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Device for retrieval of vena cava filter with combination of a multi-loop snare and Amplatz catheter

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Abstract

A 25-year-old woman diagnosed as having a non-massive pulmonary embolism and deep vein thrombosis from the right superficial femoral to the right common iliac vein was treated by deployment of a DENALI® Vena Cava Filter. Filter retrieval was attempted 6 months later using a BARD snare retrieval kit. However, the conventional technique was unsuccessful because of a tilt and attachment of the filter head to the vessel wall. Hence, we passed an EN Snare Endovascular Snare System through an Amplatz Left 1 guiding catheter to successfully penetrate the attached portion of the filter hook and vessel wall. This combination provided controlled direction and a strong backup force that helped capture and retrieve the filter. This technique could be an alternative method to retrieve inferior vena cava filter with severe tilt and tight attachment to the vena cava wall when the conventional technique is unsuccessful.

Keywords

Deep vein thrombosis, pulmonary embolism, endovascular procedure, filter migration

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Introduction

The aim of inferior vena cava (IVC) filter deployment is to mechanically prevent venous clots from reaching the pulmonary circulation. Potential indications include venous thromboembolism (VTE) with absolute contraindication to anticoagulant treatment, recurrent pulmonary embolism (PE) despite adequate anticoagulation, and primary prevention of high-risk VTE. Based on the trials investigating the efficacy of IVC filter,[1,2] however, routine use of IVC filter is not recommended, and a retrievable filter should be removed when it is no longer needed.

The usual practice is to remove a retrievable filter using a single loop snare catheter. However, this single loop snare is sometimes ineffective in cases of filter migration, fracture, or adhesion to the venous wall. A number of advanced retrieval techniques, such as the loop snare technique and cone-over-guide-wire technique, have been described for the above cases.[3,4] Herein, we describe a case of successful filter retrieval despite severe filter migration and adhesion to the vena cava wall by a technique using a multi-loop snare and Amplatz catheter.

Case presentation

A 25-year-old woman taking oral contraceptives and antipsychotics was diagnosed as having deep vein thrombosis (DVT) of the right common iliac, common femoral, and superficial femoral vein and subsequent non-massive PE. To treat the extensive venous thrombosis located in iliac and femoral vein which has a potential risk causing critical pulmonary thromboembolism (PTE), the patient underwent DENALI® Vena Cava Filter (BARD Peripheral Vascular Inc., Arizona, USA) deployment at another hospital. Anticoagulation therapy (60 mg/day of edoxaban) was also started. Five months after the onset, the thrombi remarkably diminished on computed tomography (CT) scan, leaving behind a small thrombus at the common femoral vein.

Based on the result of CT scan, she was referred to us for filter retrieval since the hospital she underwent the filter deployment has few technical experiences of filter retrieval. Six months after the onset, filter retrieval was attempted via the jugular vein approach using a BARD snare retrieval kit (BARD Peripheral Vascular, Inc. Arizona, USA). However, the conventional single loop snare could not capture the head of the filter because the head of filter was severely tilted and the filter hook was tightly attached to vena cava

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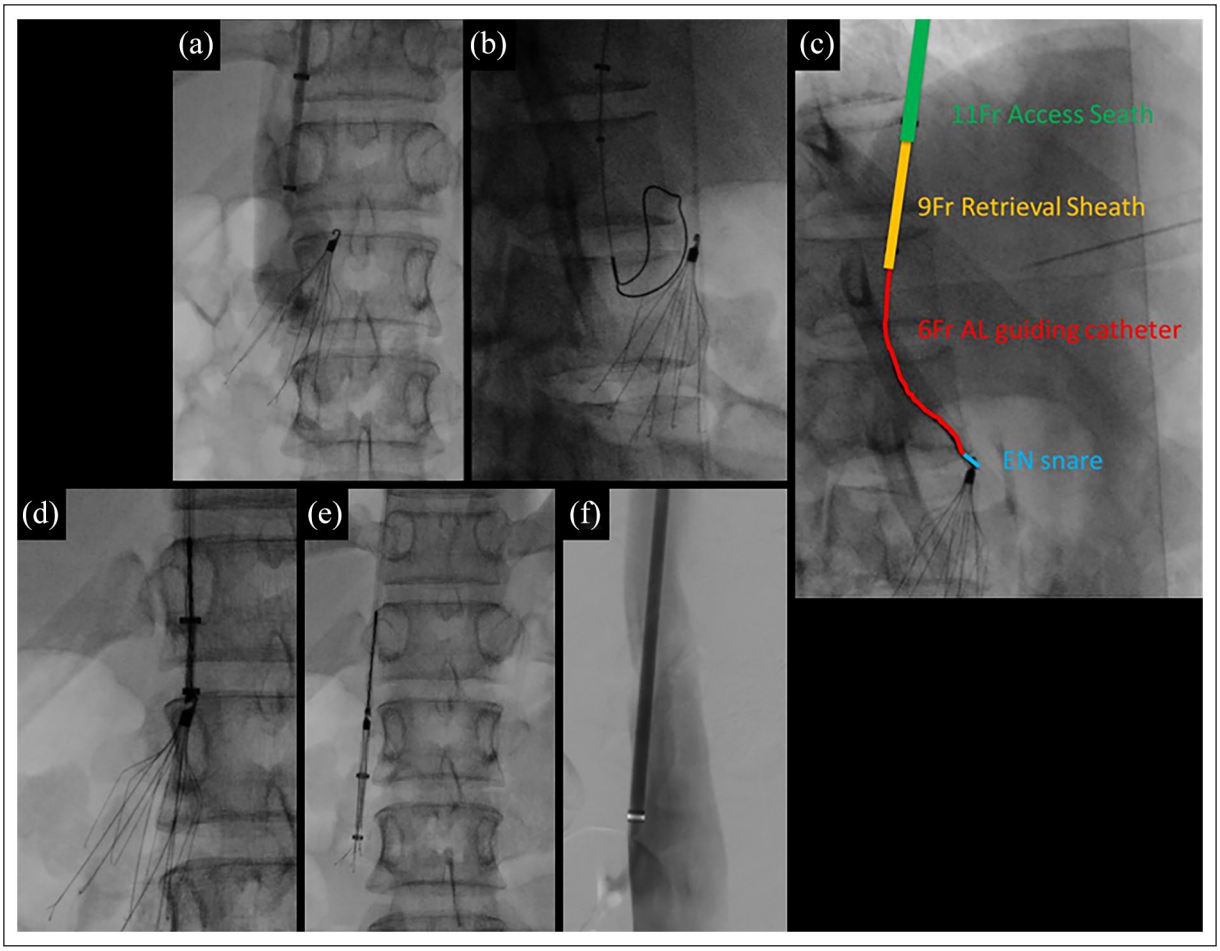

Figure 1. Course of the procedure of retrieving a complicated vena cava filter by using a multi-loop snare and an Amplatz Left 1 catheter: (a) A venogram performed before the procedure showing that the severely tilted head of the filter and its foot embedded in the vena cava wall. (b) A single loop snare unable to capture the filter head. (c) A 6 Fr Amplatz Left 1 catheter introduced into a 9 Fr retrieval sheath for directing a multi-loop snare to the filter head. Rotation was applied to the snare to capture the filter head. (d) The filter pulled into the 9 Fr retrieval sheath. (e) The filter finally delivered from the 11 Fr access sheath. (f) The final venography demonstrating no evidence of extravasation of contrast.

wall (Figure 1(a) and (b)). "Wire-loop snare technique" using a 0.035-inch Radifocus guide wire (Terumo Corp., Tokyo, Japan) was also unsuccessful because the guide wire slipped away while applying traction using a single loop snare. We then attempted a procedure using a multi-loop EN Snare® Endovascular Snare System (Merit Medical, Utah, USA) and a 6 Fr Amplatz Left 1 (AL-1) Heartrail guiding catheter (Terumo Corp., Tokyo, Japan) (Figure 1(c)). The tip of AL-1 as an inner catheter was guided through a 9 Fr retrieval sheath and directed toward the filter hook. The multi-loop snare was advanced toward the filter hook with continuous rotation until it was manipulated through the narrow space between the hook and vessel wall. Finally, the filter was detached from the wall and pulled into the retrieval sheath with a strong backup force provided by the AL-1 guiding catheter (Figure 1(d) and (e)). A venography performed after filter retrieval revealed no evidence of venous injury (Figure 1(f)). The patient reported no adverse event for up to 2 years after filter retrieval even though small thrombi remained at the right common femoral vein after the procedure.

Discussion

Several reports have described non-conventional techniques for retrieval of vena cava filters complicated by tilting and severe adhesions to the vessel wall. One of the most widespread and feasible methods is the "wire-loop snare technique."[3,5] This technique uses a curved catheter to hook under the apex of the filter. A guide wire passed through the curved catheter winds around and loops back to the retrieval catheter and is subsequently caught by a snare. The filter is straightened by applying traction at both ends of the guide wire and captured by the guide wire itself. However, this technique is sometimes unsuccessful in cases of severe adhesions of the filter to the vena cava

wall. In such cases, the looped wire slips away from the snare because of its insufficient strength to grasp and pull the wire. Furthermore, this technique carries a potential risk of the looped wire getting stuck in the filter legs. Under such circumstances, both the filter and looped wire may become irretrievable. Our method is free from this risk and may be superior to the wire-loop snare technique with regard to safety.

The case using multi-loop snare and curved catheter for vena cava filter retrieval has been reported.[6] In its presentation, however, the curved catheter was used to make wire loop under the IVC filter leg and the multi-loop snare was used to grasp the looped wire, which is to say "wire-loop snare technique." In this case, on the other hand, we manipulated the multi-loop snare to grasp filter hook directly using the strong backup force provided by the curved catheter (AL guiding catheter). We did not make the wire loop like the previous report.

The combination use of curved catheter and single loop snare to grasp the tilted filter hook has been introduced as "realignment technique."[7] The concept of this technique is similar to our method except for the difference whether using the single loop snare or the multi-loop snare. We used multi-loop snare, not single loop snare, since the single loop snare could not grasp the filter hook in this case.

There were two determinant factors of procedural success in this case. First, the AL-1 guiding catheter provided an appropriate direction control to approach the filter hook. In addition, the shaft of the catheter on the contralateral wall of the IVC provided a favorable backup force to the snare. Second, the EN Snare Endovascular Snare System exhibited an excellent ability to penetrate the attached site of the filter hook and vena cava wall. The EN Snare is designed with three interlaced loops to retrieve and manipulate foreign objects in the body. The snare core wire is made of super elastic nitinol that provides flexibility, kink resistance, and torque control. The snare is designed to rotate and expand for excellent retrieval within a variety of vessel sizes.

Conclusion

An IVC filter severely tilted and attached to vessel wall can be successfully retrieved using a combination of an AL-1 catheter and a multi-loop snare. This technique has a potential to be an alternative method to retrieve IVC filter with severe tilt and tight attachment to the vena cava wall when the conventional technique is unsuccessful.

Declaration of conflicting interests

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Ethical approval

The institutional review board at our institution does not require approval for brief case reports.

Informed consent

Written informed consent was obtained from the patient(s) for their anonymized information to be published in this article.

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