Case Reports

Chronic Inferior Vena Cava Filter Thrombosis:

Endovascular Treatment and One-Year Follow-Up with Intravascular Ultrasonography

Andrés Mesa, MD, FACC
Eliana Milazzo, MD
Oscar Rivera, MD
Tabata Hernández, MD
Gilberto Umanzor, MD

Inferior vena cava (IVC) filter thrombosis can be fatal when it is not detected and treated. Its management can be challenging, because little evidence supports specific treatments. We present the case of a 72-year-old man with a history of deep vein thrombosis in whom IVC filter thrombosis developed 7 years after filter placement. Recanalization with oral anticoagulation had failed. Using intravascular ultrasonography, we performed pharmacomechanical thrombolysis, deploying 2 stents simultaneously through the IVC filter and then 2 more into the iliac veins, with excellent results. One year later, the patient's veins and IVC filter were patent, his symptoms were greatly improved, and only nonobstructive neointimal hyperplasia was seen. This case highlights the usefulness of balloon venoplasty and double-barrel stent placement in restoring blood flow through an occluded IVC, and the value of intravascular ultrasonography during and after such procedures. ***(Tex Heart Inst J 2020;47(2):140-3)***

Thrombosis, the most frequent complication after inferior vena cava (IVC) filter placement, can be fatal when undetected and untreated.[1,2] Little evidence supports any specific treatment. We present the case of an elderly man in whom IVC filter thrombosis developed 7 years after filter placement, and we describe our endovascular management of the condition.

Case Report

A 72-year-old man had a medical history of left hip replacement complicated by deep vein thrombosis in his left leg. To prevent pulmonary embolism, a Cordis OptEase® Retrievable Vena Cava Filter (Cardinal Health) had been placed in his IVC. Seven years later, he underwent left knee surgery that necessitated postoperative anticoagulation with rivaroxaban because of recurrent bilateral femoral deep vein thrombosis.

Three months later, the patient had prominent edema in both legs and was referred to us. Physical examination revealed hyperpigmentation, venous eczema, and lipodermatosclerosis of both legs. The patient's Clinical-Etiologic-Anatomic-Pathophysiologic (CEAP) score was IVb, his Villalta score was 20, his Venous Clinical Severity Score (VCSS) was 15, and his Venous Insufficiency Epidemiologic and Economic Study Quality-of-Life and Symptoms (VEINES-QOL/Sym) questionnaire score was 66.3.[3] Abdominal and pelvic computed tomograms showed the infrarenal IVC filter in place, with extensive thrombosis below it and in both iliac veins. Venous Doppler ultrasonography revealed bilateral chronic recanalized thrombosis in the common femoral, deep femoral, femoral, popliteal, and posterior tibial veins. We prepared the patient for endovascular treatment.

Endovascular Technique

With the patient under moderate sedation, we used ultrasonographic guidance, the Seldinger technique, and a 4F Micropuncture® Introducer Set (Cook Medical Inc.) to enter both femoral veins, first with a short 8F sheath and then with an 11F sheath. Venograms showed occluded external iliac veins and multiple collateral vessels (Fig. 1).

We crossed both iliac veins, the IVC, and the IVC filter by using a 0.035-in Roadrunner® PC Hydrophilic Wire Guide (Cook Medical) and a 4F Navicross® Support Catheter (Terumo Interventional Systems) for recanalization. We performed pharmacomechanical thrombolysis with use of an 8F AngioJet™ ZelanteDVT™ catheter

Key words: *Endovascular procedures/instrumentation; leg/blood supply; stents; thrombolytic therapy/methods; treatment outcome; thrombectomy/methods; ultrasonography, interventional/methods; vena cava filters/adverse effects; vena cava, inferior/diagnostic imaging; venous thrombosis/diagnosis/etiology/therapy*

From: *Department of Cardiology, Texas Heart Institute; and Department of Cardiology, CHI St. Luke's Health–Baylor St. Luke's Medical Center; Houston, Texas 77030*

Address for reprints: *Andrés Mesa, MD, Texas Heart Institute, 6624 Fannin St., Suite 1970, Houston, TX 77030*

E-mail: *amesa@cvvi.org*

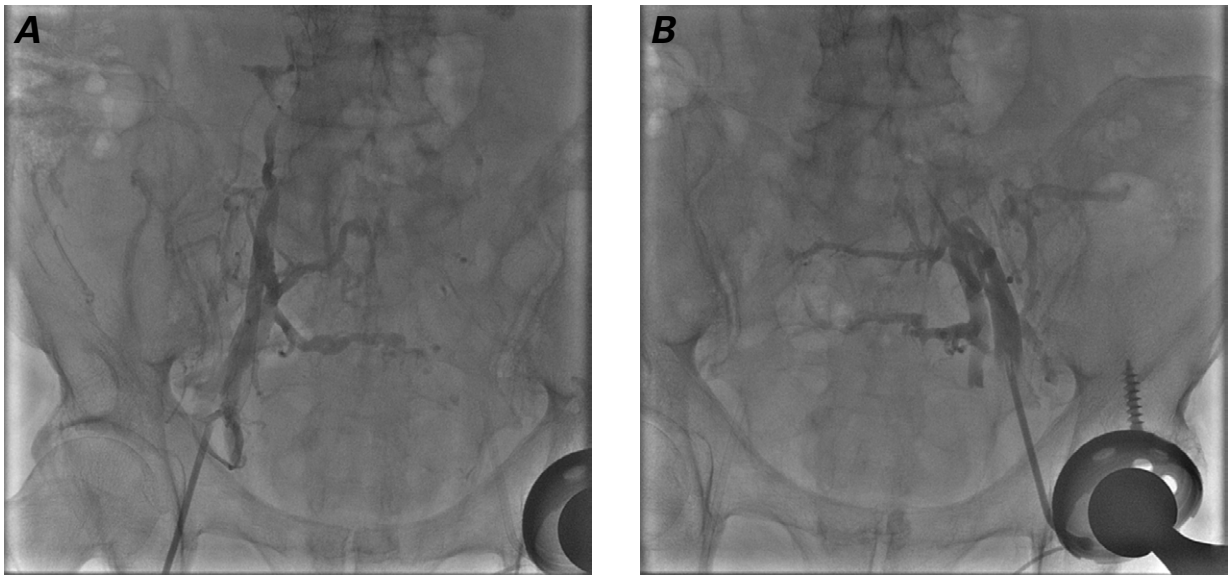

Fig. 1 *Preprocedural venograms show occluded* ***A****) right and* ***B****) left external iliac veins, along with collateral circulation vessels.*

(Boston Scientific Corporation) and 10 mg of local tissue plasminogen activator (5 mg through each catheter during a 25-min dwelling time). After this, we used a Visions PV 0.035-in digital IVUS catheter (Philips) to obtain intravascular ultrasonograms (IVUS) of the femoral veins, iliac veins, and IVC. The IVC filter and its struts were occluded, and a thick, highly echogenic layer surrounding the filter suggested marked chronic postphlebitic fibrosis (Fig. 2). We exchanged the previous wire for a 0.135-in Amplatz Super Stiff™ Guidewire (Boston Scientific) bilaterally and predilated the occlusion with two 14-mm × 4-cm Vida™ PTV Dilatation Catheters (Bard Peripheral Vascular, part of BD) at a pressure of 10 atm by using the kissing-balloon technique. Repeated high-pressure dilation displaced and deformed the IVC filter, creating enough space through which to pass stents. Predilation of the IVC continued down to the common iliac, external iliac, and femoral veins. We deployed two 24 × 70-mm Wallstent™ Endoprostheses (Boston Scientific) simultaneously through the IVC filter by using the double-barrel technique. We then singly deployed a 16 × 90-mm Wallstent in the right iliac vein and a 16 × 40-mm Wallstent in the left iliac vein. We used the same Vida balloons and the kissing-balloon technique to postdilate the IVC (Fig. 3) and inflated a 12 × 100-mm Ultraverse® 035 PTA Balloon Dilatation Catheter (Bard Peripheral) to a pressure of 4 atm in the left and right iliac veins.

Postprocedural IVUS revealed that all diseased segments were covered by the stents, ensuring inflow and outflow. A bilateral venogram showed good flow through the IVC. No complications resulted from filter extrusion. In total, we used 12,000 U of heparin to keep the patient's activated clotting time consistently

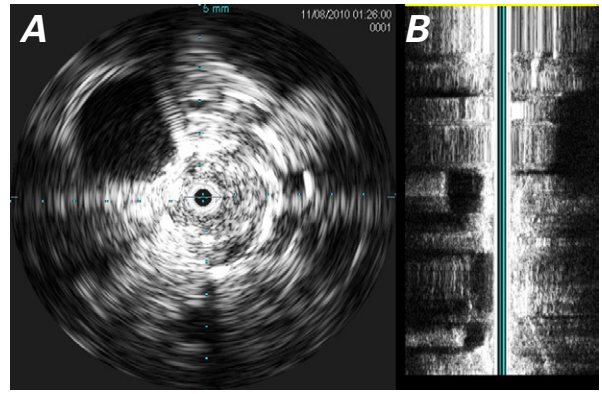

Fig. 2 ***A****) Intravascular ultrasonogram shows occlusion of the inferior vena cava filter and its struts.* ***B****) The thick echogenic layer surrounding the filter suggests marked chronic postphlebitic fibrosis.*

greater than 250 seconds. The total procedural time was approximately 4 hours.

When discharged from the hospital, the patient was prescribed subcutaneously injected enoxaparin (100 mg 2×/d); after 2 weeks, this was changed to 20 mg/d of oral rivaroxaban. After one month, most of his symptom scores had substantially improved (CEAP, IVb; Villalta, 7; VCSS, 5; and VEINES-QOL/Sym, 83). After one year, his clinical recovery and improved scores were maintained, and abdominal and pelvic computed tomograms showed patent cavoiliac grafts within the IVC filter. A venogram showed patency of the stent-grafts and the rest of the venous system, with proper flow in both iliac veins and the IVC (Fig. 4); and IVUS revealed patency of both stent limbs at the level of the IVC filter, along with nonobstructive neointimal hyperplasia (Fig. 5).

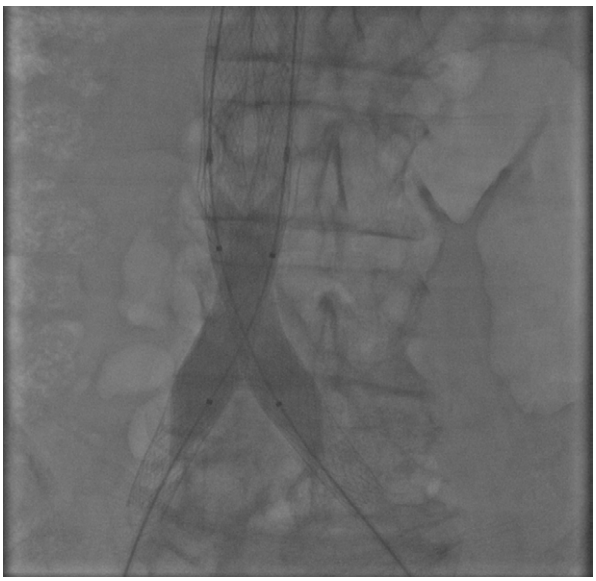

Fig. 3 *Intraprocedural venogram shows postdilation of the Wallstent endoprostheses after use of 14-mm × 4-cm kissing balloons at a pressure of 10 atm.*

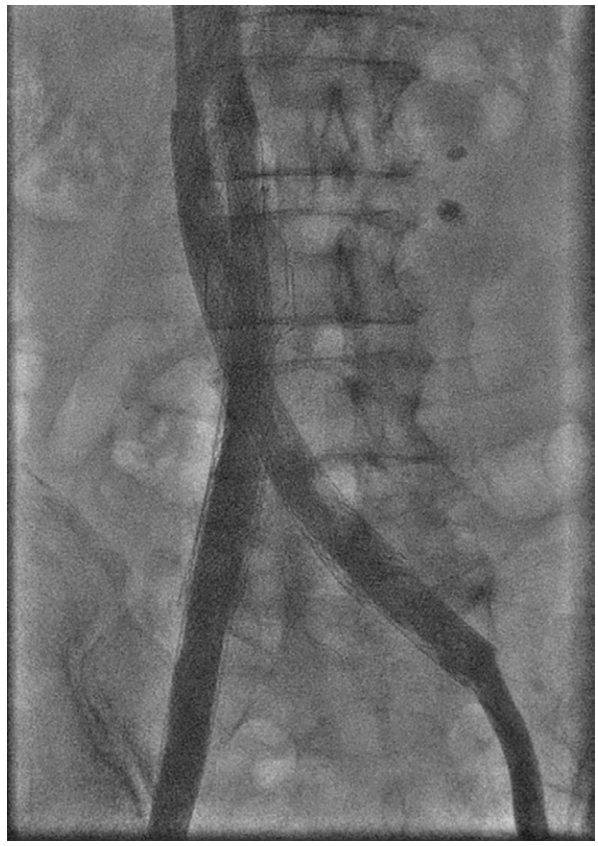

Fig. 4 *One-year follow-up venogram shows patency and proper flow in both iliac veins and in the inferior vena cava.*

Discussion

Thrombosis of an IVC filter is a multifactorial condition that has been attributed to hemodynamic changes in the IVC after filter insertion, primary thrombosis of the filter, and filtering of thromboemboli from distal veins.[4] Risk factors include inadequate anticoagulation and lack of monitoring after filter placement.

The reported prevalence of IVC filter thrombosis ranges from 2% to 30%. The actual prevalence is unclear, because some patients with partial occlusion are asymptomatic. Symptoms range from mild swelling of the lower extremities while walking to incapacitating edema at rest, venous claudication or ulcers, acute lumbar pain, and new collateral abdominal circulation. Compromised distal arterial supply may necessitate lower-limb amputation, and thrombosis above the filter may cause pulmonary embolism.[4]

The standard initial and confirmatory tests for IVC filter thrombosis are computed tomography and venography. Intravascular ultrasonography before and after the procedure can reveal reductions in both diameter and cross-sectional area. Furthermore, IVUS is more sensitive than venography in detecting stenotic and substantial lesions (>50% reduction in venous area)[1] and in differentiating chronic (fibrotic) lesions from acute ones.[2]

Treatment must be individualized. Pharmacomechanical thrombolysis involves macerating the thrombus with a device like the AngioJet system while infusing a thrombolytic drug (such as tissue plasminogen activator) directly into the lesion to debulk the thrombus. This approach is useful in treating acute filter thrombosis (<4 wk since onset), but not chronic thrombosis, because of the fibrotic changes that thrombus undergoes over time. In patients with chronic occlusion, pharmacomechanical thrombolysis is an adjuvant therapy for treating superimposed acute thrombus before balloon venoplasty.[5]

Balloon venoplasty macerates thrombus, which maximizes the thrombolytics-thrombus interaction, facilitating tissue disruption with subsequently improved blood flow through the filter in cases of neointimal hyperplasia. Aggressive balloon venoplasty is necessary to enlarge the lumen enough to enable stenting.[6] Filter damage and consequent filter migration and caval wall penetration have not been reported.[2,6-8]

Stenting across an obstructed IVC filter has proved to be safe. Neglén and colleagues[2] reported no deaths and low morbidity rates after this procedure. Their results, although obtained from relatively few patients (n=25), suggested that patency rate is influenced not by the presence of a filter, but by the severity of postthrombotic obstruction.

Double-barrel stenting is advisable. The filter architecture is used as an anchor for 2 parallel stents, ensuring in situ filter recanalization. This technique also decreases the risk of migration or perforation if a stent fractures, and it may drain both lower extremities with laminar flow better than that achieved with single stenting.[9,10]

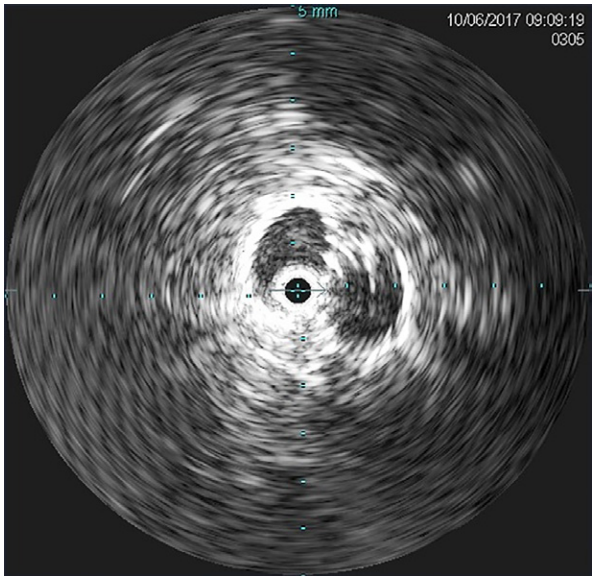

Fig. 5 *One-year follow-up intravascular ultrasonogram of the inferior vena cava stent struts shows patent right and left stent limbs.*

Postprocedural monitoring is crucial. Although different investigators have reported different patency rates, the tendency in recanalized stents is toward reocclusion. Partovi and colleagues[10] reported a primary patency rate (PPR) of 85.7% and a secondary patency rate (SPR) of 100% (mean follow-up period, 51.1 ± 27.7 mo). In contrast, Ye and associates' shorter-term case series[8] had respective cumulative PPRs and SPRs of 67% and 91% at one year and 45% and 77% at 2 years. These results may differ because the study by Portovi's group[10] included patients who had varying degrees of IVC occlusion, whereas the study reported by Ye's group[8] included only patients who had severe postthrombotic syndrome (Villalta score, >15). Neglén and colleagues[2] found that patients with stenting across the filter had a PPR of 32% and an SPR of 42%, and that the incidence of occlusive postthrombotic disease was high (68%). Patients should undergo follow-up IVUS to inform further clinical decisions.

The current case illustrates the effectiveness of using balloon venoplasty, double-barrel stent placement, and IVUS guidance to restore blood flow through an occluded IVC filter. We recommend using IVUS to monitor lesion size and possible reocclusion after pharmacomechanical endovascular treatment.

References

1. Gagne PJ, Tahara RW, Fastabend CP, Dzieciuchowicz L, Marston W, Vedantham S, et al. Venography versus intravascular ultrasound for diagnosing and treating iliofemoral vein obstruction. J Vasc Surg Venous Lymphat Disord 2017;5(5):678-87.
2. Neglen P, Oglesbee M, Olivier J, Raju S. Stenting of chronically obstructed inferior vena cava filters. J Vasc Surg 2011;54(1):153-61.
3. Soosainathan A, Moore HM, Gohel MS, Davies AH. Scoring systems for the post-thrombotic syndrome. J Vasc Surg 2013;57(1):254-61.
4. Tardy B, Mismetti P, Page Y, Decousus H, Da Costa A, Zeni F, et al. Symptomatic inferior vena cava filter thrombosis: clinical study of 30 consecutive patients. Eur Respir J 1996;9(10):2012-6.
5. Kasirajan K, Gray B, Ouriel K. Percutaneous AngioJet thrombectomy in the management of extensive deep venous thrombosis. J Vasc Interv Radiol 2001;12(2):179-85.
6. Vedantham S, Vesely TM, Parti N, Darcy MD, Pilgram TK, Sicard GA, Picus D. Endovascular recanalization of the thrombosed filter-bearing inferior vena cava. J Vasc Interv Radiol 2003;14(7):893-903.
7. Razavi MK, Hansch EC, Kee ST, Sze DY, Semba CP, Dake MD. Chronically occluded inferior venae cavae: endovascular treatment. Radiology 2000;214(1):133-8.
8. Ye K, Lu X, Li W, Yin M, Liu X, Qin J, et al. Outcomes of stent placement for chronic occlusion of a filter-bearing inferior vena cava in patients with severe post-thrombotic syndrome. Eur J Vasc Endovasc Surg 2016;52(6):839-46.
9. Banerjee S, Patel HM, Sheorain VK, Grover T, Parakh R. Double barrel in situ recanalization of thrombosed nonretrievable IVC filter. Ann Vasc Surg 2016;33:229.e11-5.
10. Partovi S, Kalva SP, Walker TG, Taj SM, Ganguli S. Long term follow-up of endo-vascular recanalization of chronic inferior vena cava occlusion secondary to inferior vena cava filters. Vasa 2017;46(2):121-6.