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Successful management of infected right iliac pseudoaneurysm caused by penetration of migrated inferior vena cava filter: A case report

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Abstract

BACKGROUND

Indwelling inferior vena cava (IVC) filters might cause various complications, including filter penetration, filter fracture, filter migration, and thrombosis of the IVC. Penetration and migration complications are common, while a caudal migrated double-basket filter with associated infected iliac pseudoaneurysm has seldom been reported.

CASE SUMMARY

We report a 64-year-old female admitted for sudden onset of severe right abdominal pain after IVC filter placement for 3 mo. The patient had a history of failed endovascular IVC filter retrieval. Computed tomography showed that the retrieval hook of the filter penetrated the right common iliac artery and vein, leading to right iliac artery pseudoaneurysm accompanied by right ureteral obstruction with ipsilateral hydronephrosis, and bilateral iliac veins were occluded. Emergency open repair was performed to remove the IVC filter, the right iliac pseudoaneurysm, and the compromised segments of the iliac veins and IVC with right common iliac artery reconstruction. *Staphylococcus aureus* was isolated from the tissue culture. The patient was discharged on postoperative day 12 with anticoagulation therapy and antibiotic therapy after discharge. Six-month follow-up computed tomography revealed that the right common iliac artery was patent, and only mild hydronephrosis was detected.

CONCLUSION

An indwelling IVC filter, even 'embedded' within organized thrombus, could still cause life-threatening complications. Open procedures remain the last resort for IVC filters with severe complications.

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Core Tip: Few cases are reported about symptomatic penetration caused by double-basket indwelling inferior vena cava (IVC) filter. Herein, we report an unusual case of infected iliac pseudoaneurysm caused by penetration of an indwelling caudal migrated double-basket IVC filter. After open repair and antibiotic therapy, the patient had a good result at 6-mo follow up. This case demonstrated that an indwelling IVC filter in iliocaval confluence, even 'embedded' within organized thrombus, could still cause life-threatening complications, and a more aggressive strategy might be necessary for this situation. Open procedures remain the effective treatment for indwelling IVC filters with severe complications.

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INTRODUCTION

Caval interruption *via* inferior vena cava (IVC) filter for the prevention of fatal pulmonary embolization was acceptable in selected patients with venous thromboembolism concomitant with contraindication to anticoagulation or failed anticoagulation therapy. According to the Society of Interventional Radiology, routine removal of retrievable IVC filter was recommended once the risk of pulmonary embolization was mitigated because indwelling IVC filters might cause various complications, including filter penetration, filter fracture, filter migration, and thrombosis of the IVC. Penetration complications were widely reported in previous studies, with a reported rate of 0%–40% [1], and the clinical manifestations varied considerably. Symptomatic penetrations of the surrounding structures were reported in some previous studies, which were relatively more common in conical IVC filters [2]. Most IVC filters could be retrieved *via* endovascular approaches, while open surgery was the last resort when endovascular approaches failed or were inappropriate in patients with severe complications caused by IVC filters [3]. The present study reports an unusual case of infected right iliac pseudoaneurysm with hydronephrosis caused by penetration of indwelling caudally migrated double-basket IVC filter (a type of non-conical filter) that was successfully treated *via* open procedure and antibiotic therapy.

CASE PRESENTATION

Chief complaints

A 64-year-old female with IVC filter placement 3 mo ago was presented to our institution with severe right abdominal pain for 1 d.

History of present illness

The patient was admitted to a local hospital for deep venous thrombosis of the left lower extremity 3 mo ago. A double-basket retrievable IVC filter (Visee WXF-32, Shandong Visee Medical Devices Company Limited, China) was placed in infrarenal IVC through the right femoral vein, and anticoagulation therapy was applied. Endovascular retrieval of the IVC filter through the femoral vein approach with standard technique failed 10 d later in the local hospital. Imaging follow-up ceased due to the COVID-19 pandemic.

The patient presented to our institution 3 mo later with severe right abdominal pain for 1 d. The patient had no fever or chills. She denied melena, but her urine was reddish.

History of past illness

The patient had history of scoliosis and poorly controlled diabetes mellitus.

Personal and family history

The patient was addicted to smoking and alcohol.

Physical examination

After admission, the patient had a heart rate of 97 bpm, a respiratory rate of 23 breaths per minute, and a blood pressure of 126/73 mmHg. Physical examination revealed diffused abdominal tenderness and rebound tenderness. The right lower limb was slightly swollen, and the pulse in the right femoral artery was weak.

Laboratory examinations

Laboratory tests showed no hepatic or kidney dysfunction, with hemoglobin of 101 g/L, leukocyte count of $14.74 \times 10^9/L$, and neutrophilic granulocyte percentage of 91.0%. During the surgery, partial pseudoaneurysm was extracted for tissue culture. *Staphylococcus aureus* was isolated from the tissue culture, which was sensitive to moxifloxacin.

Imaging examinations

Computed tomography angiography showed that the retrieval hook of the filter penetrated the right common iliac artery (CIA), leading to a 52 mm × 48 mm × 55 mm right iliac artery pseudoaneurysm, accompanied by right ureteral obstruction with ipsilateral hydronephrosis (Figure 1A and B). Bilateral iliac veins and lower part of the IVC were completely occluded, with substantial pelvic varicosities (Figure 1C).

FINAL DIAGNOSIS

The final diagnosis of the presented case was *Staphylococcus aureus* infected right iliac pseudoaneurysm and hydronephrosis caused by penetration of the migrated IVC filter.

TREATMENT

Considering right iliac artery pseudoaneurysm caused by the IVC filter and occlusion of bilateral iliac vein, an emergency open repair was conducted immediately. A midline transperitoneal approach was performed under general anesthesia. A pseudoaneurysm with abscess was found in the pelvic cavity, without intestinal perforation (Figure 2A). The right CIA, internal iliac artery, and external iliac artery were controlled after heparinization. Subsequently, the pseudoaneurysm associated with the surrounding infected tissues were debrided. The crevasse was located at the distal part of the right CIA, and right ureteral obstruction was found (Figure 2B). The IVC and bilateral common iliac veins were completely obstructed by the organized thrombus (Figure 2C). Then, the IVC filter was completely removed (Figure 2D). After that, the right CIA was revascularized through a directed *in situ* anastomosis, and then right ureterolysis was performed. The right dorsal pedal arterial pulses were palpable without any sign of limb ischemia, and the swolleness of the right lower limbs did not aggravate after surgery. Postoperative pathology indicated a large amount of inflammatory cell infiltration and necrosis in the wall of the pseudoaneurysm and the organized thrombus in the IVC (Figure 3A). Antibiotic therapy with ceftriaxone was initiated before operation considering the signs of peritonitis. Moxifloxacin was used after the results of culture and sensitivity test were available.

OUTCOME AND FOLLOW-UP

The patient recovered uneventfully postoperatively. The bilateral dorsal pedal arterial

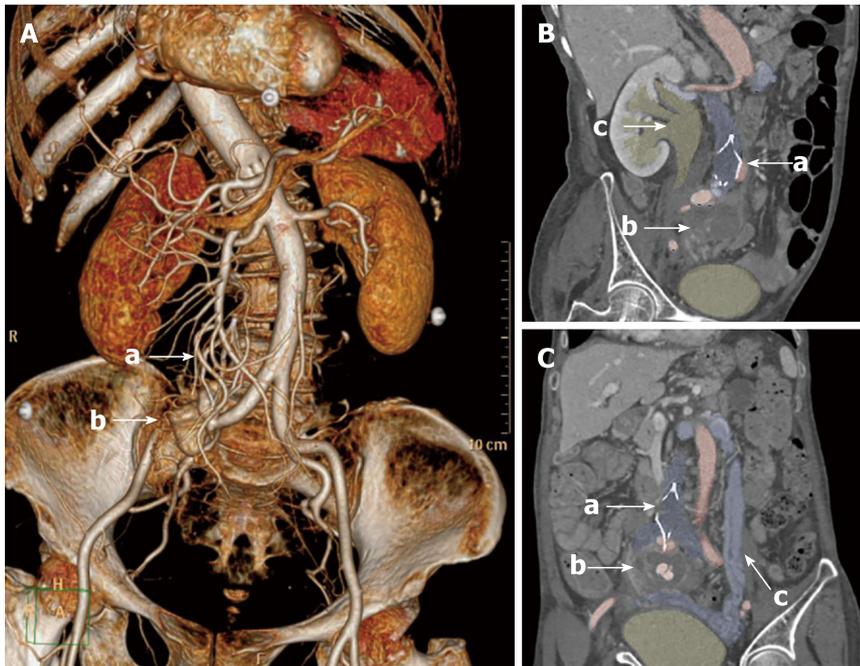


Figure 1 Preoperative computed tomography of patient. A: Preoperative computed tomography indicated the retrieval hook of inferior vena cava filter (arrow a) penetrated into the right common iliac vein and artery causing pseudoaneurysm (arrow b). Scoliosis was also found in the computed tomography scan; B: The right ureter was compressed by the pseudoaneurysm (arrow b) with ipsilateral hydronephrosis (arrow c); C: The infrarenal inferior vena cava and bilateral common iliac veins were occluded with significant pelvic varicosities (arrow d).

pulses were palpable, and the swolleness of the right lower limbs was alleviated. The bacterial culture of peritoneal drain was negative on postoperative day 7. Computed tomography urography and single-photon emission computed tomography renal radionuclide imaging revealed that the right urinary tract was incompletely obstructed, while the bilateral renal function was normal. The patient was discharged on postoperative day 12. She received anticoagulation therapy with 20 mg rivaroxaban *quaque die* and a total of 6 wk antibiotic therapy with 0.4 g moxifloxacin *quaque die* after discharge.

Six-month follow-up showed the patient recovered well without abdominal pains or claudication, and the edema in the right lower limb improved. Laboratory tests showed no signs of infection with normal levels of procalcitonin. Computed tomography angiography revealed that the right external iliac artery and internal iliac artery were patent, and only mild hydronephrosis was detected (Figures 3B and C).

DISCUSSION

Current evidence suggested a high prevalence of IVC penetration in the long-term follow-up of IVC filter, reaching approximately 15%-70% [4]. However, IVC penetrations tend to be asymptomatic in most situations, with a reported rate of 0.4%-8.0% for symptomatic penetration [3,4]. Moreover, few cases in the literature reported symptomatic penetration caused by double-basket IVC filter (a type of non-conical filter). In a systematic review involving 70 longitudinal studies of different types of IVC filter, the caval penetration rate was 5.5% for non-conical IVC filters, but no penetration was detected in double-basket filters, including TrapEase and OptEase filters, similar to the case of the present study [3]. The high risk of fracture in double-basket filters might have contributed to the penetrated complications according to a previous study [4]. However, the filter remained intact in our case, and the penetration was believed to be associated with caudal migration of the IVC filter, which was rather rare in clinical practice, as it was against the direction of blood flow.

To the knowledge of the authors, five cases with caudal migration of the IVC filter have been reported previously [5,6] and only one with double-basket filter, which was thought to be associated with venous thrombectomy using Fogarty embolectomy catheter without fluoroscopy monitoring. A caudal migrated double-basket filter with associated infected iliac pseudoaneurysm has seldom been reported previously.

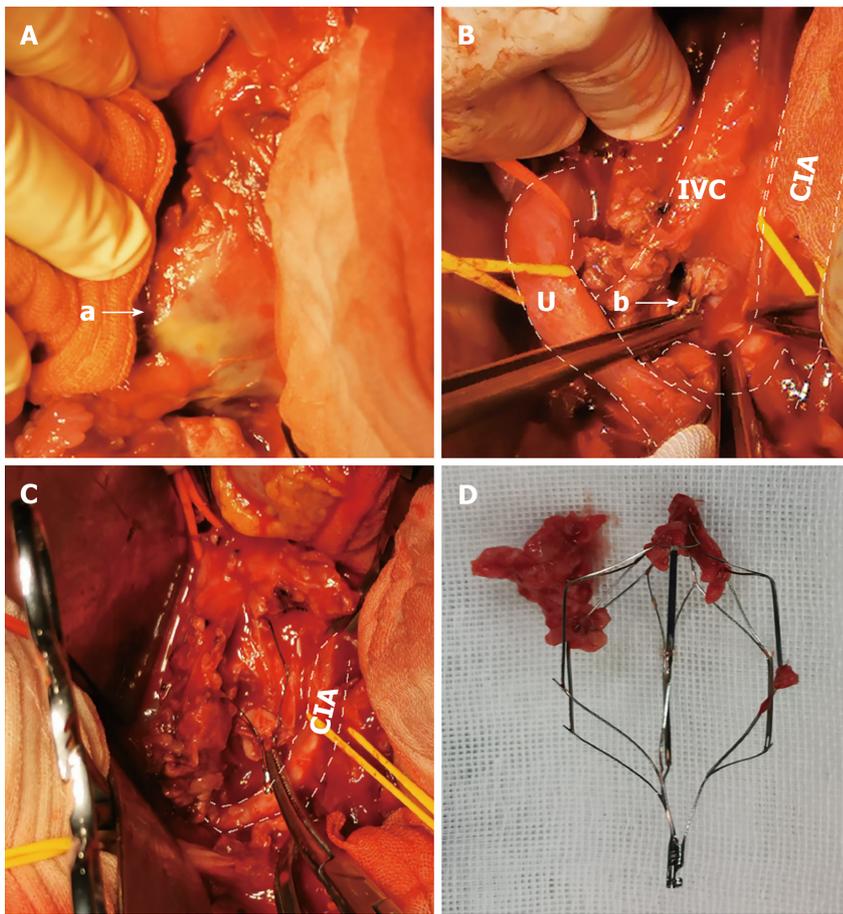


Figure 2 Intraoperative images of patients. A: Right iliac pseudoaneurysm with abscess (arrow a); B: The indwelling inferior vena cava filter (arrow b) penetrated the right common iliac vein and artery, and the ureter was dilated; C: The inferior vena cava filter was embedded in the organized thrombus. The inferior vena cava was open, while no back-bleeding of lumbar veins were found; D: The double-basket Visec WXF-32 IVC filter. Image designations: U: Ureter; IVC: Inferior vena cava; CIA: Common iliac artery.

Considering the surgical history of previously failed endovascular retrieval and that no risk factors of filter migration was detected[5,6], the reason for the caudal migration in our case might be iatrogenic, which could result in an abnormal filter position.

Infected pseudoaneurysm was another relatively rare but intractable complication of IVC filter[7]. In our case, *Staphylococcus aureus*, which is a Gram-positive coccus, was isolated from resected pseudoaneurysm, and massive inflammatory cell infiltration was found in the tissues of the pseudoaneurysm and thrombus in IVC. The findings of tissue culture and pathology examination suggested that the IVC filter might be a potential source of infection. Besides, because the patient had right ureteral obstruction with ipsilateral hydronephrosis caused by pseudoaneurysm, this infection might originate from the urinary tract.

We hypothesize that the caudal migration resulted in abutting of the retrieval hook in the wall of CIV that induced a persistent inflammatory response, and then vascular damage was presented. The filter-associated chronic ilio caval thrombosis somehow 'fixed' the IVC filter in the abnormal position with the retrieval hook against the pulsating right iliac artery resulting in the pseudoaneurysm formation. The right iliac pseudoaneurysm, which occurred with the compression of the right urinary tract, caused ipsilateral hydronephrosis. In addition, the concurrent infection made it more intractable.

According to current guidelines, indwelling retrievable IVC filters should be routinely removed in patients with mitigated pulmonary embolization risk[8,9]. However, the general IVC filter retrieval rates remained low. Thus, the decision for filter placement should be cautiously considered.

For filters unable to be retrieved *via* standard techniques, advanced endovascular techniques were recommended, with high success and low procedure-associated complication rates[9]. In addition, open retrieval was suggested in certain scenarios, including cardiac or pulmonary migration, pseudoaneurysm, and persistent symptoms after failed endovascular retrievals[8,10]. As the migrated IVC filter caused

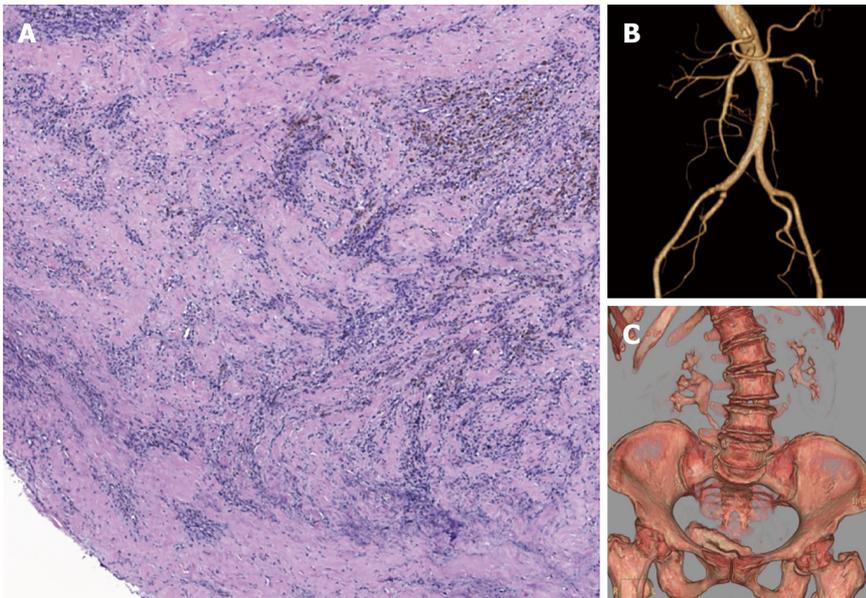


Figure 3 Surgical pathology and 6-mo follow-up computed tomography. A: Organized thrombus of inferior vena cava with massive inflammatory cell infiltration; B: Computed tomography urography indicated mild right hydronephrosis; C: Computed tomography angiography indicated patency of bilateral iliac arteries.

infected pseudoaneurysm with ureteral obstruction and chronic ilio caval thrombosis, an emergency open procedure was appropriate in our case. Debridement of the compromised segment of vessels and hematoma in combination with *in situ* revascularization was applied to the infected pseudoaneurysm, and the compression symptoms were relieved, which was difficult to achieve *via* endovascular approaches.

Antibiotic therapy is another important part of infected aneurysm treatment. As for the duration, the optimal length of antibiotic therapy for infected pseudoaneurysm was controversial and should be individualized, but antibiotic therapy for at least 6 wk to 6 mo postoperatively may be considered according to current consensus[11,12]. In our case, the choice of moxifloxacin was based on the results of culture and sensitivity tests of the resected pseudoaneurysm, which was an effective and relatively safe option for the treatment of patients with intra-abdominal infections. The infected tissue was debrided with no prosthetic material used, and the bacterial culture of peritoneal drain turned negative on postoperative day 7 and day 9. After a 6-wk antibiotic therapy, the patient had no fever, and the laboratory tests indicated normal levels of procalcitonin and leukocyte count, thus, the antibiotic therapy ceased.

The current study indicated that asymptomatic patients with failed endovascular IVC filter retrieval do not require open surgical filter removal the majority of the time, even in the presence of significant filter penetration[13], and the filter-associated thrombus was the major cause of filter retrieval failure[14]. But there is no reliable way to evaluate whether a filter in the ilio caval confluence, even within chronic thrombosis, would result in symptomatic filter penetration. Thus, the decision to leave the filter “permanent” should not be applied lightly, as permanent filters are not permanently harmless for patients.

CONCLUSION

This case demonstrated that an indwelling IVC filter in ilio caval confluence, even ‘embedded’ within organized thrombus, could still cause life-threatening complications, and an improper filter retrieval procedure might be the trigger of all problems. Patients with indwelling IVC filters should undergo regular follow-up, and a more aggressive strategy might be necessary for those patients with filters in an abnormal position to reduce the risk of long-term filter-associated complications. Open procedures remain the effective treatment for indwelling IVC filter with severe complications.

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