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Case Report

Successful multi-step catheter intervention for thrombotic inferior vena cava filter retrieval



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ABSTRACT

A 45-year-old man, who was implanted with an inferior vena cava (IVC) filter in his infrarenal IVC, had a complication of deep vein thrombosis (DVT) propagation from the IVC, beyond the IVC filter, to the right calf and left external iliac veins. The entire IVC filter was covered with a massive thrombus. We first decided to retrieve the IVC filter itself, which was suspected of causing allergic reaction. The thrombotic IVC filter was successfully retrieved using multi-step catheter intervention. To our knowledge, this is the first case report to describe successful multi-step catheter intervention for retrieval of an IVC filter covered with a massive thrombus.

<Learning objective: Inferior vena cava (IVC) filter thrombosis is one of the most serious IVC filter complications. It is difficult to retrieve the IVC filter covered with a massive thrombus. Multi-step catheter intervention technique may be useful to retrieve an IVC filter with thrombotic occlusion.>

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Introduction

Thrombotic inferior vena cava (IVC) occlusion after IVC filter implantation is the most common cause of acquired IVC thrombosis [1]. Herein, we describe a case of successful multi-step catheter intervention for retrieval of an IVC filter, which was completely covered with an extensive thrombus relating to hyper-eosinophilia. Catheter-directed thrombolysis (CDT) and percutaneous transluminal angioplasty (PTA) were performed for residual deep vein thrombosis (DVT) after IVC filter retrieval.

Case report

A 45-year-old man presented to a nearby hospital with a sudden onset of right leg swelling in September 2016. Enhanced computed tomography (CT) revealed proximal DVT from the right common iliac vein to the right calf vein and pulmonary embolism (PE) in the right pulmonary artery without right ventricular overload. An ALN

IVC filter (ALN Implants Chirurgicaux, Ghisonaccia, France) was implanted in the infrarenal IVC, and unfractionated heparin was given as a continuous intravenous infusion and the dose was adjusted to keep activated partial thromboplastin time at 1.5–2.0 times higher than normal limit. This was overlapped and followed by vitamin K antagonist administration. Prothrombin time-international normalized ratio was 2.0–3.0 within optimal range. On the eighth day of admission, a follow-up enhanced CT revealed the DVT propagation from the renal IVC beyond the IVC filter (Fig. 1A) to the right calf vein and left external iliac vein (EIV). The entire IVC filter was covered with a massive thrombus (Fig. 1B). The patient was referred to our center for further treatment.

On physical examination, the patient's blood pressure, heart rate, and oxygen saturation were found to be 104/62 mmHg, 93 beats/minute and regular, and 97% in room air, respectively. His legs were severely swollen. The blood test results were as follows: white blood cell count, 22,800 cells/ μ L (neutrophil 36%, eosinophil 50.0%); platelet count, 31,000 cells/ μ L; aspartate aminotransferase, 70 U/L; alanine aminotransferase, 102 U/L; serum urea nitrogen, 21 mg/dL; creatinine, 0.84 mg/dL; international normalized ratio of prothrombin time, 2.16; activated partial thromboplastin time, 44 s; D-dimer, 23.7 μ g/ml. The diagnosis of heparin-induced thrombocytopenia (HIT) was

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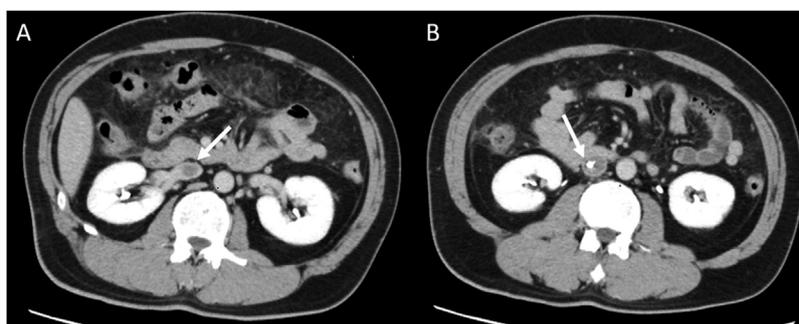


Fig. 1. (A) Enhanced computed tomography image showing the deep vein thrombosis propagation at the renal inferior vena cava (IVC) (white arrow). (B) The head of the IVC filter is completely covered with a massive thrombus (white arrow).

confirmed by the serological assays after HIT suspicion. Although 15 mg of rivaroxaban was administered orally twice daily (instead of warfarin, because of suspected drug allergy), the eosinophilia remained. We therefore decided to retrieve the IVC filter, which was suspected as a potential cause of the hyper-eosinophilia. Bilateral venography revealed DVT from the IVC to the right popliteal vein (Fig. 2A) and left EIV (Figs. 2B and 3A, Supplementary File 1). First, PTA (Power Flex Pro 10 mm, Cordis, Hialeah, FL, USA) was performed for recanalization of the IVC via the left femoral vein (Fig. 3B: first step). Despite recanalization of blood flow through the IVC, the filter head was out of the recanalized root (Fig. 3C, Supplementary File 2). Exposing the filter head into this root with the balloon displacement technique was successful (Fig. 3D, Fig. 4: second step). However, the filter could not be retrieved with the ALN recovery kit via the right internal jugular vein because the thrombus attached to the head of the IVC filter was too large for the retrieval device (Fig. 3E, Supplementary File 3) because of the extensive thrombus attached around the IVC filter. We decided to remove IVC filter

to suprarenal IVC without DVT. The IVC filter was then fixed with an 8-Fr multipurpose guiding catheter by using the loop snare technique and was pulled up to the suprarenal IVC without the thrombus (Fig. 3F, Supplementary File 4 and Fig. 3G, Supplementary File 5, and Fig. 5: third step). Eventually, the filter could be successfully retrieved with the ALN recovery kit (Fig. 3H, Supplementary File 6: final step). After the IVC filter was retrieved, the eosinophil count recovered to its normal range. The patient's leg symptoms did not improve owing to residual and extensive DVT even though the anticoagulant therapy and elastic compression had been continued. An additional intervention for IVC thrombosis was required. We performed CDT for bilateral DVT for six days. In addition, PTA from the right common femoral vein to the right superficial femoral vein was performed because of residual stenosis after CDT. Final venography revealed recanalization of bilateral DVT (Fig. 2C and D), and the leg symptoms markedly improved. The patient was discharged from the hospital with elastic compression stockings and a prescription for 15 mg of rivaroxaban to be taken once daily.

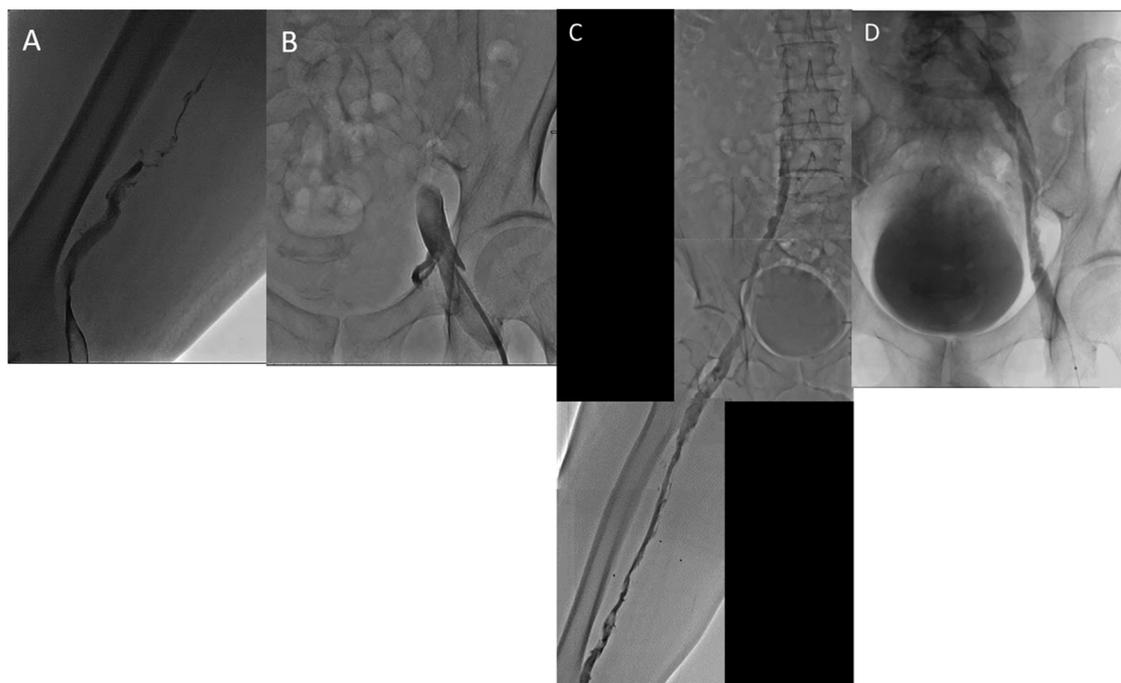


Fig. 2. (A) Right venogram showing deep vein thrombosis (DVT) from inferior vena cava (IVC) to the right popliteal vein before catheter intervention. (B) Left venogram showing DVT from IVC to the left external iliac vein before catheter intervention. (C) Final venogram showing the recanalization of the right lower deep vein. (D) Final venogram showing the recanalization of the left lower deep vein.

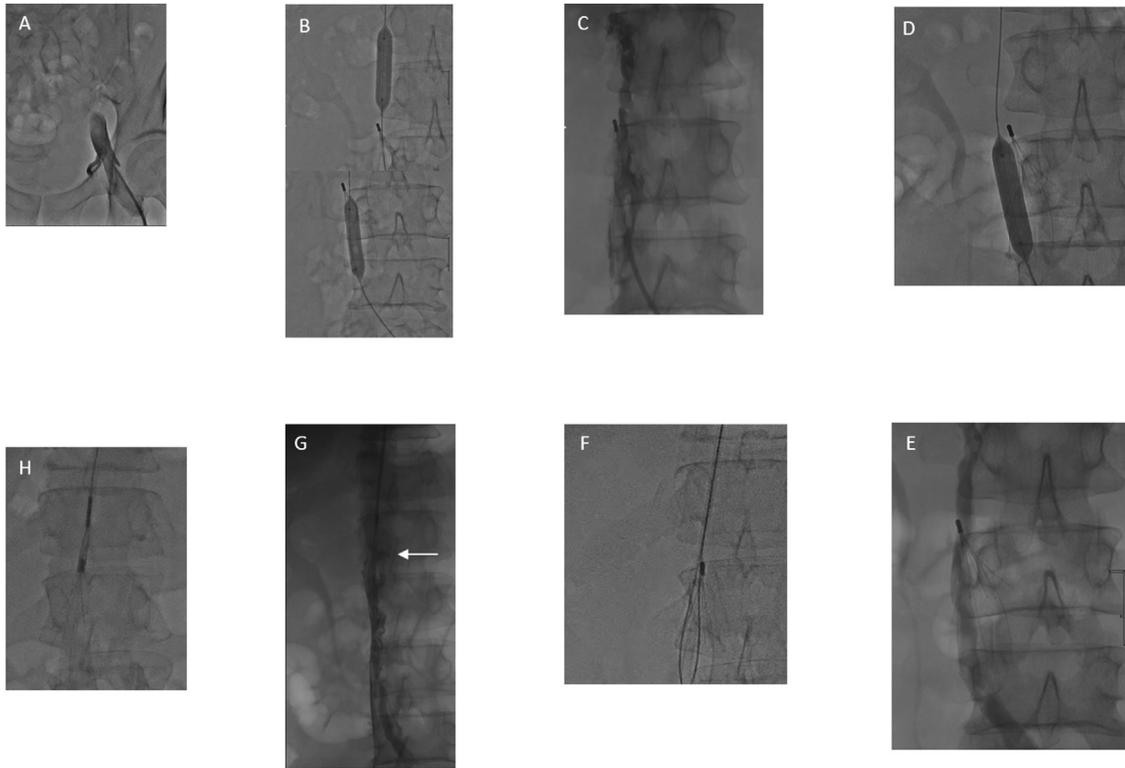


Fig. 3.

Serial images of multi-step catheter intervention for retrieval of the inferior vena cava (IVC) filter. (A) Left venogram before percutaneous transluminal angioplasty (PTA). (B) First step: PTA was performed for recanalization of IVC. (C) The head of the IVC filter was involved in the IVC thrombus after PTA. (D) Second step: the balloon displacement technique was performed. (E) The filter head is exposed after balloon displacement technique into the IVC root. (F) Third step: the loop snare technique was performed to remove IVC filter to suprarenal IVC without deep vein thrombosis. (G) Imaging after removing the filter to suprarenal IVC with the loop snare technique (white arrow). (H) Final Step: successful recovery after using the recovery kit.

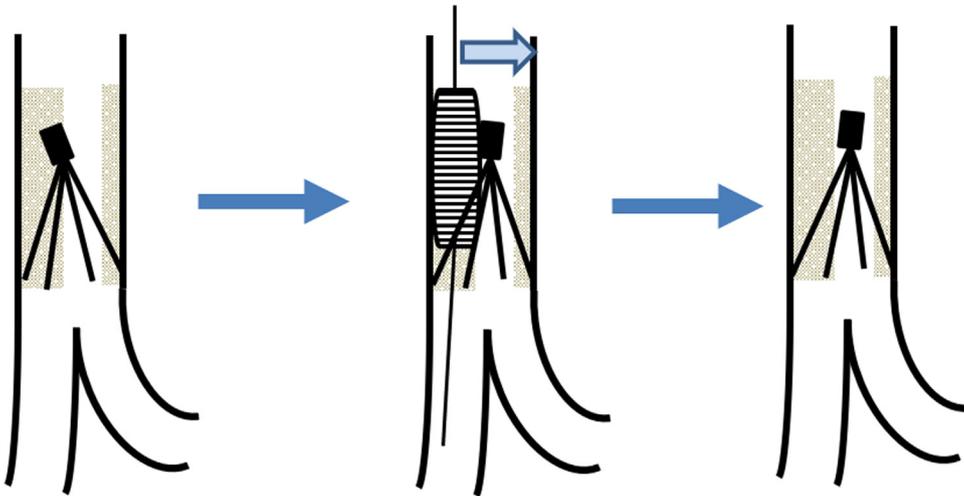


Fig. 4. Schematic illustration of balloon displacement technique.

Discussion

Various combinations of PTA, the balloon displacement technique, and the loop snare technique were useful to retrieve the IVC filter covered with a massive thrombus in this case with an allergic reaction to the filter. Several reports have shown the

efficacy and safety of other techniques for IVC filter retrieval in difficult cases [2,3]. However, these previous reports regarding catheter techniques showed a limited way to retrieve a filter that was completely covered with a massive thrombus. PTA is generally used to recanalize and restore venous patency for venous stenosis and occlusion in patients with proximal DVT. As the first step, PTA was effective in pushing the root into the IVC thrombus. The

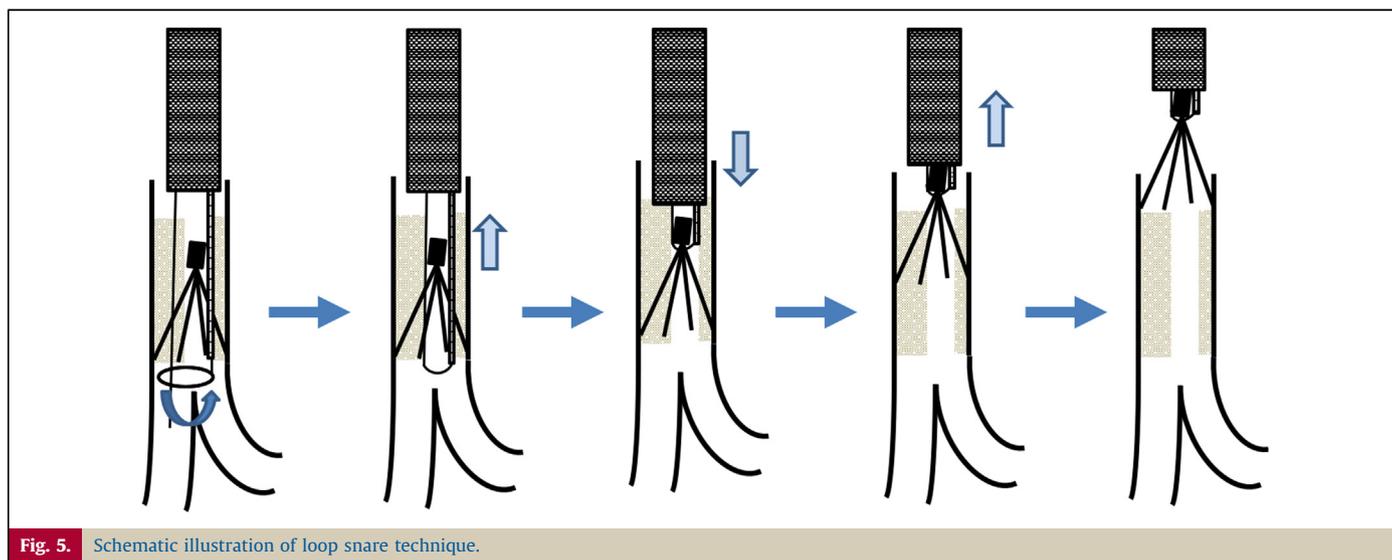


Fig. 5. Schematic illustration of loop snare technique.

balloon displacement technique is performed to displace a severely tilted filter from the cava wall for difficulty of IVC filter retrieval [2]. As the second step, the balloon displacement technique was effective to remove the filter head into IVC recanalized root. In this case, as the third step, the loop snare technique was used to move the filter upward to suprarenal IVC without DVT. As a result, the filter was successfully retrieved using the ALN recovery kit (final step). This indicates that a multi-step catheter intervention may be an effective treatment option for retrieval of IVC filters covered with a massive thrombus.

In our case, an allergic reaction after IVC filter implantation was suspected, but not confirmed by a skin patch test. Only one case report about allergic reaction of IVC filter, had been reported previously [4]. In the report, the patient developed severe pruritis after implantation of nickel-containing IVC filter [4]. The patient's hypersensitivity to nickel was confirmed by a positive skin patch test, and then pruritis resolved after IVC filter retrieval [4]. ALN filter used in our case, is composed of stainless steel. Our case report may be a first report to show an allergic reaction to stainless IVC filter. Because an allergic reaction of IVC filter is extremely rare, it may not be necessary to perform a skin patch test of IVC filter routinely before IVC filter implantation. However, permanent IVC filter should be avoided if there is a documented history of hypersensitivity to metal. Moreover, our case was also complicated with HIT. Extensive IVC filter thrombosis may develop from the captured clots in the filter, or extend from the ilio-femoral DVT; type of IVC filters used, hypercoagulable conditions, and strategies of anticoagulant therapy, have been reported as major factors contributory to IVC filter thrombosis [5–8]. HIT as a rare but severe complication may occur due to unfractionated heparin or low molecular weight heparin and in turn complicates the treatment for DVT, usually making it refractory to the standard anticoagulant therapy, sometimes going to extreme to induce extensive IVC filter thrombosis [8]. In our case, we must consider that the main reason of massive thrombus around IVC filter is HIT. However, it is uncertain whether the allergic reaction to IVC filter contributed to IVC filter thrombosis, because there are few reports about IVC filter allergy.

The indication of IVC filter is very important for management of venous thromboembolism. The US Food and Drug Administration recommend IVC filter use in the following conditions: 1) Pulmonary thromboembolism when anticoagulant therapy is contraindicated; 2) Failure of anticoagulant therapy in thromboembolic diseases; 3) Emergency treatment following massive

pulmonary embolism when anticipated benefits of conventional therapy are reduced; and 4) Chronic, recurrent pulmonary embolism when anticoagulant therapy has failed or is contraindicated [9]. The PREPIC 2 randomized trial found that placement of an IVC filter for 3 months did not reduce recurrent PE, including fatal PE, in anticoagulated patients with PE and DVT who had additional risk factors such as DVT involving the iliac segment [10]. In our case, the use of IVC filter should have been avoided under anticoagulant therapy.

To our knowledge, this is the first case report to describe a successful multi-step catheter intervention for thrombotic IVC filter retrieval. This catheter intervention technique may be taken into consideration in retrieval of IVC filter covered with massive thrombus as well as in this case.

Conflict of interest

All authors indicated no potential conflict of interest.

Acknowledgment

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.jccase.2019.07.006>.

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