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## Educational Review of Predictive Value and Findings of Computed Tomography Scan in Diagnosing Bowel and Mesenteric Injuries After Blunt Trauma: Correlation With Trauma Surgery Findings in 163 Patients

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### Abstract

**Background and Aims:** Laparotomy can detect bowel and mesenteric injuries in 1.2%–5% of patients following blunt abdominal trauma. Delayed diagnosis in such cases is strongly related to increased risk of ongoing sepsis, with subsequent higher morbidity and mortality. Computed tomography (CT) scanning is the gold standard in the evaluation of blunt abdominal trauma, being accurate in the diagnosis of bowel and mesenteric injuries in case of hemodynamically stable trauma patients. Aims of the present study are to 1) review the correlation between CT signs and intraoperative findings in case of bowel and mesenteric injuries following blunt abdominal trauma, analysing the correlation between radiological features and intraoperative findings from our experience on 25 trauma patients with small bowel and mesenteric injuries (SBMI); 2) identify the diagnostic specificity of those signs found at CT with practical considerations on the following clinical management; and 3) distinguish the bowel and mesenteric injuries requiring immediate surgical intervention from those amenable to initial nonoperative management.

**Materials and Methods:** Between January 1, 2008, and May 31, 2010, 163 patients required laparotomy following blunt abdominal trauma. Among them, 25 patients presented bowel or mesenteric injuries. Data were analysed retrospectively, correlating operative surgical reports with the preoperative CT findings.

**Results:** We are presenting a pictorial review of significant and frequent findings of bowel and mesenteric lesions at CT scan, confirmed intraoperatively at laparotomy. Moreover, the predictive value of CT scan for SBMI is assessed.

**Conclusions:** Multidetector CT scan is the gold standard in the assessment of intra-abdominal blunt abdominal trauma for not only parenchymal organs injuries but also detecting SBMI; in the presence of specific signs it provides an accurate assessment of hollow viscus injuries, helping the trauma surgeons to choose the correct initial clinical management.

### Résumé

**Contexte et buts :** La laparotomie permet de détecter les lésions traumatiques de l'intestin et du mésentère chez 1,2 % à 5 % des patients qui ont subi un trauma abdominal fermé. Dans de tels cas, un diagnostic tardif est fortement associé à un risque accru de sepsie persistante et à des taux plus élevés de morbidité et de mortalité. La tomodensitométrie (TDM) est la modalité de référence pour l'évaluation des traumas abdominaux fermés, pour un diagnostic exact des lésions traumatiques de l'intestin et du mésentère chez les patients victimes de traumatismes et stables sur le plan hémodynamique. Les buts de la présente étude sont les suivants: 1) examiner la corrélation entre les signes de la TDM et les observations peropératoires dans les cas de lésions traumatiques de l'intestin et du mésentère par suite de trauma abdominal fermé et analyser la corrélation entre les facteurs radiologiques et les observations peropératoires tirées de notre expérience auprès de

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25 patients victimes de traumatismes avec lésions de l'intestin grêle et du mésentère; 2) établir la spécificité de diagnostic des signes trouvés lors de la TDM ayant des considérations pratiques pour la gestion clinique subséquente; 3) distinguer les lésions traumatiques de l'intestin et du mésentère nécessitant une intervention chirurgicale immédiate des lésions pouvant initialement être prises en charge de façon non chirurgicale.

**Matériel et méthodes :** Du 1<sup>er</sup> janvier 2008 au 31 mai 2010, 163 patients ont dû subir une laparotomie par suite d'un trauma abdominal fermé. De ce nombre, 25 patients présentaient des lésions traumatiques de l'intestin ou du mésentère. Les données ont été analysées rétrospectivement et une corrélation a été établie entre les rapports de chirurgie opératoires et les observations préopératoires de la TDM.

**Résultats :** Nous présentons une revue iconographique des conclusions importantes et fréquentes sur les lésions traumatiques de l'intestin et du mésentère lors d'une TDM et confirmées en peropératoire lors de la laparotomie. En outre, nous évaluons la valeur prédictive de la TDM pour les lésions traumatiques de l'intestin grêle et du mésentère.

**Conclusions :** La tomodensitométrie multibarrettes est la modalité de référence pour l'évaluation des traumas abdominaux fermés intra-abdominaux non seulement pour les lésions aux organes parenchymateux, mais également pour détecter les lésions traumatiques de l'intestin grêle et du mésentère; en présence de signes précis, elle offre une évaluation juste des lésions aux viscères creux et aide les traumatologues à choisir la bonne option de prise en charge clinique initiale.

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Following blunt abdominal trauma, the incidence of hollow viscus and mesenteric injuries ranges between 3.1%–5% [1], exceeding 10% in the case of patients with associated lesions [2].

In case of blunt trauma, there are 3 main mechanisms responsible for causing the lesions of hollow viscus and mesentery: 1) direct energy applied to the bowel wall causing compression or contusion; 2) sudden deceleration determining a shearing stress between the fixed and mobile attachments of the bowel, ultimately leading to tearing; and 3) sudden increase in intraluminal pressure causing burst injuries [3].

In blunt abdominal trauma, the most often injured tract of the gastrointestinal system is the small bowel (67.3%), followed by the colon (20%), duodenum (8.4%), appendix (2.1%), stomach (1.1%), and rectum (1.1%) [4].

The location of injury within the gastrointestinal tract correlates well with prognosis, accounting for various degree and quality of peritoneal soiling (with higher contamination

in case of colonic lesions); moreover, each affected tract has its own surgical risk [5].

Surgical treatment is not always necessary for every bowel or mesenteric traumatic injury. When a small bowel and mesentery lesion mandates surgery, a prompt diagnosis is essential.

Any delays in diagnosis and subsequent surgical treatment may lead to development of bowel gangrene and delayed perforation (Figure 1), with subsequent risk of uncontrolled intra-abdominal septic complications, and exponential increase of mortality rates due to enteric content spread [6]. A delay of 24 hours or more is associated with an increase in mortality rate as high as 30% [1,7].

Early diagnosis is therefore a key factor in preventing septic complications and reducing mortality rates in bowel traumatic injuries, but it is poorly supported and hardly achieved by basic clinical examination and commonly used diagnostic methods.

In fact, diagnosis based on the clinical triad (abdominal pain, guarding and absence of bowel sounds) has low sensitivity and it is neither helpful nor reliable in the case of

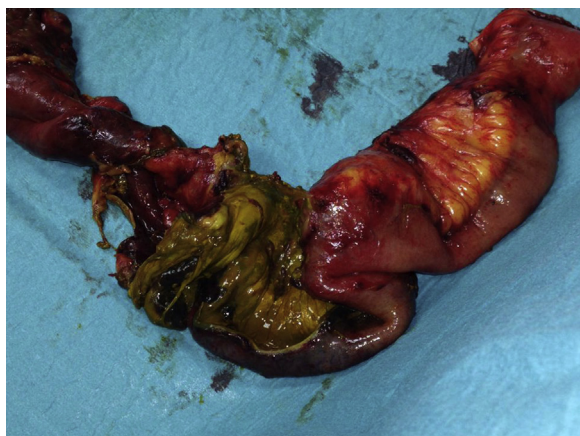


Figure 1. Dreadful consequences of a late diagnosis and delayed surgical treatment of small bowel and mesenteric injuries with major devascularization leading to bowel gangrene and perforation. Intraoperative images courtesy of Dr Salomone Di Saverio, MD, FACS, FRCS.

Table 1  
Patterns of possible intraoperative findings of small bowel and mesenteric injuries in blunt abdominal trauma and correspondent surgical treatment

Lesion type	Operative findings	Management
Bowel	Perforation (transmural lesion)	Surgical treatment (resection or repair)
	Partial lesion of serosal +/- muscular layer	
	Devascularization secondary to mesenteric laceration	Possible conservative treatment
	Serosal tear	
Mesentery	Intestinal wall hematoma	Surgical treatment (resection or repair)
	Actively bleeding tears	
	Laceration with devascularized bowel	Possible conservative treatment
	Non bleeding lacerations	
	Hematoma	

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