Retrieval of a Wall-Embedded Recovery Inferior Vena Cava Filter Using Rigid Bronchoscopy Forceps

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ABSTRACT

Optional inferior vena cava (IVC) filters are an attractive option to help prevent pulmonary embolism because these filters can be retrieved when the risk for thromboembolic events has passed. Retrieval of IVC filters can be difficult if the filter tilts and its tip becomes embedded into the wall of the IVC. A case is presented in which rigid bronchoscopy forceps were used to retrieve a filter that had become embedded in the wall of the IVC.

KEYWORDS: IVC filter, filter retrieval, implantable devices, rigid bronchoscopy forceps

Objectives: Upon completion of this article, the reader should understand that if attempted IVC filter retrieval fails because the filter is tilted and embedded in the wall of the IVC, rigid bronchoscopy forceps may be used for retrieval.
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Retrievable inferior vena cava (IVC) filters have become an important option in the prevention of pulmonary embolism (PE) from deep vein thrombosis (DVT). Retrievable or optionally retrievable IVC filters can be removed when they are no longer needed or can be left in place as permanent filters. Currently, there are two FDA-approved retrievable IVC filters: the Günther Tulip filter (Cook, Bloomington, IN) and the Opt-Ease filter (Cordis Endovascular; Johnson & Johnson, Warren, NJ). The Recovery filter (Bard Peripheral Vascular, Tempe, AZ) was available as a retrievable filter but was taken off the market in the United States in the fall of 2005 and replaced with a modified version called the G2 filter (Bard Peripheral Vascular, Tempe, AZ). At the present time, the G2 is FDA approved as a permanent filter. Retrieval of the G2 filter can be done "off label" using the same technique that was used to remove the original Recovery filter. There is currently an ongoing multicenter trial to assess the safety and efficacy of using the G2 as a retrievable filter. The Recovery and G2 filters are nitinol devices composed of six arms and six legs that extend out from a superior cap. The filter is retrieved via an internal jugular vein approach with a retrieval cone (Recovery Cone Removal System; Bard Peripheral Vascular, Tempe, AZ). The retrieval cone consists of nine struts and a urethane membrane that surrounds the filter forming a cone.[1–3] The filter is then withdrawn into the sheath for retrieval. However, there are cases in which

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the retrieval device cannot capture the filter, especially when the tip is tilted and cannot be engaged. This case report shows our experience with retrieving a recovery filter whose tip was tilted and embedded in the wall of the IVC.

CASE REPORT

A 35-year-old woman had a history of a DVT and PE, and she was being treated with Coumadin. She had a Recovery IVC filter placed at an outside hospital because she needed to stop taking Coumadin temporarily for a planned orthopedic surgery. The patient developed a DVT after the surgery and was placed back on Coumadin. Four months after surgery, her DVT resolved and it was determined that she no longer needed the IVC filter. Physicians at her outside hospital attempted to remove the filter using the Recovery Cone Removal System but were unsuccessful. Six week later, the patient was referred to our interventional radiology (IR) clinic to discuss undergoing a second attempt at filter removal.

A preprocedure computed tomography venogram (CTV) to assess the IVC and the filter was performed (Fig. 1). The CTV revealed the filter was tilted. No thrombus was demonstrated in the filter, IVC, iliac veins, or the deep veins of the lower extremity. The patient was brought to the IR suite for another attempt at filter removal. Initial fluoroscopic exam of the filter revealed that the filter had fractured, and one of the struts of the filter was trapped in the top portion of the filter. As such, removal of the broken strut using a guiding catheter and snare was undertaken. Several attempts were then made to engage the tip of the filter with the Recovery Cone. However, the filter tip was tilted anteriorly and was embedded into the wall of the IVC (Fig. 2), making it extremely difficult if not impossible to engage the tip of the filter. Attempts were made to straighten the filter, but because the tip of the filter was embedded into the wall of the IVC, these attempts were unsuccessful. This attempt at filter removal was therefore aborted.

The patient was young and felt very strongly that she did not want to have the filter left in place if she did not absolutely need it. We offered to make one final attempt at IVC filter removal using rigid bronchoscopy forceps (4162; Bryan, Woburn, MA). An in situ image of the filter before the second attempt again verified the filter's location (Fig. 3). A 16F sheath was placed in the IVC via the right internal jugular vein. A 5F pigtail catheter was advanced caudal to the Recovery filter, and a cavagram was performed to assess the location and position of the filter. The cavagram confirmed that the tip of the filter was embedded in the wall of the IVC. A 12F sheath was placed within the initial sheath, and the

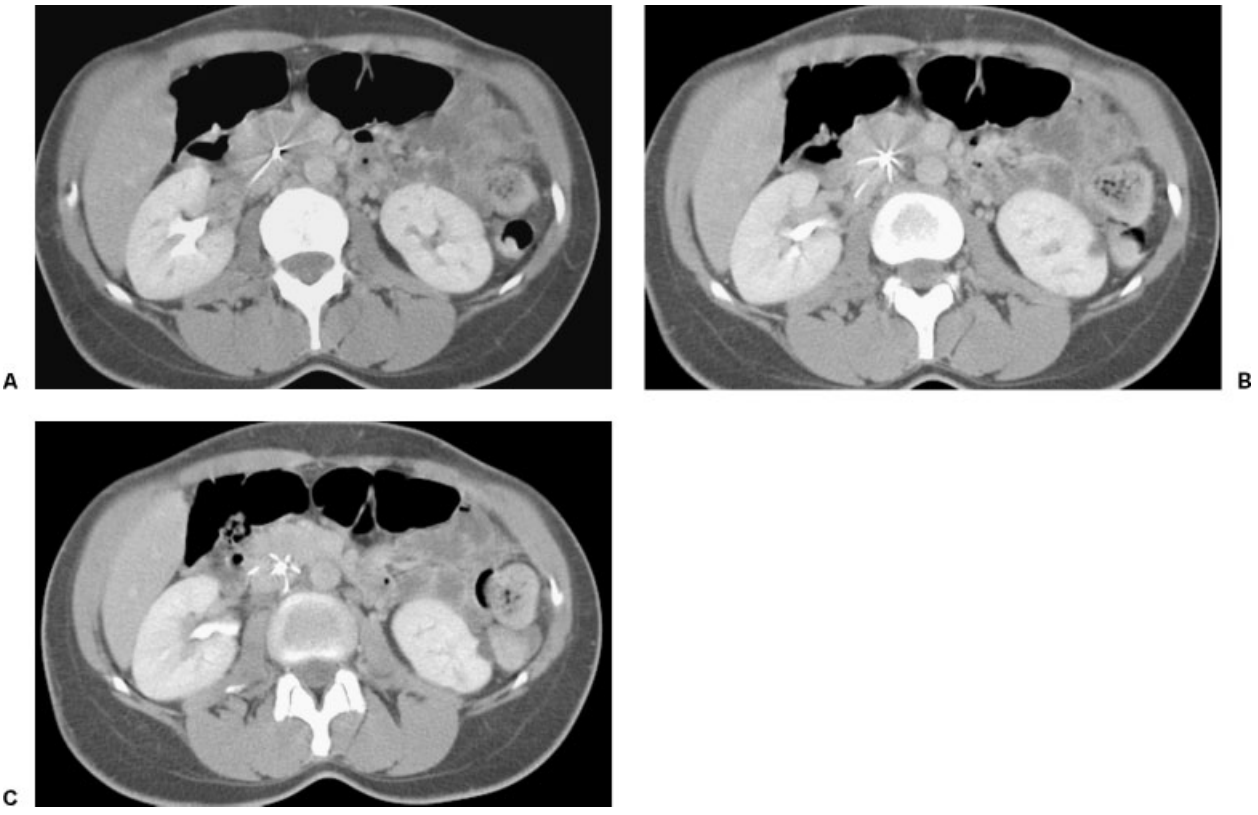

Figure 1 (A–C) Axial sections of the patient's preprocedure computed tomography venography examination scan show that filter is tilted, and there is no thrombus in filter.

Figure 2 Digital subtraction cavagram shows that filter tip is tilted anteriorly and has cap of intimal hyperplasia (arrow).

rigid bronchoscopy forceps were introduced through this sheath. The forceps then engaged the tip of the Recovery filter (Fig. 4). The forceps were used to dissect the tissue around the embedded tip of the filter. Once this tissue was dissected away, the filter moved into a less tilted position and was then centered in the IVC. The bronchoscopy forceps were then used to pull the filter cranially (Fig. 5), allowing the filter to be removed successfully. The pigtail catheter was then reinserted to obtain a postremoval cavagram (Fig. 6), which showed no evidence of extravasation or IVC injury. The filter had a total dwell time of 225 days. Upon removal of the filter, it was examined and all the remaining legs had been removed.

DISCUSSION

Trousseau first introduced the idea of IVC interruption for prevention of pulmonary embolism, and it was surgically implemented in 1893. However, it was until not nearly a century later, in 1984, that the first Greenfield filter was inserted percutaneously.[4] These filters were permanent devices. Permanent IVC filters are effective

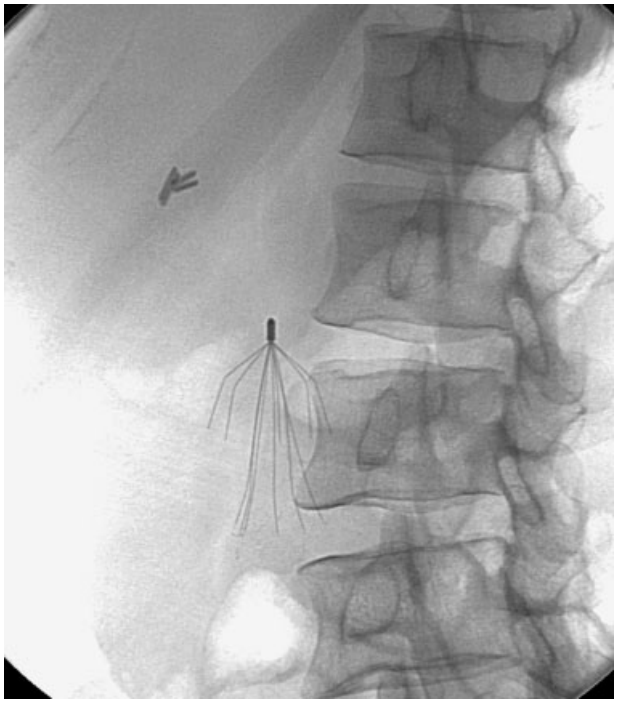

Figure 3 This is an in situ image of filter before second retrieval attempt was made.

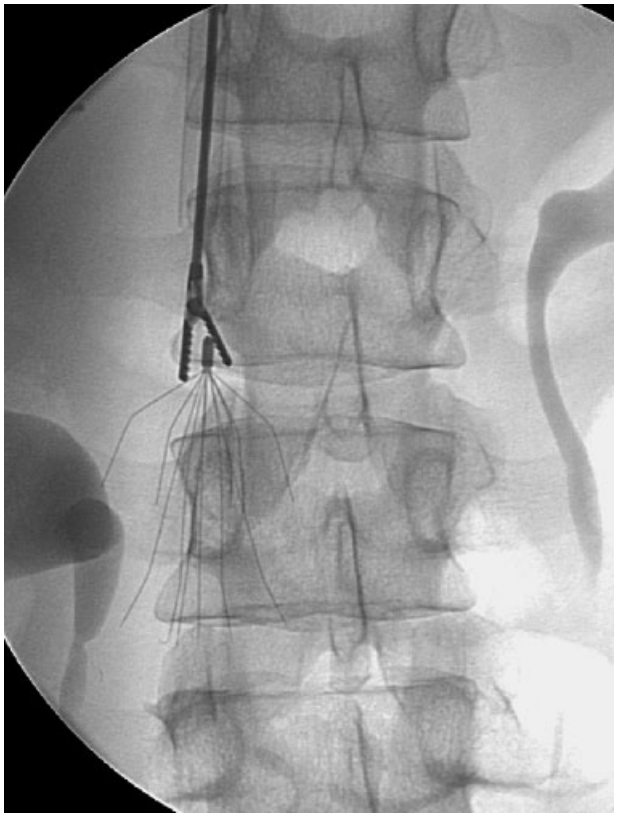

Figure 4 Rigid bronchoscopy forceps engage tip of recovery filter.

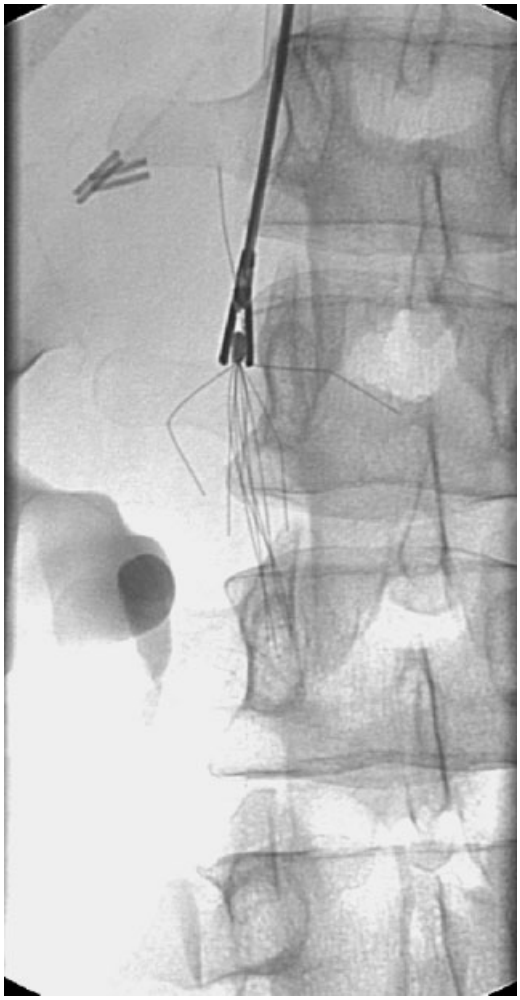

Figure 5 Filter is pulled with forceps in cranial direction.

Figure 6 Postremoval cavagram shows no evidence of extravasation or inferior vena cava injury.

at preventing PE and are relatively safe long term. However, leaving a filter in permanently is not without risk. Filters can migrate (3 to 69%), cause caval perforation (9 to 24%), thrombosis (6 to 30%), and/or total occlusion of the IVC, can have insertion site thrombosis (2 to 28%), and cause post-thrombotic syndrome (5 to 70%).[5] Retrievable IVC filters offer the promise of protection from DVT and also have the ability to be removed if they are no longer needed. Because of the ease with which retrievable IVC filters can be placed and retrieved and their high rate of protection offered against PE, the number of retrievable filters inserted annually is on the rise. Retrieval of the Recovery IVC filter is often straightforward and can be done with a high degree of success, ranging from 93 to 100%.[1,2] However, not all retrievals are straightforward. Factors that increase the difficulty in removing any optional filter include tilting of the filter, increased dwell time, and thrombus in the filter. Because leaving filters that are no longer needed in place can present risks to the patient, many interventional radiologists have been aggressive at innovating new ways to retrieve filters that are unable to be removed using traditional techniques. Asch et al[1] described removing a tilted Recovery filter using an angulated catheter to advance a wire toward the side of the tilted filter. The Recovery cone was then passed over this wire and was thereby able to engage the tip. Hagspiel et al[6] described a technique that enabled the removal of a tilted filter by placing a tip deflecting wire through the central lumen of the filter and then advancing the wire through the struts. By pulling back in the cranial direction, traction was created, thereby straightening out the filter. Kwok et al[7] described a combined jugular and femoral approach to retrieving an embedded filter, and Ray and Cothren[8] described using a snare device.

Using rigid bronchoscopy forceps to remove an IVC filter is an aggressive technique that should be reserved for patients who have a filter that is not only tilted but also embedded into the wall of the IVC.[9] Grabbing the tip of the filter with the bronchial forceps must be done with care to avoid disrupting the proximal struts of the filter or injuring the IVC. It should not replace the Recovery Cone when a filter is not embedded. The patient in this case was young and highly

motivated to have the filter removed, and therefore this technique was attempted after it was described in detail to the patient. This technique allows for removal of this tissue hood, which then causes the filter to straighten in the IVC. Alternatively, the filter can be removed in one motion once the tip of the filter has been grasped with the bronchial forceps.[9]

CONCLUSION

Retrievable inferior vena cava filters offer protection against pulmonary embolism and are easily removed the vast majority of the time. However, if a Recovery filter is tilted and has its tip embedded in the wall of the IVC, rigid bronchoscopy forceps offer an alternative method for retrieving the filter.

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