

FLATTENED INFERIOR VENA CAVA AT COMPUTED TOMOGRAPHY AFTER BLUNT LIVER INJURY

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Introduction

Computed Tomography (CT) is the principal imaging technique performed in patients who have sustained blunt abdominal trauma. CT can provide the evidence of hypovolemia or hypotension which may alert the clinicians the status of impending cardiovascular collapse. The collapsed or flattened inferior vena cava and abnormal increased enhancement of abdominal organs are associated with severe hypovolemia, haemoperitoneum and poor prognosis.

Case Report

A twenty year old man involved in motor vehicle accident was treated in the Accident & Emergency (A&E) department. He was having lower abdomen and right hypochondrium pain. The blood pressure was 80/65mmHg and pulse rate was 95/min. He was alert and conscious with Glasgow Coma Scale (GCS) of 15. The abdomen was distended with generalized guarding. Immediate full blood count (FBC) showed haemoglobin level of 11.7g/dl. He was transfused with two pints of normal saline and a pint of Hartmann solution. The blood pressure improved to 102/82mmHg and pulse rate to 90/min.

He had emergency contrast enhanced CT of the abdomen. The CT scan showed extensive haemoperitoneum with liver lacerations in segment 5,6,7,8 and extending to the caudate lobe. There was massive extravasation of contrast into the haematoma and into the peritoneal cavity. The inferior vena cava (IVC) was small; measuring 3mm to 4mm in five consecutive slices (Fig. 1, 2).

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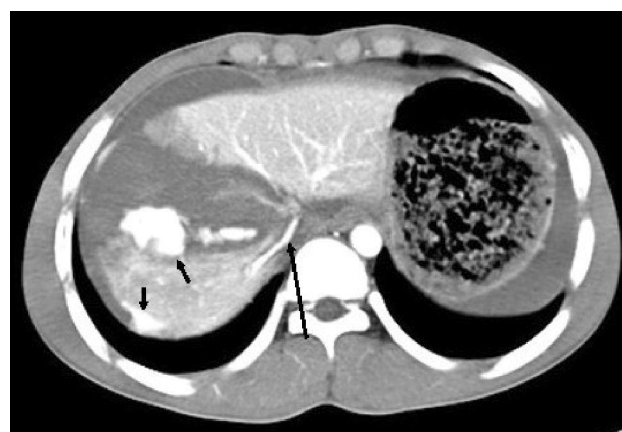


Figure 1: Axial CT scan images show liver lacerations with extensive haematoma and haemoperitoneum. The IVC (long arrow) is severely collapsed. High attenuation of contrast material (short arrows) in the haematoma and periphery to segment 7.



Figure 2: Coronal reconstruction images show the collapsed IVC (long arrow) and extravasation of contrast material (short arrow) due to active haemorrhage.

The renal veins were collapsed. The parenchyma of both kidneys and adrenal glands were markedly enhanced. The wall of the small bowel was thickened with intense enhancement (Fig. 3).

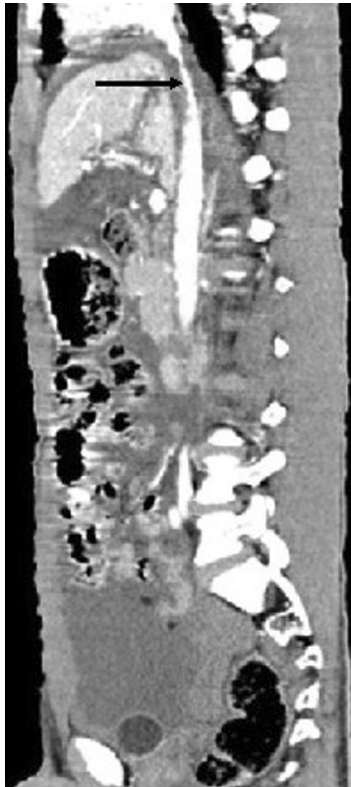


Figure 3: Sagittal reconstruction images show the collapsed IVC (arrow).

He had emergency laparotomy and intraoperatively noted gross haemoperitoneum with estimated blood loss of 6 litres. There were extensive liver lacerations



Figure 4: Axial CT scan images show intense enhancement of both kidneys and small bowel. The left renal vein is collapsed (arrow).

involving segment 6,7,8 and extending to the porta hepatis. There were vessels which bled actively and he had liver and abdominal packing. Post operatively the patient was treated in the Intensive Care Unit (ICU). However he succumbed to death twelve hours after surgery due to severe hypovolemia.

Discussion

CT has contributed significantly in the diagnosis and management of patient with liver injury. It can accurately delineate the pathologic anatomy, determine the severity of injuries and quantify the degree of haemoperitoneum.¹ A slitlike or collapsed IVC was an important CT indicator of intravascular volume depletion and a sign of hypovolemia from major haemorrhage.² It might precede the clinical detection of hypovolemia or shock.³ A collapsed IVC in patients without trauma usually did not signify hypovolemia or hypotension.^{4,5} A flat IVC must be detected at multiple levels for it to be considered a sign of hypovolemia. The IVC was collapsed if it appeared flattened, typically on multiple or at least three contiguous images to differentiate diminished venous return from transient size fluctuation that occur during respiration and changes in intraabdominal pressure.^{2,3,4,5} The IVC was defined to be flat when it measures 9mm or less in the anteroposterior (AP) diameter at the level of the renal veins.⁶ In another literature, the IVC was considered flat if its AP width below the renal veins was less than one-fourth of its lateral width.¹ With the advantage of multislice CT, the collapsed IVC is better seen on sagittal and coronal images.

The association of a flattened IVC with hypovolemia on abdominal CT was initially noted in the late 1980s in adult and paediatric patients with blunt abdominal trauma.^{5,7,8} There were other CT manifestations of hypovolemia which constitute the "hypoperfusion complex" following blunt abdominal trauma. The signs observed were decreased calibre of the aorta, marked diffuse bowel distension, moderate to extensive haemoperitoneum and abnormally intense enhancement of the small bowel wall, kidneys, pancreas and adrenals.^{5,6,9}

References

1. Yoon W, Jeong YY, Kim JK, , Lim HS, Shin SS, Kim JC, Jeong SW, Park JG, Kang HK. CT in Blunt Liver Trauma. *RadioGraphics* 2005; **25**:87-104.
2. Hewett JJ, Freed KS, Sheafor DH, Vaslef SN, Kliewer MA.. The Spectrum of Abdominal Venous CT Findings in Blunt Trauma. *Am J Roentgenol* 2001; **176**: 955-8.
3. Jeffrey RB Jr, Federle MP. The collapsed inferior vena cava: CT evidence of hypovolemia. *Am J Roentgenol* 1988; **150**: 431-2.
4. Kandpal H, Sharma R, Gamangatti S, Srivastava DN, Vashisht S. Imaging the Inferior Vena Cava: A Road Less Traveled. *RadioGraphics* 2008; **28**: 669-89.
5. Eisenstat RS, Whitford AC, Lane MJ, Katz DS. The "flat cava" sign revisited: what is its significance in patients without trauma? *Am J Roentgenol* 2002; **178**: 21-5.
6. Mirvis SE, Shanmuganathan K, Erb R. Diffuse small-bowel ischemia in hypotensive adults after blunt trauma (shock bowel): CT findings and clinical significance. *Am J Roentgenol* 1994; **163**: 1375-9.
7. Taylor GA, Fallat ME, Eichelberger MR. Hypovolemic shock in children: abdominal CT manifestations. *Radiology* 1987; **164**: 479-81.
8. Sivit CJ, Taylor GA, Bulas DI, Kushner DC, Potter BM, Eichelberger MR. Posttraumatic shock in children: CT findings associated with hemodynamically instability. *Radiology* 1992; **182**: 723-6.
9. Abbas SZ, Rashid M, Abbas SN, Khan IA. Radiological Quiz - Abdomen. *Ind J Radiol Imag* 2006; **4**: 951-2.