



Vascular and Interventional Radiology Case Report

Endovascular retrieval of an inferior vena cava filter penetrating the false lumen of a chronic aortic dissection, with concomitant ilio caval reconstruction

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ABSTRACT

Inferior vena cava filter (IVCF) placement is indicated in patients with acute venous thromboembolism who cannot be adequately anticoagulated or have failed anticoagulation. Prompt IVCF retrieval decreases the risk of complications associated with longer dwell times including fracture, penetration, and further thromboembolic events. Endovascular IVCF retrieval has been performed despite penetration into adjacent structures including the aorta; however, penetration into the false lumen of an aortic dissection is rarely seen. This case report describes endovascular management of an 11 year old IVCF that caused ilio caval thrombosis and penetrated the false lumen of a chronic type B aortic dissection.

Keywords: Inferior vena cava, IVC filter, Aortic penetration, Iliocaval thrombosis, Filter retrieval

INTRODUCTION

Patients diagnosed with acute deep vein thrombosis (DVT) or pulmonary embolism (PE) who cannot be therapeutically anticoagulated or have failed treatment are candidates for inferior vena cava filter (IVCF) insertion.^[1] On recovery from the acute event and when patients have regained the ability to tolerate anticoagulation, IVCF retrieval may be considered. Removal of an IVCF lessens the risks of prolonged implantation including ilio caval thrombosis, filter fracture or migration, penetration into structures surrounding the inferior vena cava (IVC), and other associated complications.^[2]

The case of a morbidly obese 67-year-old male with IVCF placement 11 years before, chronic type B aortic dissection, and debilitating chronic lower extremity (LE) swelling is presented. Computed tomography (CT) imaging revealed IVCF strut penetration into the peri-caval tissue and notably into the false lumen of a chronic type B aortic dissection, a contracted and thrombosed IVC, and chronic bilateral LE DVT. The patient was treated successfully with endovascular filter retrieval, ilio caval stent reconstruction, and LE venoplasty.

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CASE REPORT

A 55-year-old male who was morbidly obese (body mass index = 48) with a medical history significant for hypertension and type II diabetes presented with abdominal pain in 2009 and computed tomography arteriography (CTA) revealed an abdominal aortic dissection extending from the celiac axis to the right common iliac artery. The patient was managed medically and discharged. After knee surgery in 2010, he developed bilateral LE DVT and PE for which a retrievable G2 IVCF (C.R. Bard, Murray Hill, NJ) was placed. In 2019, CTA identified a 6.7 cm thoracic aortic aneurysm and ilio caval thrombosis extending caudally from the IVCF, which was abutting the abdominal aortic dissection. After uneventful thoracic aortic stent graft repair, serial follow-up CTA studies revealed progressive penetration of the IVCF into the false lumen of the chronic type B abdominal aortic dissection [Figures 1 and 2]. Given concerns for worsening IVCF related complications, prolonged dwell time, debilitating LE swelling, and progressive venous stasis changes a multidisciplinary discussion regarding IVCF retrieval concluded that the risk of open IVCF removal would outweigh the risks of endovascular IVCF retrieval with concomitant ilio caval reconstruction.

Under general anesthesia and with the patient supine, seven French sheaths (Cook Medical, Bloomington, IN) were placed in the right internal jugular (RIJ) and bilateral greater saphenous veins under ultrasound guidance. Initial bilateral common femoral and iliac venography confirmed long segment, chronic occlusion with collateralized flow through the lumbar veins and no visualization of the IVC. With difficulty, the chronic venous occlusions were crossed from the level of the common femoral veins (CFV) across the IVCF using a Straight Tip Stiff Glidewire (Terumo Medical, Tokyo, JN)

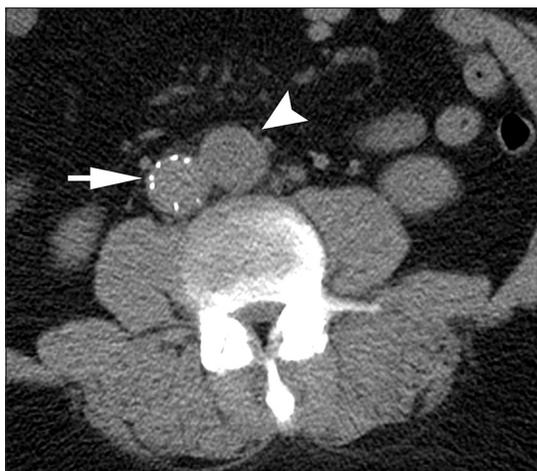


Figure 1: Unenhanced axial CT image of the indwelling inferior vena cava (IVC) filter from 2012, show all struts contained within the IVC (white arrow). None are visualized outside of the IVC or within the aorta (white arrowhead).

and four French Navicross (Terumo Medical). On successful crossing from each CFV across the IVCF, the hydrophilic wires were exchanged for two exchange-length Amplatz Superstiff wires (Cook Medical), over which intravascular ultrasonography (IVUS) was performed (PV 8.2 French, Volcano Therapeutics, Rancho Cordova, CA).

The RIJ sheath was exchanged for a 16 French \times 45 cm sheath (Cook Medical), through which 2.5-mm \times 55-cm rigid alligator forceps with double action (Karl Storz, El Segundo, CA) were introduced into the IVC to engage the IVCF [Figure 3]. The embedded filter apex was dissected free from the IVC wall and with the forceps providing consistent back traction; the entire IVCF was over-sheathed and withdrawn. Post-retrieval IVC venography confirmed successful filter retrieval without venous extravasation. Cone beam CT confirmed that the retroperitoneal vascular structures were intact. Venoplasty of the infrarenal IVC and iliac veins was performed with kissing balloons (Conquest 8 mm \times 4 cm, C.R. Bard) and followed by venography [Figure 4]. Bilateral ilio caval stent reconstruction was then accomplished starting from infrarenal IVC with kissing technique using Abre 14 mm \times 15 cm stents (Medtronic, Minneapolis, MN) which were extended to the external iliac veins, bilaterally. The stented venous segments and native veins were venoplastied using 14 mm conquest balloons to the level of the CFV, bilaterally. Completion venography and IVUS confirmed successful reconstruction of the IVC, robust venous inflow with prompt outflow, and decompression of collaterals [Figure 5].

The patient was monitored overnight in the ICU and transferred to the floor the next day. Before uneventful discharge on post-operative day 3, multiphasic CTA imaging of the abdomen and pelvis was performed confirming successful filter retrieval, patent ilio caval stents, and an unchanged chronic abdominal aortic dissection. At 3- and 6-month follow-up, the ilio caval stents remained patent with no injury to the false lumen of the chronic aortic dissection and the patient's symptoms had greatly improved with decreased leg swelling and improved ambulatory capacity [Figure 6].

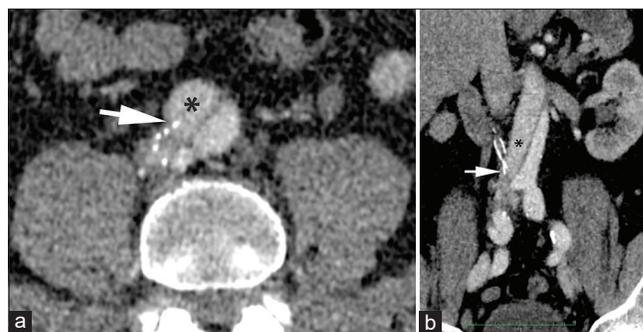


Figure 2: Contrast enhanced axial (a) and coronal (b) CT images reveal the inferior vena cava (IVC) filter struts penetrating (white arrow) into the false lumen of the abdominal aortic dissection (*). The lumen of the IVC appears contracted.



Figure 3: Intraprocedural fluoroscopic image demonstrates forceps capture of the inferior vena cava (IVC) filter apex. Bilateral wires extend from below across the IVC occlusion.

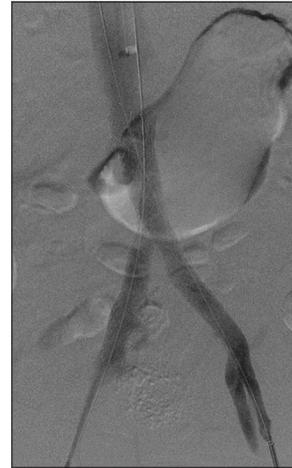


Figure 5: Completion venography after iliocaval reconstruction with stents extending from the infrarenal inferior vena cava, across the common iliac veins bilaterally, and to the external iliac veins. Improved anterograde flow dynamics through the venous system are noted with collapse of the collateralized veins noted in Figure 4.

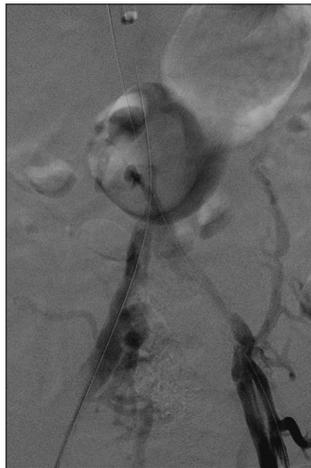


Figure 4: Intraprocedural venography after removal of the inferior vena cava (IVC) filter revealing occlusion of the bilateral common iliac veins and IVC. Collateralization of venous flow is present.

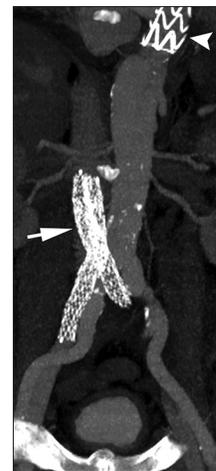


Figure 6: Reconstructed CT image at follow-up reveals the relationship from the prior thoracic aortic repair (white arrowhead) and iliocaval reconstruction (white arrow).

DISCUSSION

In 2010 and again in 2014, the FDA issued a communication encouraging IVCF retrieval as soon as medically indicated due to their associated long-term side effects.^[3,4] Although there has been a steady decline of IVCF placement since these communications, the IVCF retrieval rate remains low with Medicare claims data reporting retrieval rates improving from 6.9% in 2012 to 22.1% in 2016.^[5] The continued deficit leads to a progressively greater prevalence of complications and symptoms as complication rate increases with prolonged indwelling time.

Caval penetration, defined as the extension of an IVCF limb >3 mm beyond the caval wall, is a common IVCF complication and best seen on CT.^[2] A 2015 systematic review, which followed this definition, reported a penetration rate between 19% and 34%. Of the caval penetration cases,

approximately 20% involved surrounding structures or organs, most commonly arteries (4.4%) or the duodenum (7.2%).^[6] Although penetration into surrounding arterial structures can lead to serious adverse events including pseudoaneurysm, dissection, thrombosis, or hemorrhage, two studies reported 100% endovascular retrieval rate of 50 IVCF with aorto-iliac arterial strut penetration without major complications.^[7,8]

Penetration of IVCF into an aortic dissection is rarely seen and retrieval has only been reported in two case reports.^[9,10] In the first, an IVCF strut penetrated the duodenum and aorta, causing a localized dissection for which the patient underwent open surgical removal of the IVCF with repair of the secondary aortic dissection.^[9] In the second, an

asymptomatic patient was referred for filter retrieval and incidental aortic dissection was discovered at the point of strut penetration in the aorta.^[10] Endovascular retrieval was successful with no change to the aortic dissection in follow-up. In each of these previous case reports, a localized aortic dissection at the point of strut penetration occurred after implantation, whereas in this present case, the IVCF was implanted after the patient developed an aortic dissection into which the IVCF later penetrated the false lumen. Compared with a normal aorta, the false lumen of a chronic aortic dissection necessarily has decreased wall thickness and may be more prone to penetration as well as vascular injury during a procedure.^[11] In this case, the dissection was unchanged in >5 years and while presently asymptomatic, the IVCF appeared to be progressively penetrating within it over serial imaging studies. However, the concomitant ilio caval thrombosis, debilitating lower extremity swelling, and advancing venous stasis changes were compelling to attempt IVCF retrieval and ilio caval reconstruction. While no complication was encountered in this procedure, preparation for potential catastrophic complication should be undertaken including a multidisciplinary discussion, hemodynamic monitoring with the ability to aggressively resuscitate, an index of suspicion and capability to manage major vascular injury, and close clinical and imaging follow-up post-procedure. Longitudinally, it remains to be seen how the false lumen will evolve post-retrieval, but continued attention is planned.

CONCLUSION

Prolonged implantation of IVCFs can lead to penetration into peri-caval tissues including the aorta or as this case shows aortic dissections. Filter strut penetration into an aortic dissection should not preclude attempts at endovascular retrieval, though multidisciplinary discussion and planning are encouraged.

Contribution details

HHD: Data acquisition, literature search, and manuscript preparation; MFL: Manuscript editing/review; MSK: Concept and manuscript editing/review; BSM: Concept, manuscript preparation/editing, and Guarantor. All authors read and approved the final manuscript.

IRB and ethical approval

Institutional IRB is not required for reporting individual cases. All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation and with the Helsinki Declaration of 1975, as revised in 2000.

Declaration of patient consent

IRB approval and patient consent not required as patients identity is not disclosed.

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Nil.

Conflicts of interest

Majdalany (BSM): Scientific Advisory Board, Balt Medical.

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