Revascularization of Chronic Venous Occlusion in the Setting of Post-Thrombotic Syndrome

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ABSTRACT: Post-thrombotic syndrome is a complication that may follow deep vein thrombosis, and is associated with significant morbidity. There is growing interest in endovascular techniques to treat this complication. We present a case of May-Thurner syndrome complicated by post-thrombotic syndrome that was successfully treated using an endovascular approach.

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Post-thrombotic syndrome (PTS), often the sequelae of deep vein thrombosis (DVT) in lower extremities, carries high morbidity and often mortality. Timely intervention is critical for preventing complications and salvaging the extremity. Of late, there is growing interest in endovascular techniques, including percutaneous angioplasty with stent placement. We describe a unique case of May-Thurner syndrome complicated by PTS that was successfully treated using an endovascular approach.

Figure 1. Venous duplex showing occlusive thrombus in the left common femoral vein (CFV), near-total occlusion of the left superficial femoral (SFV) with non-compressibility of left greater saphenous vein (GSV).
CASE PRESENTATION

A 66-year-old male with past medical history of colon cancer with subtotal colectomy and ileostomy, left atrial myxoma with resection 4 months prior, and concurrent left lower-extremity DVT, presented for routine office visit. He was found to have persistent bilateral lower-extremity edema, left greater than right for 4 months despite appropriate anticoagulation with warfarin and compression stockings. Upon evaluation, his initial vital signs revealed blood pressure of 109/90 mm Hg, heart rate of 71 bpm, and pulse oximetry of 99% on room air. He had unremarkable cardiopulmonary and abdominal examination. He was found to have significant left lower-extremity edema, extending up to the upper thigh level with chronic venous stasis skin changes and varicose veins. His hemoglobin was 11.8 g/dL and international normalized ratio (INR) was 2.0.
An echocardiogram revealed mild mitral regurgitation and normal biventricular function, with left ventricular ejection fraction of 55% without any pericardial effusion. A computed tomography scan of abdomen and pelvis 4 months prior showed no organomegaly or lymphadenopathy.

The presentation was consistent with PTS, despite being compliant with warfarin therapy and therapeutic INR. Venous duplex of bilateral lower extremities revealed occlusive thrombus in the left common femoral vein (CFV), near-total occlusion of left superficial femoral (SFV), and popliteal vein with thickening of greater saphenous vein (Figure 1). The patient was then referred for venography of left lower-extremity for further assessment and definitive therapy.

Selective left lower-extremity venography was performed with the patient placed in supine frog-legged position and ultrasound-guided 6 Fr sheath placement in left popliteal vein using micropuncture access kit. Selective venogram confirmed left popliteal scarring with 50%-60% stenosis, with 100% occlusion of the femoral vein with collateral branches filling the distal

**Figure 4.** Stenting and postdilation of left common femoral vein, proximal and distal femoral vein.
CFV above the femoral head (Figure 2). A TriForce coaxial crossing system (Cook Medical) was then advanced over a stiff Glidewire to cross the occlusion in the femoral vein to enter the reconstituted segment in the CFV. Intravascular ultrasound confirmed severe compression of the left common iliac vein (CIV) up to 60.4% area compression (Figure 3). A 24 x 45 mm self-expanding Wallstent (Boston Scientific) was deployed in the left CIV and postdilated using a 16 x 40 mm Mustang XXL balloon (Boston Scientific) with good expansion (Figure 4). Following this, 14 x 80 mm, 10 x 80 mm, and 8 x 150 mm self-expanding Protégé stents (Medtronic) were deployed in the left CFV, proximal to mid femoral vein, and mid to distal femoral vein, respectively. The CFV was postdilated using a 12 x 40 mm Mustang balloon and the remainder of the stented segment was postdilated using a 6 x 200 mm EverCross balloon (Medtronic) with good expansion. Final venogram revealed excellent angiographic result with brisk flow through the entire stented segment (Figure 5), with excellent stent apposition under intravascular ultrasound imaging. Hemostasis was achieved using manual compression and the patient was discharged home the next day with marked improvement in his symptoms. His medical regimen at discharge included aspirin 81 mg indefinitely, clopidogrel 75 mg for 1 month, and warfarin for 3 months.

**DISCUSSION**

DVT of the lower extremities occurs in about 1 per 1000 people/year and is associated with significant morbidity.\(^1\) PTS is the development of symptoms and signs of chronic venous insufficiency following DVT.\(^2\) Despite adequate anticoagulation, PTS occurs
in 20%–50% of patients with history of DVT.³ PTS might develop over a matter of a few months, and in some instances a few years after symptomatic DVT.⁴ A few identified risk factors include older age, obesity, recurrent ipsilateral DVT, extensive DVT, symptoms beyond 1 month, and subtherapeutic anticoagulation. It carries significant morbidity and mortality, with a significant economic burden to health-care systems.⁵ Usually, patients present with pain, venous varicosities, edema, skin pigmentation, and eventually venous ulcers.

The patient described above had a history of DVT, was on therapeutic anticoagulation with warfarin, and had persistent symptoms beyond 3 months; thereby, he had PTS by definition. There was no discussion of switching the mode of anticoagulation, since there was no recurrence of DVT on warfarin therapy but rather onset and progression of PTS related to occlusive DVT. Presence of unilateral DVT and PTS should often raise suspicion for any extrinsic compression of the iliofemoral system. May–Thurner syndrome is an often unrecognized etiology of DVT, due to left CIV compression from the right common iliac artery, first described by May and Thurner in 1956.⁶ There is lack of awareness regarding this entity and if not treated in a timely fashion, ulceration and possible infection may result in amputation of the affected extremity.

Once PTS is suspected, there are several classification systems to clinically stage the extent of the disease, which in turn determines treatment strategy. One such classification is the CEAP (clinical, etiological, anatomic, pathophysiological) system.⁷ Our patient was CEAP class 4a (associated with pigmentation/eczema). Since PTS is a clinical diagnosis, any imaging modality would provide additional information with regard to management. Doppler ultrasound and plethysmography have been used to measure venous reflux, venous obstruction, and calf muscle dysfunction. However, it is limited in its assessment of iliac veins. Thus, an additional imaging modality such as intravascular ultrasound during venography is essential to rule out May–Thurner syndrome. Our patient had significant thrombus burden on ultrasound and changes consistent with chronic inflammation of the affected veins with significant secondary skin changes. The patient described above had intravascular ultrasound imaging during venography, which confirmed May–Thurner syndrome. Treatment for May–Thurner syndrome has evolved over the years, from conservative approach with compression stockings⁸ to surgical venovenous bypass.⁹ The advancement of endovascular techniques, including percutaneous iliac vein angioplasty with stent placement, has revolutionized the treatment for May–Thurner syndrome.¹⁰

Despite adequate anticoagulation, nearly one-half of the cases develop PTS due to mechanisms less clearly understood, as mentioned above. Treatment of PTS and chronic DVT has evolved over years, with greater emphasis on mechanical thrombectomy, thus focusing on restoration of normal flow over anticoagulation. One of the arguments for pharmacological thrombolysis or surgical thrombectomy is the fact that residual thrombus¹¹ is a strong risk factor for recurrent DVT and hence PTS. In a study comparing systemic thrombolysis to heparin, PTS developed less frequently in those treated with plasminogen activators rather than heparin. However, at the cost of increased bleeding risk (risk ratio, 2.9; 95% confidence interval, 1.1–8.1; \( P = .04 \)) than in those treated with heparin alone.¹² In another randomized trial comparing anticoagulation to...
surgical thrombectomy, improved venous patency and a reduction in PTS was demonstrated in the surgical arm, at the expense of surgical and anesthetic risks. Other preventive strategies that have been proven to be beneficial are elastic compression stockings and exercise therapy.

In chronic DVT with persistent PTS, standard endovascular chronic total occlusion revascularization techniques are employed to traverse the occlusion. One such catheter is the Wildcat catheter system, which has been successfully used to cross the chronic venous occlusion and has been reported previously. In our patient, we used the TriForce Peripheral Crossing system to successfully traverse the chronically occluded venous segment. Thrombolysis has no perceived role in chronic DVT due to the chronic nature of the coagulation cascade; however, its role in acute DVT will be dictated by the results of the pending ATTRACT (Acute Venous Thrombosis: Thrombus Removal with Adjunctive Catheter-Directed Thrombolysis) multicenter, randomized, phase 3 trial.

In a study by Raju et al., chronic occlusion affecting ilio-femoral segments treated with large-caliber, self-expanding stents extending below the groin crease were studied for the ease of deployment and long-term patency. Actuarial primary, primary-assisted, and secondary patency rates of stents at 24 months were 49%, 62%, and 76%, respectively. The stented group had significant symptomatic improvement with minimal morbidity. The same group in another review reported excellent results with iliac vein interventions with better long-term patency results. Thus, our patient underwent stenting of the chronically occluded venous segments in order to mitigate the symptoms of PTS, with excellent result post procedure. The patient was seen in the follow-up clinic and had excellent symptom improvement.

This case highlights endovascular management of May–Thurner syndrome complicated with PTS. We describe the technique of crossing chronic venous occlusion and revascularization with stenting. The importance of post-interventional care including antiplatelet therapy, anticoagulation, and early ambulation, should not be underestimated.

Editor’s Note
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