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Isolated Mesenteric Trauma Leading to Intestinal Ischemia Following a Traffic Accident: A Case Report

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Abstract **Case Report**

Mesenteric trauma is a rare and less common condition. In closed abdominal trauma, mesenteric trauma can lead to several complications, including hemorrhage, intestinal ischemia, and intestinal perforations. The clinical diagnosis is often poor initially and may resemble other conditions caused by blunt abdominal trauma, delaying management and affecting prognosis and length of hospital stay. On clinical examination, one should look for abdominal pain, abdominal rigidity, and the "belt sign." The gold-standard imaging modality remains abdominal CT angiography in hemodynamically stable patients. In hemodynamically unstable patients, FAST ultrasound is of paramount importance and indicates the need for urgent surgical exploration in the presence of moderate to massive hemoperitoneum. Laboratory tests, including complete blood count [CBC], C-reactive protein [CRP], procalcitonin, and lactate, may be ordered, but their diagnostic value is limited; they can assist in monitoring when non-surgical treatment is considered. Diagnostic scores can aid in establishing the diagnosis, such as the BIPS score [a radiological and laboratory score], the Faget-Millet score, the RAPTOR score, and the Strasbourg score. Treatment is guided by clinical presentation, radiological findings, and laboratory results. Two approaches are possible: either surgical treatment or non-surgical management with rigorous clinical and laboratory monitoring and imaging re-evaluation in the event of worsening laboratory or clinical status. In this case, the patient is a 56-year-old woman who suffered a fall from a height and was admitted to the emergency department for treatment of mesenteric trauma. She underwent surgical , during which an exploration revealed a mesenteric tear with extensive ileal ischemia extending from the distal ileum to 1.4 meters from the distal ileum, presence of another mesenteric tear 1.70 m from the DAI with no signs of intestinal distress, presence of moderate hemoperitoneum, no active bleeding, spleen, pancreas, and intact colon; presence of a hepatic laceration without active bleeding; decision to perform an ileocecal resection removing the necrotic segment of the small intestine with placement of a double ileocolic stoma; repair of the tear located 1.70 m from the DAI. The patient's course was favorable, with a 3-day stay in the intensive care unit, restoration of bowel continuity on the ^{12th}day, and discharge on the ^{17th}day. This favorable outcome is the result of early diagnosis and prompt management. Ultimately, early diagnosis and early management can contribute to a favorable outcome and a good prognosis, prevent serious complications, and reduce morbidity and mortality due to mesenteric trauma.

Keywords: mesenteric trauma, mesenteric ischemia, intestinal distress, stoma.

INTRODUCTION

Trauma is a major cause of morbidity and mortality in people under 35 years of age and the sixth leading cause of death worldwide. Closed mesenteric trauma is rare and less common than splenic and hepatic trauma, accounting for approximately 5%; it results from high-energy mechanisms with high severity and a mortality rate ranging from 10 to 30%, which can approach 40–60% in cases of delayed diagnosis[1,2] .

Acute mesenteric ischemia is a rare but serious medical-surgical emergency characterized by an interruption of intestinal blood flow leading to intestinal ischemia and necrosis. Its post-traumatic form is exceptional, described in a few isolated cases, generally associated with arterial dissection or venous thrombosis

secondary to blunt abdominal trauma. Approximately 1–5% of cases of intestinal and mesenteric injuries are due to blunt abdominal trauma, with high morbidity and mortality rates, and 0.3% of patients present with perforation[1,3–5] .

The mechanisms that can lead to mesenteric trauma are either[6,7] :

1. Shear mechanisms that may involve injuries to fixed segments such as the angle of Treitz or the root of the mesentery. These are observed in cases of direct deceleration, which can cause indirect injuries leading to risks of tearing and rupture. A typical deceleration injury is mesenteric avulsion. Factors determining the severity of injuries include tissue resistance, attachment points, and the magnitude of the resulting displacement.
2. Direct-impact injuries: These take the form of a shock wave that propagates from the surface toward the center of the body, causing a vice-like compression; the spine can act as a block of wood. Contusions of solid organs and ruptures of hollow organs can result from these direct-impact injuries.
3. “Blast” injuries: caused by sudden abdominal compression during direct impact, leading to a sudden increase in intraluminal pressure.

However, other mechanisms or factors may be involved, namely the point of impact and the direction of the shock wave.

The various types of trauma that can contribute to mesenteric trauma include:

1. Closed trauma, which accounts for 80% of mesenteric trauma and is caused by blunt force or deceleration, can result in lacerations, hematomas, hemorrhages, perforations, and gastrointestinal ischemia.
2. Penetrating trauma caused by stab wounds or projectiles [firearms]

In closed abdominal trauma, intestinal and mesenteric injuries vary, with serous or seromuscular tears being the most common, followed by transmural perforations, simple punctate ruptures, and complete wall tears. Parietal hematomas and extensive seromuscular detachments are also found; furthermore, post-traumatic stenoses may develop in the long term, potentially causing intestinal obstruction, likely related to segmental ischemia progressing to fibrosis[8,9] .

Mesenteric injuries include, among others, simple contusions or hematomas with active bleeding. In cases of active hemorrhage, the hematoma can rapidly enlarge and distend the mesenteric root. Hemoperitoneum may be observed in cases of peritoneal rupture. Mesenteric detachments may also occur due to avulsion of the proximal or distal root, potentially resulting in perforation of the mesenteric surface of the intestine and local devascularization, leading to ischemia and secondary perforation[8,9] .

Clinical examination of a patient with mesenteric trauma is difficult in the early phase due to nonspecific clinical presentation and may lead to delayed diagnosis. Identifying signs of vital distress early on, if present, points toward surgical management and early resuscitation[10] .

In most cases, the most common clinical signs are abdominal pain with guarding. One should look for the presence of bruises, wounds, and belt marks corresponding to contusions at the points of contact with the seatbelt, visible on the abdominal and thoracic walls and indicative of high-energy impact in cases of AVP; their presence is associated with gastrointestinal injury in 10% of cases[10] .

In fact, a 5- to 8-hour delay in diagnosis increases the risk of organ failure, morbidity and mortality, and length of stay in the intensive care unit. The presence of hemorrhage, gastrointestinal perforation, or rupture of a hollow organ increases the risk of death from hypovolemic shock and sepsis associated with peritonitis caused by organ perforation. Every 3-minute delay in the emergency department before appropriate surgical intervention increases the risk of mortality by 1% in a patient in hypovolemic shock[11–13] .

Various additional tests help diagnose this complex condition, namely:

1. FAST [Focused Assessment with Sonography in Trauma] ultrasound: FAST ultrasound is reliable and rapid, can confirm the presence of hemoperitoneum, and helps direct the unstable trauma patient toward urgent surgical care. The hepatorenal, splenorenal, and suprapubic spaces are examined. It should be noted that its sensitivity varies between 40–80% depending on the operator and the amount of effusion, and can reach nearly 100% when a hemostatic laparotomy is indicated. The limitations of FAST are: lack of precision regarding the source of bleeding, low sensitivity in cases of perforation, and a risk of false positives in cases of retroperitoneal or pelvic injuries. Despite these limitations, it remains indispensable in the management of polytrauma patients[14,15] .
2. Three-phase abdominal CT angiography: The gold standard imaging modality for mesenteric trauma, it allows visualization of vascular lesions and signs of intestinal ischemia. It enables mapping of lesions and the source of any bleeding. Care must be taken with free peritoneal effusion; it may be physiological in small quantities in women or benign in cases of limited mesenteric bleeding. The presence of a moderate to large volume of free fluid, even without other indirect signs of mesenteric trauma, is an argument in favor of mesenteric and intestinal trauma and warrants surgical exploration; however, isolated free peritoneal effusion has low diagnostic value, should rather be considered a

warning sign, and should not be the basis for routine surgery[16–19] .

There are various radiological scores that allow for a more precise diagnosis and guide appropriate management, which are:

1. **The Bowel Injury Prediction Score [BIPS]**[20] **:**

Enables the prediction of intestinal injury in patients with blunt abdominal trauma. It combines clinical, laboratory, and imaging findings: abdominal guarding, leukocytosis [≥ 17,000/mm³], and the presence of at least a stage 4 gastrointestinal injury. Each present criterion adds one point, for a maximum total score of 3. A BIPS score ≥ 2 identifies patients at high risk for intestinal and mesenteric injuries requiring laparotomy.

Figure 1: BIPS Score

Grade	Description
1	Isolated mesenteric contusion* without associated bowel wall thickening or adjacent interloop fluid collection
2	Mesenteric hematoma** < 5 cm without associated bowel wall thickening or adjacent interloop fluid collection
3	Mesenteric hematoma > 5 cm without associated bowel wall thickening or adjacent interloop fluid collection
4	Mesenteric contusion or hematoma [any size] with associated bowel wall thickening‡ or adjacent interloop fluid collection‡
5	Active vascular or oral contrast extravasation, bowel transection, or pneumoperitoneum

This is an exclusively radiological score; 9 signs associated with the diagnosis of mesenteric trauma are analyzed.

These signs include: pneumoperitoneum, rupture of the intestinal wall, parietal pneumatosis of the digestive tract, contrast extravasation, mesenteric hematoma, lack of parietal enhancement, focal thickening of the intestinal wall, isolated peritoneal effusion.

Each sign is assigned a certain number of points. Surgical intervention becomes highly likely with a score of 5.

2. **Faget-Millet Score**[21] :
3. **Figure 2: Faget-Millet Score**

CT signs	Score
Hemoperitoneum Small amount Abundant	 1 3
Mesenteric pneumoperitoneum	5
Bowel wall thickness	2
Arterial mesenteric vessel extravasation	3
Mesenteric stranding	2
Reduced enhancement of the bowel wall	1
Bowel wall discontinuity	5
Splenic injury	-1
Anterior abdominal wall injury	2

4. **The RAPTOR score [Radiographic Predictors of Therapeutic Operative intervention] helps identify patients with blunt abdominal trauma requiring therapeutic surgery.**

It comprises seven CT findings: hematoma, contrast extravasation, intestinal parietal hematoma, intestinal devascularization, fecalization of the digestive contents, pneumoperitoneum, and fat pad injury. One point is assigned per present finding, with an optimal threshold of ≥ 3[22] .

5. **Strasbourg Score**: This is a 0–13-point score used to identify patients at risk for surgically significant intestinal/mesenteric injury, with a cutoff of ≥8.

In patients who cannot be assessed [unconscious], a score of ≥ 8 may warrant selective diagnostic laparoscopy, and ≥ 10 in other patients[23].

Criteria	Score
Mechanism of injury	
Car	3
Motorcycle	1
Collision with a moving vehicle	2
Abdominal pain or tenderness	2
Open or closed long bone fracture	1
Lactate ≥ 1.82 mmol/L	2
Intraperitoneal free fluid on CT scan	3

Laboratory tests such as Interleukin-6, CRP, procalcitonin [PCT], and a complete blood count are recommended. CRP has low specificity because it can be elevated in all types of trauma, even in the absence of mesenteric injuries; therefore, in the absence of abdominal injuries, a white blood cell count exceeding 17,000/ml may be associated with an increased risk of mesenteric trauma when included in the BIPS score. Procalcitonin, like other markers, increases within the first 48 hours following hepatic or intestinal trauma. No single marker can establish a diagnosis and must be interpreted in conjunction with clinical and radiological findings[20,24,25] .

Treatment depends on the patient's condition and the results of additional tests: patients presenting with signs of shock require urgent resuscitation measures; emergency surgery is immediately recommended in cases of a positive FAST scan in a patient in shock, without the need for further testing. For a hemodynamically stable patient, emergency surgery is recommended if a CT scan reveals a hemorrhagic, ischemic, or perforated mesenteric lesion. In cases of intestinal ischemia or intestinal necrosis, the affected segment must be respected, with the creation of a stoma, resection, and anastomosis depending on the patient's condition. Perforations and lacerations are repaired, and anastomoses are performed according to the surgeon's preference [mechanical or manual anastomoses][26,27].

Non-surgical treatment [NST] is indicated in the absence of active bleeding or signs of gastrointestinal perforation in a hemodynamically stable patient who shows no obvious signs of mesenteric injury: mild abdominal pain [without guarding or tenderness], normal vital signs, and laboratory results without marked leukocytosis. If these criteria are met, NST may be considered. This requires rigorous and frequent clinical and laboratory monitoring during hospitalization, as well as follow-up radiological examinations to ensure that any secondary peritonitis is not missed. The monitoring period is more than 24 hours. Surgical treatment should be considered if fever develops, abdominal pain increases, or tachycardia occurs[28–30].

In cases of vascular lesions [bleeding, aneurysms], embolization [interventional radiology] may be an alternative to surgery; however, the only risk is failing to recognize an intestinal lesion or inducing secondary intestinal ischemia.

Mortality remains high. We report a case of mesenteric trauma with mesenteric ischemia, illustrating the importance of early diagnosis and multidisciplinary management.

CASE PRESENTATION

A 56-year-old female patient with no prior history of cardiovascular disease was admitted to the emergency department for evaluation of multiple trauma sustained in a motor vehicle accident involving a rollover, with no initial loss of consciousness.

Clinical examination revealed a conscious patient, hemodynamically stable, blood pressure 120/70, tachycardia at 100 bpm, anuric. Abdominal examination revealed diffuse abdominal tenderness with guarding but no rigidity, and a laceration in the suprapubic region. Elsewhere: a wound on the chin.

- **Laboratory** findings: leukocytosis at 22,000/mm³, CRP 145, creatinine 29, urea 0.54 [impaired renal function], negative lipase [33], hemoglobin at 11 g/dL
- **An abdominal CT angiogram was** ordered, showing:
  - ✓ CT findings consistent with mesenteric contusion complicated by a lack of contrast enhancement in the distal third of the ileocecal-appendicular artery, with signs of intestinal distress.
  - ✓ Peripheral hypodense image of the suprarenal abdominal aorta at the level of the D11 vertebra, possibly indicative of an intimal tear.
  - ✓ Liver trauma, classified as Grade II according to the AAST classification.
  - ✓ Failure of the lower polar branch of the left renal artery to opacify, with identification of scattered foci of infarction in the left renal parenchyma.
  - ✓ Focal thrombosis of the superior mesenteric vein and left renal vein.
  - ✓ Moderate hemoperitoneum.

The patient received medical treatment consisting of massive rehydration, analgesics, and antibiotics, followed by emergency admission to the operating room.

In the operating room, surgical exploration revealed: moderate to severe hemoperitoneum, a hepatic laceration without active bleeding, spleen, pancreas, colon, and stomach intact, a mesenteric tear with extensive small bowel ischemia extending from the DAI to 1.40 m, and another mesenteric tear at 1.70 m from the DAI with no signs of intestinal distress. Consequently, an ileocecal resection was performed, removing the ischemic small intestine and the mesenteric segment with the tear; the mesenteric tear located 1.70 m from the DAI was sutured; a double ileocolic stoma was created; the abdominal cavity was irrigated; and the abdominal cavity was closed.

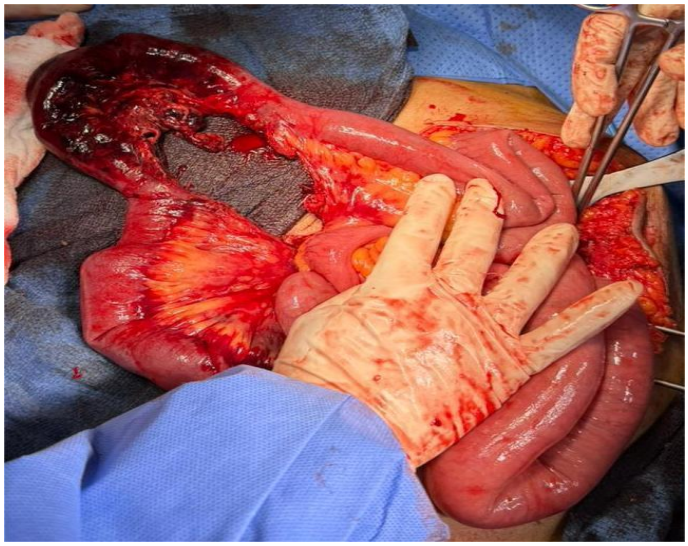

Image 1: Intraoperative image showing the mesenteric tear with small bowel necrosis

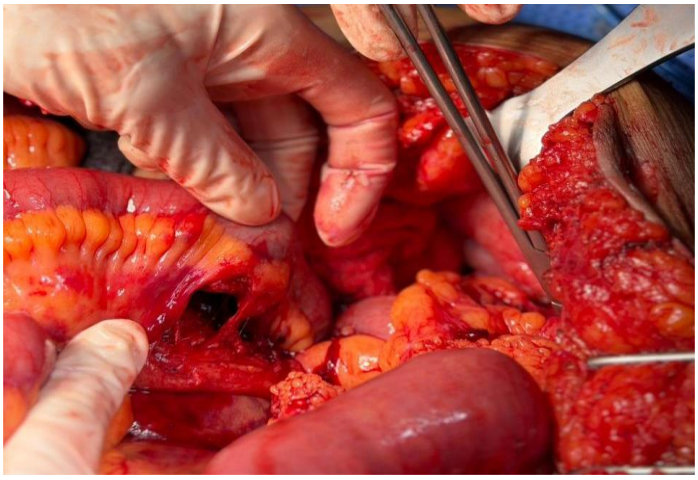

Image 2: Intraoperative image showing the mesenteric tear extending to the DAI

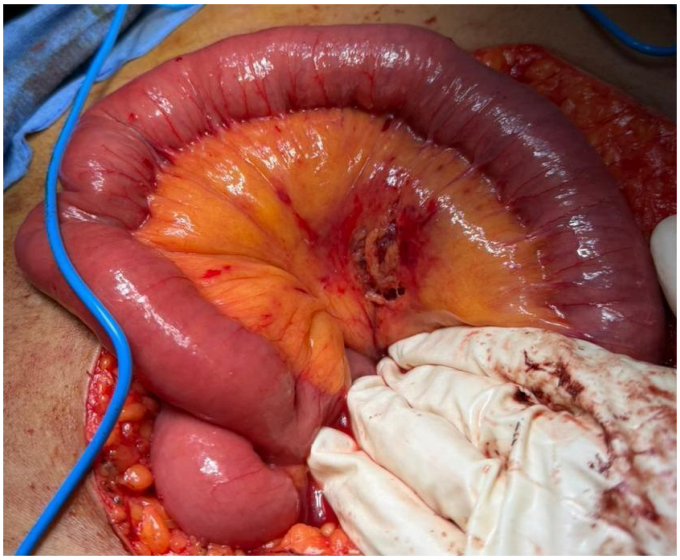

Image 3: Intraoperative image showing a mesenteric tear with no signs of mesenteric ischemia

Image 4: Surgical specimen of ileocecal resection

The patient was admitted to the intensive care unit postoperatively and was placed on rehydration, antibiotic therapy, therapeutic-dose anticoagulants [due to focal thrombosis of the superior mesenteric vein and left renal vein], and analgesics.

Her progress was good; she was discharged from the ICU on the 3rd postoperative day, with correction of renal function [which had been impaired at admission], a viable and functional stoma, and restoration of bowel continuity on the 12th day of hospitalization. She was discharged from the hospital on the 17th postoperative day.

DISCUSSION

Acute mesenteric ischemia is a condition with a high mortality rate, requiring early clinical recognition and urgent management to prevent the development of irreversible intestinal damage and reduce the risk of death[31].

The mesentery is a fold of peritoneum that contains blood vessels and nerves and connects the colon and intestines to the posterior wall of the abdominal cavity. Mesenteric injuries can result from either blunt or penetrating trauma, and their severity depends on the extent of the injury. In cases of minor injury, spontaneous healing of the mesentery is possible with appropriate care and rest in cases of minor trauma. Complications resulting from a significant tear or rupture of the mesentery, such as internal bleeding, ischemia, or even death, are observed in cases of severe injury. In 1935, Counseller and McCormack developed the "fixed-point theory," which states that most intestinal injuries during blunt abdominal trauma occur in the proximal jejunum or distal ileum. According to this theory, the anatomical fixation of these tissues to the retroperitoneum explains their fragility [1].

In a 2020 study by Yamamoto et al. involving 64 patients with blunt abdominal trauma, among those who underwent surgery, 34 cases of intestinal injuries—including 20 perforations and 30 mesenteric injuries—were predominantly located in the small intestine rather than the colon[1,32].

The diagnostic challenge in patients with blunt abdominal trauma presenting with isolated mesenteric injuries can lead to delayed management, as the patient may not exhibit any symptoms or obvious signs of perforation-related peritonitis or intestinal irritation. Furthermore, a patient with mesenteric trauma may present with signs or symptoms similar to those of other abdominal injuries, such as intestinal perforation, splenic trauma, or hepatic trauma, which can further complicate the diagnosis and delay treatment. Furthermore, the mesentery contains numerous vessels, which explains why injury to one of these vessels can lead to bleeding that may even go unnoticed[33–35].

In patients with hemodynamically stable abdominal trauma, a CT angiogram should be performed and remains the first-line examination; if the CT scan is normal, the patient should be kept under observation in the hospital for at least 24 hours with rigorous clinical and laboratory monitoring. In the event of clinical or laboratory deterioration, the presence of soft signs initially, persistent abdominal pain, or the presence of a belt sign, a repeat CT scan is recommended[1,4]

According to a study conducted in France on the management of mesenteric trauma, 100% of the experts consulted agree with the recommendation that any patient with high-energy blunt abdominal trauma should undergo a contrast-enhanced abdominal-pelvic CT angiogram, and 94% of the experts consulted agree on the use of a diagnostic score. The most well-known and widely used diagnostic scores in France are the Faget-Millet score and the BIPS; one is strictly radiological, while the other is clinical, biological, and radiological [4].

A complete blood count [CBC] and C-reactive protein [CRP] test constitute the minimum laboratory workup required in cases of mesenteric trauma, and an

initial white blood cell count exceeding 17,000/mm³ should alert the surgeon managing the patient[4].

Immediate surgery is indicated for any patient presenting with mesenteric trauma and clinical, laboratory, and radiological signs of mesenteric ischemia, as well as symptoms of peritonitis or potential intestinal infarction, in order to remove any ischemic or necrotic intestinal segments[36].

According to the French Expert Consensus, for any clinically or biologically significant deterioration, a follow-up CT scan is required prior to surgical exploration[4].

Our patient, a victim of a traffic accident, presented with mesenteric trauma and ischemia of the distal small intestine due to a mesenteric tear, along with clinical signs including abdominal tenderness with guarding, leukocytosis at 22,000/ mm³, a supraumbilical abrasion suggestive of the "belt sign," mesenteric contusion on CT angiography, and hemoperitoneum. The BIPS score was >2, which enabled us to make an early diagnosis; emergency surgical treatment was performed, consisting of resection of the necrotic small intestine with double ileocolic stoma. The duration of hospitalization in the intensive care unit was 3 days, and the patient's bowel continuity was restored on the 12th day of hospitalization; she was discharged on the 17th day. The outcome was favorable and was influenced by the early diagnosis and prompt surgical intervention. What we observed in our patient has been reported by other authors who have studied closed abdominal trauma with mesenteric injury.

Conclusion

Mesenteric trauma with intestinal ischemia resulting from a motor vehicle accident is a rare but serious condition with a high mortality rate, and the prognosis depends on the speed of treatment. It is more difficult to diagnose because its symptoms are similar to those of other abdominal injuries caused by abdominal trauma. Abdominal CT angiography is the gold-standard imaging modality, but FAST ultrasound plays an important role and can help raise suspicion of the diagnosis. The prognosis depends on the timeliness of the diagnosis, underscoring the importance of a rapid multidisciplinary approach. In cases of hemodynamic instability, surgical management is urgent; in hemodynamically stable patients, the combination of clinical, laboratory, and radiological findings guides the therapeutic approach—either non-surgical treatment or surgery. Thanks to rapid recognition of the precise diagnosis and multidisciplinary management in our patient, the outcome was favorable despite the complexity of the injuries, and continuity was restored on the 12th day of hospitalization, with discharge on the 17th day of hospitalization. Finally, strong clinical suspicion, rapid diagnosis, and appropriate management remain essential for reducing morbidity and mortality associated with mesenteric injuries following blunt abdominal trauma.

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