Spiral Computed Tomography Demonstration of Active Haemorrhage in Blunt Abdominal Trauma

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ABSTRACT

In blunt abdominal trauma, patients may still be actively bleeding despite being physiologically stable. Fast computed tomography scanning permits the detection of active haemorrhage by localising the site of extravasation of contrast enhanced blood. Though a specific sign of active bleeding, particularly arterial haemorrhage, it is insensitive to the slow, continuous venous oozing associated with retroperitoneal and pelvic skeletal injuries. However, its presence will have a critical influence on further surgical intervention. The imaging features of this uncommon entity are demonstrated in our case report.

Keywords: abdominal trauma, haemorrhage, computed tomography

INTRODUCTION

Computed tomography (CT) is the imaging modality of choice in the evaluation of suspected blunt abdominal trauma. The use of fast spiral CT and power injected intravenous contrast medium enables high CT attenuation to be achieved within the vascular system during scanning. This permits CT visualisation of active haemorrhage within the abdomen[1,2]. The authors present a case in which CT correctly demonstrated the site of such potentially life threatening haemorrhage.

CASE REPORT

A 31-year-old woman fell from a height of 3 storeys. On arrival at the emergency room, she was noted to be pale, tachypnoeic, with pulse rate of 130 per minute and blood pressure of 107/94 mmHg. Glasgow Coma Scale score was 15 and no gross neurological deficits were noted. Radiographs showed multiple left lower rib fractures with left pneumothorax and fractures of the left radius and ulna. Initial haemoglobin level was 7.5 g/dL.

She had a left chest tube inserted with subsequent re-expansion of the lung. As there was persistent tachycardia and decreasing haemoglobin level to 5.3 g/dL, an abdominal CT scan examination was performed to exclude intra-abdominal injury. Spiral CT scan with 10 mm thick contiguous sections was performed with intravenous contrast material (100 mL of 75% Iopamidol at 2mL/second injection rate) through a peripheral vein, with scanning initiated 65 seconds after commencement of the bolus dose. It demonstrated haemoperitoneum with blood layering predominantly in the left hypochondrium (Fig 1). Though the splenic outline was normal, splenic injury was considered likely in view of the maximum concentration of blood at the site and the multiple ipsilateral rib fractures.

There was also abnormal widening at the falciform ligament-ligamentum teres region with blood localising to the site. Fine 5 mm thick sections through this area showed active haemorrhage with extravasation of dense vascular contrast medium (Fig 2).

No other visceral injury was discerned. Bilateral haemothoraces, burst fracture of T12 body with 50% compromise of the spinal canal were the other pertinent findings.

Fig 1 - CT scan of the upper abdomen. Haemoperitoneum with haematocrit effect at the left hypochondrium, with higher attenuation (59 HU) of the dependent blood compared to the anteriorly located fluid (16HU). Note haematoma (76 HU) at the site of hepatic laceration (arrow head). T12 body burst fracture is evident.

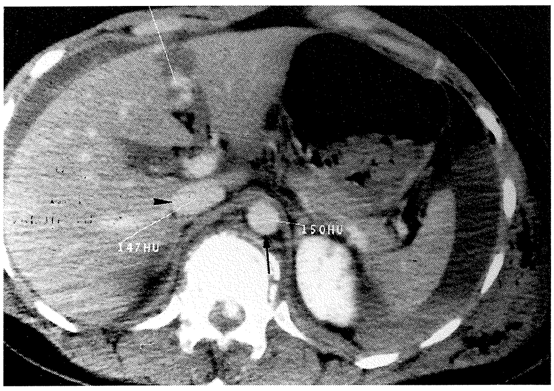

Fig 2 - Active dense haemorrhage (attenuation 136 HU) in the ligamentum teres laceration, is essentially isodense with the major adjacent arteries and veins. Attenuation in the aorta (arrow) measures 150 HU, inferior vena cava (arrow head) measures 147 HU.

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Immediate laparotomy revealed the presence of 1.5L of blood within the peritoneal cavity. There was a 4 cm laceration of the liver along the ligamentum teres with blood oozing from the raw surface. No splenic injury nor other abnormality was noted. Haemostasis was secured with diathermy. She had further operations at a later date for fixation of the left fore-arm fractures and spinal fusion for the burst fracture. She is recovering well presently.

DISCUSSION

CT has a major role in the evaluation of patients with suspected blunt abdominal trauma, allowing the accurate diagnosis of both intraperitoneal and retroperitoneal injuries. CT can detect the presence of haemoperitoneum as well as its possible aetiology; including hepatic, splenic, mesenteric and bowel lacerations[3,4]. In a haemodynamically stable patient, CT is the investigation of choice and diagnostic peritoneal lavage (DPL) need not be performed. While sensitive for the detection of intraperitoneal injury[5,6], DPL is relatively insensitive to retroperitoneal injuries[7]. Furthermore, a positive lavage does not indicate the type nor extent of organ injury, and may lead to non-therapeutic laparotomy rates of between 6%-25%[6,8]. CT after DPL may also be difficult to interpret.

The most frequent sign of injury in abdominal trauma is haemoperitoneum. The size of haemoperitoneum seen at CT is a reflection of cumulative blood loss since the time of injury. The presence of fluid within thc paracolic gutters indicates a volume of at least 200 mL in each. Haemoperitoneum per se is not a reliable sign of on-going haemorrhage[9,10]. By detecting the extravasation of dense contrast-enhanced blood, fast CT scanning can indicate the site of on-going haemorrhage.

Active haemorrhage is seen as an area of dense contrast extravasation surrounded by haematoma (clotted or partially clotted blood) of lower attenuation. The extravasated blood has an attenuation value greater than 85 Hounsfield Unit (HU), with a mean of 132 HU[2,10]. This is close to the attenuation values for the abdominal aorta or major adjacent artery[1,11]. Conversely, the density of the surrounding haematoma is always lower, ranging from 40 - 70 HU[2,10]. The attenuation values of haemoperitoneum are even lower, generally from 25 - 40 HU[10].

In our patient, the characteristic CT signs of active haemorrhage were present. Previous reports had indicated that the density of extravasated blood is generally within 10 - 15 HU of the density within the aorta or major adjacent artery[1,11]. As shown in our patient, this is also comparable to the attenuation value of the major adjacent venous structures (Fig 3). Identification of arterial or venous bleeding is difficult on the basis of the density reading alone. Arterial haemorrhage is, by far, the commoner[1,2,11]. In 2 cases of confirmed venous haemorrhage, Shanmuganathan and colleagues correctly localised on CT the venous origin of bleeding, solely on the basis of its proximity to major adjacent veins[2].

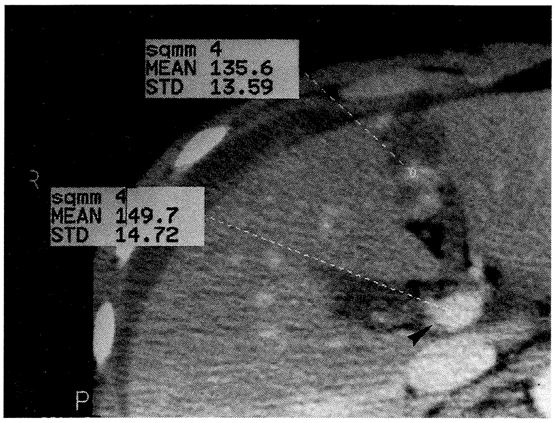

Fig 3 - Magnified view shows attenuation values of active haemorrhage (136 HU) compared to the portal vein (arrow head) (150 HU).

This specific CT sign of active haemorrhage is however, insensitive to slower rates of bleeding[2], such as in the continuous venous oozing associated with retroperitoneal injuries and pelvic skeletal fractures. Therefore, its absence does not imply a lack of active haemorrhage. It is an uncommon finding[12] and clinical judgement must be exercised. Laparotomy or repeat CT scan is warranted if there is subsequent haemodynamic decompensation.

However, in the small number of patients who may still be actively bleeding, despite appearing haemodynamically stable[1,12], the CT detection of active haemorrhage will necessitate and guide urgent surgical or radiological intervention[1,2].

ACKNOWLEDGEMENT

The authors wish to thank Dr H K Boey for his invaluable assistance towards this article.

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