

Percutaneous Removal of an IVC Filter From the Right Atrium

New-onset heart murmur leads to the discovery of a retrievable inferior vena cava filter that migrated to the heart.

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For many decades, inferior vena cava (IVC) filters have been routinely placed in patients to prevent pulmonary embolism (PE), particularly in those who are poor candidates for systemic anticoagulation. In the following case, iatrogenic IVC filter migration to the heart was discovered after observing a new heart murmur, and the device was retrieved percutaneously.

CASE REPORT

The patient was a 51-year-old man with a history of PE, hypertension, and a cerebral vascular accident, who underwent placement of an OptEase retrievable IVC filter (Cordis Corporation, Bridgewater, NJ) 1 month before presenting at our facility. At the time of placement, an IVC filter was deemed most appropriate when compared to systemic anticoagulation, because the patient had recent history of peptic ulcer disease. Approximately 1 month after placement, the patient was evaluated by his primary care physician, who detected a new heart murmur. During this visit, the patient had no complaints and was experiencing no cardiovascular-related symptoms. Subsequently, an echocardiogram was obtained to evaluate the new murmur,

which revealed the presence of a foreign body within the right atrium (RA). The foreign body was then confirmed to be the IVC filter, and the patient was transferred to our institution. A chest x-ray (Figure 1) confirmed the presence of the filter within the RA.

Completion abdominal x-ray images (Figure 2) that were obtained from the outside hospital post-IVC filter placement illustrate the filter at the appropriate level but having the incorrect orientation. The hook used for filter retrieval is seen superiorly, pointing away from its access site, which is a 180° deviation from its proper orientation.

After a discussion regarding removal of the device with

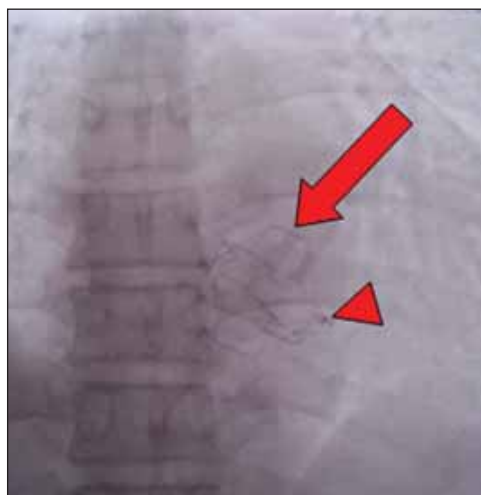


Figure 1. IVC filter in the RA as shown on chest x-ray (arrow). The retrieval hook (arrowhead) is pointing toward the tricuspid valve, away from the access site.

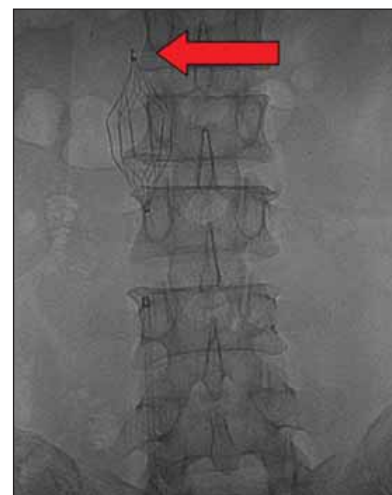


Figure 2. IVC filter shown on an abdominal x-ray on day 2 after filter placement. Note the retrieval hook (arrow) oriented superiorly away from the access site.

the patient and his family, it was decided that a percutaneous approach would be attempted first to identify if the filter could be engaged and removed. If unsuccessful, an open heart approach for retrieval would be necessary.

After satisfactory intravenous sedation, the skin and subcutaneous tissues over the right groin were infiltrated with local anesthetic, and a micropuncture needle was used to access the right common femoral vein. A guidewire was placed into the IVC under fluoroscopy followed by an 8-F–long sheath that was placed at the level of the RA. A variety of directional catheters and wires were employed in an attempt to engage the retrieval hook. Interestingly, the filter was oriented somewhat obliquely, with the retracting hook away from the opening of the right atrium (Figure 1) and against the tricuspid valve.

Eventually, a Glidewire (Terumo Interventional Systems, Somerset, NJ) was advanced into the RA and past the filter with the help of a multipurpose catheter directed toward the tricuspid valve. The multipurpose catheter was then exchanged for an Amplatz GooseNeck snare catheter (Covidien, Mansfield, MA). The Glidewire was removed, and the snare was advanced. With manipulation, the filter was turned, and the hook was engaged. Gentle retraction was applied, and the filter was retrieved after collapsing into the 18-F sheath. This maneuver enabled removal of the filter in its entirety. Postoperatively, the patient made an uneventful recovery and was discharged home in stable condition on postoperative day 1. A follow-up echocardiogram was unremarkable, with no signs of damage to the heart valves.

DISCUSSION

In 1868, Armand Trousseau suggested interruption of the IVC to prevent PE.¹ It was not until a century later that a transvenous interruption device resembling the earliest of today's filter generations was used.^{2,3} There have been extensive revisions and adjustments made to various types of filters to improve their function and decrease the risks associated with their use. However, risks associated with IVC filters continue to persist, including local complications related to the insertion, deep vein thrombosis at the site of insertion, filter migration, filter erosion of the vessel wall, filter fracture, IVC thrombosis, and inadvertent placement into the arterial system.^{3,4} Furthermore, filter migration to the renal veins, suprarenal IVC, RA, right ventricle, and the pulmonary artery have been reported.

Filter migration, particularly to the heart, is a rare complication that occurs in 0.1% to 1.2% of procedures, depending on the filter type used.^{5,6} It may occur due to technical or procedural errors (as seen in this case), poor contact between the filter and the IVC, or an increase in

IVC filter diameter due to increased abdominal pressure and extraneous physical activity, contact with the filter during future manipulations (such as central line placement), or a thrombus pushing the filter proximally.⁷⁻¹¹ Intracardiac migration may remain asymptomatic, but acute myocardial infarction, significant arrhythmia, pericardial tamponade, and severe valvular (tricuspid) insufficiency have been reported.^{12,13}

As in this case, proper imaging review of the intraoperative or postoperative IVC filter placement may have prevented future complications and the possible need for intervention. It is suspected that the filter was deployed in a reverse orientation. Because of this, the side struts that are designed to point superiorly and help to maintain the filter in its intended location would be pointing inferiorly, rendering them ineffective. In this case, the patient presented solely with a new holosystolic murmur, indicating possible tricuspid regurgitation. Patients who are symptomatic secondary to intracardiac migration of an IVC filter typically present with symptoms similar to a myocardial infarction or a PE (ie, chest pain, shortness of breath, tachycardia, and hypotension).¹⁴ The most severe complications that are seen with filter migration are arrhythmia and sudden cardiac death due to myocardial rupture.

If intracardiac filter migration is suspected, a transesophageal echocardiogram would provide detailed anatomic information and aid in determining whether percutaneous removal is feasible. Management is based on several factors, including the degree of cardiac dysfunction, the ease of percutaneous removal, the patient's ability to withstand open removal via sternotomy, and operator experience.¹³ Interestingly, the first successful percutaneous retrieval of an IVC filter from the RA was described by Greenfield et al in 1977.¹⁵ However, these techniques are not standardized, and results are largely operator dependent.

CONCLUSION

Due to the relatively low incidence of IVC filter migration to the heart and wide variety between cases reported (filter type, location, etc.), there are mixed reports on treatments for IVC filters that are displaced in the heart, ranging from close monitoring to open heart surgery for removal.^{16,17} Nevertheless, the percutaneous approach is a desirable option due to its association with decreased morbidity, ability to alleviate the need for major operative intervention, and reduced hospital stay and cost.⁶ Finally, it is essential for physicians to pursue any suspicion of filter migration for patients with IVC filters, such as signs of right-sided heart failure, arrhythmias, murmurs, and other cardiovascular-related symptoms. ■

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