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REVIEW

Hollow viscus injury due to blunt trauma: A review



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KEYWORDS

Blunt abdominal trauma;
Mesenteric injury;
Hollow viscus injury;
CT scan;
Surgery;
Non-operative management

Summary Blunt abdominal trauma results in injury to the bowel and mesenteries in 3–5% of cases. The injuries are polymorphic including hematoma, seromuscular tear, perforation, and ischemia. They preferentially involve the small bowel and may result in bleeding and/or peritonitis. An urgent laparotomy is necessary if there is evidence of active bleeding or peritonitis at the initial examination, but these situations are uncommon. The main diagnostic challenge is to promptly and correctly identify lesions that require surgical repair. Diagnostic delay exceeding eight hours before surgical repair is associated with increased morbidity and probably with mortality. Because of this risk, the traditional therapeutic approach has been to operate on all patients with suspected bowel or mesenteric injury. However, this approach leads to a high rate of non-therapeutic laparotomy. A new approach of non-operative management (NOM) may be applicable to hemodynamically stable patients with no signs of perforation or peritonitis, and is being increasingly employed. This attitude has been described in several recent studies, and can be applied to nearly 40% of patients. However, there is no consensual agreement on which criteria or combination of clinical and radiological signs can insure the safety of NOM. When NOM is decided upon at the outset, very close monitoring is mandatory with repeated clinical examinations and interval computerized tomography (CT). Larger multicenter studies are needed to better define the selection criteria and modalities for NOM.

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Introduction

In blunt abdominal trauma, intestinal and mesenteric injuries are less common than solid organ injury (liver, spleen), but they regularly pose diagnostic difficulties that may result in detrimental therapeutic delay. At times, the

clinical and radiological picture of intestinal or mesenteric injury is obvious, leading to treatment without delay. But some injuries that require prompt surgical intervention may present with muted or subclinical signs. CT is the most effective imaging study for the positive diagnosis of intestinal and mesenteric lesions in stable and minimally symptomatic patients, but it does not always enable selection of patients who require therapeutic intervention. The choice of treatment is difficult, with two opposing pitfalls: non-therapeutic laparotomy versus therapeutic delay. There are currently no established criteria to guide safe management, although there has been an increasing tendency toward NOM in recent

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Essential points and practices

- An intestinal or mesenteric injury should be suspected in all cases of blunt abdominal trauma.
- Clinical or radiological evidence of a lesion that requires operative intervention is not always present at the initial stage.
- Some injuries do not require surgery therapy (limited hematoma, serosal wound). CT is effective for making a positive diagnosis of intestinal or mesenteric injury, but not as effective in predicting the need for surgery.
- Surgical treatment allowing restoration of digestive continuity in one-stage can be achieved in the majority small intestinal and colonic lesions as long as surgery is performed early.
- Non-operative management is seeing increasing use in hemodynamically stable patients with minimal symptoms, particularly for mesenteric bruising or hematoma without free abdominal fluid, or for isolated low-volume peritoneal effusion without CT evidence of associated intra-abdominal injury.
- Delay before surgical intervention increases morbidity and mortality.
- Surgical exploration is an appropriate and safe option whenever there is doubt regarding appropriate management.

years. So it seems important to fully understand the signs of these traumatic injuries in order to recognize difficult situations and effectively manage these patients.

Epidemiology

Hollow organ and mesenteric injury are found in 3–5% of patients treated for blunt abdominal trauma [1–3]. They represent 16% of all lesions seen in blunt abdominal trauma and are third in order of frequency after liver and splenic injury [4]. Most studies of blunt trauma with intestinal injury are single-center retrospective series with low numbers and long inclusion periods, limiting the epidemiological scope and clinical validity of the authors' conclusions. The HVI trial, a large multicenter study conducted in the early 2000s by EAST (Eastern Association for the Surgery of Trauma, USA) [1], showed that the 95 participating trauma centers in the study received an average of only 14 blunt intestinal injuries per year, confirming the relative rarity of these injuries.

These lesions occur as a result of high-energy trauma involving motor vehicle accidents (MVA) in 70–90% of cases (car, two wheeler, pedestrian) [1,5–7]. Two epidemiological points concerning MVA's stand out in several studies. Clinical studies [1] and also data from MVA registries [8,9] have shown a greater risk of intestinal injury for passengers than for drivers [8], particularly for rear-seat passengers [9]. The second point is that automobile seat belts play a potentially causative role, paradoxically increasing the risk of intestinal injury. This effect was observed as early as 1960 [10] when lap seat belts with two-point attachment were commonly used [11]; it is still observed with modern three-point lap and shoulder seatbelts [9,12], as well as modern airbag systems [13]. These particular points probably deserve further epidemiological and biomechanical research [14] for better understanding and prevention.

Pathophysiology

In most studies, intestinal injuries are grouped with corresponding lesions of their mesenteries (mesocolon and mesentery), and considered as a single clinico-anatomic entity. All regions of the abdominal intestine can be affected and lesions are quite variable in their clinical presentation. Small intestinal injuries constitute more than half of all blunt intestinal injuries, with equal involvement of the jejunum and ileum. The second most frequent location of injury is the colon; several studies show that left colon is more commonly injured than the transverse or right colon [5,7]. Duodenal lesions are less common, representing only 10% of the total, and often in association with pancreatic trauma. Blunt trauma injuries of the rectum and stomach are even less frequent, representing only 5% of the total [1].

There are several types of intestinal and mesenteric injury; some examples are shown in Figs. 1 and 2. The most common intestinal lesions are serous or seromuscular tears. Next comes full-thickness perforation, which can be a punctate blowout or a full-thickness tear of the intestinal wall. In addition, there are mural hematomas and extensive seromuscular lesions with de-gloving of the intestine. Late post-traumatic intestinal strictures may occur resulting in bowel obstruction, probably due to localized segmental ischemia that progresses to fibrotic stricture [15]. Mesenteric injuries range from bruising, to hematoma, to frank bleeding through the torn peritoneal envelope. If bleeding is active, a hematoma may rapidly enlarge, distending the entire mesenteric root. If the peritoneum overlying the mesentery is torn, hemoperitoneum results. Mesenteric disinsertion may occur with avulsion of the proximal or distal mesenteric root; this may cause intestinal perforation along the mesenteric surface of the bowel and localized devascularisation of an intestinal segment resulting in ischemia and secondary perforation.

The three main mechanisms leading to these injuries are direct impact, deceleration, and increased luminal pressure. With direct impact, energy is transmitted as a shock wave passing from the surface to the body core, causing vise-like compression. Velocity plays a major role in the intensity of impact energy, which is measured by the equation $E = mv^2$. Lesions consisting of bruising, tearing and lacerations tend to be located opposite to where the force is exerted (*contrecoup*).

Deceleration trauma is linked to the sudden velocity change within milliseconds of a body moving from high speed (e.g., passenger in a motor vehicle) to zero speed (at impact with the obstacle). During the brutal arrest of the body, the intestine and its mesentery pursue a translational back and forth movement. The resultant injury depends on the strength of the tissues, their fixation, and the generated displacement. Mesenteric disinsertion is a typical deceleration lesion. These devascularizing lesions have been described by several authors [16–18] and typically occur at the junction between fixed and mobile segments (ligament of Treitz, ileo-cecal junction, sigmoid loop fixation points).

The third traumatic mechanism is increased luminal pressure due to abrupt abdominal compression during the direct impact. These forces, when applied to the partially air-filled intestine, can cause intestinal blowout. Intestinal bursting lesions preferentially involve the proximal jejunum [19,20].

The resulting clinical lesion is often the combined product of all three mechanisms in varying proportions, and it is

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