Case – Endoscopic and endovascular management of inferior vena cava filter erosion into the right proximal ureter

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Introduction

Inferior vena cava (IVC) filters are commonly implanted to prevent thrombotic events from the lower extremities.[1] IVC filter struts, designed to exert outward radial force, can penetrate through the caval wall and into surrounding organs.[1] A recent systematic review reported penetration rates of 33.9%, with 19% of those cases showing evidence of organ/tissue involvement on computed tomography (CT) scan.[1] However, symptomatic IVC filter erosion has a reported incidence of less than 0.5%.[2] Frequency of erosion into the renal collecting system is difficult to estimate due to limited case studies reporting these events. We present a rare case of IVC filter struts eroding into the ureter. Endovascular removal of the IVC filter alone in this case would result in perforation of the renal pelvis, therefore, a combined endoscopic and endovascular approach was used.

Case report

A 47-year-old woman presented with right flank pain. She had a retrievable IVC filter (Celect™, Cook Medical) placed eight years ago, prior to an elective gynecological surgery, due to her increased risk of thrombosis secondary to May-Thurner syndrome. Sixteen months after IVC filter insertion, she presented with right flank pain; CT scan did not reveal hydronephrosis, nor any cause for her pain. One month later, she underwent an attempted filter removal, which failed due to significant filter tilting and leg penetration beyond the IVC wall (Fig. 1A). Six years later, she underwent percutaneous nephrolithotomy to remove a 1.4 cm right lower pole stone. Postoperatively, one stone fragment fell into the ureter, and she presented with renal colic after 11 days (Fig. 2A). CT scan revealed the stone was lodged at the location of IVC filter leg protrusion into the right proximal ureter, associated with proximal hydroureteronephrosis.

Right ureteroscopic laser stone extraction was performed, and followup imaging confirmed resolution of the hydronephrosis (Fig. 2B). At the time of percutaneous nephrolithotomy (PCNL) and ureteroscopy, there was no foreign body visualized in the ureteric lumen. Despite resolution of hydronephrosis, her right-sided flank pain continued to worsen. Two years later, CT scan revealed new hydroureteronephrosis above the level of IVC filter leg protrusion into the proximal ureter (Fig. 2C).

Hoping to resolve her symptoms, she consented to re-attempt filter removal. A multidisciplinary discussion recommended deferring endovascular removal pending endoscopic removal of the ureteral component, given the protrusion of the IVC filter strut into the collecting system. She underwent a right ureteropyeloscopy to endoscopically treat the IVC filter leg that had eroded into the ureter. The IVC filter leg was visualized within the proximal ureter and noted to have a hook-like configuration protruding into the ureteric lumen (Fig. 3).

Given this hooking, endovascular removal of the IVC filter could not be performed until this was treated. Retrograde pyelogram confirmed moderate hydronephrosis above the level of the erosion (Fig. 4). Ureteropyeloscopy was then performed using a flexible ureteroscope inserted into the ureter over a safety wire. The hook-like configuration was protruding into the proximal ureteric lumen 3 cm below the ureteropelvic junction (Fig. 3). This was completely lasered using a 272 μ holmium laser fibre at 0.5 J and 10 Hz until the entire hook portion of the filter was obliterated to dust, leaving the straight filter leg to allow for less traumatic endovascular removal. A 7 Fr, 24 cm double-J stent was inserted at the end of the operation.

Six weeks later, the patient underwent endovascular IVC filter retrieval with right internal jugular vein access under general anesthesia. An 18 Fr x 30 cm Cook vascular sheath was placed after serial dilation over wire, and a 14 Fr

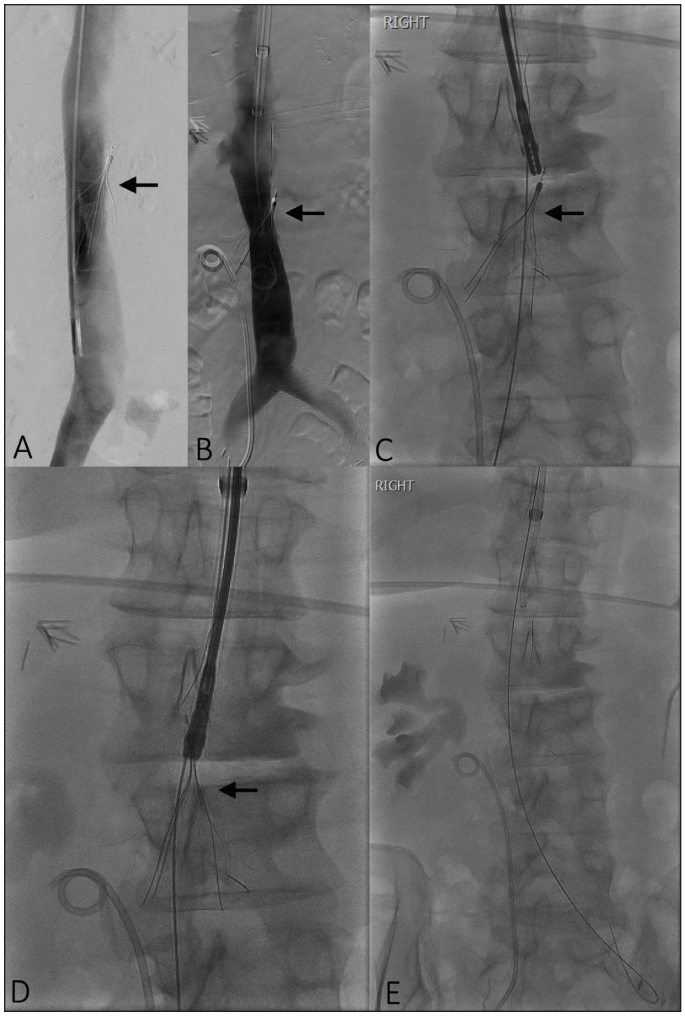

Fig. 1. Fluoroscopic images taken at time of inferior vena cava (IVC) filter removal. ***(A)*** Position of IVC filter at initial failed attempt of IVC filter removal 17 months following insertion; ***(B)*** position of IVC filter eight years following IVC filter insertion after endoscopic lasering of IVC filter leg hooked into the right proximal ureter; ***(C)*** forceps placement to engage the base of IVC filter; ***(D)*** base of IVC filter engaged and filter angulated back into the IVC; ***(E)*** post-removal fluoroscopic image demonstrating IVC filter removed in its entirety.

vascular sheath was advanced telescopically coaxially with the tip placed just above the level of the filter. The filter's retrieval hook was found to be embedded within the caval wall (Fig. 1). Lymol (#4162) endobronchial forceps were used to dissect the fibrin cap off the tip-embedded-filter, the IVC filter hook base was engaged with forceps, and the filter was removed entirely (Fig. 1). Three weeks later, a cystoscopy and retrograde pyelogram revealed no ureteric stricture or contrast leak and stent was removed. CT scan four months later revealed resolution of hydronephrosis and patients' pain had almost completely subsided.

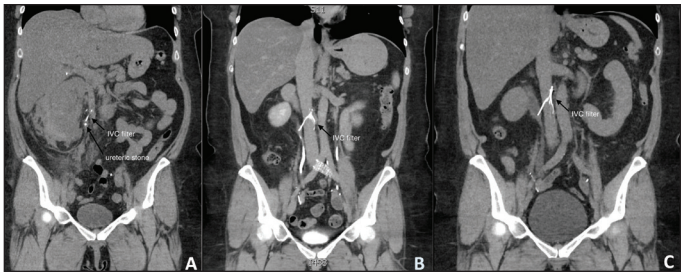

Fig. 2. Computed tomography (CT) scan demonstrating: ***(A)*** inferior vena cava (IVC) filter leg erosion into the right proximal ureter resulting in ureteric inflammation and stone fragment entrapment following percutaneous nephroscopic stone extraction; ***(B)*** urogram following ureteroscopic removal of stone fragment demonstrating free drainage of contrast and no evidence of obstruction; ***(C)*** progression of erosion of IVC filter leg into the right proximal ureter and development of hydroureteronephrosis proximal to the point of erosion.

Discussion

IVC filters are known to be effective, however, complications, including penetration into organs and tissues, are possible, and this risk increases with indwelling filter time.[1-3] The PRESERVE trial is currently underway to better understand the long-term safety of IVC filters.[4] A review of the literature reveals 16 cases of IVC filters eroding into the renal pelvis or collecting system. Of these cases, presentation and symptoms varied: four were asymptomatic (found incidentally),[5-8] one was observed during filter placement,[9] three presented with abdominal and back or flank pain,[7,10,11] five with hematuria with or without flank or abdominal pain,[7,11,12] and two with flank pain with or without dysuria.[7]

Management options vary widely in the literature. Of the 16 cases, there was no intervention in two,[7] ureteral repositioning in one,[7] ureteric stents in four,[7,10] right gonadal vein ligation and filter removal in one,[11] lifelong nephrostomy to drain kidney (after failed stenting) in one,[4] hemostatic clips placed robotically on exposed wire in one,[5] robotic dissection to free up the prongs in one,[6] and open excision with or without caval reconstruction (after endovascular techniques failed) in five.[7-9,12]

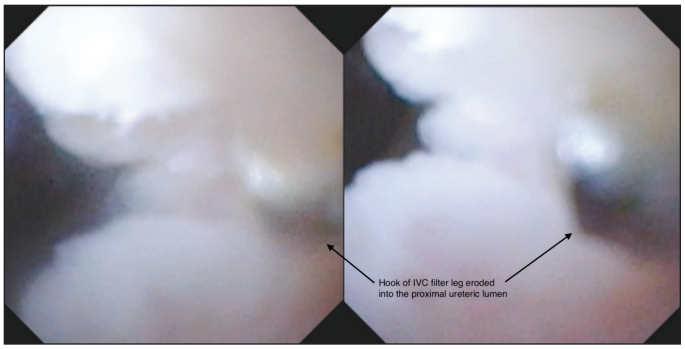

Fig. 3. Intraoperative endoscopic images demonstrating the hook of the IVC filter leg into the right proximal ureter (3 cm below the ureteropelvic junction).

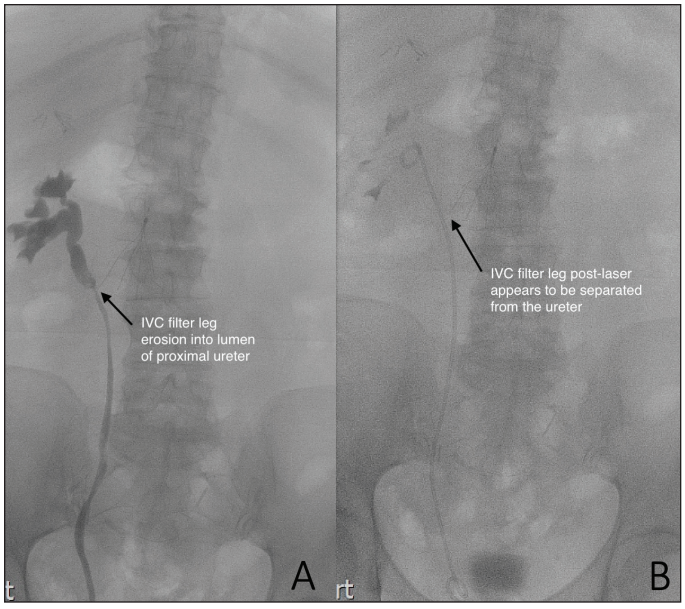

Fig. 4. Intraoperative fluoroscopic images at the time of right ureteropyeloscopy to treat the IVC filter leg erosion into the ureter. ***(A)*** Retrograde pyelogram prior to laser removal of the IVC filter leg erosion; ***(B)*** post-treatment image demonstrating release of the IVC filter leg from the proximal ureter and a stent placed.

Conclusions

There are several learning points from our unique case. Although rare, IVC filters can erode into the ureter so should be removed as soon as thrombotic protection is no longer needed.[2] This case provides a reminder to be suspicious of caval penetration if a patient with an IVC filter presents with flank pain. If a filter leg has eroded into the ureter, a patient can be symptomatic without hydronephrosis, therefore, removing the filter may resolve symptoms. Though treatment of IVC filter erosion into the renal pelvis and collecting system remains uncertain due to few reported cases and limited experience, combined endoscopic and endovascular approaches may be successful in avoiding the morbidity associated with a major operation.

Competing interests: The authors do not report any competing personal or financial interests related to this work.

This paper has been peer-reviewed.

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