Retrieval option of an OptEase inferior vena cava filter embedded in the vessel wall with vascular retrieval forceps via the internal jugular vein: a case report

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Abstract: The OptEase inferior vena cava filter (OIVCF) after prolonged indwelling times sometimes faced with complicate retrieval of the filter using standard technique (ST) via the common femoral vein (CFV). Here we describe a novel strategy for the retrieval of OIVCF after prolonged indwelling times via the internal jugular vein. We failed to retrieve the filter using the ST on post implantation day 38. We reattempted to retrieve the filter on day 72 via the right internal jugular vein and right CFV. Using a 10-Fr guiding catheter and vascular retrieval forceps (VRF), we retrieved the OIVCF via the right internal jugular vein.

Keywords: OptEase; inferior vena cava (IVC) filter; pulmonary embolism; deep vein thrombosis

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Introduction

An inferior vena cava filter (IVCF) is sometimes used as an important optional treatment device to prevent the development of a pulmonary embolism (PE) from a venous thromboembolism (VTE) (1). A temporary IVCF can be removed if there is no risk of VTE and the U.S. Food and Drug Administration recommends removal of an IVCF at the earliest (2). However, in some cases, it is difficult to remove the IVCF because of tilting of the device when deployed in the inferior vena cava (IVC), migration, thrombus formation in the IVCF, and prolonged indwelling time (1,3,4). The most common reason for failure of IVCF retrieval with standard techniques (STs) is tilting of the IVCF when deployed (5), which causes endothelial overgrowth of the IVC and the hook of the IVCF becoming embedded in the wall of the IVC. Previous reports have discussed several methods for IVCF retrieval, including the use of biopsy forceps, balloons, guide-wires, and multi-snares (1,5,6). However, retrieval by any of these methods is associated with some difficulties. The OptEase® Retrievable Vena Cava Filter (Cordis Japan Co., Ltd., Tokyo, Japan) is among the most widely used, but tilting of the filter and embedding of the caudal filter hooks have been reported in some cases (4-7). To address such problems, this article describes an original technique for the retrieval of an OIVCF where the hook has become embedded in the vessel wall.

Case presentation

A 48-year-old woman was admitted to our hospital because of a 1-month history of dyspnea. Her medical history included hypertension, hyperuricemia, uterine myoma, and gastroesophageal reflux disease. On admission, swelling of the right calf was greater than that of the left calf and her heart rate was >100 bpm. Computed tomography (CT) revealed pulmonary artery embolization, and echography of the lower extremities showed deep vein thrombi in the anterior and posterior tibial veins. Moreover, the blood pressure of the pulmonary artery was 65 mmHg. We had planned to implant an OIVCF in the IVC before an anticoagulation therapy with rivaroxaban and heparin-natrium. After 1 week, a follow-up CT showed no thrombus in either pulmonary artery. However, bleeding of the uterine myoma rendered retrieval of the OIVCF difficult. Therefore,

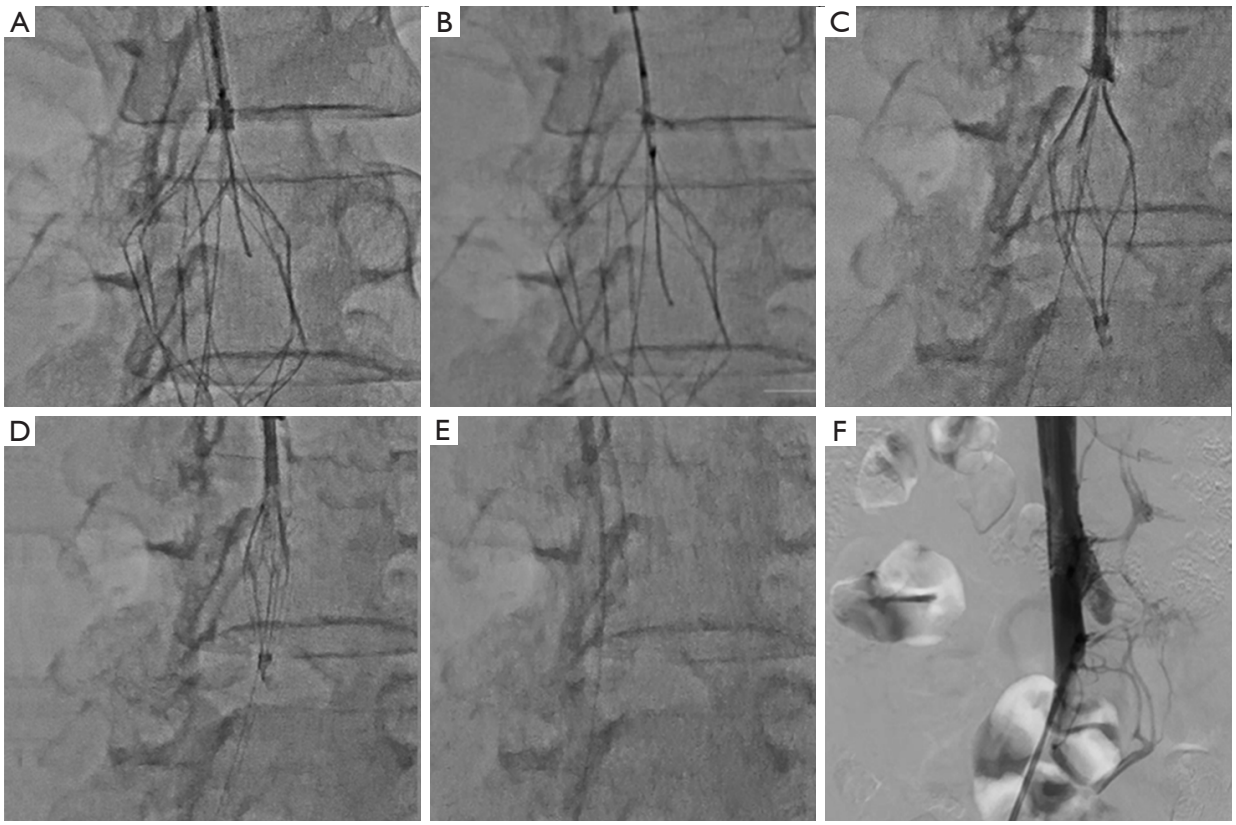

Figure 1 The angiograms in retrieval procedure. (A) Spring coil of a vascular retrieval forceps (VRF) via a 10-Fr guiding catheter was passed through the central ring of the head of the inferior vena cava filter (hIVCF); (B) VRF was barely able to grasp the central ring rim of the hIVCF; (C-E) a 10-Fr guiding catheter was used to approach the IVCF coaxially and was thrusted against the OptEase IVCF; (F) the venogram after removal of the IVCF showed no extravasation.

we planned to retrieve the OIVCF on post-implantation day 38. After cannulating the right common femoral vein (CFV) with a 10-Fr sheath (25 cm; Medikit Co., Ltd., Tokyo, Japan), a standard retrieval technique was attempted several times, but it was not possible to dislodge the hook of the IVCF. Thus, other techniques, including the sling (5) and balloon-trap techniques (6), were attempted. Because the hook was deeply embedded in the wall of the IVC, it was not possible to retrieve the OIVCF during that session. CT after the session showed that the OIVCF was distorted, but there was no sign of retro-peritoneum hematoma. The hook of the OIVCF had migrated 8 mm to the bifurcation of the IVC.

On day 72, we reattempted to retrieve the OIVCF. After cannulating the right internal jugular vein with a 10-Fr sheath (60 cm; Medikit Co., Ltd.) and the right CFV with a 6-Fr sheath (Terumo Corporation, Tokyo, Japan), a VISTA BRITE TIP® Guiding Catheter (10 Fr; 80 cm; JOHNSON & JOHNSON K.K., Tokyo, Japan) was inserted via the right internal jugular vein. After wiring the central circle of the head of the OIVCF (hOIVCF) with a 0.014-inch guidewire (Hi-Torque Command; Abbott Vascular, Tokyo, Japan), the guidewire was passed through the 10-Fr sheath via the right internal jugular vein and then tugged bilaterally. The OIVCF coaxial was passed through the guiding catheter from the right internal jugular vein and the hOIVCF was caught using an EN snare (Sheen Man Co., Ltd., Osaka, Japan), and an attempt was made to cover the OIVCF with the 10-Fr guiding catheter. However, the grasping power of the EN snare was insufficient to cover the OIVCF with the 10-Fr guiding catheter. Therefore, vascular retrieval forceps (VRF, 3 Fr; 120 cm; Cook Japan Inc., Tokyo, Japan) were used to grasp the hOIVCF instead of an EN snare. After passing through the central ring of the hOIVCF with the spring coil of the VRF via the 10-Fr guiding catheter (*Figure 1A*), the VRF was barely able to grasp the central ring rim of the hOIVCF (*Figure 1B*). While being careful not to push

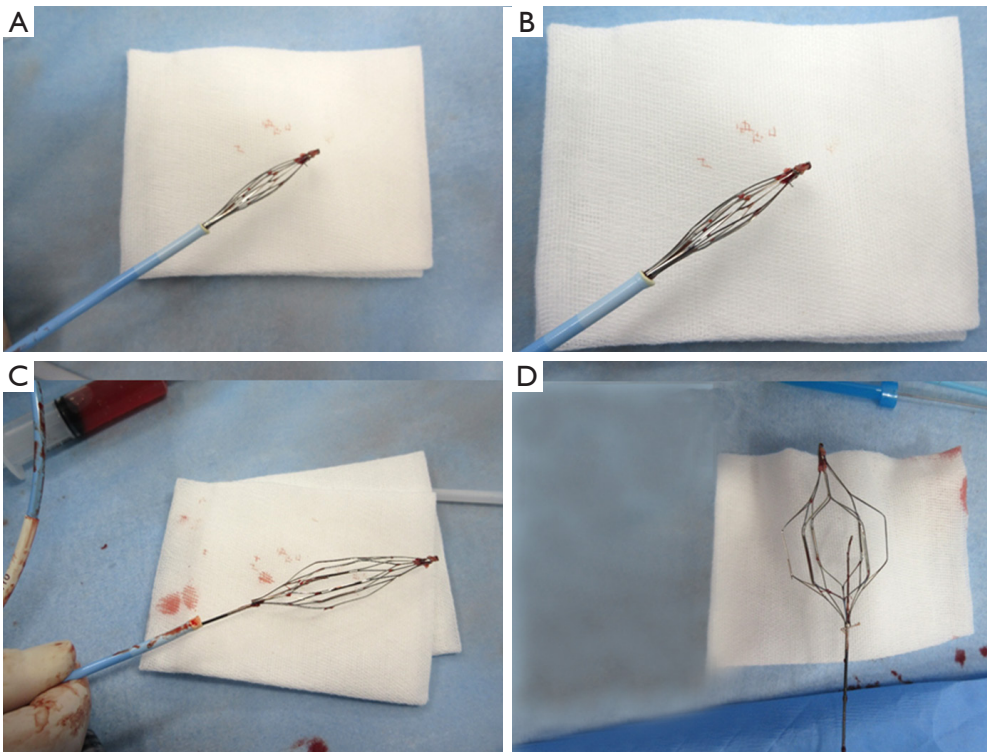

Figure 2 The retrieved OptEase inferior vena cava filter and vascular retrieval forceps.

the OIVCF caudally and pull the barbs cranially, the 10-Fr guiding catheter was slowly and forcefully pushed to cover the OIVCF. Finally, the OIVCF was completely retrieved into the 10-Fr guiding catheter and finally removed (*Figure 1C,D,E*). A venogram after the removal of the OIVCF showed no extravasation (*Figure 1F*) and CT after the procedure showed no retro-peritoneum hematoma. The retrieved OIVCF is shown in *Figure 2*. The patient was discharged the day after OIVCF removal. At a 2-week follow-up visit, there was no clinical evidence of PE, deep vein thrombosis (DVT), or retro-peritoneum hematoma.

Discussion

The incidence of VTE is 1 case per 1,000 persons in the general population, and the rate of IVCF implantation continues to increase (5). An IVCF is implanted as an effective bridge to anticoagulation therapy. However, Kuyumcu *et al.* (5) reported that the majority of IVCFs are not removed and the mean retrieval rate is 34% (a-d). This low IVCF retrieval rate can be influenced by several factors, including migration, filter fracture, embedding of the filter hook, and thrombus formation in the IVCF (1), which may prolong filter dwelling times and complicate retrieval.

The OIVCF is laser cut from a nitinol alloy and diamond-shaped with two baskets linked to six vertical struts, fixation barbs at the cranial end to prevent migration, and a blunted hook at the inferior tip for retrieval. Therefore, standard retrieval is possible through either the right or left CFV.

The description of the OIVCF recommends retrieval of the device within 12 days (7). However, in several cases, we could not control pulmonary artery thrombus, DVT, and pulmonary hypertension in this limited period. Although the OIVCF is a retrievable device, neo-intimal growth over the struts, clot formation, and IVCF thrombus can easily preclude disengaging the hooks and removal of the OIVCF through the right or left CFV (8).

There have been previous report on different retrieval techniques via the CFV ranging from minor modifications of STs to more advanced methods, such as the endovascular use of forceps and lasers (5). Here we described a case in which the OIVCF was removed via the right internal jugular vein after retrieval via the right CFV had failed.

In the first attempt, other techniques, such as the “wire loop-and-snare”, “balloon displacement technique” and

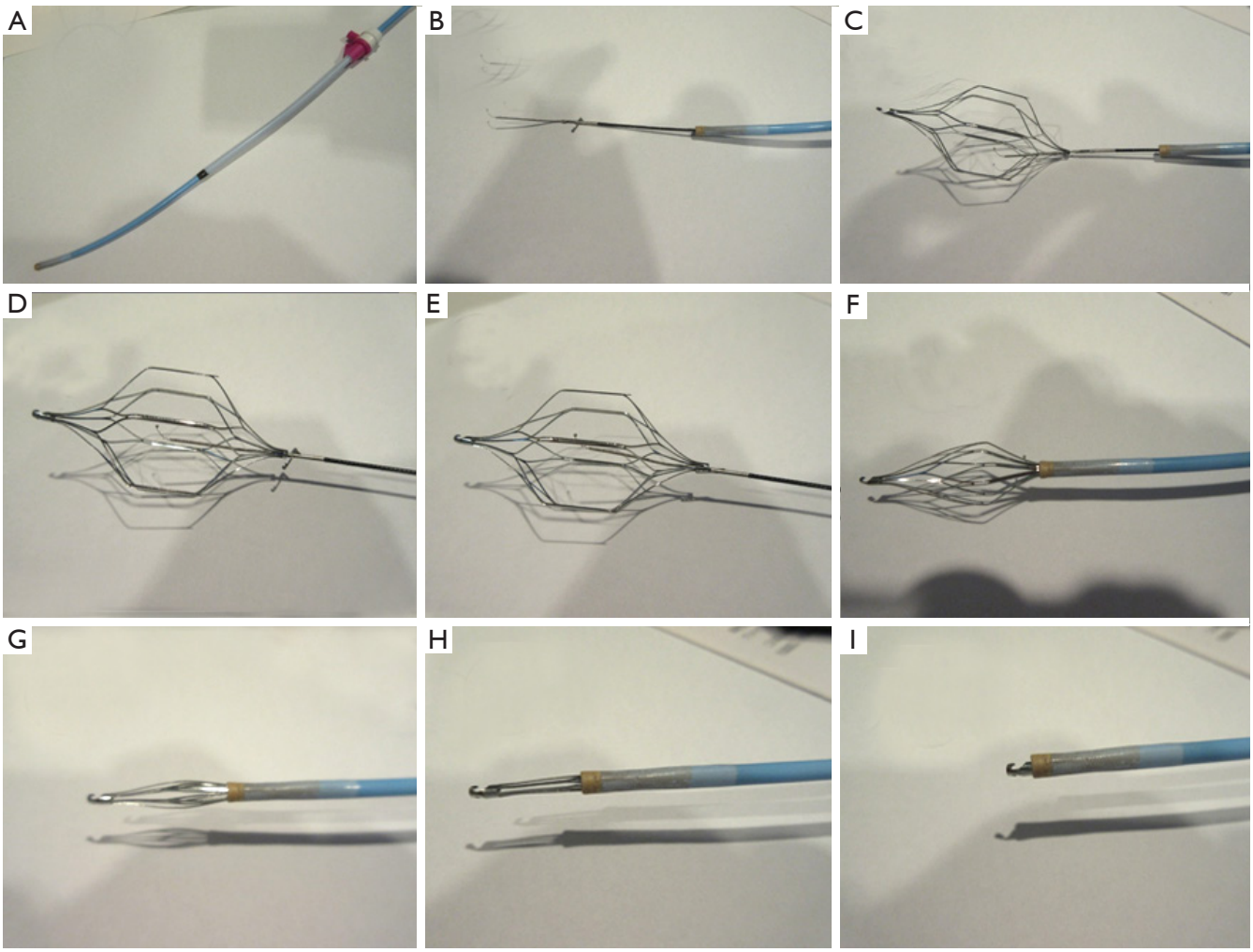

Figure 3 In vitro simulation. (A) System model of a 10-Fr guiding catheter in a 10-Fr guiding sheath; (B) a vascular retrieval forceps (VRF) through the 10-Fr guiding catheter; (C) spring coil of the VRF via a 10-Fr guiding catheter passing through the central ring of the head of the inferior vena cava filter (hIVCF); (D) the VRF was used to grasp the central ring rim of the hIVCF; (E) use of the vascular retrieval forceps was barely able to grasp the central ring rim of the head of the inferior vena cava filter (IVCF); (F) thrusting the 10-Fr guiding catheter against the OptEase IVCF coaxially; (G-I) retrieval of the OptEase IVCF into the 10-Fr guiding catheter.

"double guidewire and snare technique" had not worked well. Moreover, the OIVCF had fractured and migrated deeply into the right CFV.

After the first attempt, other options were considered, including retrieval by cardiovascular surgery, re-retrieval by a cardiologist, and permanent implantation of the fractured OIVCF. The PREPIC Study Group reported that implantation of an IVCF reduced the risk of PE, but increased the risk of DVT, which had no effect on survival (9). The patient initially chose to have the filter removed by a cardiologist.

Since there was little chance to retrieve the filter through the CFV, a new method to retrieve the OIVCF via the right internal jugular vein *in vitro* was simulated. However, because the barbs were imbedded in the vessel wall, the OIVCF would not migrate cranially. However, by grasping the central ring rim of the hOIVCF and slowly thrusting the 10-Fr guiding catheter against the OIVCF, it was possible to retrieve the OIVCF into the 10-Fr guiding catheter (*Figure 3*). We thus attempted this method *in vivo*.

This strategy has some limitations. First, this procedure is complicated by the angle of the barbs. If the barbs are

inclined toward the outside, they may become imbedded and prevent retrieval of the IVCF into the 10-Fr guiding catheter. Retrieving the OIVCF into the 10-Fr guiding catheter would require greater force. Second, this method can be achieved only by grasping the central ring rim of the hOIVCF. Thrusting the 10-Fr guiding catheter coaxially against the OIVCF is a very important tip when applying this strategy. Use of a VRF is an acceptable method to grasp the central ring rim of a hOIVCF. Third, pulling the OIVCF into the 10-Fr guiding catheter is not recommended, but rather thrusting the 10-Fr guiding catheter against the IVCF. However, the OIVCF has fixation barbs that can damage the wall of the IVC when pulling the OIVCF cranially.

To the best of our knowledge, this is the first report of this new strategy for deep embedding OIVCF. In case of failure of the ST and other advanced techniques for retrieval of an OIVCF, this novel strategy may be effective. This method should be considered as an option in complications with retrieval of OIVCFs.

Conclusions

We report a new strategy for the retrieval of an OIVCF after a prolonged indwelling time with the use of VRF and a coaxial approach via the internal jugular vein.

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Footnote

Conflicts of Interest: Both authors have completed the ICMJE uniform disclosure form (available at http://dx.doi.org/10.21037/jxym.2017.09.02). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. Written informed consent was obtained from the patient for publication of this manuscript and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this Journal.

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