Iliac Vein Stent Fracture due to a Migrated Retrievable Vena Cava Filter

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Introduction

Although there is a lack of evidence from comparative trials, use of a self-expanding venous stent is strongly recommended for the treatment of chronic iliac vein compression to rapidly restore inline venous flow and to prevent postthrombotic syndrome.[1-3] Inferior vena cava (IVC) filter implantation before endovascular treatment for deep venous thrombosis (DVT) is regarded as an effective method to reduce the risk of fatal iatrogenic pulmonary thromboembolism during mechanical thrombectomy.[4, 5] In this report, we share our experience with a case of venous stent fracture due to caudal migration of an IVC filter, which occurred during endovascular treatment for acute DVT related to May-Thurner syndrome. To the best of our knowledge, this is the first report of iliac vein stent fracture caused by an IVC filter.

Case report

A 55-year-old woman was admitted to our institution due to left lower leg swelling and pitting edema persisting for 5 days. Computed tomography (CT) revealed extensive DVT involving the left common iliac vein to the popliteal vein, as well as thrombosis within the calf veins. Significant left common iliac vein compression between the spine and the right common iliac artery, suggesting chronic iliac vein compression syndrome (May-Thurner syndrome), was also noted. To establish rapid restoration of continuous inline venous flow, mechanical thrombectomy through popliteal vein access was scheduled. The institutional review board of our institution approved this case report, and the patient provided written informed consent.

Mechanical thrombectomy and IVC filter insertion

Popliteal vein puncture was performed using a micropuncture set with a 21-gauge needle (Cook Medical, Inc., Bloomington, IN, USA) under ultrasonographic guidance, followed by insertion of an 8-Fr angiography introducer sheath (Radifocus; Terumo Corp., Tokyo, Japan). Then, a headhunter-type angiographic catheter (Boston Scientific Corp., Natick, MA, USA) was introduced to pass through the venous segment that had thrombosis.

After the catheter entered into the IVC lumen, a double-basket-shaped retrievable IVC filter equipped with a 90-cm-length introducer set (OptEase filter; Cordis Corp., Warren, NJ, USA) was introduced along a stiff guidewire (Cook Medical, Inc.) and deployed in the infrarenal IVC under fluoroscopic guidance. After IVC filter insertion, mechanical thrombectomy was performed after bolus injection of 40,000 units urokinase (Green Cross Corp., Yongin, Korea). An 8-Fr guiding catheter (Guider Softtip XF; Boston Scientific Corp.) was introduced for thrombus aspiration. After several aspiration attempts, adjuvant venous stenting with a 14-mm × 8-cm self-expanding bare metal stent (Protege Stent System; ev3 Endovascular, Inc., Plymouth, MN, USA) along the common iliac vein was performed for the treatment of chronic iliac vein compression between the spine and the right common iliac artery. For adequate stent placement, after the stent delivery system entered into the IVC, the delivery system was pulled back while the proximal end (<1 cm) of the stent was opened. Under full magnification of fluoroscopy, when the flared proximal end of the stent began to be constrained by the occlusive lesion, the stent was deployed (Fig. 1).

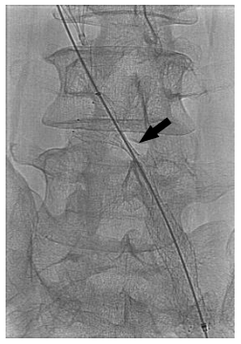

Fig. 1. Placement of common iliac vein stent. Note constrained stent (arrow), where cross right common iliac artery.

Filter retrieval

Approximately 3 weeks after IVC filter insertion and mechanical thrombectomy, filter retrieval was performed. Preoperative scout radiography revealed caudal migration of the IVC filter and associated hooking of the proximal end of the left common iliac vein stent, resulting in stent fracture around the proximal end (Fig. 2).

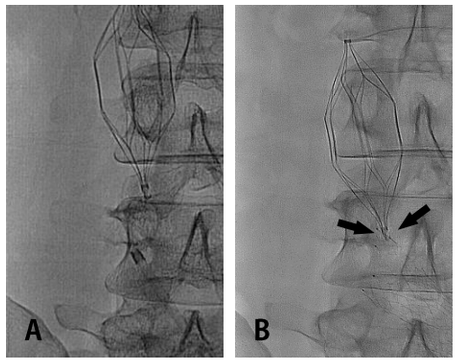

Fig. 2. (A) Radiograph taken at inferior vena cava (IVC) filter insertion. (B) Radiograph taken 3 weeks after insertion, showing caudal migration of the IVC filter and the fractured stent hooked around the caudal retrieval hook (arrows).

Retrieval of the IVC filter and fractured stent was planned. Although there was a possibility of the fractured stent shifting and migrating into the heart, we did not perform any kind of additional preparation for this possibility because the IVC filter was already deployed and the fractured stent appeared to be firmly hooked by the IVC filter. First, retrieval was attempted through right common femoral vein access using an 8-Fr angiography introducer sheath (Radifocus, Terumo Corp.) and a loop-snare device with a loop diameter of 10 mm (ev3 Endovascular, Inc.). The initial retrieval attempt failed because the fractured stent segment was hooked around the caudal hook, which interfered with folding of the filter into the snare system and the 8-Fr introducer sheath. After failure of this first attempt, we snared and tried to pull back the fractured stent fragment, but further caudal migration of the IVC filter occurred, causing snaring of the caudal hook to become impossible. Subsequently, a 12-Fr introducer sheath (Ultimum EV, St. Jude Medical, Plymouth, MN, USA) was inserted through the right common femoral vein and a modified loop-snare technique was attempted using a 5-Fr reverse-curve angiocatheter (Yashiro, Terumo Corp.) and an angled 0.035-in hydrophilic guidewire (Glidewire, Terumo Corp.) to sling around the caudal end of the IVC filter (Fig. 3).

Once the reverse-curve angiocatheter passed between the struts of the IVC filter, the angled guidewire was introduced through the catheter. After externalization of the leading tip of the guidewire with snare, the angiosheath was advanced, and the IVC filter was successfully engaged. Finally, the IVC filter and fractured stent segment were successfully removed (Fig. 4). After removal, the patient showed neither procedure-related complications nor subjective symptoms suggesting DVT recurrence.

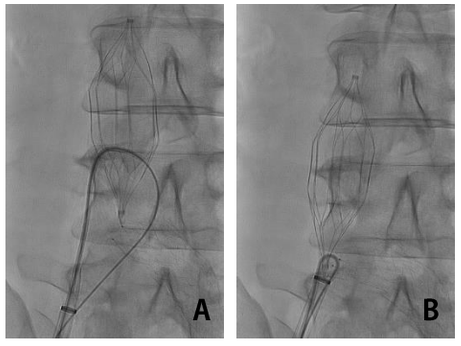

Fig. 3. Fluoroscopic image, showing a loop-snare technique using a reverse-curve catheter and a 0.035-in guidewire and successful engagement of the IVC filter into the sheath.

Discussion

Fig. 4. Photograph of the fractured stent fragment.

Adjuvant endovascular treatment after catheter-directed thrombolysis for DVT can include venous stenting with a self-expanding metal stent and/or angioplasty with a balloon catheter. Usually, for treatment of iliac vein obstruction, venous stenting is preferred over balloon angioplasty because the fibrotic nature of venous stenosis often results in elastic recoil after balloon angioplasty.[6]

Adjuvant treatment for acute DVT can establish early inline venous flow restoration and offer acceptable patency, especially in cases of chronic venous outflow obstruction, such as in May-Thurner syndrome.[7, 8]

Although there have been promising results of venous stenting for May-Thurner syndrome, there also have been some reported complications, including early thrombosis, stent migration, and transitory low back pain.[2, 3] However, to the best of our knowledge, iliac vein stent fracture has not been reported. Moreover, our case of stent fracture due to hooking by a migrated IVC filter is the first reported case. Venous stent fracture in other anatomical locations, such as the left subclavian vein, which can result from chronic stress between the sternum and the left common carotid artery, is already well documented. In our case, stent fracture occurred within 3 weeks after endovascular treatment. Follow-up radiography revealed caudal migration of the IVC filter and entrapment of the fractured stent fragment by the caudal hook of the IVC filter. Hence, iliac vein stent fracture can be related to IVC filter migration. Hooking of an iliac vein stent by a migrated IVC filter might cause chronic stress to the stent strut according to respiratory movement, and could lead to unexpected stent fracture.

As discussed before, adjuvant iliac vein stenting can be expected to have better symptom relief and a better patency rate than catheter-directed thrombolysis only in patients with May-Thurner syndrome. However, the consequence of stent fracture is uncertain. Although there was no evidence of stent failure at 1 year after filter removal in our patient, further close observation may be necessary.

Caudal migration is a rarely reported complication of IVC filter implantation, and is mainly related to filters with a cranial hook and caudal flaring strut, such as the Celect filter (Cook Medical, Inc.).[9] Such caudal migration is usually accompanied with caval wall penetration by the flaring strut during filter placement or the dwelling period. However, caudal migration of an OptEase retrievable filter with a double-basket structure has not been reported. Factors causing spontaneous migration of an IVC filter are uncertain, but, in our patient, the unique design of the OptEase filter including the absence of fixating barbs, which prevent caudal migration, as well as hemodynamic blood flow variations related to the respiratory cycle, with secondary change in the caliber of the IVC, could be related to caudal migration of the filter.

In our case, the fractured stent fragment was hooked by the caudal hook. As a result, standard filter retrieval involving snaring of the hook was impossible. Therefore, we performed a loop-snare technique for filter retrieval in the caudal direction. With this technique, both the IVC filter and the fractured stent fragment were successfully removed.

In conclusion, although the exact mechanism is uncertain, iliac vein stent fracture can be caused by a migrated IVC filter. Therefore, when an IVC filter is inserted in a patient with adjuvant iliac vein stenting for the treatment of May-Thurner syndrome, cautious follow-up is required for caudal migration of the filter.

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