

## Vascular Interventions Case Report

# Not so fast with the filter! Is it really in the inferior vena cava?

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### ABSTRACT

Inferior vena cava (IVC) filter placement can lead to rare but sometimes serious complications, including malposition of the IVC filter in a non-target vessel or organ. We present the case of a 74-year-old male who presented to our institution for a percutaneous nephrostomy tube change and was incidentally found to have two IVC filters, one of which was properly positioned in the IVC and one of which was improperly deployed in the right ascending lumbar vein. Venography through the sheath before filter loading and deployment decreases the risk of malpositioning the IVC filter.

**Keywords:** Complication, Inferior vena cava filter, Lumbar vein, Malposition, Venography

### INTRODUCTION

Inferior vena cava (IVC) filters were developed for use in patients with deep venous thrombosis (DVT) and/or pulmonary embolism (PE) as a way to prevent future episodes of PE and to reduce mortality rates associated with venous thromboembolism. As with all procedures, IVC filter placement can lead to rare but serious complications, which may be categorized as access site complications and immediate or delayed device-related complications.<sup>[1-3]</sup> Access site complications include hematoma, venous thrombosis, and arteriovenous fistula. Device-related complications that occur immediately during the procedure include failed filter deployment and filter malposition. IVC filter placement may also be associated with long-term risks of filter migration, filter fracture and embolization, IVC perforation and penetration of adjacent organs, caval thrombosis, DVT, and filter tilting.

### CASE REPORT

A 74-year-old male with a medical history of cerebral vascular accidents, hyperlipidemia, and transurethral resection of the prostate was brought to the hospital by ambulance due to respiratory distress and altered mental status. He was admitted to the hospital after being diagnosed with urosepsis secondary to a right obstructing mid-ureteral calculus associated with hydroureteronephrosis. Interventional radiology was consulted for percutaneous nephrostomy (PCN) tube change.

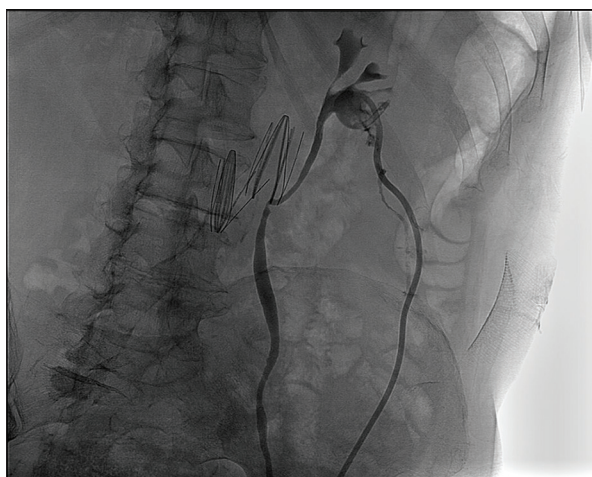
Review of the computed tomography (CT) scan of the abdomen and pelvis before the procedure revealed incidental findings of two IVC filters that had likely been placed many years ago at a

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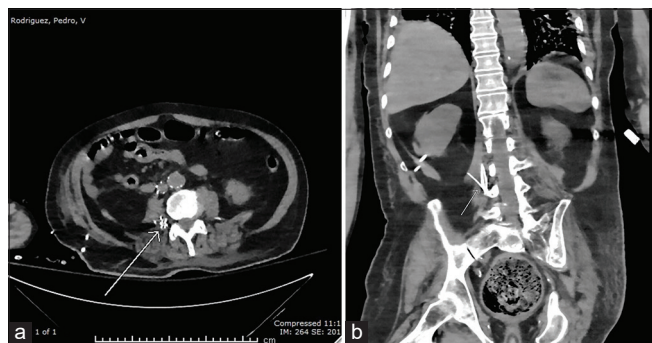
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different institution given the lack of any operative report in our hospital's system. Fluoroscopy during the PCN tube change confirmed the existence of an infrarenal IVC filter in conjunction with a second IVC filter in the right ascending lumbar vein [Figure 1].

We hypothesize that the infrarenal IVC filter was likely placed in this patient after the initially placed IVC filter was discovered to be malpositioned within the right ascending lumbar vein [Figure 2]. The filter used was a VenaTech (B. Braun Interventional Systems, Inc., Bethlehem, Pennsylvania) filter. The procedure was likely performed through a right groin access. After successful cannulation of the femoral vein, cavogram was probably performed with the sheath or a multi-sidehole catheter in



**Figure 1:** A 74-year-old male who presented with respiratory distress and altered mental status secondary to urosepsis. Fluoroscopic image during percutaneous nephrostomy tube change demonstrates two inferior vena cava (IVC) filters simultaneously in the infrarenal IVC and in the right ascending lumbar vein.

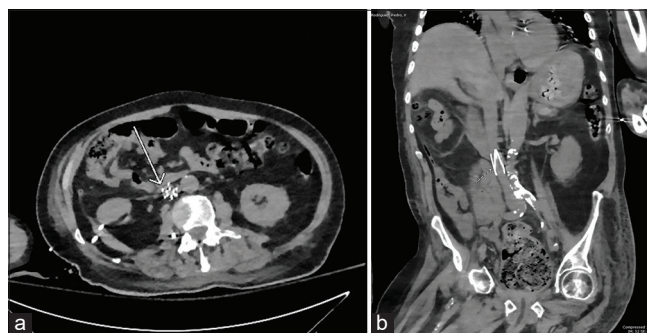


**Figure 2:** A 74-year-old male who presented with respiratory distress and altered mental status secondary to urosepsis. (a) Axial view on non-contrast computed tomography (CT) image shows the inferior vena cava (IVC) filter (white arrow) within the right ascending lumbar vein. (b) Coronal view on non-contrast CT image confirms the abnormal location of the IVC filter (white arrow) within the right ascending lumbar vein.

the common iliac vein. The renal vein inflow into the IVC was identified, and appropriate landmarks for positioning the IVC filter in the infrarenal cava were determined. The wire was then advanced through the sheath, or the sheath was advanced without a wire. Given the similar vertical anatomy and locations of the ascending lumbar vein and IVC, the wire and the sheath were likely unintentionally advanced into the right ascending lumbar vein and positioned at level of the predetermined fluoroscopic landmarks. We deduce that no venogram was performed after appropriate sheath positioning, and the filter was advanced through the sheath and deployed, but the filter failed to expand after deployment. Venogram showed the filter to be in the ascending lumbar vein rather than in the IVC. Once the proceduralist probably realized this error, the sheath was then retracted into the iliac vein and advanced into the IVC. Cavogram was repeated and a second filter was appropriately deployed in the infrarenal IVC [Figure 3].

## DISCUSSION

Filter malposition during IVC filter placement is an uncommon complication of the procedure. However, most malpositions are related to maldeployment of the IVC filter in the wrong location within the IVC as a result of the filter being deployed either too high or too low in relation to the renal vein confluence or are related to significant filter tilt with the hook of the filter against the wall of the IVC or jutting into the inflow of a vein draining into the IVC. Another issue sometimes encountered arises from filter deployment mechanism malfunction, including failure of detachment from the deployment mechanism or failure of opening of the primary or secondary legs of the filter with consequent filter migration. Unintentional deployment of the IVC filter into a vein other than the IVC is much more rarely encountered. We present a case of unintentional IVC filter deployment into



**Figure 3:** A 74-year-old male who presented with respiratory distress and altered mental status secondary to urosepsis. (a) Axial view on non-contrast computed tomography (CT) image shows the inferior vena cava (IVC) filter (white arrow) within the infrarenal IVC. (b) Coronal view on non-contrast CT image confirms proper placement of the IVC filter within the infrarenal IVC.

the right ascending lumbar vein. Although this error may be easily written off as technical incompetence, we saw this as an opportunity to learn the importance of the basic steps of IVC filter placement and the related anatomy. We tried analyzing the errors that could have led to this malposition.

While malposition of the IVC filter is a relatively rare complication, there have been a few unusual cases of IVC filter malposition in other non-target vessels. One case report highlights a scenario in which the IVC filter was deployed in a paraspinal vein.<sup>[1]</sup> Since the IVC filter was already loaded into the sheath, which was revealed to be too low after the guidewire was removed, a paraspinal vein was inadvertently catheterized during an attempt to push the entire apparatus farther up the IVC. In another study, the IVC filter was accidentally placed in the right renal vein because the venogram was performed from the right renal vein, which appeared unusually vertical due to the patient's contorted body position.<sup>[4]</sup> There have been four recognized cases of the IVC filter malposition in the right gonadal vein.<sup>[5-8]</sup> One of those cases involved a significantly dilated right ovarian vein that was confused for the IVC because of infrarenal IVC agenesis.<sup>[5]</sup> On the post-procedure scan, the dilated right ovarian vein was distinguished from the IVC by finding the ovarian vein communicating with the pelvic varicosities and the IVC communicating with the bilateral common iliac veins. Other factors that may lead to malpositioning include suboptimal access route and intraprocedural technique. A pre-deployment venogram through the sheath can help differentiate the IVC from the right gonadal and other non-target veins. In another report describing IVC filter placement through a right cubital venous approach, the tip of the sheath accidentally became lodged in the right renal vein and was pulled back as far as the level of the right atrium to change the direction of the tip. Because the IVC filter could not be pulled back from the sheath during this maneuver, inadvertent pushing of the dilator released the filter from the sheath into the right atrium. The IVC filter subsequently migrated to the right ventricle.<sup>[9]</sup>

Although anatomic variants are abundant, special consideration should be given to certain veins or organs during IVC filter placement due to their vertical paracaval orientation [Table 1]. To prevent operator error during IVC

**Table 1:** Common non-target locations of inferior vena cava filter malposition and their associated access routes.

Non-target vessel/organ	Associated approach
Ascending lumbar vein	Femoral
Gonadal veins	Jugular
Paraspinal veins	Jugular, femoral
Renal vein	Jugular

filter placement, the strategies listed below may help avoid adverse outcomes:

- If available, review the CT scan of the abdomen and pelvis before IVC filter placement to become familiar with the patient's anatomy, particularly the IVC and its relation to other venous structures
- The sheath should not be advanced without a wire, and final sheath position should be checked with a venogram. Do not skip over the pre-deployment venography through the deployment sheath after advancing the sheath to its final position
- If there is any suspicion of filter maldeployment, post-deployment venogram should be performed.

## CONCLUSION

IVC filter malpositioning into paracaval veins is a rare preventable complication of IVC filter placement. Performing a venogram after final caval sheath positioning, before loading/deploying the IVC filter, is a critical step in IVC filter placement technique and should not be omitted.

## Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

## REFERENCES

1. Funaki B. Inferior vena cava filter malposition in a paraspinal vein. *Semin Intervent Radiol* 2006;23:298-302.
2. Grewal S, Chamarthy MR, Kalva SP. Complications of inferior vena cava filters. *Cardiovasc Diagn Ther* 2016;6:632-41.
3. Rao B, Duran C, Steigner ML, Rybicki FJ. Inferior vena cava filter-associated abnormalities: MDCT findings. *AJR Am J Roentgenol* 2012;198:W605-10.
4. Jaber B, Arslan B, Ahmen O, Turba UC, Tasse J, Madassery S. Inadvertent noncaval filter deployment and its management. *J Vasc Surg Cases Innov Tech* 2019;5:360-4.
5. Ding PX, Han XW, Liu C, Ren KW. Inferior vena cava filter misplacement in the right ovarian vein and successful removal by loop-snare technique in a patient with inferior vena cava agenesis. *J Vasc Surg Cases Innov Tech* 2018;4:324-6.
6. Kazmers A, Ramnauth S, Williams M. Intraoperative insertion of Greenfield filters: Lessons learned in a personal series of 152 cases. *Am Surg* 2002;68:877-82.
7. Sharma S, Mukund A, Agarwal S, Srivastava DN. Case of a

misplaced IVC filter: A lesson to learn. *Cardiovasc Intervent Radiol* 2010;33:880-2.

8. Tan WP, Sherer BA, Khare N. Unfriendly filter: An unusual cause of hydronephrosis and hematuria. *Urology* 2016;87:e9-10.
9. Wakabayashi Y, Takeuchi W, Yamazaki K. Inferior vena cava filter misplacement in the right atrium and migration to the right ventricle followed by successful

removal using the endovascular technique: A case report and review of the literature. *SAGE Open Med Case Rep* 2015;3:2050313X15595833.

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