

Abdominal Imaging / Imagerie abdominale

Small-Bowel and Mesenteric Injuries in Blunt Trauma of the Abdomen

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Bowel and mesentery are injured in an estimated 1%–5% of cases after blunt trauma [1–3] and is the third most common type of injury from blunt trauma to abdominal organs [4–7]. There are 3 basic mechanisms that govern injury to bowel and mesentery, and include direct crushing force, shearing force, and a sudden increase in intraluminal pressure that results in burst injuries [8]. Missed or delayed diagnosis is multifactorial. Symptoms may be absent on initial presentation and, when present, may be nonspecific. Furthermore, clinical assessment of some patients may not be reliable in the presence of concomitant injuries. The result of these undiagnosed injuries is increased morbidity and mortality [2,9–13].

Diagnostic tests in patients with suspected abdominal injury include peritoneal lavage, ultrasonography, and computed tomography (CT). Although sensitivity of peritoneal lavage for detection of hemoperitoneum is higher than 90% [14–16], it is neither specific nor sensitive, with undetected bowel perforation seen in up to 10% of cases [17]. Focused ultrasound assessment in trauma has a sensitivity of 86% for detection of free intra-abdominal fluid but is nonspecific with regard to organ injury [18]. In comparison, multidetector CT is more sensitive and specific than diagnostic peritoneal lavage, abdominal ultrasound, and clinical examination for the diagnosis of bowel and mesenteric injuries [19], with improved diagnostic accuracy making it the imaging modality of choice for evaluation of abdominal and pelvic trauma [20–29].

It must be remembered that not all bowel and/or mesenteric injuries are surgically significant [28]. Those injuries that require surgical intervention include complete and serosomuscular tear, devascularized bowel, active mesenteric bleeding, and mesenteric injury associated with bowel ischemia. CT aids immensely by allowing differentiation of these significant injuries from those injuries that may be better managed conservatively. Our pictorial essay illustrates common and uncommon multidetector CT findings of bowel and mesenteric injury after blunt abdominal trauma.

Features of Bowel and Mesenteric Injury

Intraperitoneal and Retroperitoneal Fluid

Although low in specificity, free fluid is by far the most sensitive CT feature of bowel and/or mesenteric injury [30,31] seen in up to 93% of patients [23]. In fact, in patients with blunt abdominal trauma, the absence of intraperitoneal fluid nearly excludes a surgically significant bowel and/or mesenteric injury [28]. Attenuation of fluid in trauma may vary, depending on its origin, that ranges from low-attenuation extravasated intraluminal bowel contents to intermediate-to-high-attenuation blood or orally administered contrast. By virtue of localizing at the site of injury, retroperitoneal fluid may indicate injury of a retroperitoneal segment of bowel. Another localizing sign is the presence of fluid in the mesentery or between loops of bowel [32,33]. Intraperitoneal fluid has a tendency to accumulate in the dependent spaces, including the pelvis. It, however, must be kept in mind that small, isolated, simple fluid located deep in the pelvis may also be seen in female patients as well as in up to 4.9% of male patients [34].

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Specific Findings of Bowel Injury

Extraluminal Air

Intraperitoneal or retroperitoneal extraluminal air (Figure 1) is a relatively specific sign of bowel perforation seen in 20%–55% of patients [9,23,28,31,34]. Gas from ruptured bowel commonly accumulates deep to the anterior abdominal wall. A diagnostic pitfall at this location is subcutaneous emphysema that extends to the extraperitoneal space and produces pseudopneumoperitoneum [35]. Other sites where extraluminal air may collect include the porta hepatis, mesentery or mesenteric veins, and the portal vein [21]. Small amounts of free air are often overlooked [36], and the use of wide window settings while viewing CT images improves detection. It must be remembered that isolated free air may also be seen in causes unrelated to bowel injury. The presence of signs, including adjacent bowel thickening or mesenteric stranding, helps improve the probability of diagnosing bowel injury [36].

Extraluminal Contrast

The presence of extravasated contrast is a specific sign of bowel perforation. The sensitivity of extraluminal contrast, however, is low, attributed in part to techniques due to early scanning before oral contrast reaches and distends the site of bowel perforation or due to dilution of a small volume of extraluminal contrast by larger intraperitoneal free fluid [28,31]. A false-positive result may be seen with extraluminal contrast from intraperitoneal bladder rupture, which, unlike contrast extravasation from bowel injury, is seen in delayed images after bladder filling and is usually of higher attenuation [23].

Bowel-Wall Defect

A defect in the bowel wall (Figures 2 and 3) is highly specific for bowel injury [8] but, due to the small size of the

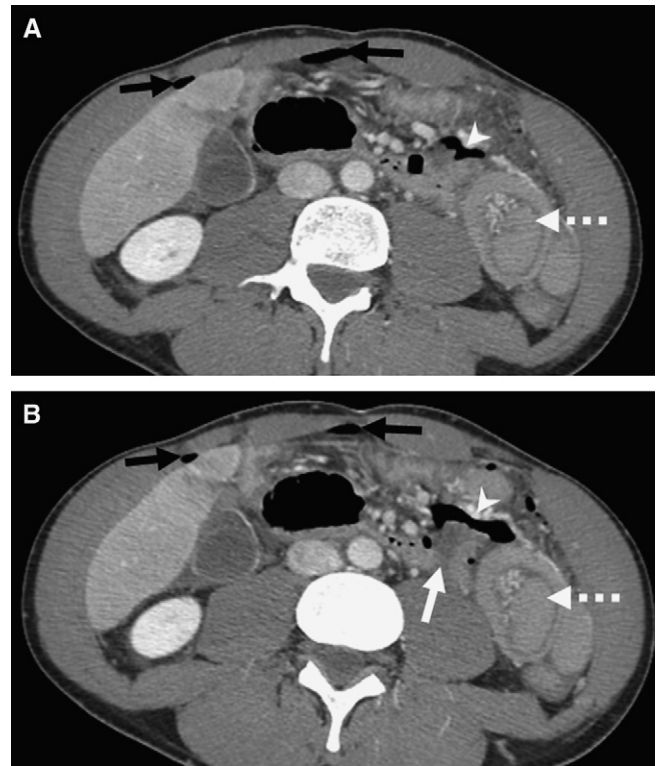


Figure 1. Bowel perforation at the ligament of Treitz in a 55-year-old woman after a motor vehicle accident. (A, B) Axial computed tomography image, showing a suspicious defect (white arrow) with focal fluid and extraluminal air (arrowhead) adjacent to the duodenojejunal junction. There also is free pneumoperitoneum (black arrows). There is a posttraumatic jejunojejunal intussusception (dashed arrow). The patient later underwent resection of a 9-cm segment of the small bowel and manual reduction of the intussusception.

defect, is only seen in a minority of cases and is often evident only with careful inspection at surgery.

Intramural Air

This very uncommon finding in bowel injury may indicate full-thickness involvement that requires surgery [20,21].

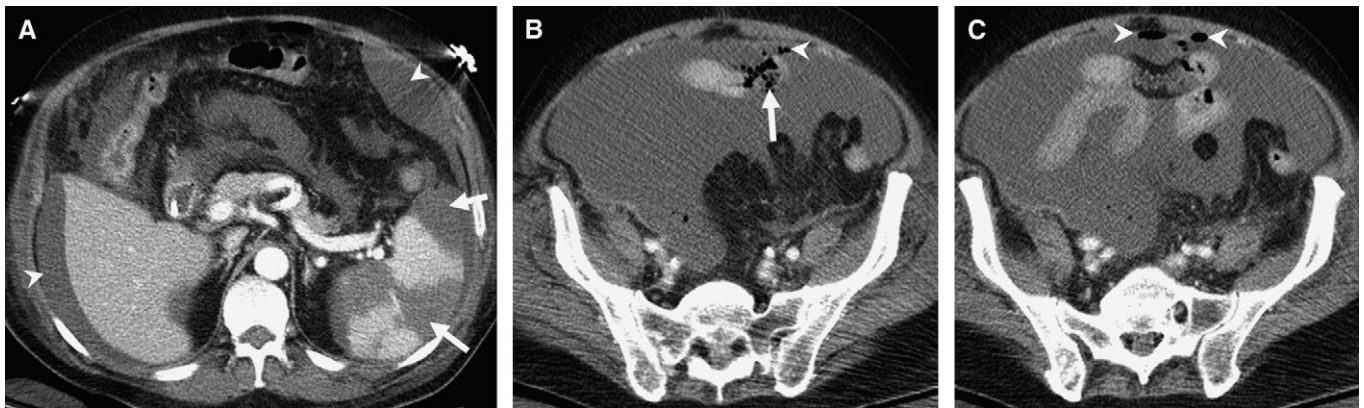


Figure 2. Splenic lacerations and ileal perforation in a 66-year-old woman involved in a motor vehicle injury. (A) Axial contrast-enhanced computed tomography (CT), revealing multiple large splenic lacerations (arrows) with hemoperitoneum (arrowheads). (B, C) Caudal CT sections, revealing an ileal loop perforation (arrow in B) with free extraluminal air (arrowhead in C). There is a large hemoperitoneum.

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