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Specific Radiological Findings of Traumatic Gastrointestinal Tract Injuries in Patients With Blunt Chest and Abdominal Trauma

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Abstract

Gastrointestinal hollow viscus injury after blunt chest and abdominal trauma is uncommon and complicates 0.6%-1.2% of all cases of trauma. Early recognition of such injuries significantly decreases morbidity and mortality. Since physical examination is not accurate in detecting such injuries, contrast-enhanced computed tomography has been the mainstay for diagnosis in many emergency departments. This pictorial essay aims to review the incidence, mechanisms, and signs of gastrointestinal hollow viscus injuries in the setting of blunt chest and abdominal trauma.

Résumé

Les lésions aux viscères creux du système gastro-intestinal consécutives à un traumatisme thoracique et abdominal ne sont pas courantes: elles n'aggravent que de 0,6 à 1,2 % des traumatismes. Toutefois, leur détection précoce réduit considérablement le taux de morbidité et de mortalité. Puisque l'examen physique ne permet pas de déceler efficacement ce type de lésions, de nombreux services d'urgence ont recours à la tomodensitométrie avec injection de produit de contraste pour poser un diagnostic. Cet essai descriptif vise à analyser l'incidence des lésions aux viscères creux du système gastro-intestinal, ainsi que les mécanismes et les signes qui leur sont associés, dans un contexte de traumatisme contondant au thorax et à l'abdomen.

Key Words: Hollow viscus injury; Gastrointestinal tract; Blunt trauma; Computed tomography

Trauma is the leading cause of death in individuals under the age of 45 years and the fourth leading cause of death for all ages [1]. The death rate due to trauma was 180,000 in 2007 within the United States alone [1]. The incidence of hollow viscus injury (HVI) following blunt abdominal trauma (BAT) and chest trauma is between 0.6%-1.2%, and 5% with severe BAT [1−5]. Contrast-enhanced computed tomography (CECT) is the diagnostic modality of choice in the assessment of hemodynamically stable patients with blunt chest and abdominal trauma [2]. Timely identification of such injuries on CT is crucial for patient management and prognosis [6]. This review aims to identify general and specific radiological signs of gastrointestinal HVI in patients with blunt chest and abdominal trauma, with a focus on CECT findings. In addition, the epidemiology, mechanism of injury, and management of such injuries is briefly reviewed.

General Findings

Although a variety of imaging signs are usually present in HVI, more specific findings may not be sensitive and the more sensitive signs are not highly specific [1]. For example, for an average-size patient, collimation of 1.25 mm (4-slice and 16-slice) or 0.6 mm (64-slice), 120 kVp, and 300 mA may be appropriate [7], however, the use of dynamic scan

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parameters to reduce radiation dose and accommodate for body size are strongly advised and should be in line with the ALARA principle (As Low As [is] Reasonably Achievable) principle. As a primary screening study, a single portal venous phase examination is usually sufficient. In specific circumstances such as suspected bowel perforation, delayed phase examination with oral contrast may increase sensitivity and specificity of findings (ie, pooling of contrast material outside of the lumen).

Pneumoperitoneum

Although free air in the peritoneal cavity is sensitive for HVI, it may not be specific for the diagnosis of small bowel injury (SBI). A study of 275,557 trauma admissions with HVI following BAT found that pneumoperitoneum on CT scan was pathognomonic for HVI (91.5%) but was not discriminating for SBI, as only 43.8% of the patients with pneumoperitoneum had a perforated SBI, and the rest had other HVI [8]. Lung window greatly increases the sensitivity of detecting small pneumoperitoneum [1]. Pneumoperitoneum should be distinguished from pseudopneumoperitoneum (collection of air between the abdominal wall and peritoneum), as the latter may be a false-positive and may be caused by rib fracture, pneumothorax, pneumomediastinum, and extraperitoneal rectal injury [1].

Free Fluid

Hematoma between bowel loops often indicates an injury to the bowel or mesentery, as blood from solid organ laceration frequently collects within the subdiaphragmatic spaces, paracolic gutters, or pelvis [9]. Hemoperitoneum is seen as an intermediate attenuation fluid (>25 Hounsfield units [HU]). Oral contrast is rarely used in trauma scans, with the exception of low-acuity scans or rescanning to clarify if HVI is present. Leaking oral contrast hyperattenuates on CT (>150 HU), similar to fluid seen with active arterial bleeding (with a similar attenuation to major arteries). Hypoattenuating fluid (<20 HU) in the setting of HVI usually indicates small bowel injury [9].

Bowel Wall Findings

Intramural hematoma results in circumferential or eccentric thickening of the bowel wall, and is an indicator of blunt trauma to the bowel wall. Intense focal enhancement suggests bowel injury or perforation if associated with free peritoneal fluid, while diffuse bowel wall enhancement can be seen with shock [9].

Mesenteric Injury

Presence of mesenteric hematoma may indicate the presence of a bowel injury or mesenteric vessel laceration. The sentinel sign (presence of higher attenuation of blood near the site of injury) is a strong evidence for HVI [9].

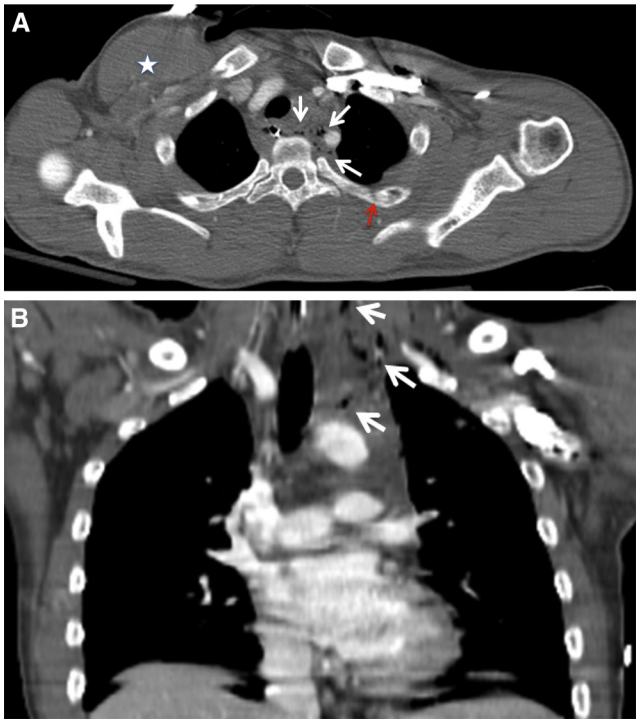

Figure 1. Esophageal perforation with extraluminal fluid and pneumomediastinum (arrows) (A) tracking into the base of the neck (B). Incidental left posterior third rib fracture (red arrow) and right pectoralis muscle hematoma/edema (*) noted. This figure is available in colour online at http://carjonline.org/.

Esophagus

Esophageal injury occurs in 1% of blunt chest and abdominal trauma and typically involve the cervical and upper thoracic parts of the esophagus [10]. Esophageal injuries in general are rare, mainly due to the small size of the esophagus, its relatively protected position, and to the fact that a significant number of patients with esophageal injuries will often succumb secondary to associated vascular injuries [11]. Mortality for esophageal trauma ranges from 0%-22% [11].

The underlying mechanisms of injury are shearing force secondary to rapid acceleration/deceleration, increased intraluminal pressure with closed glottis, direct blow to the neck, hyperextension, and rupture by a vertebral body fracture [10]. Diagnosis requires a high index of suspicion as it relies mainly on the presence of indirect radiological signs [11]. Subcutaneous, muscular thoracic or cervical emphysema, abnormal course of a nasogastric tube, widened mediastinum, pneumomediastinum, pneumopericardium, left-sided pneumothorax, pleural effusion, and left lower lobe atelectasis may be seen on CECT [11]. More specific signs include localized esophageal wall thickening, mucosal hyperemia, mucosal dissection, esophageal hematoma, and edema [10,11] (Figure 1).

Esophageal injuries are associated with mediastinitis, periesophageal fluid, extraluminal gas, pleural effusions, and possible contrast extravasation. Mucosal lacerations, most intramural hematoma, some cervical, and contained perforations can be managed conservatively [10]. Uncontained