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Case Report
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Inferior Vana Cava Occlusion Revascularization: Case Report

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Abstract

This case illustrates management of a patient with disabling symptoms from Inferior Vena Cava (IVC) filter occlusion. Inferior vena cava obstruction from organized thrombus and fibrosis can lead to severe bilateral lower extremity edema despite chronic anticoagulation therapy. Complete Endovascular revascularization with self-expanding stents is a feasible and attractive treatment option with remarkable clinical response.

Introduction

Chronic occlusion of the Inferior Vena Cava (IVC) is an uncommon condition that could be caused by variety of underlying diseases. Patients can present with a myriad of signs and symptoms, depending on collateral venous drainage. We present a patient with chronic, post-thrombotic occlusion of IVC filter with intractable bilateral lower extremity swelling. Patients with similar clinical conditions are often misdiagnosed to have lymphedema and not offered revascularization [1-3]. The patient was treated with progressive balloon dilation and self-expanding stents in a cardiac catheterization lab resulting in remarkable clinical improvement.

Case Presentation

An 85-year-old-female with past medical history of right lower extremity Deep Vein Thrombosis (DVT) underwent non-retrievable IVC filter implantation in 2004. She initially presented to us in 2013 with progressive worsening of bilateral lower extremity pitting edema and past medical history of Lupus antibody, Coronary artery disease with previous coronary stents, and peripheral artery disease with previous bilateral iliac stenting. She was on chronic anticoagulation therapy with warfarin since 2004. Her ultrasound evaluation then showed bilateral femoral vein occlusion from chronic DVT. Because of interactive progression of the bilateral swelling despite anticoagulation therapy, an endovascular procedure was performed via bilateral popliteal vein access. Balloon venoplasty was performed after 30 hr of ultrasound enhanced thrombolytic infusion with EKOS catheter (EKOS Corporation, Bothell, WA) in the occluded IVC filter and bilateral iliac vein. Despite recanalization and re-establishment of outflow in the IVC and transient improvement of the lower extremity painful swelling, on subsequent follow-up after 6 months she started having even worst progression of bilateral lower extremity swelling.

Over the year of follow-up after the initial endovascular venous intervention patient continued to have worsening bilateral lower extremity swelling, pain, and disabling discomfort with chronic venous stasis changes (Figure 1A and 1B). She was brought back to the cath-lab. Ultrasound guided bilateral common femoral vein access was achieved using a 6 French sheath. Bilateral femoral venography showed partially obstructive thrombotic disease of bilateral iliac veins. The IVC was occluded through the IVC filter (Figure 2). A collateral tributary (superficial epigastric vein) drained the blood to IVC cranial to the occlusion in-side the IVC filter. Weight based heparin (90 unit/kg) was given IV to achieve therapeutic activated clotting time.

A very aggressive wire escalation technique used along with crossing catheter was not successful. Multiple different wires including a stiff angle glide (Terumo Corporation, summerset NJ) wire were unsuccessful in crossing. Ultimately, distal end (back end) of the stiff angled glide wire and 0.035 Quick-Cross catheters (Spectranetics Corporation) were used with contralateral fluoroscopy guidance to remain inside the frame of the filter but cross through the occlusion successfully. A 0.035” J-wire was inserted in to the SVC through the Quick-cross catheter. (Figure 3) Balloon venoplasty was performed using a 10 mm balloon for allowing crossing the IVC filter occlusion

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Figure 1A and B: Chronic venous stasis changes.

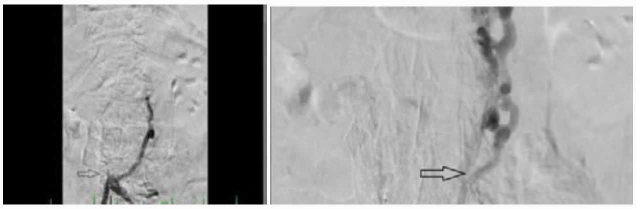

Figure 2: IVC was occluded through the IVC filter.

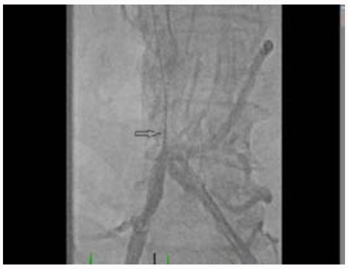

Figure 3: SVC through the Quick-cross catheter.

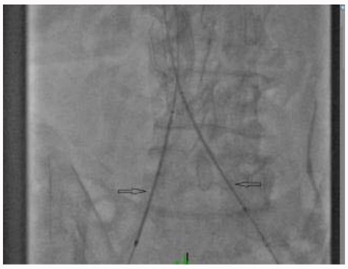

Figure 4: Protégé stents were deployed in simultaneous kissing fashion extending superior and inferior to the IVC filter.

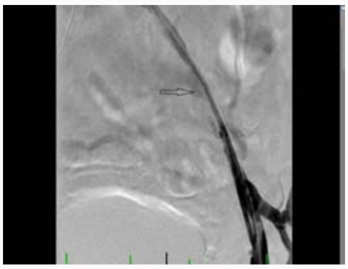

Figure 5: Left external iliac vein still had severe stenosis.

from the left femoral vein approach also. Sheaths were exchanged for a 9 French sheath in each femoral vein. After pre-dilating on both sides with 10 mm balloon, 14 mm x 10 mm balloons were advanced simultaneously into the IVC via both access sites and simultaneous kissing balloon inflations were performed. Post-venoplasty a significant flow through the IVC was re-established. Two 14 mm x 80 mm self-expanding Protégé stents were deployed in simultaneous

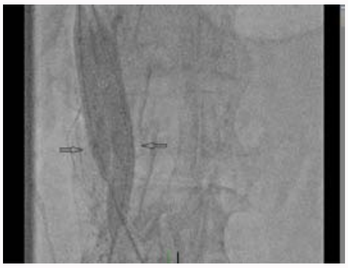

Figure 6: Simultaneous kissing balloon inflations were performed.

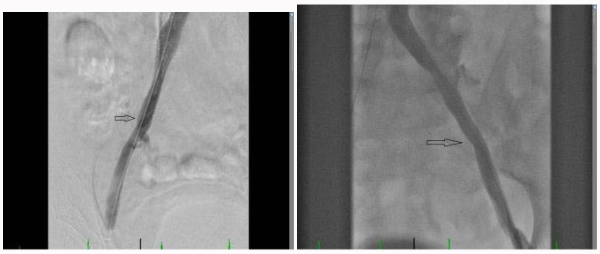

Figure 7A and 7B: Robust blood flow was observed through bilateral iliac veins.

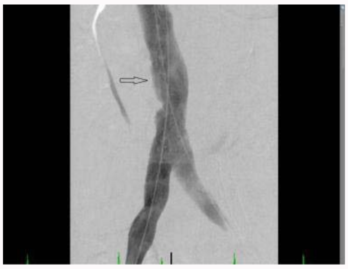

Figure 8: IVC.

kissing fashion extending superior and inferior to the IVC filter (Figure 4). Subsequently, two 14 mm x 60 mm Protégé stents were deployed again in simultaneous kissing fashion overlapping with the first stent and extending into the ipsilateral iliac veins. The left external iliac vein still had severe stenosis (Figure 5) which was treated with 12 mm x 80 mm Protégé self-expanding stent that was post dilated with a 10 mm balloon. Stents were post-dilated with 14 mm x 60 mm balloons and simultaneous kissing balloon inflations were performed (Figure 6). At the end of the procedure, robust blood flow was observed through bilateral iliac veins (Figure 7A and 7B) & IVC (Figure 8). Bilateral venous access was removed with manual compression for hemostasis. Patient was discharged home the next morning with continued treatment with Coumadin and Aspirin. In 24 hr post-intervention patient had 4100 ml urine output with positive balance of 2800 ml. Patient continued to have improvement in swelling and pain. During the one-month, follow-up patient had venous ultrasound showing patency of the venous flow through bilateral iliac veins.

Discussion

The IVC filter is a commonly used device for the prevention of Pulmonary Embolism (PE). Increased use of IVC filters over past few decades has led to an increasing frequency of long-term filter-related complications. These complications include, but are not limited to local thrombosis and increased risk of recurrent lower extremity Deep Vein Thrombosis (DVT) [1-3]. The incidence of

DVT and IVC thrombosis after filter placement varies widely (6% to 37%) in different patient populations [4,5]. Although previous recommendations and guidelines discussed endovascular treatment options in *de novo* DVT in non-filter-bearing IVC and iliofemoral thrombosis, there are more recent reports describing the safety and outcome of endovascular treatment for filter-bearing IVC thrombosis [6-8]. If the patient has, a thrombosed filter-bearing IVC with total venous occlusion, significant lower extremity edema and pain are often present and severe complications such as sensory deficits, venous stasis, or ulceration may also be present [9]. For patients that are good anticoagulation candidates and caval filtration is not needed, stenting of the IVC is a choice. A recent retrospective review [10] of 708 patients with chronic non-malignant post-thrombotic iliocaval outflow obstruction included 25 patients with thrombosed IVC with occluded IVC filters. This study revealed that stenting across the filter may be safely performed with no apparent tear of the IVC, clinically manifesting bleeding, or PE. There was no mortality and only minimal morbidity associated with filter baring IVC stenting. The patency was related to the severity of post-thrombotic disease. A comparison of occlusions with and without IVC filters in same study showed no significant difference in cumulative primary and secondary patency rates at 56 months indicating that the presence of filters did not affect the outcome.

We are reporting this case with three primary discussion objectives. (1) Although multiple reports of feasibility, and success of endovascular treatment of an IVC occlusion have been published in vascular surgery & interventional radiology literature; interventional cardiologist with the endovascular skills of crossing chronic total occlusion using wide array of wires, crossing catheters and hybrid access approaches are likely to have similar or higher success in treating such complex venous occlusive disease. The knowledge of the pharmacokinetics and pharmacodynamics of anticoagulant and thrombolytic agents may further enhance success rate of interventional cardiologists. Because of very low risk of requirement of surgery to treat any complications, such procedure can be performed in cardiac catheterization lab. (2) This case example could be used to discuss wiring technique for IVC occlusion. A 0.014" wire does not have required tip load and body to cross through tough fibrosis from organized thrombus in IVC. A 0.018" wire can be used along with Crossing Catheter (CC) for initial attempts to cross the proximal fibrous cap. A wire with one-piece core and spring coil design can be used along with a 0.018" CC or Over the Wire (OTW) balloon. Shaping the wire with a 45^0 band 2 mm - 3 mm from the tip is useful to cross Chronic Total Occlusion (CTO). The CC is advance over the wire to the proximal fibrous cap. The wire is advance through the CC or OTW balloon and spin in one direction very rapidly with forward pressure to give a drilling effect. The examples of such wires are V 18 Control wire (Boston Scientific) or Treasure 12 (Asahi Corporation). For précised rapid spinning of the wire in one direction a device, SPINR (Merit Medical), can be used to adjust the speed from 0-2500 Rounds per Minute (RPM). The tip load against the lesion normally changes according to the length of wire extended from the tip of CC. For the CTO wires like Treasure or Astato wire the tip load dramatically increases with only short wire extending out of the CC. The tip load can increase by up to 10 times with such maneuvers [9]. If the initial wire is unsuccessful in crossing the next 0.018" wire for escalation is Astato 30 (Asahi Corporation). Astato 30 is a high-penetration wire with tapered tip and 30 gram tip load that can break through very tough fibrous tissue. The effective tip load of an Astato wire depending on the distance out of CC can be much higher and that along with tapered tip requires careful control and vigilance. The other wiring technique is to create a "knuckle" using a 0.035" soft tip and stiff shaft wires such as stiff angled glide wire (Terumo Corporation) along with a 0.035"CC. When the tip of wire engages the proximal cap body of the stiff wire is pushed forcefully to create a loop which in turn causes blunt dissection and less likely to cause perforation. The wire and CC is advance with force simultaneously under the fluoroscopic guidance. This technique is very useful technique with high success rate to cross fibrous IVC occlusion. A wire puncture through the wall of fibrosis of occluded IVC, as long as the CC is not advanced through, is unlikely to cause significant bleeding. Simultaneous antegrade and retrograde approach can be used if only antegrade approach from the femoral vein access fails. Basilic vein access in the right arm or jugular vein access is the choices for retrograde wiring of IVC occlusion. Similar escalation as described above can be used simultaneously from both sides in a hybrid approach. When above described wiring techniques fail careful consideration of alternate technique should be weighed for risk benefit analysis. We previously reported a technique of using Brockenbrough (septal puncture) needle to cross fibrotic IVC occlusion [10]. Frequent changes of image intensifier in contralateral angles are crucial while crossing through chronic total occlusion. In this case in particular contralateral angles were used to stay within the frame of IVC filter while advancing the back-end of stiff angled glide wire along with a 0.035" CC. Backend of wire is very stiff and can penetrate through resilient fibrous tissue such as in this case. With every cm advancement of the wire the CC was advanced fixing the wire. Frequent change of fluoroscopy angle confirmed the wire's progress within the IVC filter fraWhile the number of IVC filter placement is increasing steadily, the optional filter accounts for more than half of all filters. A large proportion of patients have permanent IVC filters placed while patient's clinical condition only requiring retrievable IVC filter. For many patients the retrievable filters are left in-situ and not retrieved after clinical need is over. Such practice trends demand for societies to come up with an evidence-based guideline for appropriate use criteria similar to management of coronary artery disease and peripheral artery disease. These guidelines should also advice the importance of clinical and imaging follow-up after IVC filter placement.

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