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Case Report

Transhepatic inferior vena cava filter retrieval due to chronic occlusion of jugular and subclavian veins

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ABSTRACT

Retrieval of inferior vena cava filters is routinely performed via an internal jugular venous access. We present a case of a 55-year-old woman with myeloproliferative disorder, complicated by venous thrombosis. She was referred to interventional radiology for removal of an inferior vena cava filter, which had been placed 5 months prior for mechanical prophylaxis in the setting of femoral orthopedic surgery. Due to the patient's chronic occlusion of the bilateral jugular and subclavian veins, a transhepatic approach was used to retrieve the filter successfully without immediate complications.

Introduction

Inferior vena cava (IVC) filters have been used to prevent pulmonary embolism (PE) since the late 1960s [1,2]. Anticoagulation is the standard of care treatment for venous thromboembolism. However, in cases of contraindications to, failures of, or complications with therapeutic anticoagulation, IVC filter placement is indicated [1–3]. Potentially retrievable IVC filters, as opposed to permanent filters, are placed when the risk of PE is thought to be temporary. Once the PE risk has subsided, these IVC filters can be removed after assessing the risks and benefits of the retrieval procedure for each individual [2,4,5].

Standard technique for removal of a retrievable, conical IVC filter involves engagement of the filter apex/hook and withdrawal of the filter into a sheath. This is typically performed via an internal jugular vein access, which provides the straightest course to the target filter. A subclavian vein access can also be utilized in cases of jugular venous occlusion. We describe a case where occlusion of bilateral jugular and subclavian veins precluded the standard access routes for an IVC filter retrieval. We therefore performed an unusual, transhepatic approach for successful and safe IVC filter removal.

Case report

A 55-year-old woman, with a history of myeloproliferative disorder complicated by mesenteric venous thrombosis requiring

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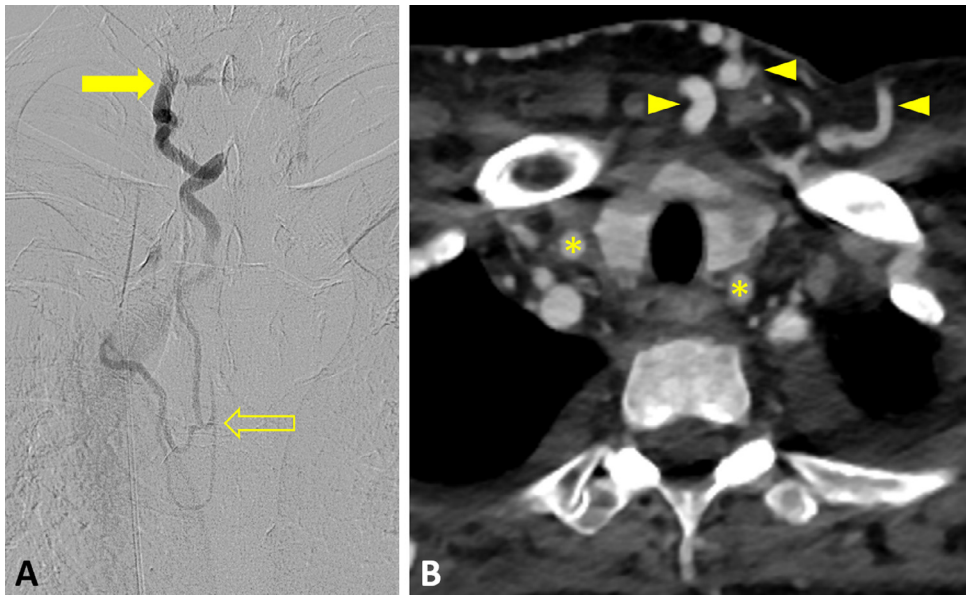

Fig. 1 – Chronic occlusion of the internal jugular veins. (A) Digital subtraction venogram of a right neck vein (arrow) near the anticipated location of the internal jugular vein demonstrates tortuous venous collateral vessels extending down to the mediastinum (open arrow). (B) Axial contrast-enhanced CT image of the upper chest demonstrates no identifiable internal jugular veins near the common carotid arteries (asterisks) bilaterally. Large anterior chest wall collateral vessels are noted (arrowheads). Bilateral subclavian veins were also occluded centrally (not shown)

small bowel resection, presented to our hospital for failure to thrive due to short gut syndrome and urgent evaluation for small bowel transplant. She had been on therapeutic anticoagulation given her severe underlying hypercoagulability. Five months prior to the presentation, she experienced a right hip fracture from a mechanical fall and underwent surgical fixation at an outside hospital. Considering her hypercoagulable state, which was further exacerbated by postoperative immobility, an IVC filter was placed via a femoral vein access for mechanical prophylaxis of PE. She was later resumed on therapeutic anticoagulation with enoxaparin.

During the present admission, interventional radiology was consulted for IVC filter removal given the risk of filter-related caval thrombosis and possibility of the indwelling IVC filter complicating the future small bowel transplant surgery. Initial attempt at filter retrieval was aborted due to inability to obtain standard access via jugular and subclavian veins due to chronic occlusion (Fig. 1A). Although the femoral veins were patent, retrieval via access from below the filter was not attempted due to anticipated high risk of filter fracture/embolization and caval injury. Subsequent ultrasound and computed tomography confirmed bilateral internal jugular and subclavian vein occlusions and no accessible route from above the diaphragm (Fig. 1B). We therefore discussed a transhepatic venous access with the patient.

The patient returned to interventional radiology after holding her enoxaparin for 24 hours. The procedure was performed under general endotracheal anesthesia 146 days after the initial IVC filter placement. Using an AccuStick Introducer System (Boston Scientific, Marlborough, MA), percutaneous access was obtained into a peripheral middle hepatic vein tributary then into the suprarenal IVC (Fig. 2A). Following uneventful cavography, a trilobed snare was advanced under fluoroscopy through a long 10F sheath (Flexor; Cook, Bloomington, IN) to capture the hook at the filter apex (Fig. 2B). The IVC filter was collapsed and withdrawn in its entirety into the sheath (Fig. 2C). The filter was removed and confirmed to be intact. Postremoval cavography showed no significant vascular injury (Fig. 2D). The sheath was then pulled back to the hepatic parenchymal tract, and an 8-mm Amplatzer IV plug (AVP4; St. Jude Medical, Plymouth, MN) was deployed for tract embolization (Fig. 2E). Following uneventful observation in the recovery unit, the patient was discharged the same day with no complications. Enoxaparin was resumed the following morning.

Discussion

While many conical retrievable IVC filters can be placed via either jugular or femoral venous access, they are designed to be removed from a superior approach targeting their apical hooks. Therefore, neck and chest central venous occlusions pose a great challenge for standard IVC filter removal procedures.

To the authors' knowledge, only 1 case describing a similar transhepatic approach for IVC filter removal has been reported [6]. In that case, a G2 EXPRESS Filter (Bard Peripheral Vascular, Tempe, AZ) was removed from a 46-year-old woman with Factor V Leiden deficiency complicated by brachiocephalic vein and superior vena cava occlusions. The retrieved device in our case was a Celect Platinum Filter (Cook, Bloomington, IN). While the experience is very limited, the 2 cases demonstrate the feasibility of a transhepatic approach

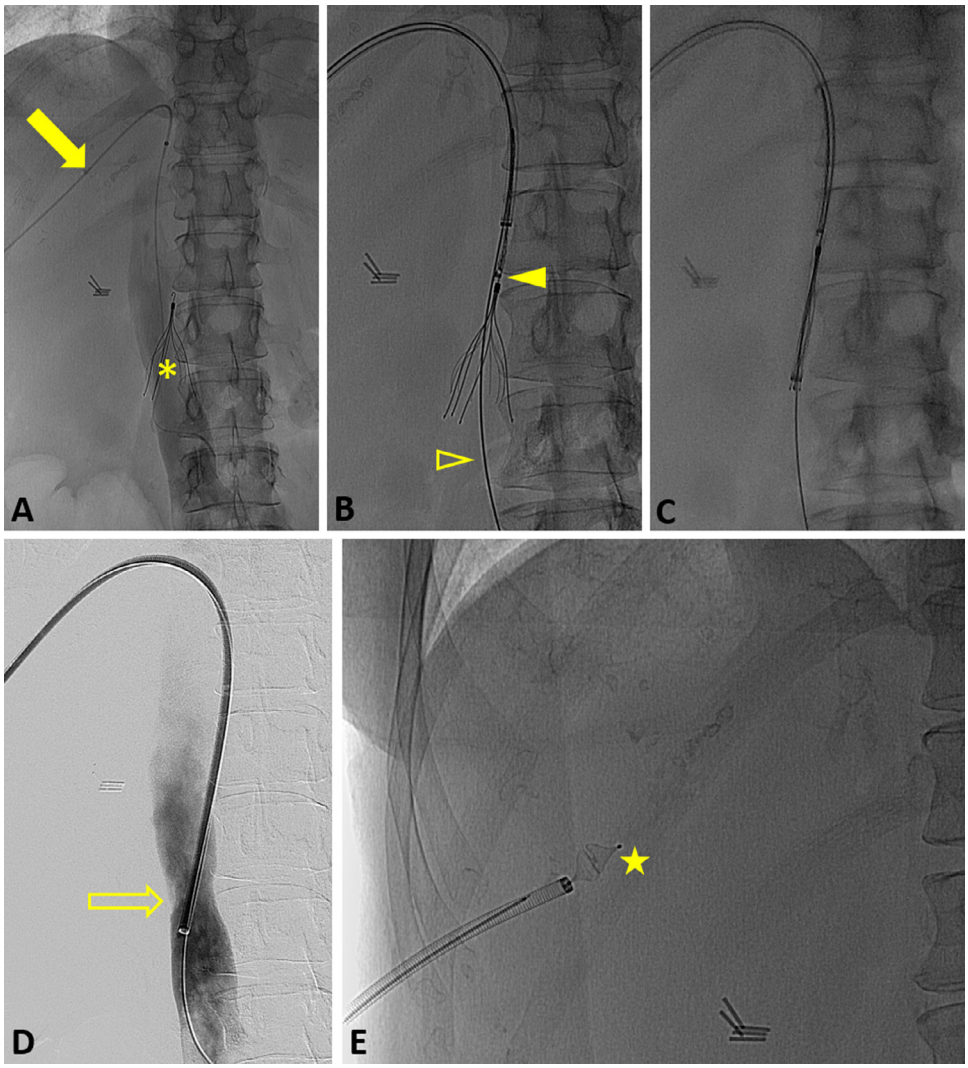

Fig. 2 – Transhepatic IVC filter removal. (A) Inferior vena cavogram performed via percutaneous antegrade access into the middle hepatic vein (arrow) demonstrates the presence of an IVC filter (asterisk) without IVC stenosis or filling defects. (B) A spot radiograph demonstrates a snare device tightly engaging the filter hook (arrowhead). A stiff safety wire (open arrowhead) was placed alongside the snare and down the IVC to avoid kinking of the sheath and increase the stiffness of the system. (C) A fluoroscopic image demonstrates complete collapse of the filter within the sheath. (D) Digital subtraction cavogram immediately post filter removal demonstrates minimal narrowing of the IVC at the level of the filter feet without tear or extravasation. (E) A final spot radiograph demonstrates an Amplatzer IV plug (AVP4; St. Jude Medical, Plymouth, MN) deployed within the parenchymal tract (star) prior to sheath removal. IVC, inferior vena cava

for filter removal when no neck, upper extremity, or chest venous access is possible.

Percutaneous transhepatic access has been used in patients requiring long-term central venous access (eg, hemodialysis) when other, more traditional venous sites have been exhausted [7,8]. These catheters are associated with a higher risk of dislodgement and occlusion. In one study, 1 of the 16 patients died from massive intraperitoneal hemorrhage the day after catheter placement [8]. While our procedure of transient transhepatic access is different from indwelling catheter placement, we approached the access cautiously in terms of the bleeding risk. We held anticoagulation prior to this procedure, whereas we usually continue anticoagulation for routine filter removal via an internal jugular vein access. We also embolized the hepatic parenchymal tract with a mechanical device during deaccess.

In addition to the bleeding risk, another major limitation of transhepatic access for filter retrieval is its potential incompatibility with complex retrieval techniques. Given the necessary acute angulation of the access sheath and associated mechanical restraints, the loop-snare technique is expected to be challenging and the use of rigid endobronchial forceps would be impossible. Therefore, it may be inadvisable to attempt a transhepatic route if the retrieval process is highly likely to require techniques beyond the standard snare method.

In conclusion, our case demonstrates the feasibility of IVC filter removal via a percutaneous transhepatic venous access in a patient whose anatomy precludes the jugular or subclavian venous access. The technique essentially combines the established methods of transhepatic venous access and snare retrieval and may be applicable to other foreign body removal procedures. The procedure should be performed after a careful individualized assessment when the benefit of filter removal is thought to outweigh the risk of transhepatic access.

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