The wire loop technique for IVC filter removal

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ABSTRACT

Inferior vena cava (IVC) filters are effective therapy to prevent pulmonary embolism in patients with contraindication to anticoagulation. However, IVC wall penetration by the filter struts is a common complication that can lead to symptoms specially when adjacent organs are impacted. This case report and video describe the wire loop technique for successful endovascular IVC filter retrieval in a patient with lower back pain caused by a spinal strut penetration. The patient's back pain resolved after filter retrieval and he remained stable on anticoagulation with no recurrence of venous thromboembolism. (J Vasc Surg Cases Innov Tech 2021;7:369-70.)

Keywords: Inferior vena cava filter removal; Venous thromboembolism; Wire loop technique

Inferior vena cava (IVC) filter placement is an effective therapy to decrease the risk of pulmonary embolism specially in patients with venous thromboembolism (VTE) who cannot receive anticoagulation.[1,2] Timely removal of retrievable IVC filters is necessary as prolonged dwell time leads to numerous complications. A common complication is the strut penetration into adjacent structures including aorta, vertebral body, kidney and liver parenchyma, the intestines (most commonly the duodenum), portal and renal veins, and urinary tract.[3] A literature review during 1970-2014 reports IVC filter penetration in 19% of patients with 19% of those penetrations demonstrating organ/structure involvement.[4] Although symptomatic in only 8% of patients, this complication can lead to debilitating symptoms.[4] In addition, the use of multiple terms to define IVC disruption (penetration, perforation, tenting) prevents accurate reporting of such complications. A classic definition of penetration implies strut protrusion through the IVC wall >3 mm,[5,6] whereas tenting describes the presence of the struts immediately adjacent to the external wall of the IVC (<3 mm).[7]

Filter retrieval success decreases with prolonged dwell time and penetration, necessitating the use of advanced endovascular techniques.[8] This report provides a video demonstration of the wire loop technique for successful retrieval of a tilted IVC filter with strut penetration into the spine causing chronic back pain. Written informed consent was obtained from the patient for this publication and accompanying video.

CASE PRESENTATION

A 60-year-old patient with a history of deep vein thrombosis and prothrombin mutation presented with lower back pain that was increasing over a year. Four years prior, the patient developed acute respiratory distress syndrome and respiratory failure. His hospital course at that time was complicated by prolonged intubation, iliac vein thrombosis requiring thrombolysis, and stenting of the left common iliac vein with a 14 × 120 mm eLuminexx bare metal stent (Bard, Tempe, Ariz). He subsequently developed duodenal ulcer bleeding and underwent placement of an Eclipse IVC filter in the infrarenal position (Bard). On recovery, the patient was placed on lifelong anticoagulation without experiencing bleeding or recurrent VTE. Lower extremity Doppler ultrasound showed a patent left common iliac vein stent and no presence of thrombus in the lower extremities. Computed tomography scan revealed a tilted IVC filter with the apposition of the hook to the posterior wall, and multiple struts penetrating the IVC wall with a posterior strut penetrating into the spine with a mild periosteal reaction and likely causing the patient's symptoms. IVC filter retrieval proceeded under general anesthesia in a hybrid operating room using right jugular access (Supplementary Video, online only). A 16 F stiff sheath 40 cm in length (Cook Medical Inc, Bloomington, Ind) was advanced over an Amplatz wire (Boston Scientific, Marlborough, Mass). A low-dose 3000 units of intravenous heparin was administered to prevent clot formation around the sheath. An Omniflush catheter (Angiodynamics, Tempe, Ariz) was reshaped below the IVC filter and retracted under radiographic guidance to hook around the IVC filter apex, rather than one of the struts. An ENsnare (Merit Medical, South Jordan, Utah) was introduced in a buddy catheter fashion into the sheath. A soft hydrophilic 0.035 Glidewire 260 cm in length (Terumo, Somerset, NJ) was advanced between the filter legs and snared and exteriorized as a handle to manipulate and retrieve the filter. The use of the hydrophilic wire in this case

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prevents wire kinking, and the catheter allows us to prevent the wire from getting stuck in the filter. The sheath was advanced over the looped wire under direct vision to engage the filter hook. Meticulous sheath manipulation externally and traction on the loop under different magnified angles is key at this stage to align the IVC filter hook with the sheath. Significant resistance is usually encountered when attempting to disconnect the fibrosed filter struts from the wall of the cava. Forward pushing and gentle rotation of the sheath are necessary to release the fibrosed IVC filter legs from the wall of the cava. The filter was removed in its entirety, and the completion angiogram showed no evidence of extravasation or thrombus. If the sheath contains a thrombus or there is inability to aspirate from the side port, the sheath should be removed and flushed on the table before advancing doing the final angiogram to avoid dislodging any thrombus. The patient tolerated the procedure well and was discharged the same day. The patient's back pain resolved, and he remained stable on anticoagulation without subsequent VTE for 3 years.

DISCUSSION

The wire loop technique is an advanced endovascular retrieval method for IVC filters complicated by tilting and migration.[9-12] This case report and video illustrate details and tips for a successful wire loop technique in challenging IVC filter retrieval characterized by strut penetration, extensive fibrosis, prolonged indwelling time of 4 years, and a severe tilt with the hook abutting the wall of the cava. A thorough evaluation of back pain, abdominal pain, or any unusual abdominal symptoms is important to rule out long-term complications of indwelling IVC filters. To avoid complications associated with prolonged indwelling time and tilting of the IVC filters, they should be removed as soon as the patient is no longer at risk for recurrent VTE and can tolerate anticoagulation. Current FDA guidelines suggest filter removal within 54 days of placement.[13] General anesthesia provides significant comfort with the use of a large sheath and sometimes the need of additional femoral access (not used in this case). Gentle manipulation under magnified radiographic imaging at various angles allows for the IVC filter tip engagement and may require additional time. Therefore, low-dose anticoagulation after placement of the large sheath and frequent flushing with heparinized saline are important to prevent thrombus formation as demonstrated in the video. If resistance to aspiration through the side port of the sheath develops at the end of the procedure, it is recommended advancing a catheter and performing the completion venogram through injection in a catheter directly into the IVC. This patient had no complications, but it is important to check for extravasation, device fracture or embolization, IVC dissection, pseudoaneurysm, or stenosis after the retrieval. This technique is also preferred to advanced retrieval as it is safe, effective, and uses readily available tools instead of off-label devices such as laser sheath, bronchoscopy forceps, or gastrointestinal scopes.[14]

CONCLUSIONS

The wire loop technique is effective for IVC filter retrieval with prolonged dwell time and severe tilt. Strut penetration into surrounding structures could lead to significant complications, and all retrievable IVC filters should be removed when caval interruption is not warranted.

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