Caval Penetration with Retroperitoneal Hemorrhage Following Placement of an Inferior Vena Cava (IVC) Filter

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ABSTRACT

Placement of inferior vena cava (IVC) filters is an increasingly common request at our institution. The rise in utilization of caval filtration is probably multifactorial and includes pulmonary embolism (PE) prophylaxis most notably in the setting of trauma, the approval and widespread use of temporary/removable filters, and the perceived low complication rates associated with new generation filter designs. We present a unique case of IVC penetration by a new generation filter that resulted in a retroperitoneal hemorrhage in a fully anticoagulated patient.

KEYWORDS: Vena cava filters, vena cava complications

Objectives: Upon completion of this article, the reader should understand that patient anticoagulation status is one of many factors to consider when selecting the type of IVC filter.

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CASE REPORT

A 43-year-old African American woman with a past medical history of essential thrombocythemia, chronic pulmonary embolism, and pulmonary artery hypertension presented for placement of an inferior vena cava (IVC) filter. The patient was on chronic anticoagulation at the time of filter placement, and despite therapeutic doses of low molecular weight heparin (Lovenox; Sanofi-Aventis, Bridgewater, NJ) and warfarin, the international normalized ratio (INR) remained subtherapeutic at 1.6, necessitating filter placement. Following a normal inferior vena cavagram, a G2 Filter System (Bard, Tempe AZ) was placed via a right jugular approach, just below the renal

veins at the superior endplate of L2 (Fig. 1). No untoward events occurred during the procedure, and the patient returned to her hospital room in stable hemodynamic condition. She was discharged home the following day to continue combined anticoagulation with low molecular weight heparin and warfarin until a therapeutic INR of 2 to 3 could be achieved, at which point the filter was to be removed.

Six days following discharge, the patient presented to an outside hospital with complaints of right upper thigh and groin pain. A computed tomography (CT) scan demonstrated retroperitoneal and psoas hematoma with perforation of the IVC by a single strut from

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Figure 1 Supine abdominal radiograph with the top of the filter (arrowhead) at the superior endplate of L2.

the G2 Filter (Fig. 2). The patient was transferred to our institution for evaluation and management.

Initial fluoroscopic imaging revealed inferior migration of the filter to the inferior endplate of L3, just above the confluence of the iliac veins (Fig. 3A). In addition, two filter struts on opposing sides projected beyond the confines of the IVC (Fig. 3B). A decision was made to remove the filter if possible given her normal coagulation profile. From a right internal jugular approach, the filter was removed using the Cone Recovery System (Bard, Tempe, AZ) without difficulty. No devices other than the Cone Recovery System were necessary. Repeat imaging showed a normal-appearing IVC without active extravasation. Prior to procedure completion, a TrapEase (Cordis J&J, Miami, FL) filter was placed just below the renal veins (Fig. 4). The patient remained hemodynamically stable and with a stable hematocrit, aspirin, low molecular weight heparin, and warfarin were resumed. Her hematocrit improved and her back pain resolved. A CT demonstrated no change in the retroperitoneal hematoma and stable position of the filter, so she was discharged home on day 4. She was seen back in the pulmonary clinic with a hematocrit of 33, which was up from the low point of 24.

Figure 2 Coronal reconstruction from a noncontrasted computed tomography demonstrating inferior vena cava penetration by a single filter strut with adjacent retroperitoneal hemorrhage.

She was ambulating and not hypoxic on her home O₂. She was planned to continue anticoagulation and start pulmonary rehabilitation.

DISCUSSION

We present a case of IVC penetration with associated symptomatic retroperitoneal hemorrhage related to a recently deployed G2 Filter. The type of IVC filter initially inserted was based on the best medical care in the view of the interventional radiologist. Although the G2 Filter did not have approval by the Food and Drug Administration for removal at the time of placement, a jugular access was desired in this patient, and there was reasonable hope the patient could become effectively anticoagulated and the filter removed, although the time frame was uncertain. Given the unlimited removal time for the Recovery Filter (Bard, Tempe, AZ), the G2 Recovery was chosen for this particular patient. Due to recurrent pulmonary embolism while on warfarin, the patient was receiving therapeutic doses of low molecular weight heparin and warfarin following filter placement. The patient also had pulmonary hypertension and a deep chronic cough, likely producing episodic increases in central venous pressure. These factors are felt to have contributed to inferior filter migration, penetration, and exaggerated bleeding once IVC penetration occurred.

Although filter migration may have occurred in this patient, bleeding would certainly have been less likely without the associated anticoagulant therapy.

Figure 3 (A) Fluoroscopic image demonstrating inferior migration of the inferior vena cava (IVC) filter with the top of the filter now at the inferior endplate of L3. (B) Fluoroscopic image from the inferior vena cavagram demonstrating multiple projecting struts (arrowheads) beyond the IVC lumen.

Because caval perforation was unexpected, there was not a great deal of concern about allowing the patient to achieve a full level of anticoagulation with the filter in place. More controversial, however, was removing the filter in light of a perforation of the IVC with CT evidence for hemorrhage and the necessity for full anticoagulation in the future as well as another filter needing to be placed in the interim. Although several options were considered, the most acceptable choices consisted of leaving the filter in place, discontinuing the anticoagulant therapy, and removing the G2 Filter with replacement of another filter. Because the patient had previously failed anticoagulation, the clinical teams were reluctant to again attempt this therapy alone, and surgical options were left as a last resort. Once caval perforation and hemorrhage had occurred, the clinical teams felt strongly about removing the source for hemorrhage, that is, the filter. Our decision was therefore to attempt filter removal as gently as possible with a low tolerance for leaving the filter in place should there be difficulty with retrieval. In addition, should abrupt caval hemorrhage occur, rescue measures were planned including balloon tamponade, covered stenting, and

vascular surgery backup. All of this was discussed with the clinical teams and the patient, who agreed to proceed.

Since the inception of the catheter-deployed IVC filters, numerous designs have emerged. One of the initial smaller designs was the titanium Greenfield filter (Boston Scientific, Natick, MA), which had difficulty with caval perforation necessitating a change in design.¹ Since that time, several case reports have emerged regarding perforation of the IVC by filter struts (legs?), although the incidence of such complications is small. A small percentage of patients require combined IVC filter placement and anticoagulation due to chronic or recurrent thromboembolism while on therapeutic anticoagulation. More commonly, patients who initially had a contraindication to anticoagulation, such as in the post-operative state, are treated with retrievable filters and are subsequently fully anticoagulated prior to filter removal. Although this case demonstrates the potential for retroperitoneal hemorrhage in such situations, it may be that the risks can be lowered by careful selection of certain filter designs theoretically less likely to perforate the IVC. To that end, the G2 Filter was replaced with a

Figure 4 Fluoroscopic image shows the top of the TrapEase filter positioned at the superior endplate of L2.

TrapEase filter based its smaller anchor leg profile and inferred lower risk for caval penetration.

Selecting an IVC filter can be difficult due to the ever-growing number of options. Anticoagulation status of the patient is one factor that the interventional radiologist should consider in making the decision. A retrospective review of 96 Recovery IVC filters placed at Massachusetts General Hospital yielded an IVC penetration rate of 27.5%.² A similar review at the same institution evaluated 751 patients with the

TrapEase IVC filter, yielding a 0.0% migration and caval penetration rate.³ It is important to also state that in all of the previously mentioned cases of caval penetration, there were no reported cases of associated retroperitoneal hemorrhage.

In a retrospective review of 84 Greenfield IVC filters, one associated retroperitoneal hemorrhage was documented.⁴ A case report by Woodward et al described delayed retroperitoneal hemorrhage following placement of an SSG IVC filter.⁵ However, this case was associated with lumbar artery perforation. This may explain the hematoma without a corresponding caval abnormality in our case. There is a paucity of reports describing retroperitoneal hemorrhage following IVC filter placement, and insufficient data to allow one to choose the least traumatic and therefore safest filter design in the anticoagulated patient.

Despite similarities in filter efficacies, every IVC filter is unique. These differences should be explored and considered when choosing an IVC filter. In addition, it is important to realize that although the complication rate is low, IVC filter placement is not without short- and long-term risks. These risks should be discussed at length with both the patient and referring physician. Careful consideration of the clinical situation is necessary to lower the risks of IVC filter placement and avoid devastating consequences.

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