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INTERVENTIONAL RADIOLOGY

TECHNICAL NOTE

Günther Tulip inferior vena cava filter retrieval using a bidirectional loop-snare technique

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ABSTRACT

Many advanced techniques have been reported in the literature for difficult Günther Tulip filter removal. This report describes a bidirectional loop-snare technique in the setting of a fibrin scar formation around the filter leg anchors. The bidirectional loop-snare technique allows for maximal axial tension and alignment for stripping fibrin scar from the filter legs, a commonly encountered complication of prolonged dwell times.

Inferior vena cava (IVC) filters are an effective means to prevent pulmonary embolism in the setting of a contraindication to anticoagulation. Their ease of placement and retrieval makes them a frequently used tool in interventional radiology. When conventional methods of retrieval fail, the operator must use creative means to extract the filter. Failure of retrieval is associated with a longer dwell time, more transverse tilt, and the presence of an embedded hook (1–4). A variety of advanced techniques have been reported in the literature when conventional methods fail. A rare cause of conventional failure is straightening of the filter hook when excessive axial force is applied. In this case report we encountered this complication along with adhered filter leg anchors likely secondary to fibrin scar formation. This report describes a novel technique for IVC filter retrieval through the use of a bidirectional loop-snare.

Technique

This case report was approved by our institutional review board. A 52-year-old woman with a history of ulcerative colitis and end-stage liver disease secondary to primary sclerosing cholangitis presented to our institution with decompensated liver disease after a failed hepatic transplant. A computed tomography (CT) scan demonstrated thrombosis of the right ovarian vein with extension into the infrarenal IVC. Interventional radiology was consulted for IVC filter placement due to ongoing surgical needs. A Günther Tulip filter (Cook Medical) was placed using conventional methods. A subsequent abdominal CT demonstrated adequate placement of the IVC filter in the suprarenal IVC, with the apex centered in the vein (Fig. 1).

The patient presented for filter removal 224 days after installation. A preprocedural CT was not performed. However, it was noted that the patient had a diagnostic CT of the abdomen and pelvis for unrelated reasons four months prior to retrieval, which demonstrated an unchanged position without invasion. Internal jugular venous access was obtained using conventional techniques and inferior vena cavography confirmed adequate placement of the filter. While the filter apex appeared to be centered within the IVC, pre-retrieval vena cavography demonstrated several of the filter legs to extend beyond the contrast, indicating wall implantation versus fibrin scar formation around the anchors (Fig. 2). A Günther Tulip filter retrieval kit (Cook Medical) was used to engage the filter hook. The sheath was advanced under significant force over the filter but the leg anchors would not dislodge from the IVC wall (Fig. 3). No buckling was observed while advancing the sheath over the filter, therefore a stiffer sheath was not thought to be of benefit. The IVC collapsed intermittently with each advancement of the sheath. During the initial attempt at removal the snare straightened the filter hook, so that it could no longer be engaged through standard means. As an alternative, a reverse curve SOS catheter (AngioDynamics) was used to direct a

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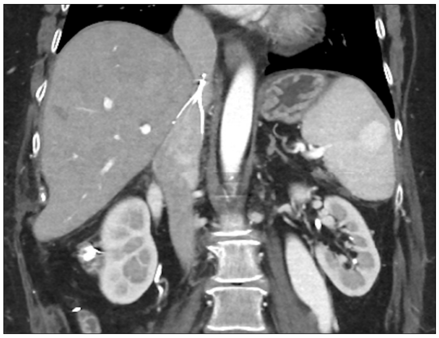

Figure 1. A Günther Tulip is placed in the suprarenal IVC. Coronal contrast-enhanced CT image demonstrates that the position of the IVC filter is amenable for removal. The apex of the filter is seen to be in the center of the IVC.

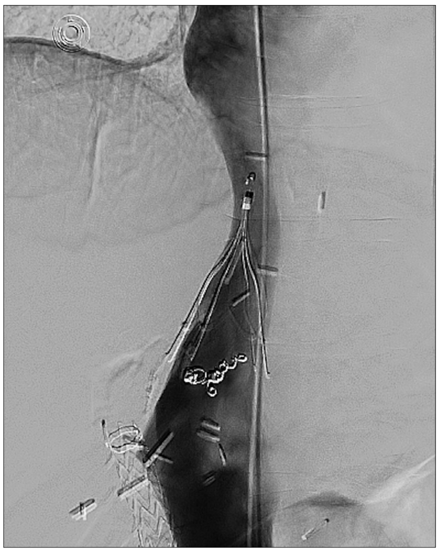

Figure 2. Digitally subtracted inferior vena cavography demonstrating multiple filter legs extending outside the margins of the contrast. This suggests invasion of the legs through the vessel wall.

glidewire (Terumo Medical Corp.) between the legs of the filter (Fig. 4). The glidewire was snared from above yielding loop-snare engagement of the filter. Despite the alignment and stability that this technique al-

Main points

- Delayed retrieval of Gunther Tulip IVC filters allows the formation of fibrin scars on the filter leg anchors.
- Fibrin scar formation increases the risk of trauma to the IVC including intussusception and dissection. Novel methods are needed for retrieval when conventional methods fail.
- In this case, the bidirectional loop-snare technique allowed maximum axial stability from above while a second loop-snare was able to effortlessly "strip" the leg anchors from the IVC wall.

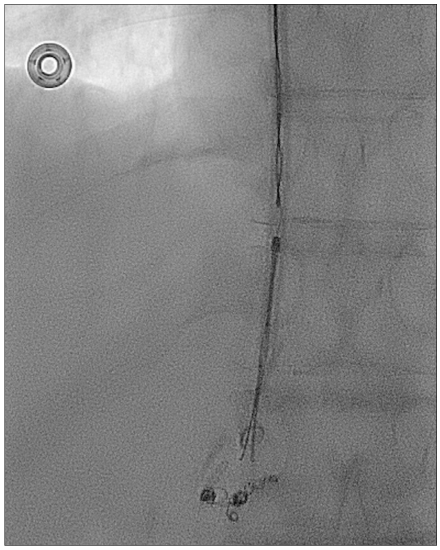

Figure 3. A catheter envelops the majority of the IVC filter with only the anchors being free. Despite significant inferior pressure, the filter legs could not be detached from the IVC wall using a conventional filter retrieval kit.

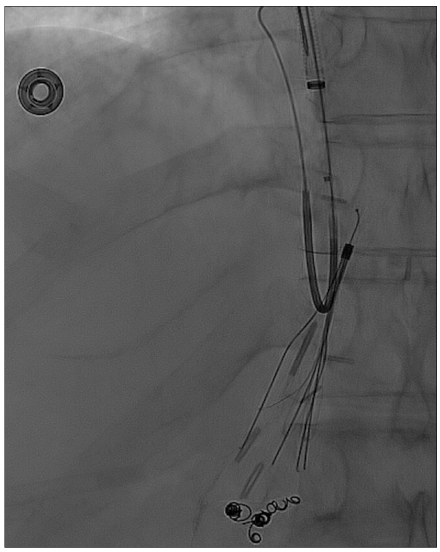

Figure 4. A glidewire was directed between the legs of the IVC filter through a SOS catheter, which was then engaged by a snare to obtain loop-snare access from the internal jugular vein (not shown). The straightened filter hook is seen.

lows, the legs would still not release from the IVC wall. High forces on the sheath only resulted in collapse of the IVC and abdominal pain. An angioplasty balloon was used in an attempt to separate the filter from the wall without success. As a last resort, access was gained from the right common femoral vein. A femoral sheath was placed. With the filter collapsed into the right jugular sheath, a SOS catheter was used to encircle the right jugular sheath from below. A

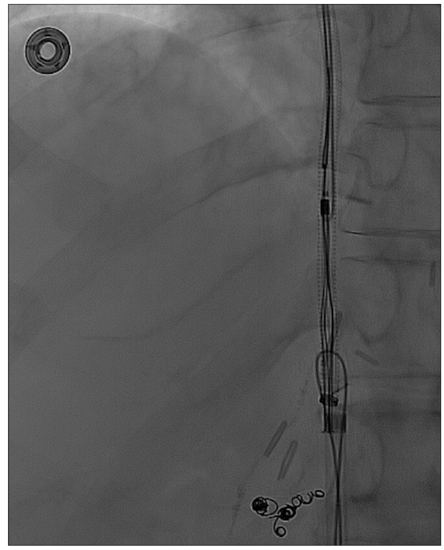

Figure 5. Fluoroscopic image demonstrates the loop snare access from above providing stability at the IVC filter apex, while the loop-snare from below encompasses the filter legs. The inferior loop-snare is then directed inferiorly to "strip" the legs from the caval wall.

second glidewire was then directed from below to encircle the adhered legs yielding bidirectional loop-snare engagement (Fig. 5). The filter was held in place from the superior loop-snare access, and the looped glidewire was pulled inferiorly effectively detaching the legs from the wall (Supplementary Movie E1). Cavography following each failed maneuver revealed no injury throughout the procedure, and the patient remained hemodynamically stable. Considering the ease with which the bidirectional loop-snare technique detached the legs from the IVC wall, postremoval vena cavography was felt unnecessary. The patient denied the presence of pain during this portion of the procedure and displayed no evidence of postprocedure complications.

Discussion

Retrievable IVC filters are commonly used to prevent pulmonary embolism (PE) in the setting of failed or contraindicated anticoagulation. In general, IVC filters are safe and effective temporary methods of PE prevention. However, these retrievable filters are not without their risks. It is well known in the literature that IVC filters have the potential to migrate, perforate organs, erode into adjacent tissues, or invade the wall of the vena cava. Some degree of pressure is necessary to secure their anchors to the vessel wall, although this at times compromises the integrity of the IVC wall during

Movie 1. Video demonstrating the Gunther Tulip Filter leg anchors being stripped from below while supported from the apex above using the bidirectional loop-snare technique.

retrieval. Overall, complications are rare (1.7%) and may include IVC dissection, IVC intussusception, IVC thrombosis, IVC stenosis, and filter fracture (1). Presumably, these complications are a result of the shearing force generated with several advanced techniques.

Routine and advanced filter retrieval techniques have been reported to be effective in 73.2% and 94.7% of patients respectively (1). A variety of factors are known be associated with higher routine retrieval failure rates including longer dwell time, more transverse tilt, and presence of an embedded hook (1–4). It has been postulated that fibrin caps form around the IVC filter apex when their position is near the caval wall (5, 6). This position creates local eddy currents, which promote the deposition of fibrin, similar to the fibrin sheaths that form around indwelling venous catheters. It is reasonable to assume the same phenomenon occurs at the filter anchors. A variety of advanced techniques have been used when routine methods of filter retrieval fail as summarized in a review by Iliescu and Haskal (7). Esparaz et al. (5) reported an advanced technique for disrupting the apical fibrin cap using a hydrophilic guidewire. This technique relies on the stability the anchors provide to disrupt the fibrin cap from above. In an alternative scenario where the filter apex is free but the anchors are embedded or adhered to the vessel wall by fibrin, the clinician must take care not to damage the vessel wall by "dragging" the adhered anchors along the axis of the vessel. The bidirectional loop-snare technique described in this report allows for the axial stability and alignment provided from above via the traditional loop-snare technique combined with a fibrin scar disrupting, looped, guidewire from below. The bidirectional loop-snare technique is particularly advantageous in the unusual circumstance when the filter hook has straightened. However, this technique requires access from above and below and should be reserved until measures from the initial access site have been exhausted. The presence of multiple wires and points of attachment creates an environment that risks entanglement of wires and snares. Thus, as a precaution, only once the majority of the filter was collapsed within the sheath, was the inferior wire introduced. Wire selection may also be of importance in minimizing entanglement risk, as glidewires are averse to entanglement by nature.

In conclusion, while routine filter retrieval techniques have a high technical success rate, the operator must be aware of alternative methods of removing IVC filters. Fibrin scar formation represents one challenge that must be overcome not only at the apex, but likely at the filter anchors as well. This technique provides superior axial stability at the filter apex that allows the filter anchors to be stripped from the vessel wall.

Conflict of interest disclosure

The authors declared no conflicts of interest.

References

1. Al-Hakim R, Kee ST, Olinger K, Lee EW, Moriarty JM, McWilliams JP. Inferior vena cava filter retrieval: effectiveness and complications of routine and advanced techniques. J Vasc Interv Radiol 2014; 25:933–940. [CrossRef]
2. Avgerinos ED, Bath J, Stevens J, et al. Technical and patient-related characteristics associated with challenging retrieval of inferior vena cava filters. Eur J Vasc Endovasc Surg 2013; 46:353–359. [CrossRef]
3. Dinglasan LV, Oh JC, Schmitt JE, Trerotola SO, Shlansky-Goldberg RD, Stavropoulos SW. Complicated inferior vena cava filter retrievals- associated factors identified at preretrieval CT. Radiology 2013; 266:347–354. [CrossRef]
4. Van Ha TG, Vinokur O, Lorenz J, et al. Techniques used for difficult retrievals of the Gunther Tulip inferior vena cava filter: experience in 32 patients. J Vasc Interv Radiol 2009; 20:92–99. [CrossRef]
5. Esparaz AM, Ryu RK, Gupta R, Resnick SA, Salem R, Lewandowski RJ. Fibrin cap disruption: an adjunctive technique for inferior vena cava filter retrieval. J Vasc Interv Radiol 2012; 23:1233–1235. [CrossRef]
6. Lynch FC. Balloon-assisted removal of tilted inferior vena cava filters with embedded tips. J Vasc Interv Radiol 2009; 20:1210–1214. [CrossRef]
7. Iliescu B, Haskal ZJ. Advanced techniques for removal of retrievable inferior vena cava filters. Cardiovasc Interv Radiol 2012; 35:741–750. [CrossRef]