Fatal avulsion of inferior vena cava following blunt abdominal trauma

Introduction

Although rare, avulsion of the inferior vena cava as a result of blunt trauma is one of the most lethal injuries to intra-abdominal viscera, with a mortality rate approaching 100% (Castelli et al, 2005).

With the presentation varying from subtle haemodynamic instability to profound hypovolaemic cardiac arrest, a high index of suspicion will allow permissive hypotensive resuscitation and prompt surgical intervention.

Data on inferior vena cava injuries and their management are probably underreported in the literature. This article reports a case of a 25-year-old woman with a blunt traumatic avulsion of the retrohepatic inferior vena cava.

Discussion

Avulsion of the inferior vena cava as a result of blunt trauma remains a surgical challenge (Castelli et al, 2005). Since it is located in the relatively protected retroperitoneal space, inferior vena cava injury is usually associated with severe injuries to other intra-abdominal organs. A number of factors may determine the patient's survival. These include the level of injury (supra- *vs* infra-renal), the severity of shock, and time taken to diagnosis and treatment (Kuehne et al, 1999).

Retrospective studies have shown the highest mortality rate to be associated with injuries of the retrohepatic vena cava as a result of difficulty in obtaining surgical access (Hansen et al, 2000), and with avulsions or lacerations larger than 5 cm because of the rapid blood loss and haemodynamic instability.

It is unusual for inferior vena cava injury to be diagnosed preoperatively. Computed tomography findings such as retroperitoneal haematoma have been described in a few reports. However, a 6-year retrospective study by Netto et al (2006) showed that computed tomography imaging may underestimate the severity of the inferior vena cava injury. In the authors' case, computed tomography was of little value in suggesting an inferior vena cava injury, and it could be argued that prompt exploration of the abdomen was consequently

Figure 1. Computed tomography of the abdomen showing free fluid on the left side (white arrow). The inferior vena cava is clearly visible (red arrow head).

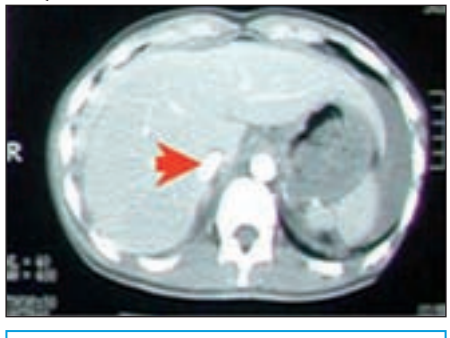


Figure 2. Computed tomography of the abdomen. The inferior vena cava is not visible, suggesting the level of avulsion.

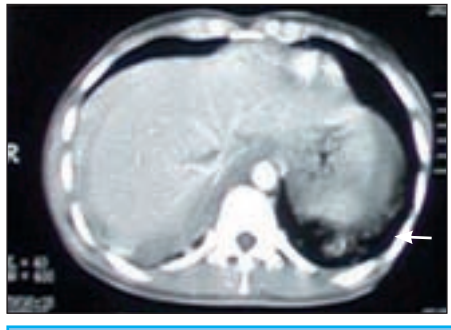
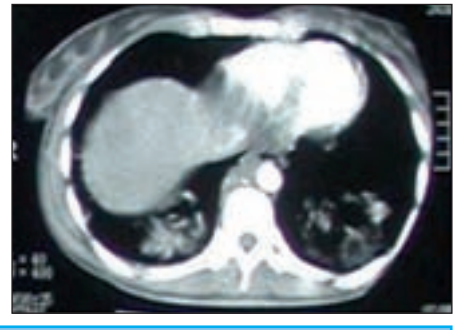


Figure 3. Computed tomography of the thorax showing the right atrium compressed with the possibility of leakage.



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Case Report

A 25-year-old woman was brought in by ambulance to the accident and emergency department following a road traffic accident where the car hit a tree at 70 miles/hour. At the scene, her Glasgow Coma Score was 9/15 and her blood pressure was 94/64 mmHg, for which she was fluid resuscitated. On arrival at accident and emergency, she was conscious and maintaining her airways. Although she was complaining of abdominal and back pain, there was no external haemorrhage. Secondary survey showed rigid abdomen with guarding. Trauma series showed stable cervical spine and pelvis, with no evidence of rib fractures or blunt trauma to the chest. Computed tomography of her chest and abdomen revealed pulmonary contusion with a small right pneumothorax. The right atrium, right ventricle and inferior vena cava appeared compressed and no obvious leakage could be seen in the pleural or pericardial space (*Figures 1–3*).

The patient deteriorated haemodynamically and was immediately taken to the operating theatre. On laparotomy more than 3 litres of blood was found, and as soon as the tamponade was released, the patient sustained cardiac arrest. With ongoing resuscitation, the laparotomy was extended as a left anterolateral thoracotomy, to cross clamp the descending aorta and to perform open cardiac massage after opening the pericardium. The abdomen was packed with four quadrant packs. Despite transfusion of 13 units of blood and ten cycles of cardiopulmonary resuscitation the patient died. On removing the abdominal packs, the retrohepatic inferior vena cava was found to be completely transected.

delayed. FAST (focussed abdominal sonar for trauma) would confirm retroperitoneal haematoma or free fluid in abdomen (Ollerton et al, 2006).

To date only a few reports have been published on the management of inferior vena cava injuries. This reflects the lack of surgical experience in dealing with these dreaded injuries even in dedicated trauma centres.

Conventional open surgical repair has anecdotally been the mainstay for such injuries. However, interventional endovascular approaches appear to be appealing for their technical feasibility, their speed and the minimal associated tissue trauma (Castelli et al, 2005; Albert et al, 2006). Erzurum et al (2003) described a case of uncontrolled haemorrhage from a retrohepatic inferior vena cava injury. The open surgical technique was aborted because there was difficulty in gaining adequate access and control. The patient underwent successful endovascular stenting. Similarly Watarida et al (2002) reported the use of endograft for a posterior inferior vena cava blunt injury. The long-term fate of endografts in low pressure venous system requires further evaluation.

Conclusions

Blunt traumatic avulsion of the inferior vena cava remains a lethal condition. Management requires a high index of suspicion and prompt diagnosis, and until innovative surgical techniques are developed, the outcome remains dismal. **BJHM**

Albert D, Sam AD, Frusha JD, McNeil JW, Olinde AJ (2006) Repair of a blunt traumatic inferior vena cava laceration with commercially available endografts. *J Vasc Surg* **43**(4): 841–3

Castelli P, Caronno R, Piffaretti G, Tozzi M (2005) Emergency endovascular repair for traumatic injury of the inferior vena cava. *Eur J Cardiothorac Surg* **28**(6): 906–8

Erzurum VZ, Shoup M, Borge M, Kalman PG, Rodriguez H, Silver GM (2003) Inferior vena cava endograft to control surgically inaccessible haemorrhage. *J Vasc Surg* **38**(6): 1437–9

Hansen CJ, Bernadas C, West MA, Ney AL, Muehlstedt S, Cohen M, Rodriguez JL (2000) Abdominal vena caval injuries : Outcomes remain dismal. *Surgery* **128**(4): 572–8

Kuehne J, Frankhouse J, Modrall G, Golshani S, Aziz I, Demetriades D, Yellin AE (1999) Determinants of survival after IVC trauma. *Am Surg* **65:** 976–81

Netto FAC, Tien H, Hamilton P et al (2006) Diagnosis and outcome of blunt caval injuries in the modern trauma center. *J Trauma* **61**(5): 1053–7

Ollerton JE, Sugrue M, Balogh Z, D'Amours SK, Giles A, Wyllie P (2006) Prospective study to evaluate the influence of FAST on trauma patient management. *J Trauma* **60**(4): 785–91

Watarida S, Nishi T, Furukawa A et al (2002) Fenestrated stent-graft for traumatic juxtahepatic IVC injury. *J Endovasc Ther* **9:** 134–7