Interventional radiologists at Penn Medicine are performing retrieval of tip-embedded inferior vena cava (IVC) filters using rigid endobronchial forceps, a technique developed by Penn Interventional Radiology. The efficacy and safety of the technique has recently been confirmed in a clinical study published in the journal *Radiology*. [1]

The largest venous trunk in the body, the IVC is a conduit for thromboemboli originating in the legs. Among hypercoagulable individuals, particularly those with contraindications for anticoagulant therapy, caval blood clots are a primary cause of catastrophic pulmonary embolism. Percutaneous placement of permanent or retrievable IVC filters is an effective way to trap these clots before they reach the lungs.

Although the FDA recommends that IVC filters be removed when no longer needed, it is estimated that fewer than half of retrievable devices are taken out each year. This number includes the 5 to 10 percent of retrieval attempts that fail because the filter tip is embedded in the vessel wall. Tip-embedded filters must be removed because they present a substantial risk for vessel occlusion, fracture, and further penetration through the IVC into bowel, bone, arteries and other structures. Standard retrieval of IVC filters involves capturing the devices with snares or cones. Neither technique is effective, however, when the filter tip is embedded in the vessel wall (Fig. 1).

Every tip-embedded filter retrieval is considered a high-risk procedure. Incomplete, failed or overly aggressive removal of the filter can result in vessel damage and/or further distortion/fracture of the filter.

**IVC Filter Retrieval at Penn**

For more than a decade, interventional radiologists at Penn Medicine have been developing methods to improve the results of IVC filter retrieval and to optimize retrieval of tip-embedded caval filters. The approach to these complex retrievals involves the use of rigid endobronchial forceps placed into the IVC from the right internal jugular vein through a sheath, dissecting away engulfing tissue, grasping the filter tip and removing the device (Fig. 2). The technique incorporates several imaging modalities, including rotational venography, spot radiography and CT venography.

In a recent retrospective study at Penn, the endobronchial forceps approach was used successfully to retrieve 109 of 114 (96%) tip-embedded IVC filters. Three minor complications and one major complication occurred (the latter involved a patient in whom the struts as well as the tip were embedded), but these resulted in no permanent sequelae.

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**Figure 1:** A tip-embedded IVC filter appears on inferior vena cavagram. This filter has entered the vessel wall and cannot be retrieved by standard methods.

**Figure 2:** Endobronchial forceps grasping an IVC filter after freeing the embedded tip of the device.

**CASE STUDY**

Mr. W, a 37-year-old man, presented to Penn Interventional Radiology with a filter embedded in the wall of his inferior vena cava. According to his medical records, he had a history of deep vein thrombosis, for which he’d been taking warfarin for some years. Recently, however, he’d experienced a bleeding ulcer, requiring him to temporarily cease taking the drug.

To protect Mr. W from pulmonary emboli in this interim, a retrievable filter was placed in his inferior vena cava at his community hospital. After Mr. W’s ulcer had healed and he re-started warfarin, he returned to the hospital to have the IVC filter removed. An inferior vena cavagram at this time showed the tip of the filter embedded in the vessel wall, however, and the retrieval attempt was abandoned.

*(Case study continued on back page)*

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CASE STUDY  (Continued from front page)
Mr. W was then referred to Penn Interventional Radiology, where he was scheduled for a complex IVC filter retrieval after an office consultation. His anticoagulation was not interrupted for the one-hour procedure, which was performed in an outpatient setting. Following access at the right internal jugular, endobronchial forceps were used to cut away the tissue surrounding the embedded tip, allowing the filter to be grasped and removed (Fig. 2).

Following the procedure, Mr. W was observed for two hours; he went home the same day. He had no adverse effects from the procedure and remains under the care of his family physician.

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FACULTY TEAM
The specialists with the Interventional Radiology Division at Penn Medicine offer the diagnosis and treatment of a variety of diseases, disorders and conditions using minimally invasive techniques. In addition to dedicated IR suites, the Division has an active outpatient clinic, admitting and consulting services.

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