Successful Endovascular Removal of a Perforated Inferior Vena Cava Filter Complicated by a Large Retroperitoneal Hematoma: Pitfall of Catheter-Directed Thrombolysis

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Abstract

Keywords

- ▶ deep vein thrombosis
- ▶ IVC filter complications
- ▶ IVC wall penetration
- ▶ thrombolysis
- ▶ endovascular procedure

Symptomatic caval perforation is rare complication after inferior vena cava (IVC) filter insertion. A 44-year-old woman developed back pain after the placement of retrieval IVC filter during catheter-directed thrombolysis (CDT). Her computed tomography showed a large right-sided retroperitoneal hematoma. After 2 weeks, endovascular removal of the perforated filter was successfully performed without complication. Because thrombolytic agents can accelerate bleeding caused by endovascular procedures, the bleeding rate of the IVC filter deployment during CDT might be higher than expected.

Treatment for extensive iliofemoral deep vein thrombosis is challenging, because patients treated with anticoagulation agents are still at high risk for developing recurrent thrombosis or postthrombotic syndrome, including edema, eczema, leg ulcers, and venous claudication. In addition, the optimal use of advanced therapies, such as thrombolysis and catheter-based interventions, remains uncertain.¹ Recently, a randomized control trial investigating the efficacy of catheter-directed thrombolysis (CDT) was conducted, and the results were encouraging. CDT improved the long-term outcome after iliofemoral deep vein thrombosis by reducing the incidence of postthrombotic syndrome compared with conventional treatment.² Here, we report a case of iliofemoral deep vein thrombosis that developed a large retroperitoneal hematoma caused by the perforation of an inferior vena cava (IVC) filter during CDT.

Case Presentation

A 44-year-old woman, with a history of oral contraceptive use, was hospitalized for phlegmasia cerulea dolens of her left

leg. A laboratory examination revealed mild inflammation with an increased C-reactive protein level of 1.55 mg/dL, white blood cell count of 14,540/mm³, elevated D-dimer level of 36.0 µg/mL, and fibrinogen degradation product level of 49.8 µg/mL. Other basic laboratory data were normal including activated partial thromboplastin time (APTT) of 32.8 seconds prothrombin time (PT) of 1.10 international normalized ratio (INR), fibrinogen level of 284 mg/dL, antithrombin III complex activity of 90%, protein S activity of 84.4%, and protein C activity of 127%. Emergent eight-row computed tomography (CT), with intravenous contrast, of the chest, abdomen, and lower extremities demonstrated extensive left-sided iliofemoral-popliteal deep vein thrombosis due to iliac vein compression (▶ Fig. 1A), and confirmed no evidence of pulmonary embolism. Therefore, a retrievable IVC filter (ALN Implants Chirurgicaux, Bormes les Mimosas, France) was immediately inserted from the right internal jugular vein. Subsequently, CDT with a Fountain infusion catheter (Merit Medical Systems Inc., South Jordan, UT) and urokinase (480,000 U/day) was started after the placement of a 4-French

Fig. 1 (A) Image with 8-row computed tomography (CT) of the pelvis with intravenous contrast showing left-sided iliofemoral deep vein thrombosis due to iliac vein compression on day 1. (B) Image with 8-row CT of the abdomen with intravenous contrast showing a large right-sided retroperitoneal hematoma ($6 \times 5 \times 12$ cm) on day 7. (C) Image with 64-row multidetector CT of the pelvis with intravenous contrast showing resolution of left-sided iliofemoral deep vein thrombosis on day 22. (D and E) Images with 64-row multidetector CT of the abdomen with an intravenous contrast showing the penetrated struts of the filter (arrowheads) on day 22. Abbreviations: rt.CIA, right common iliac artery; rt.CIV, right common iliac vein; lt.CIA, left common iliac artery; lt.CIV, left common iliac vein; T, thrombus.

sheath in the left popliteal vein and venous angioplasty of the iliofemoral veins as reported previously by Yamada et al³ (►Fig. 2A–D). On day 3, the CDT was replaced by anticoagulation therapy with intravenous heparin (15,000–25,000 U/day controlled by APTT at the values of $1.5\text{--}2.5 \times$ the standard value) because venography of her left leg confirmed fair reflow with a minor residual thrombus. Her leg pain was relieved, and the edema of her left leg was improved considerably. On day 7, she suddenly complained of right-sided back pain with a slight decrease in the hemoglobin level from 13.9 to 10.1 g/dL. Repeat CT showed a large right-sided retroperitoneal hematoma ($6 \times 5 \times 12$ cm) from the L2 to S1 vertebral levels along the right iliopsoas muscle (►Fig. 1B). With the discontinuation of heparin, her complaints were relieved. After 2 weeks, 64-row multidetector CT confirmed the diminishing size of the retroperitoneal hematoma, clearly demonstrated the penetrating struts of the IVC filter to the hematoma (►Fig. 1D, E), and confirmed the absence of deep vein thrombi in both legs including a residual thrombus in the left iliofemoral vein (►Fig. 1C). After receiving informed consent from the patient, we decided to remove the perforated IVC filter percutaneously to avoid the risk of re-bleeding. On day 23, with the vascular surgery team on standby, the filter was successfully retrieved in the routine fashion using a dedicated retrieval catheter and a sheath from the right

internal jugular vein (►Fig. 3A–C). Special attention was paid during the maneuver; the filter was cautiously retracted within the sheath to confirm the lack of IVC wall tenting by the struts and to prevent the struts from closing outside of the IVC. There was no contrast extravasation on the postretrieval vena cavogram (►Fig. 3D). Additionally, a venogram from the left common femoral vein revealed fair reflow with residual stenosis by iliac vein compression; however, no thrombi were detected in the left iliofemoral vein (►Fig. 2E). Because the patient refused venous stent implantations, no further catheter interventions were performed. The patient was transferred to the intensive care unit for overnight observation. The day after the filter removal, intravenous heparin was restarted and then replaced by oral warfarin controlled by PT at 1.5 to 2.5 INR. Her in-hospital course was uneventful, and she was discharged on day 31 with a prescription of warfarin at 4 mg/day. Five months later, she was stable on oral warfarin without recurrence of deep vein thrombosis.

Discussion

The use of a retrievable IVC filter is an alternative to permanent filters that provides protection from pulmonary embolism and reduces the long-term risks associated with a permanent IVC filter. Radiological examinations such as CT have shown that

Fig. 2 (A) Fluoroscopic image of the inserted inferior vena cava filter. (B) Venogram of the left common femoral vein showing massive thrombotic occlusion of the vessel. (C) Fluoroscopic image of the venous angioplasty using a balloon catheter (7 × 40 mm). (D) Placement of the Fountain infusion catheter on day 1. (E) Venogram of the left common femoral vein showing fair reflux with residual stenosis, without thrombus on day 23.

retrievable filters may fracture, migrate, become embed in the IVC wall, or penetrate through the IVC wall. However, retrievable IVC filters can be removed safely using routine procedures.^{4,5} To date, major complications associated with the IVC filters have been reported uncommon.^{6,7} Indeed, symptomatic penetrations, such as gastrointestinal bleeding, aortic perforation, and retroperitoneal hemorrhage, are very rare with a reported overall incidence of only 0.3%.⁸

According to the current American Heart Association's scientific statements regarding venous thromboembolism, the placement of a retrievable IVC filter for iliofemoral deep vein thrombosis is "reasonable" for a time-limited indication (Class IIa; Level of Evidence C).¹ We routinely deploy a retrievable IVC filter during CDT for the purpose of preventing pulmonary

embolism triggered by thrombus dislodgement. In the CaVenT study, 20 cases of CDT-related bleeding were reported (20/90; 22%). However, the rate of IVC filter deployment during CDT and its associations to the bleeding complications were not discussed.² Because thrombolytic agents can accelerate bleeding caused by endovascular procedures, the bleeding rate of the IVC filter deployment during CDT might be higher than expected.

The variability of thrombolytic agents may also contribute to the complications. Instead of tissue plasminogen activator (TPA), which is commonly used for CDT in Europe and the United States of America, we used urokinase as previously described,³ because the Japan Ministry of Health, Labor and Welfare does not approve the use of TPA for peripheral venous thromboembolism. Since urokinase does have more

Fig. 3 (A) Fluoroscopic image of the inserted inferior vena cava filter. (B) Pre-retrieval cavogram with the filter. (C) Fluoroscopic image of the filter removal. (D) Post-retrieval vena cavogram showing no contrast extravasation on day 23. The arrowhead indicates the penetrated struts of the filter.

unfavorable effects than TPA, such as the consumption of serum fibrinogen, the monitoring of fibrinogen level as well as APTT and PT might ensure its safe administration.

The treatment of symptomatic penetrations of retrievable IVC filters includes different therapeutic options, such as conservative treatments, endovascular techniques, and surgical interventions. In most cases, filter removal was abandoned,⁹ or the IVC filter was removed surgically in patients with unstable conditions despite discontinuation of anticoagulation therapy.¹⁰ To our knowledge, only a few cases have been reported in which the perforated IVC filter causing a retroperitoneal hematoma was removed percutaneously.^{8,11} Our patient's condition was successfully stabilized by the discontinuation of heparin. We then observed the patient for 2 weeks to exclude the possibility of active bleeding during the IVC wall healing process. However, without the use of anticoagulants, the IVC filter can be thrombosed, creating another complex clinical problem.¹² We believed that filter removal at this time would be accompanied by a lower risk of re-bleeding and minimized the observational period without anticoagulants, because the endovascular maneuver of the filter removal would be easier and simpler than if performed later, and leaving the perforated filter in the IVC might have the potential to cause re-bleeding with trunk movement after restarting anticoagulants.

In addition, the use of 64-row multidetector CT, which could visualize the details of the local anatomy, helped confirm the absence of filter fractures, the involvement of other organs, or the filter tilting, which could complicate the procedure. If the filter was tilted, or accompanied by the above-mentioned findings, we would not have chosen endovascular removal and would have considered surgical removal, as we believed that a complex endovascular procedure would be dangerous and increase the patient's risk of re-bleeding. Fortunately, the interval after filter placement was not long (~3 weeks) and the filter was not tilting in the IVC without other critical findings, so we could perform the endovascular retrieval maneuver without difficulty using biplanar X-ray fluoroscopy followed by anticoagulation therapy consisting of heparin and warfarin.

In conclusion, with the careful medical assessments and supports afforded by the current diagnostic imaging techniques, the endovascular retrieval of an IVC filter can be safely performed in selected patients who have a retroperitoneal hematoma resulting from the filter perforation, although routine filter removal in this setting is not recommended. Further studies are needed to confirm the safety of IVC filter deployment during CDT. Moreover, special attention should be paid when a retrievable IVC filter is placed in patients who are scheduled to undergo CDT.

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