US showed free intraperitoneal fluid; intraoperatively about 1 liter of free blood, devitalized related small bowel loop, treatment was by resection anastomosis.

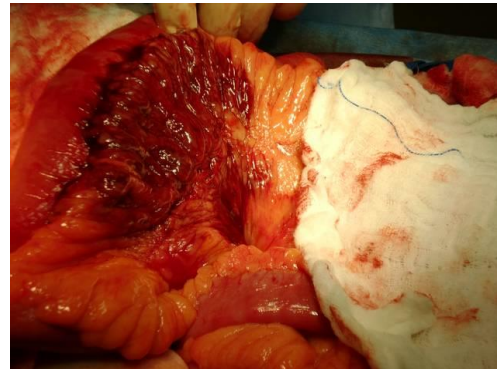


Fig. 2: Same case in fig 1.



Fig 3: Sigmoid colon gangrene with associated mesenteric laceration in a 55 years old male following road traffic accident, the patient was initially stable and on the 3rd day developed fever, abdominal pain, tenderness and rebound tenderness. Treatment was by exteriorization resection.

DISCUSSION

Our retrospective study illustrates the difficulties in diagnosis of mesenteric injury after blunt abdominal trauma because 35% were missed at initial evaluation. This injury is rare, and physical examination is unreliable in multiple blunt trauma patients who do not require urgent laparotomy. Although technical improvements increase the reliability of US, CT, and DPL, their individual sensitivity remains poor in the diagnosis of mesenteric injury in hemodynamically stable patients^[14].

Early recognition, especially of devascularising mesenteric injuries is important in order to reduce the risk of bacterial contamination and its sequelae in patients with blunt bowel and mesenteric injuries; but this can be difficult with current diagnostic tools. In complicated cases with perforation, because the neutral pH and low bacterial count of the succus entericus cause only minimal peritoneal irritation, the early physical findings can be mild. In addition, the plain radiographs and blood studies including white cell blood count and

amylase activity are equivocal and most of the time not helpful for diagnosing intestinal injury^[15-19]. Because of its potential morbidity, clinicians should suspect mesenteric injury in all cases of blunt abdominal trauma.

The consequences of a missed diagnosis may be fatal and the development of haemorrhage and peritonitis may cause appreciable morbidity^[11,15,20]. However, a relatively minor trauma may result in severe injury. In our study intestinal and mesenteric trauma affected different age groups, ranging from 14 till 63, most of who were injured in road traffic accidents^[21].

The seat belt syndrome^[10,12,22], was seen in 5 of our patients, 3 in the early group and 2 in the delayed group due to unexpected recognition of the injury.

Clinical findings were not conclusive or diagnostic in most cases as there were no consistent signs or symptoms that could be attributed to the mesenteric injury.

The presence of free blood in the peritoneal cavity is neither pathognomonic nor diagnostic as it causes very minimal peritoneal irritation with vague abdominal symptoms leading to delayed diagnosis.

Hypotension and shock does not usually occur except in massive injuries with excessive blood loss.

If the perfusion of the intestine is compromised by large defects, then abdominal pain, tenderness, distension, and compromised bowel sounds may be detected. If this remains undetected for long time, the bowel may necrose resulting in peritonitis and sepsis.

Small lacerations or contusions of the mesentery usually passes unnoticed, they may be asymptomatic during the hospital admission. These lesions may lead to partial thickness ischemia of the bowel wall with mucosal ulceration and submucosal inflammation and fibrosis^[23]. Others have reported full thickness ischemia with fibrosis of all layers^[24, 25] and this is in concordance with our study which showed similar cases.

The most common clinical findings in our series were tachycardia, low grade fever associated with pain and tenderness over different areas of the abdominal cavity with diminished or absent bowel sounds.

All patients were conscious during initial examination. In patients in whom the primary clinical findings were hypotension or abdominal distension the diagnosis of the mesenteric injury was made during exploratory laparotomy because these signs are not specific for mesenteric injury. These signs (hypotension, shock, and abdominal distension) are also found in other abdominal injuries. Primary exploratory laparotomy is the decision of choice for these patients and the likelihood of detecting a mesenteric injury is high.

There has been no single or combined reliable diagnostic method to detect mesenteric injury. DPL, US and CT scans have been evaluated in many studies as a diagnostic tool in mesenteric injuries^[25-29], and in recent years there has been considerable debate about their diagnostic specificity and sensitivity in patients after blunt abdominal trauma.

In many cases CT may avoid unnecessary exploratory laparotomy when it is unequivocally clear in patients after blunt trauma in general but for intestinal and mesenteric injuries it has a low sensitivity^[27-30]. On the other hand US and DPL have the sensitivity but not the specificity, which makes them poor indicators for laparotomy in hemodynamically stable patients.

In our series the diagnosis and the indication for exploratory laparotomy were confirmed by lavage in 20 patients in the early group and 5 patients in the delayed group whereas CT findings led us to take 3 patients in the early and 2 patients in the delayed group to the operating room. We had no false negative or false positive results of DPL in our series. The US findings were helpful in three patients in the early group and one in the delayed group. In 6 patients in the delayed group and 4 in the early group the diagnosis was made on clinical findings alone.

Our findings have shown that delay in diagnosing mesenteric injuries can lead to several morbidities which are more common in the delayed group.

The longer hospital stay and the number of postoperative complications in the delayed group may be attributed mainly to the delay in diagnosis and to the late referral and transportation from other hospitals.

Mesenteric lesions often coexist with other injuries that make the patient's condition more serious and favour sending them to the operating

room without delay. This increases the possibility of detecting associating lesions while overlooking injuries of the bowel and the mesentery. In our study associated injuries were found in 28 of the 43 patients.

Our study had some limitations because of the small numbers. Because mesenteric injury is a very rare injury, the only way to precisely define the ideal threshold should be an evaluation in a large prospective multi-institutional study, using a receiver operating characteristic curve methodology^[31].

CONCLUSION

In conclusion, mesenteric injuries are difficult to diagnose even with thorough evaluation with serial physical examination, ultrasound, DPL or CT scanning. A low threshold for exploration based on clinical suspicion is of paramount importance in order to reduce the complications following delayed treatment of these injuries.

REFERENCES

1. **Watts DD, Fakhry SM**, EAST Multi-Institutional Hollow Viscus Injury Research Group. Incidence of hollow viscus injury in blunt trauma: an analysis from 275,557 trauma admissions from the EAST multi-institutional trial. *J Trauma* 2003;54:289- 94.
2. **McAnena OJ, Moore EE, Marx JA**. Initial evaluation of the patient with blunt abdominal trauma. *Surg Clin North Am* 1990; 70: 495-512.
3. **Wisner DH, Yong C, Blaisdell FW**. Blunt intestinal injury. *Arch Surg* 1990;125:1319-23.
4. **Hanks PW, Brody J.M**. Blunt injury to the mesentery and small bowel: CT evaluation. *Radiol Clin North Am*. 2003;41:1171-1182.
5. **Shebrain S, Zelada J, Lipsky AM, Putnam B**. Mesenteric injuries after blunt abdominal trauma: Delay in diagnosis and increased morbidity. *Am Surg*. 2006;72:955-961.
6. **Sorensen VJ, Mikhail JN, Karmy-Jones R.C**. Is delayed laparotomy for blunt abdominal trauma a valid quality improvement measure in the era of

-
- nonoperative management of abdominal injuries?. *J Trauma*. 2002;52:426-433.
7. **Miller PR, Croce MA, Bee TK, Malhotra AK, et al.** Associated injuries in blunt solid organ trauma: implications for missed injury in nonoperative management. *J Trauma* 2002;53:238 - 44.
 8. Williams RD, Sargent FT. The mechanism of intestinal injury in trauma. *J Trauma* 1963; 3: 288–294.
 9. Hughes T.M. The diagnosis of gastrointestinal tract injuries resulting from blunt trauma. *Aust N Z J Surg*. 1999;69:770-777.
 10. **Asbun HJ, Irani H, Roe EJ, Bloch JH.** Intra-abdominal seat belt injury. *J Trauma* 1990; 30: 189–193.
 11. **Dautervie AH, Flancbaum L, Cox EF.** Blunt intestinal trauma—a modern day review. *Ann Surg* 1985; 201: 198–203.
 12. **Rutledge R, Thomason M, Oller D, et al.** The spectrum of abdominal injuries associated with the use of seat belts. *J Trauma* 1991; 31: 820–826.
 13. **Vanderschot PM, Broos PL, Gruwez JA.** Stenosis of the small after blunt abdominal trauma. *Unfallchirurg* 1992;95: 71–73.
 14. **Fakhry SM, Watts DD, Luchette FA, EAST Multi-Institutional Hollow Viscus Injury Research Group.** Current diagnostic approaches lack sensitivity in the diagnosis of perforated blunt small bowel injury: analysis from 275,557 trauma admissions from the EAST multiinstitutional HVI trial. *J Trauma* 2003;54:295 - 306.
 15. **Stevens SL, Maull KI.** Small bowel injuries. *Surg Clin North Am* 1990; 70: 541-61.
 16. **Dauterine AH, Flancbaum L, Cox ER** Blunt intestinal trauma. *Ann Surg* 1985; 201: 198-203.
 17. **Evans JP.** Traumatic rupture of the ileum. *Br J Surg* 1973; 60:119-21.
 18. **Cobb LM, Vinocur CD, Wagner CW, Weintraub WH.** Intestinal perforation due to blunt trauma in children in an era of increased nonoperative treatment. *J Trauma* 1986; 26: 461-3.
 19. **Eversk M, DeGaeta L.** Abdominal trauma. *Emerg Med Clin North Am* 1985; 3: 525-39.
 20. **Garret JW, Braunstein PW.** The seat belt syndrome. *J Trauma* 1962; 2: 220–228.
 21. **Ansari S, Akhdar F, Mandoorah M, Moutaery K.** Causes and effects of road traffic accidents in Saudi Arabia. *Public Health*. 2000 Jan;114(1):37-9.
 22. **Johnstone BR, Waxman BP.** Transverse disruptions of the abdominal wall—a tell tale sign of seat belt related hollow viscus injury. *Aust N Z J Surg* 1987; 57: 455–460.
 23. **Bryner VM, Longerbeam JK, Reeves CD.** Posttraumatic ischemic stenosis of the small bowel. *Arch Surg* 1980; 115: 1039–1041.
 24. **Marks CG, Nolan DJ, Piris J, Webster CV.** Small bowel strictures after blunt abdominal trauma. *Br J Surg* 1979;66: 663–664.
 25. **Shively E, Pearlstein L, Kinnaird DW, et al.** Post traumatic intestinal obstruction. *Surgery* 1976; 6: 612–617.
 26. **Ceraldi CM, Waxman K.** Computerized tomography as an indicator of isolated mesenteric injury. *Am Surg* 1990; 56: 806–810.
 27. **Elton C, Riaz AA, Young N, Schamschula R, Papadopoulos B, Malka V.** Accuracy of computed tomography in the detection of blunt bowel and mesenteric injuries. *Br J Surg*. 2005;92:1024-1028.
 28. **Stuhlfaut JW, Soto JA, Lucey BC, Ulrich A, Rathlev NK, Burke PA, et-al.** Blunt abdominal trauma: Performance of CT without oral contrast material. *Radiology*. 2004;233:689-694.
 29. **Nghiem HV, Jeffrey RB, Mindelzun RE.** CT of blunt trauma to the bowel and the mesentery. *AJR* 1993; 160:53–58.
 30. **Tillou A, Gupta M, Baraff LJ, et al.** Is the use of pan-computed tomography for blunt trauma justified? A prospective evaluation. *J Trauma*. 2009 Oct;67(4):779-87.
 31. **Hanley JA, Mc Neil BJ.** The meaning and use of the area under a receiver operating characteristic (ROC) curve. *Radiology* 1982;143:29 - 36.
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