Safe endovascular retrieval of a vena cava filter after duodenal perforation

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Abstract: The use of vena cava filters (VCF) is a common procedure utilized in the prevention of pulmonary embolism (PE), yet VCFs have some significant and known complications, such as strut penetration and migration. Deep vein thrombosis (DVT) and PE remain a major cause of morbidity and mortality in the United States. It is estimated that as many as 900,000 individuals are affected by these each year with estimates suggesting that nearly 60,000–100,000 Americans die of DVT/PE each year. Currently, the preferred treatment for DVT/PE is anticoagulation. However, if there are contraindications to anticoagulation, an inferior vena cava (IVC) filter can be placed. These filters have both therapeutic and prophylactic indications. Therapeutic indications (documented thromboembolic disease) include absolute or relative contraindications to anticoagulation, complication of anticoagulation, failure of anticoagulation, propagation/progression of DVT during therapeutic anticoagulation, PE with residual DVT in patients with further risk of PE, free-floating iliofemoral IVC thrombus, and severe cardiopulmonary disease and DVT. There are also prophylactic indications (no current thromboembolic disease) for these filters. These include severe trauma without documented PE or DVT, closed head injury, spinal cord injury, multiple long bone fractures, and patients deemed at high risk of thromboembolic disease (immobilized or intensive care unit). Interruption of the IVC with filters has long been practiced and is a procedure that can be performed on an outpatient basis. There are known complications of filter placement, which include filter migration within the vena cava and into various organs, as well as filter strut fracture. This case describes a 66-year-old woman who was found to have a filter migration and techniques that were utilized to remove this filter.

Keywords: endoscopy; endovascular retrieval; vena cava filter; venous thromboembolism.

Vena cava filter (VCF) migration and filter penetration is a complication of VCF placement that has previously been described [1]. There are varying stances on the feasibility of retrievability of these filters, especially in patients who are otherwise asymptomatic [2]. Our institution has found success in removing filters that have been found to be causing various medical issues including pancreatitis and ongoing abdominal pain. This success has been achieved by utilizing an approach that incorporates not only interventional radiologic modalities but also by the use of endoscopic procedures in conjunction with known interventional techniques. This case describes utilizing dual modalities simultaneously to successfully retrieve an inferior vena filter.

Case description

At the time of the patient’s initial presentation, she was a 57-year-old woman who was involved in a motor vehicle crash in 2009 that resulted in traumatic left lower extremity amputation, a right femur fracture, and pulmonary and cardiac contusions. The patient’s hospital course was complicated by a left common femoral deep vein thrombosis (DVT). Due to the patient injury burden, she was at a significantly increased risk of bleeding. Based on the Society of Interventional Radiology (SIR), this patient met two clinical scenarios that would deem her appropriate for IVC filter placement: (1) a documented venous thromboembolism (VTE) with contra-indication to anticoagulation due to the risk of bleeding; and (2) a trauma patient with a high risk for VTE. The patient
underwent placement of a Cook Celect VCF at that time. In 2010, there was an attempt to retrieve the VCF. Guidelines have been instituted for retrieval of these filters [3]. Indications include the following: (1) the risk of clinically significant pulmonary embolism (PE) is acceptably low because of the primary therapy; (2) the patient is not anticipated to return to a high risk for PE, as was the case for our patient; (3) the patient’s life expectancy is long enough that the patient will benefit from filter removal; and (4) the filter can be safely removed. Unfortunately, a trapped thrombus was identified during attempted retrieval and thus the procedure was aborted. The patient was initially placed on warfarin and then was transitioned to apixaban because the anticoagulation guidelines changed. The patient moved out of town and was lost to follow-up.

In 2018, the patient underwent a screening colonoscopy and esophagogastroduodenoscopy (EGD) for ongoing reflux symptoms, which at that time showed several VCF struts perforating into the second and third portions of the duodenum. The patient was referred to our institution for consultation, and the patient agreed to pursue endovascular retrieval. The procedure was performed in a hybrid operating room with endovascular capabilities. The patient was prepped and draped for potential laparotomy. A dual 12 and 7-Fr sheath system was advanced into the inferior vena cava (IVC), and a contrast cavagram was performed showing strut perforation outside of the contrast column. After several attempts, the hook was ensnared with a multiloop snare (Figure 1). A flexible endoscope was passed into the duodenum, and the filter was removed from the vena cava with direct visualization of the duodenum and no occurrence of bleeding (Figure 2). A postretrieval cavagram was performed, showing no extravasation of contrast. The filter had been in situ for 3,655 days (Figure 3). The patient

Figure 1: Esophagogastroduodenoscopy findings of filter strut penetrating duodenum. (A) Endoscope entering the second portion of the duodenum, which first identifies the VCF penetrating the duodenum. (B) A closer inspection of the second portion of the duodenum with VCF strut perforation. (C) Endoscope entering the third portion of the duodenum, which further identifies VCF strut perforation. (D) The third portion of the duodenum with clear visualization of the VCF strut fully penetrating the duodenum.
remained hemodynamically stable overnight. A complete blood count (CBC) in the morning showed no signs of significant blood loss. She was ultimately discharged and was seen 8 days later in clinic. At that time, she was doing well and remained asymptomatic from the procedure. The patient continues to be followed by her primary care physician and remains asymptomatic. She was most recently seen in May 2021.

Discussion

With the high prevalence of individuals affected each year by DVT/PE—approximately 900,000—the current preferred treatment for DVT/PE remains anticoagulation [4, 5]. However, as previously discussed, this is not always possible and intravenous fluids have to be utilized. This utilization, with all procedures, does come with risks and complications. The definition of filter perforation is when a filter component penetrates >3 mm of the wall of the vena cava and enters the pericaval space and/or the adjacent structures [6]. In a retrospective review by Desai et al. [7], they report that retrievable filters have a higher rate of perforation than permanent filters when left in place longer than originally anticipated. A majority of these perforations in patients remain asymptomatic; however, there are documented cases of patients becoming symptomatic from filter penetration. Case studies reviewing filter migration have noted that there could be an increased risk of bleeding and/or perforation during removal of these filters and have recommended against removal of these filters due to the possibility of harm to the patient [7]. We believe that with enhanced endoscopic and endovascular techniques, IVC filter migration, although rare, can be treated and provide patient relief without increasing the chance of significant harm to the patient. We believe that patients with significant symptoms from filter migration are best approached with these minimally invasive endovascular techniques. This is significantly less morbid than an exploratory laparotomy and IVC reconstruction. It should be acknowledged that this procedure itself must be performed with care and with monitoring. Our institution has a multicenter experience with aorto-iliac and caval penetrations that indicate that bleeding in these cases is low risk [8]. However, bleeding from a vascular source is a risk of this procedure, therefore mechanisms, including endovascular occlusion balloons and stents, were immediately available if this were
to occur. If luminal (mucosal) bleeding occurred, heat probe cautery and endoscopic clips were immediately available for use. Due to the limited number of reports of filter migration into organs and their subsequent removal, success is based on the resolution of patient symptoms. This case, along with others that were performed at other institutions [9] as well as our own [10], demonstrates that the safe removal of VCFs with struts perforating into the duodenum can be achieved with advanced endovascular and interventional techniques [3, 11].

**Conclusions**

The retrieval of VCFs that have suffered migration, penetration of surrounding organs, or strut fracture is feasible with the appropriate techniques and available equipment. This technique utilizing not only interventional radiology techniques but also endoscopic techniques in combination provides a safe approach to the removal of complex VCFs. With the incidence of VCFs placed, there will inevitably be more cases that present such as the one described. It is essential that clinicians continue to adapt to these cases and have feasible techniques to adequately address them. This case report again demonstrates the ability to deal with complications that occur from VCFs utilizing a multidisciplinary approach.

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**Competing interests:** None reported.

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**References**