VDM Vascular Disease Management

CASE REPORT

Patency Restored to an Occluded Femoralfemoral Venous Bypass Graft With the ClotTriever Thrombectomy System

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Keywords
Femoralfemoral Vein Bypass
Mechanical Thrombectomy
Deep Vein Thrombosis
Palma Procedure

January 2023
ISSN 2152-4343

VASCULAR DISEASE MANAGEMENT 2023;20(1):E8-E11

Abstract

A 36-year-old female with a rare, femoralfemoral venous bypass and history of severe postthrombotic syndrome presented with complete total occlusion of the native left femoral veins and graft. Symptom management with conservative therapies had provided little benefit, however no other option had been available to restore patency. The patient underwent successful mechanical thrombectomy with the ClotTriever System (Inari Medical), restoring flow within the graft and previously thrombosed vessels.

Introduction

"Postthrombotic syndrome (PTS) develops in up to 50% of patients with deep vein thrombosis (DVT).[1] Those patients can expect a reduced quality of life[2] and limited options for treatment. Conservative treatment such as anticoagulation can only prevent new thrombus formation and thrombolytic treatment, while less conservative, is similarly lacking in effectiveness as it cannot dissolve older, chronic thrombotic material. The ClotTriever System (Inari Medical) for mechanical thrombectomy has been shown to be effective[3,4] at removing thrombus in patients with a range of thrombus chronicities. Here I describe a previously untested use of this device to recanalize a totally occluded, rare femoralfemoral venous graft.

Case Report

A 36-year-old female presented to our clinic for a second opinion regarding progressively worsening and disabling left lower extremity post thrombotic manifestations that had failed anticoagulation therapy. Her symptoms included limb heaviness, tightness, and exacerbated pain. Numerous varicosities and collaterals from previously diagnosed occlusion of the left common iliac and left external iliac veins were evident through her abdomen and left thigh.

Medical History

The patient had a longstanding history of chronic, recurrent venous thromboembolism (VTE) with PTS. She experienced her first deep vein thrombosis (DVT) at age 24 and was later diagnosed with factor V deficiency. Two years later, overlapping stents were placed in the left common iliac and left external iliac veins, which subsequently became chronically occluded despite anticoagulation. Multiple attempts to recanalize these vessels failed, and the patient developed collaterals on the abdominal and pelvic walls. By age 31, she was experiencing severe symptoms of PTS and with no option for thrombectomy available at that time, she was referred for vascular surgery to divert the blood flow

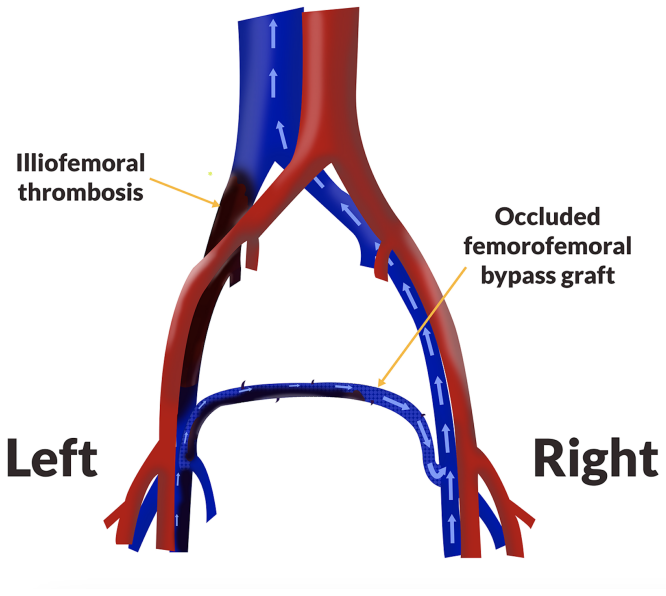

Figure 1. Occluded femoralfemoral venous bypass graft. Illustration depicts minimal flow from thrombosed vessels on the left and through the bypass graft, with subsequent draining on the right.

around the stented vessels. She underwent a Palma procedure at the University of Florida in which the right greater saphenous vein was used to create a femoralfemoral venous bypass graft. Five years later, the grafted vessel had thrombosed (**Figure 1**), which compromised the patient's left leg and left her unable to work. She consulted with multiple specialists but was offered no further treatment plan beyond symptom management. The patient was advised to remain on conservative anticoagulation therapy and wear compression stockings indefinitely.

Differential Diagnosis

Acute-on-chronic occlusive venous thrombosis was strongly suspected in the left femoral vein and venous bypass graft due to the patient's history of chronic, recurrent VTE and confirmed hypercoagulability. Swelling, pain, and skin color changes were evident (CEAP 4B-5), contributing to a confirmed diagnosis of chronic thrombotic venous occlusion with PTS.

Investigations

Bilateral duplex ultrasound imaging was performed preoperatively, confirming that in addition to the previously diagnosed iliac stent occlusion, the native left femoral vein and femoralfemoral bypass graft were also completely occluded. Extensive and meticulous venous mapping of the bilateral lower extremities was conducted to determine patency and flow pattern of the affected areas, and to locate the anastomosis.

Management

Due to the severity of the patient's symptoms, a plan was made to perform intravascular ultrasound (IVUS), venoplasty, and mechanical thrombectomy to recanalize the occluded femoralfemoral vein bypass and restore venous flo*w.*

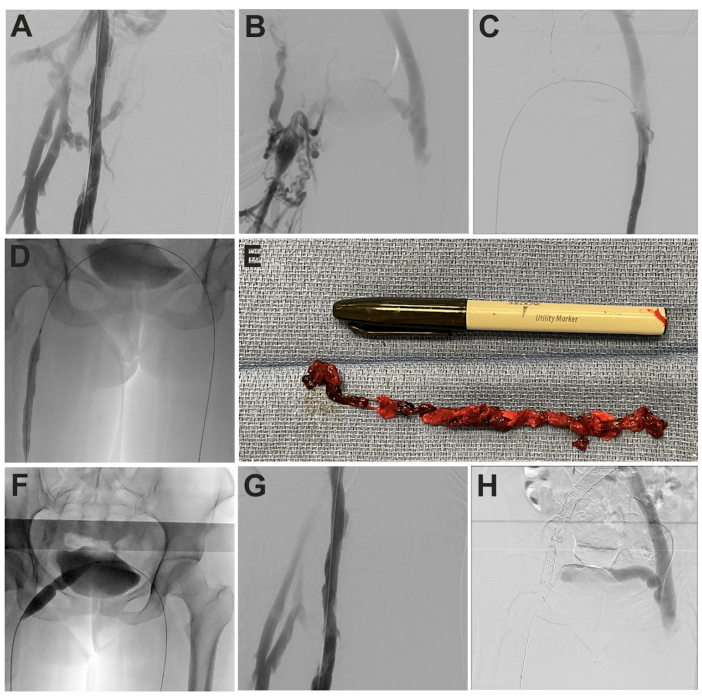

Figure 2. Mechanical thrombectomy of a femoralfemoral venous graft. Preprocedural venography demonstrated total chronic obstruction of the left and common femoral veins **(A)**. A guidewire crossed the occluded left iliac veins and femoralfemoral graft **(B)** and emerged into to the right popliteal vein **(C)**. Primary dilatation of the graft and native left common femoral, femoral, and popliteal veins **(D)**. Mechanical thrombectomy was performed through the graft retrieving extensive chronic thrombus **(E)**. Atlas balloons treated the graft following thrombectomy **(F)**. Postprocedural venography confirms normal flow through the native left popliteal and femoral veins **(G)**, filling the venous graft, right iliac vein and the IVC **(H)**.

The patient was brought to the cardiac catheterization lab where moderate sedation was achieved. The left popliteal vein was identified, followed by ultrasound-guided cannulation with a microneedle. An 8 Fr x 10-cm diagnostic sheath was then advanced over an 0.035" Amplatz stiff guidewire (Boston Scientific), and venography of the left lower extremity veins was performed. Venography identified total chronic occlusion of the left and common femoral veins (**Figure 2A)** and occluded left iliac veins with evidence of prior stents.

A 0.035" microcatheter and 0.035" Glidewire (Terumo) were used to cross the left femoral vein chronic total occlusion. The crossing catheter was then exchanged for a 8-mm x 80-mm semicompliant balloon to improve wire support. After crossing into the left anastomosis site, the crossing catheter was reintroduced and advanced into the occluded left superficial and common femoral veins. After several maneuvers, the guidewire was able to cross the left-sided cap of the occluded femoralfemoral venous graft (**Figure 2B**) and emerge into to the right femoral and popliteal veins (**Figure 2C**). The crossing catheter was then exchanged for an IVUS catheter, and assessments of the entire femoralfemoral graft and left-sided veins were performed.

The 0.035" Amplatz wire was exchanged over the IVUS catheter for a Glidewire. Next, a 6-mm x 60-mm semicompliant balloon was advanced and used to perform primary dilatation of the venous graft, followed by dilatation of the native left common femoralfemoral veins and popliteal veins (**Figure 2D**).

A 12 Fr dilator was used to facilitate advancement of the 14 Fr ClotTriever sheath over the Amplatz wire and through the left popliteal vein. The ClotTriever catheter was advanced through the left femoral vein, across the saphenous vein graft, and positioned in the mid-segment of the right femoral vein. The ClotTriever catheter's coring element and collection bag were expanded and then retracted through the sheath, capturing and extracting chronic thrombotic lesions from within the graft. Mechanical thrombectomy was performed for a total of 4 passes through the venous graft followed by the native left common femoral, femoral, and left popliteal veins. Extensive chronic thrombus was retrieved (**Figure 2E**).

Atlas balloons (14-mm x 40-mm and 16-mm x 40-mm) were then used to treat the venous graft. Both were inflated at the anastomosis site and at the proximal native left common femoralfemoral veins (**Figure 2F**). Venous flow was achieved through the graft and the native veins, with normal flow through the native left popliteal and femoral veins (**Figure 2G**), filling the venous graft and into the right iliac vein and the IVC (**Figure 2H**). Final venogram and IVUS assessments confirmed restored patency in the native left femoral veins and within the femoralfemoral venous graft, with a reduction in venous collateralization. Hemostasis at the left popliteal access was achieved with figure of 8 sutures, and IV heparin was given.

The patient tolerated the procedure well and suffered no immediate complications. She reported a remarkable immediate improvement in left lower extremity congestive symptoms at the termination of the procedure and had an uneventful postoperative course.

Discussion

Patients with DVT who develop severe, debilitating PTS are often resigned to symptom management with conservative therapies[5] that provide little benefit or relief. The chronic nature of this patient's disease meant that neither anticoagulation, which can only prevent new thrombus from forming, nor thrombolytics, which cannot dissolve chronic thrombus, would be effective. Although her graft had become chronically occluded, preventing flow from the lower left extremity, no other option had been available to this patient to restore patency until now.

With the advent of safe and effective technologies, mechanical thrombectomy capable of removing thrombus of all chronicities[3] has quickly supplanted thrombolytics as the treatment of choice for DVT in our practice. Careful and meticulous planning made it possible to safely cross the occluded femoralfemoral bypass graft. Prior to this procedure, no substantial flow had been observed in the left leg and only the right leg drained. Post procedure, a flow convergence was demonstrated on live image video—blood was carried from the left leg, through the bypass graft to the right-sided iliac vessels, meeting flow from the right leg. Both sides subsequently drain through the right iliac vein.

To our knowledge, recanalization of a totally occluded graft such as this one using mechanical thrombectomy has not been attempted previously. As this report demonstrates, it is now possible to remove highly chronic thrombus safely and effectively.

Following the procedure, the patient was discharged in stable condition with improved symptoms and a 4-cm reduction in left calf width. At 6-week follow-up, a duplex ultrasound confirmed patency. Her symptoms of swelling and pain, and the external appearance of left lower extremity skin, were remarkably improved.

Conclusion

A patient with a rare femoralfemoral venous bypass graft developed total chronic obstruction of the native left femoral veins and the saphenous vein graft. The patient was in grave pain and discomfort, debilitated, and unable to work; however, no treatment options were available beyond symptom control. She underwent successful mechanical thrombectomy with the ClotTriever System, restoring flow within the graft and previously thrombosed vessels. The procedure resulted in an excellent outcome for the patient: Her pain and discomfort resolved, she regained full use of her left leg, and she was able to return to work.

The success of this case demonstrates that mechanical thrombectomy, previously untested as a solution to restore patency to a totally occluded bypass graft, has the potential to treat thrombosed vascular reconstructions. Further studies are warranted. ■

Compliance with Ethical Standards: This study was not supported by any funding. The author declares that he has no conflict of interest. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee

and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No Institutional Review Board (IRB) approval was required.

Consent for publication was obtained for the individual person's data included in the study.

Disclosure: Dr. Bisharat is a consultant for Inari Medical.

Manuscript accepted December 6, 2022.

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