

## Conversion of Antegrade to Retrograde Access for Endovascular Superficial Femoral Artery Interventions Using a Failed Previously Performed Femoropopliteal Bypass Graft as a Conduit

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### Abstract

Endovascular therapy is a common approach for superficial femoral artery (SFA) symptomatic disease, commonly accessing the contralateral femoral artery, crossing the aortic bifurcation. Occasionally, antegrade recanalization is not feasible secondary to causes such as ostial SFA occlusion, wire perforation or inability to obtain distal re-entry.

The authors report a 66-year-old woman with lifestyle-limiting claudication caused by aortoiliac and SFA atherosclerosis, who was previously treated with an iliac stent and a femoropopliteal bypass prosthetic graft. When her prosthetic graft occluded about one year after its construction, an antegrade approach to the SFA via retrograde puncture to the contralateral femoral artery was used for revascularization. After initial attempts to recanalize the occluded SFA, they used the prosthetic graft as a conduit to enter the occluded artery distally, eventually converting the retrograde access into antegrade. To the best of our knowledge, this is the first report in the use of this technique.

Using a failed femoropopliteal bypass as a conduit to access the SFA in a retrograde manner can be safely and effectively performed especially in flush occlusions when there is no SFA proximal stump for recanalization.

**Keywords:** Endovascular technique; Vascular access; Femoral artery

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### Introduction

The standard endovascular approach to treat superficial femoral artery (SFA) atherosclerosis is from the contralateral common femoral artery (CFA) and crossing over the aortic bifurcation [1]. Occasionally, antegrade recanalization is not feasible secondary to ostial SFA occlusion, wire perforation or inability to obtain distal re-entry. For these cases, some have published success in crossing these lesions with the use of distal arterial access [2].

The authors report a 66-year-old woman with lifestyle-limiting claudication caused by aortoiliac and SFA atherosclerosis, previously treated with an iliac stent and a femoropopliteal bypass. When her prosthetic graft occluded, an antegrade SFA approach via retrograde contralateral femoral artery puncture was used for revascularization, utilizing the prosthetic graft as a conduit to enter the occluded artery distally, eventually converting the retrograde access into antegrade. To the best of our knowledge, this is the first report in the use of this technique.

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### Case Report

A 65-year-old Caucasian female presented with left leg life style-limiting claudication. She reported severe left calf cramping at 100-yard ambulation, which disappeared with rest. Her ankle-brachial index was 0.63. She underwent angiography, which revealed left external iliac artery occlusion, successfully treated with stenting. A long SFA occlusion was also demonstrated, with reconstitution above the knee joint. At that time, only the iliac lesion was treated, with further therapy depending upon clinical response. Low-dose aspirin and 75-mg of clopidogrel were given daily after stenting and this intervention resulted in symptomatic

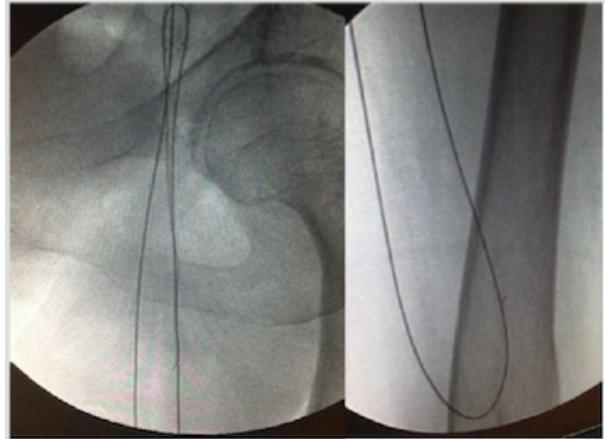
improvement. About a year after, she presented with ischemic left lower extremity rest pain. A left femoropopliteal bypass with an expanded polytetrafluoroethylene (e-PTFE) graft was performed, resulting in symptom resolution.

Six months later, she presented with ischemic rest pain secondary to bypass occlusion. Vein mapping demonstrated sub-optimal autogenous vein conduit. Aortoiliac arteriogram was performed through a right CFA percutaneous access. A 70% left common iliac artery stenosis was noted, as measured on intravascular ultrasound (IVUS, Volcano Corp., San Diego, California). This stenosis was not obviously present at the moment of the index intervention 18 months prior. A 7-French Raabe sheath (Cook Medical, Bloomington, Indiana) was advanced up and over the aortic bifurcation. Left lower extremity circulation revealed a patent external iliac artery stent and a flush left SFA occlusion. A small occluded bypass stump was noted, and distal images showed popliteal artery reconstitution right above the knee (**Figure 1**). An 0.035" guidewire (Terumo Interventional Systems, Somerset, New Jersey) was used to attempt crossing the native SFA system, unsuccessfully. Ultimately, the guidewire was used to traverse the occluded femoral-popliteal bypass, and as the distal anastomosis was crossed, the wire was directed in a retrograde fashion into the previously occluded native SFA, allowing proximal navigation towards the left groin (**Figure 2**). This retrograde wire maneuvering ultimately resulted in re-entering the true CFA lumen. The wire was then snared from the right groin using a tri-lobed snare (Inter-V, Gainesville, Florida), bringing it back through the sheath.

Then, reentry in the distal popliteal artery easily obtained, now in an antegrade manner. Angioplasty and four self-expanding Supera™ (IDEV Technologies, Houston, Texas) stents were required to revascularize the femoropopliteal segment (**Figures 3 and 4**).



**Figure 1** Pre-intervention angiogram (left panel) shows the distal end of a widely patent left external iliac stent. The left common and deep femoral arteries are patent. The superficial femoral artery is completely occluded from its origin, and a small stump of the previously performed bypass can be seen. On the right panel, distal reconstitution from lateral collateral vessels can be seen at the above-the-knee popliteal level, just above the knee joint.



**Figure 2** An 0.035" guidewire can be seen first going down distally in an antegrade manner (left panel) and then looping backwards going again towards the left groin (right panel), where it will be grasped by a tri-lobed endovascular snare, in order to be delivered through the right common femoral artery sheath. To follow, a glide catheter was advanced over the wire now exiting the right groin sheath, advancing it up and over the aortic bifurcation and through the chronically occluded SFA. In this manner, the distal end of the glide catheter is now positioned right above a very short segment of occluded distal SFA, which was easily crossed with gently pressure, regaining intraluminal position.

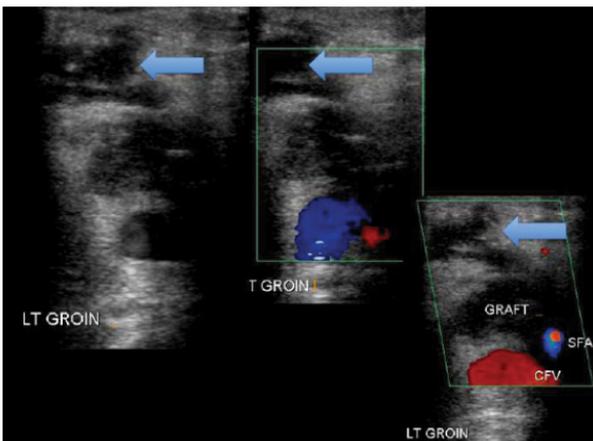


**Figure 3** Three views are offered in this figure showing the appearance of the popliteal artery after regaining distal entry and after balloon angioplasty. Dissection subtle defects can be seen, which were corrected with subsequent stenting.

Left common iliac artery stenting was ultimately performed. On her initial one-month follow-up, the patient denied ischemic lower extremity ischemic symptoms, but complained of a left groin soft lump. Ultrasound showed fluid around the proximal graft (**Figure 5**), indicating a prosthetic bypass graft infection. She then underwent prosthetic graft resection, sartorius muscle coverage and Negative Pressure Wound Therapy (Kinetic Concepts, Inc., KCI, San Antonio, TX) application. Cultures revealed *Propionibacterium* species and yeasts, treated with intravenous



**Figure 4** Completion angiographic views showing the revascularized femoropopliteal arterial segment, after angioplasty and placement of four self-expanding Nitinol stents. A palpable dorsalis pedis pulse was elicited after intervention.



**Figure 5** Duplex ultrasound images showing an occluded graft with fluid around its proximal aspect (blue arrow). The SFA can be seen widely patent after endovascular intervention.

antibiotic and anti-fungal medication. On follow-up she had no evidence of infection and a well perfused left lower extremity.

The fact that now her lower extremity was well perfused, simplified enormously the management of her infected graft. Removal of the distal end of the graft was facilitated by the fact that a Supera™ stent was placed distally. The high stent radial force allowed us to clamp the distal SFA with the stent inside its lumen, to obtain proximal arterial control. Popliteal artery repair at this level did not require a vein patch and rather, primary arterial wall closure was performed over the existing stent. Proximally, a vein patch was required.

## Discussion

SFA chronic total occlusion (CTO) has been traditionally treated with femoropopliteal bypasses. Autologous venous conduit is still considered the gold standard for treatment of long SFA lesions [3]. However, SFA therapy has changed during the last few decades [1], with endovascular therapy gaining immense popularity.

Ever since, multiple techniques such as angioplasty, stenting or atherectomy [4], wires, catheters and stents have been used and created, refining this modality.

Our patient initially presented with severe claudication, which was adequately treated by inflow revascularization alone. Unfortunately her disease progressed, and now her femoral segment required therapy. This was managed following current TransAtlantic Inter-Society Consensus (TASC) recommendations [3], which suggest best outcomes with open revascularization for SFA occlusions over 15-20 cm. Scalli et al reported comparable patency SFA revascularization rates after open or endovascular methods [5].

However, Al-Nouri and colleagues have cautioned against performing stenting of advanced SFA lesions [6]. A 36-month retrospective chart review of SFA interventions revealed that those performed for TASC C-D lesions are more likely to fail and more likely to lead to bypass or amputation. Furthermore, endovascular interventions performed for TASC C-D lesions that fail have a negative impact on limb salvage. This issue is still largely debatable and it depends on the individual practice expertise [7].

This patient's bypass failed about 12 months after construction. Alternatives revascularization methods included redo bypass but now to the below-the-knee popliteal artery, remote endarterectomy [8], retrograde SFA puncture distal to the adductor canal with the patient remaining supine [9], thrombolysis of the occluded bypass graft or femoro-popliteal retrograde access [10]. Our choice was to use the occluded PTFE segment as a conduit to obtain access to the distal SFA. A clear bypass stump was seen, and directing a wire into this area was quite easy, as well as advancing it through it. An obvious caveat of this approach is inability of obtain reentry at the popliteal or CFA level. But the clear benefit of this approach is obtaining SFA access in cases where the so-called proximal SFA stump or knob is absent (flush ostial SFA occlusions).

The advantages of a retrograde recanalization have been extensively discussed for infrainguinal interventions, all reporting high success [2,11] probably due to the less organized nature of the distal atherosclerotic plaque. This too was obvious in our case, with the wire navigating with ease up the occluded SFA. Schmidt et al. [9] reported on retrograde SFA recanalization after direct puncture at the adductor canal level. A 4% (n=2/50) pseudoaneurysm rate at the distal puncture site was reported as the main complication. Retrograde access through a previously occluded bypass eliminates the potential for this complication. Further follow-up is obviously required for our approach. However, our goal was not to prove the long-term results of endovascular revascularization after a failed open surgical bypass but rather, to describe a technical maneuver to be used in cases of ostial SFA occlusion in the face of a failed bypass graft.

## Conclusions

Using a failed femoropopliteal bypass as a conduit to access

the SFA in a retrograde manner can be safely and effectively performed as a bail-out strategy for challenging SFA occlusive cases, especially in flush occlusions when there is no SFA proximal stump for recanalization.

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## Authors Declaration

The authors have no financial or proprietary interest in the subject matter or materials discussed in the manuscript.