» **Case Report** «

Penetration of an Inferior Vena Cava Filter into the Aorta

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Transvenous placement of inferior vena cava (IVC) filters is commonly performed in selected patients with deep venous thrombosis and pulmonary embolism. However, filter placement is sometimes associated with serious complications. A common complication is asymptomatic perforation of the IVC and penetration of adjacent organs by the filter. Here, we report a case of an 83-year-old man whose prophylactic IVC filter penetrated the aorta. The patient was closely followed without surgical intervention for more than a year, and no additional complications were observed.

Keywords: deep venous thrombosis, inferior vena cava filter, penetration

Introduction

Venous thromboembolism is a common disease associated with significant morbidity and mortality. Pulmonary embolism (PE) is best prevented by anticoagulation management, and use of an inferior vena cava (IVC) filter can be advantageous in cases where anticoagulant medication is contraindicated or ineffective.¹⁾ However, implanted IVC filters sometimes produce clinically significant complications such as IVC thrombosis or penetration of adjacent organs.^{1–3)} We report a case in which one of the hooks of an IVC filter penetrated the aorta.

Case Report

An 83-year-old man presented to our hospital with complaints of right leg pain and respiratory discomfort. His medical history included hypertension, prostate

cancer, and obesity. Computed tomography (CT) showed deep venous thrombosis (DVT) in the right iliofemoral vein and multiple bilateral PE. Lung infarction was suspected in the right upper lobe. He was admitted to the Department of Cardiovascular Internal Medicine at our hospital, and anticoagulant therapy (heparin) was initiated.

A CT scan on day 7 showed residual DVT in the right iliofemoral vein. A predeployment venogram did not show any abnormalities in the IVC, and a retrievable ALN filter (ALN Implants Chirurgicaux®, Ghisonaccia, France) was placed in the lumen of the IVC without difficulty by cardiovascular physicians; the filter was inserted below the renal veins via the right jugular vein. Plain abdominal radiography, a cavagram, and CT showed that the filter was located at the L2 level (**Fig. 1**). Anticoagulant therapy (warfarin) was continued. The patient was discharged 17 days after the filter was implanted. Because his prostate cancer was in an advanced stage and his prognosis was poor, cardiovascular physicians decided not to remove the filter.

The patient remained asymptomatic for 1 year and 4 months after discharge, at which point he returned to our institution for a follow-up examination for prostate cancer. A CT scan revealed that one of the struts of the filter had perforated the IVC wall and was deeply embedded in the aortic lumen, while

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Fig. 1 (A) Plain abdominal radiography shows the filter is located at the L2 level. (B) A cavagram shows no abnormalities in the aorta or the wall of the IVC. (C) Computed tomography (axial view) shows no abnormalities in the aorta or the wall of the IVC. IVC: inferior vena cava.

the other struts remained in the lumen of the IVC (Fig. 2). Vital signs were normal, no evidence of aortocaval fistulas or pseudoaneurysms was found, and no other obvious defects in the IVC were noted. Physicians in the Department of Cardiovascular Internal Medicine asked us to examine the patient at this time. Because he was asymptomatic, he was carefully monitored via CT every 6 months. Anticoagulant therapy with warfarin was continued. The patient is doing well 1 year after the diagnosis of IVC wall and aortic penetration.

Discussion

An IVC filter is indicated for secondary prophylaxis in patients with acute DVT who cannot receive

anticoagulant therapy because of major bleeding, pending surgery, or severe, prolonged thrombocytopenia and in patients with recurrent PE under adequate anticoagulation treatment.⁴⁾

Although IVC filters can be safely implanted in most cases, they sometimes penetrate the venous wall and damage surrounding organs including the aorta, duodenum, and ureter.⁵⁾ This situation is difficult to diagnose without CT or angiography because most patients do not display any symptoms.⁶⁾ In stable patients with evidence of bleeding, angiography can be used to establish a diagnosis and a treatment strategy such as embolization and stent graft placement.

IVC filters carry risks associated with insertion procedures, device failure, and delayed complications caused by the filters. Periprocedural complications

Fig. 2 (A, B) Computed tomography of the abdomen shows penetration of the IVC wall and aorta by the filter's hook. IVC: inferior vena cava.

Fig. 3 Plain abdominal radiography demonstrates filter malposition and leg expansion.

include those related to the puncture site or delivery system and malposition, tilting, or incomplete opening of the filter.⁴⁾ Delayed complications include migration or disruption of the filter and penetration of the IVC wall by the filter.^{3,4)} In our case, penetration of the IVC wall and aorta was detected 1 year and 4 months after the filter was inserted.

Complications related to insertion of IVC filters occur in 4%–11% of patients, but result in death in only approximately 0.12% of patients.¹⁾ IVC penetration by permanent IVC filters varies widely from 3.5% to 38% depending on the filter type.³⁾ Previous reports suggest that permanent and retrievable filters are similar in terms of safety and efficacy.⁷⁾ There are no reports examining the difference between the

perforation rates of retrievable and permanent IVC filters. In our case, the patient received a retrievable ALN filter, which has been reported to be a relatively safe device with a low rate of major complications.⁸⁾

Pulsation of the aorta and respiratory motion are considered to be the main causes of caval perforation by the filter leg,¹⁾ and a previous study suggests that IVC filters with smaller diameters have an increased incidence of penetration.²⁾ In our case, no clear predisposing factor could be identified. However, by comparing “before and after” plain abdominal radiography images, malpositioning and alterations in the shape of the filter could be discerned after penetration (Figs. 1A and 3). In addition, CT showed that the aorta was tortuously bent to the right, which may have contributed to IVC penetration. It is difficult to detect IVC penetration via plain abdominal radiography; however, filter malposition and leg expansion may be predictors of penetration.

In the case described here, the patient underwent plain CT analysis every 6 months. There are no previous reports addressing the appropriate frequency of clinical imaging examinations in patients with IVC filters. However, considering the clinical course of this case, close observation with plain abdominal radiography and CT every 6 months is reasonable. To the best of our knowledge, this is the first report of simultaneous caval and aortic penetration by an IVC filter in a patient who survived for more than a year without surgery.

Although most retrievable IVC filters are initially inserted for temporary purposes, approximately 50% are not retrieved.⁹⁾ An unresolved issue is, how long they can be left in place? It is generally recommended that they be retrieved within 10–14 days after insertion.

Longer times can hinder their removal because of the adherence of fibrotic material to their struts. Epithelialization of the struts of retrievable IVC filters is also a concern and has been observed within 12 days after placement.¹⁰⁾ Exactly how long various retrievable IVC filters can remain in place before they can no longer be safely removed requires further study. Retrievable filters should be removed as soon as they are no longer needed. However, in cases where a retrievable IVC filter has to remain in place for an extended period, close observation with clinical imaging is necessary in order to detect delayed device-related complications.

Conclusion

Implanted IVC filters sometimes cause serious complications, which may evolve asymptotically. We suggest that patients with implanted IVC filters, even those who are asymptomatic, should receive careful plain abdominal radiography and serial CT analysis during their follow-ups. Retrievable filters should be removed as soon as they are no longer needed. In cases where IVC filters penetrate the aorta, the patient can be observed by regular follow-ups without surgery.

Disclosure Statement

All authors have no conflicts of interest to declare.

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