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Case Report

Retrohepatic IVC injury: A new treatment approach with arterial stent graft

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ABSTRACT

Traumatic injuries to the inferior vena cava (IVC) are rare and among the most dreadful injuries encountered in evaluation of both penetrating and blunt traumatic settings. Clinical outcome of IVC injury is multifactorial with injuries being classically managed surgically. In this report, we present a case of 52 years old male patient with successfully treated blunt retrohepatic IVC injury utilizing arterial stent graft and anticoagulation regime without short-term complications. Evidence based standardized approach for endovascular management of IVC injury is not yet available. We hope that our report can contribute to worldwide procedure and postprocedural anticoagulation standardization.

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Introduction

Traumatic injuries to the inferior vena cava (IVC) are rare and among the most dreadful injuries encountered in evaluation of both penetrating and blunt traumatic settings, carrying a high mortality rate as almost 30%-50% of diagnosed cases die before reaching a health care facility [1]. Furthermore, only 50% of those who survive the accident will make it until discharge.

Inferior vena cava injuries are usually classified by location as infrarenal, suprarenal and retrohepatic. Classically, traumatic injuries to the IVC are repaired surgically and several

surgical repair techniques have been established for management of IVC injury based on the injury location and presence of free bleeding versus contained hematoma [2]. However, there are few case reports of successful endovascular management of the injury depending on the patient's condition [3].

Endovascular stent repair of venous injuries is not thoroughly studied, and there are no clear guidelines for management and long-term follow-up. We hereby report a case of a traumatic retrohepatic IVC injury that was diagnosed on trauma protocol abdominopelvic CT and managed by primary endovascular repair.

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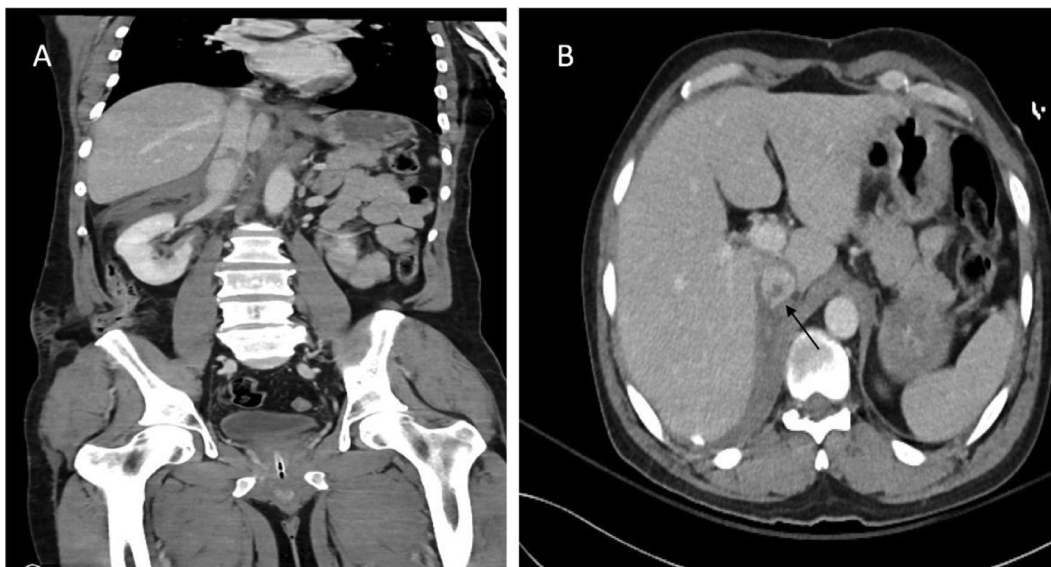


Fig. 1 – Coronal (A) and axial (B) images of the abdomen showing large retroperitoneal hematoma with IVC wall irregularities, filling defects as well as a focal IVC wall defect without active bleeding. A note of bowel containing traumatic right lumbar hernia.



Fig. 2 – Frontal (A) and lateral (B) views of cavogram showing retrohepatic IVC wall irregularity and triangular filling defect representing an intimal flap. No active bleeding.

Case report

We report a 52 years old male patient without significant medical or surgical history brought to our emergency department by ambulance with a history of pedestrian injury by a speeding car. Upon primary survey evaluation, he was vitally stable with a Glasgow coma score of 15/15. His primary adjunct survey revealed hemoperitoneum in focused assessment with sonography in trauma (FAST) scan. The secondary evaluation showed superficial facial and left ankle lacerations and contusions over both iliac crests. The patient, therefore, was shifted

to the Radiology department and trauma protocol whole-body computed tomography (CT) was performed. The scan revealed a large right retroperitoneal hematoma with retrohepatic IVC wall irregularity and intramural filling defects suggestive of IVC injury without active bleeding. Grade II right renal injury, as well as a noncomplicated traumatic bowel-containing right lumbar hernia were also seen (Fig 1). Findings were discussed with the trauma and vascular/interventional radiology teams. Considering the patient's clinical status, the multidisciplinary team elected to perform a primary endovascular repair via a covered stent. A right femoral vein approach was chosen, and a cavogram was performed, confirming the CT findings of

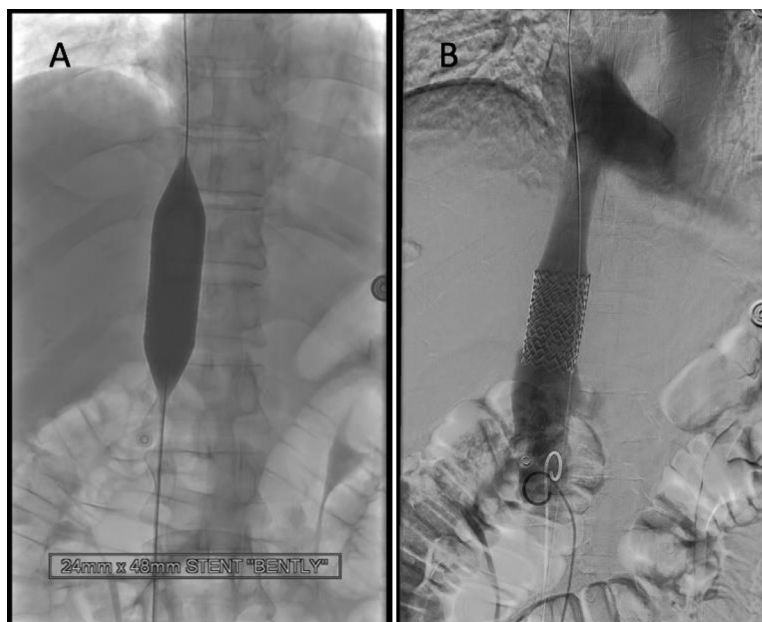


Fig. 3 – Deployment (A) and post deployment cavogram (B) showing proper position of IVC with normal contour. No filling defects or active bleeding.

a focal area of a triangular filling defect representing an intraluminal flap with focal IVC wall irregularity, involving the suprarenal retrohepatic IVC without evidence of active bleeding (Fig. 2).

After securing the left renal vein, a balloon mounted covered stent (BENTLY Begraft 24 × 48 mm) was inserted and deployed at the entry area. Post stent placement contrast injection showed good coverage of the IVC injury area without evidence of filling defects or active bleeding (Fig. 3). The procedure time was 12 minutes. The patient was discharged from the Interventional Radiology department in stable condition. The patient was started on Warfarin 5 mg, 2 days after the procedure for 7 days after which it was tapered to 3.5 mg for 5 months. Also, the patient was put on low dose daily Aspirin 81 mg starting 6 hours after the procedure till the day of submission of this report. The course of his stay in the hospital was uneventful, with subsequent surgeries performed for extremities fractures. A follow-up abdominal CT was performed 10 days after endograft repair, which showed a normal contour of the IVC, a patent graft and near complete resolution of retroperitoneal hematoma (Fig. 4). The patient was discharged shortly afterward with follow-up appointments.

Discussion

Traumatic injury to the IVC is rare and is usually associated with various solid organ and hollow viscus injuries [3]. Only a few articles in the literature have described the imaging appearance of traumatic IVC injury. Tsai et al retrospectively studied 12 patients with CT confirmed IVC injuries, 50% of which were attributed to penetrating injuries while the other half had blunt trauma as their mechanism of injury [4].

They concluded that most common CT findings of IVC injury among penetrating and blunt mechanisms of trauma include; retroperitoneal hematoma (67% and 83%, respectively), hepatic laceration (67% and 83%, respectively), active extravasation (33% and 83 % respectively), and IVC contour abnormality (17% and 50%, respectively). Other reported findings in the literature include an intimal flap, thrombus formation, and hemopericardium [4].

Clinical outcome of IVC injury is multifactorial with active extravasation, level of IVC injury, hypotension, and presence of associated major vascular injury as major determining factors [3,4]. Distance of the injury from the heart is also a strong prognostic factor [5]. IVC injuries affecting the infrarenal IVC carry the best-reported survival rate due to relatively easy access for ligation with a reported mortality rate of 23% [2,6]. Injury to the retrohepatic segment of the IVC, on the other hand, carries a poor prognosis with 78% reported mortality rate, largely due to associated severe hepatic injury and difficulty gaining good exposure to that region for bleeding control. Injuries to the suprahepatic IVC are almost always lethal with a reported mortality rate of 100% due to the difficulty of bleeding control [7].

Over the past few decades, even with advances in imaging of trauma with multidetector CT and improved clinical care, the overall survival rate of IVC injury has not shown significant improvement [1,8]. Classically, IVC injury is repaired surgically with only a few cases reported in the literature about the successful endovascular management of the IVC injury. Conservative management of patients with IVC injury has been reported. This clinical choice is generally governed by the patient's overall condition, hemodynamic stability, and the presence of a contained hematoma without active bleeding [3,9].

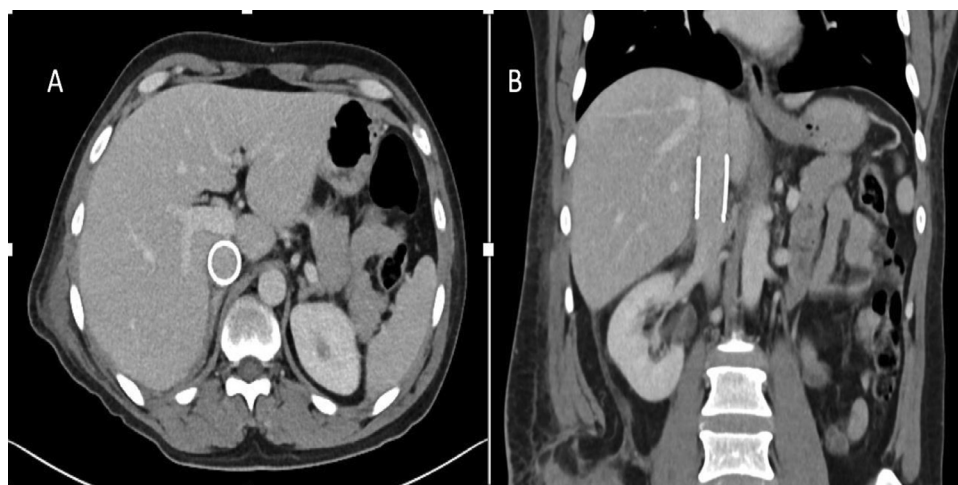


Fig. 4 – Axial (A) and coronal CT (B) follow-up images showing significant improvement of retroperitoneal hematoma with stable patent retrohepatic IVC stent.

Piffaretti et al reported a case of successful intraoperative endovascular treatment of actively bleeding retrohepatic IVC injury using a 32 × 58 mm tube endograft (Zenith), with a procedure time of 8 minutes [6]. Bisulli M et al reported successful active bleeding control of blunt trauma-related IVC injury with compliant balloon catheter with immediate hemodynamic stability [10].

Endovascular stent repair of venous injury is not well studied nor documented in literature as the currently available endografts are designed for the management of arterial abnormalities without clear guidelines for venous repair utilization and long-term follow-up. Further studies on utilization, procedure technique, and thrombosis prevention for endovascular treatment of venous pathologies should be carried out for worldwide approval and procedure standardization.

Patient consent statement

Written informed consent from the patient is not required by the IRB of our institute for radiology case reports publications as there is no exposure of patient's identifying information.

REFERENCES

- [1] Giannakopoulos TG, Avgerinos ED. Management of peripheral and truncal venous injuries. *Front Surg* 2017;4:46.
- [2] Kobayashi LM, Costantini TW, Hamel MG, Dierksheide JE, Coimbra R. Abdominal vascular trauma. *Trauma Surg Acute Care Open* 2016;1(1):e000015.
- [3] Cheaito A, Tillou A, Lewis C, Cryer H. Management of traumatic blunt IVC injury. *Int J Surgery Case Rep* 2016;28:26–30.
- [4] Tsai R, Raptis C, Schuerer DJ, Mellnick VM. CT appearance of traumatic inferior vena cava injury. *Am J Roentgenol* 2016;207(4):705–11.
- [5] Huerta S, Bui TD, Nguyen TH, Banimahd FN, Porral D, Dolich MO. Predictors of mortality and management of patients with traumatic inferior vena cava injuries. *Am Surg* 2006;72(4):290–6.
- [6] Piffaretti G, Carrafiello G, Piacentino F, Castelli P. Traumatic IVC injury and repair: the endovascular alternative. *Endovasc Today* 2013(November):39–44.
- [7] Rosengart MR, Smith DR, Melton SM, May AK, Rue LW. Prognostic factors in patients with inferior vena cava injuries. Vol. 65. 1999. 849-55; discussion 855-6.
- [8] Navsaria PH, de Bruyn P, Nicol AJ. Penetrating abdominal vena cava injuries. *Eur J Vasc Endovasc Surg* 2005;30(5):499–503.
- [9] Netto FA, Tien H, Hamilton P, Rizoli SB, Chu P, Maggisano R, et al. Diagnosis and outcome of blunt caval injuries in the modern trauma center. *J Trauma* 2006;61(5):1053–7.
- [10] Bisulli M, Gamberini E, Coccolini F, Scognamiglio G, Agnoletti V. Resuscitative Endovascular Balloon Occlusion of Vena Cava (REBOVC): an option in managing traumatic vena cava injuries. *J Trauma Acute Care Surg* 2018:211–13 \$V Publish Ahead of Print.