



An innovative modification of the retrograde approach to angioplasty and recanalization of the superficial femoral artery

Martin Weng Chin H'ng, Sundeep Punamiya

ABSTRACT

Endovascular therapy has been performed for chronic limb ischemia for nearly 50 years. Superficial femoral artery occlusions can be managed by the retrograde contralateral ("crossover"), antegrade ipsilateral, or retrograde popliteal ("facedown") approaches. The retrograde approach was initially fraught with limitations and served as a backup option. Refinements to this technique have made it an enticing option and possibly the first choice in selected patients. We herein describe an innovative modification of this method.

Endovascular therapy has been performed for chronic limb ischemia since 1964, with intraluminal and subintimal angioplasty of the superficial femoral artery (SFA) gaining popularity in the last decade (1). SFA occlusions can be managed by retrograde contralateral or antegrade ipsilateral approaches (2, 3); when these approaches fail, some practitioners resort to using a re-entry device (4, 5). The retrograde popliteal approach was initially fraught with limitations and served as a backup option (1, 4, 6). However, refinements to this technique have made this an enticing option (2–7), and it has been advocated as a first-line treatment in select patients (3). We herein describe another modification of this method.

Technique

We present a case of a 94-year-old woman who led an independent life. She was a chronic smoker, and had hypertension, diabetes, and renal impairment. During her current admission, she was diagnosed with wet gangrene of her right little toe on a background of peripheral vascular disease and chronic total occlusion (CTO) of the SFA as shown by Doppler ultrasonography. The treatment plan was to attempt angioplasty and recanalization prior to ray amputation.

A retrograde right popliteal artery approach was considered but was not achievable because the patient was unable to lie prone. We decided to proceed with her lying in the supine position instead. The right common femoral artery (CFA) was punctured antegradely under ultrasound guidance. A 5.5 F sheath (Radifocus Introducer II, Terumo, Tokyo, Japan) was inserted, and lower limb angiograms were acquired. These images showed flush occlusion of the SFA with no nubbin and reconstitution at the femoropopliteal junction with an intact run-off below the knee (Fig. 1).

The ostium of the SFA could not be cannulated from the antegrade direction (Fig. 2). The atheroma within the proximal right SFA was punctured retrogradely using a micropuncture introducer set (Cook Medical, Bloomington, Indiana, USA) under ultrasound guidance. Gentle prodding of the mandrill wire was performed while slowly retracting the micropuncture needle until it could be advanced smoothly in the subintimal plane (Fig. 3a). The dilator of the micropuncture set was then threaded over the mandrill wire and into the CFA before exchanging that wire for an angled Glidewire (Terumo Corp., Tokyo, Japan) (Fig. 3b). Using a 4 F Ber 2 catheter (Cordis Corp., Miami, Florida, USA) for support, the Glidewire could be negotiated through the sheath (Fig. 3c), thereafter enabling the sheath to be advanced into the occluded proximal SFA (Fig. 3d). The Ber 2 catheter and Glidewire were then removed

From the Department of Diagnostic Radiology (M.W.C.H. ✉ martinhngwc@gmail.com), Tan Tock Seng Hospital, Singapore, Singapore.

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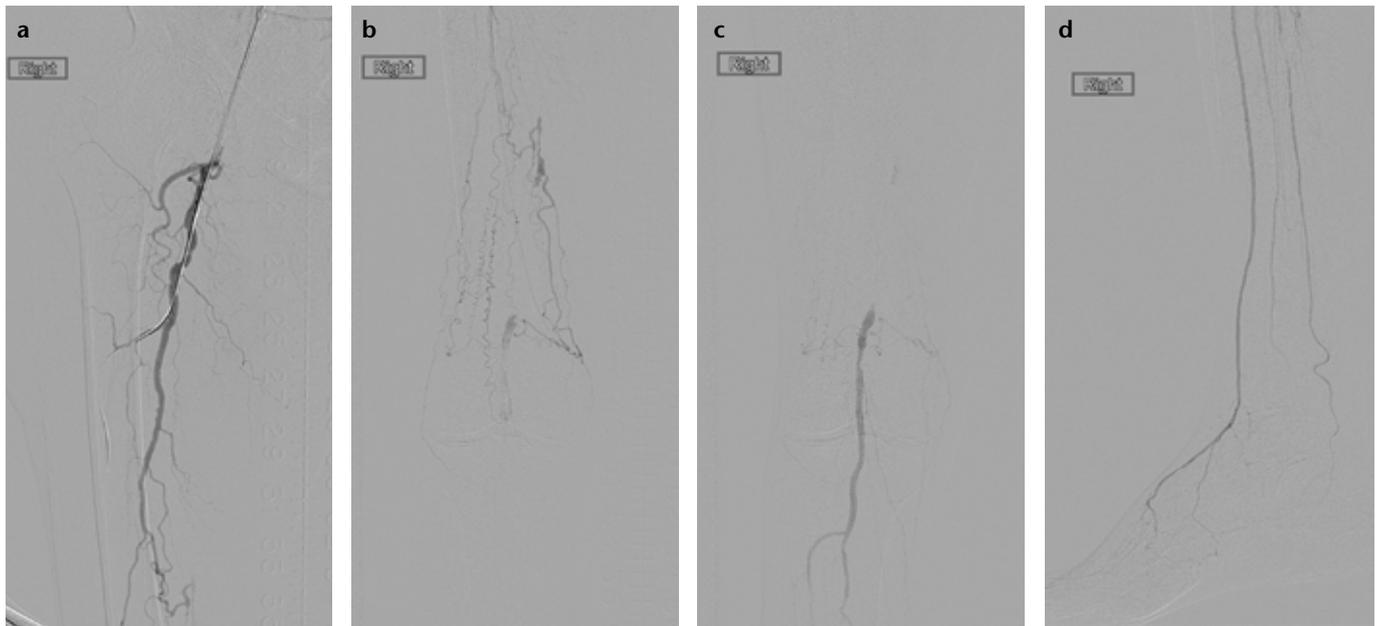


Figure 1. a–d. A 94-year-old woman with peripheral vascular disease, chronic total occlusion of the superficial femoral artery (SFA), and toe gangrene. Angiogram via the right groin sheath (a) showing occlusion of the entire SFA beginning at its origin. The popliteal artery is reconstituted via profunda femoris collaterals and appears patent (b). There is a three-vessel run-off below the knee (c) with no significant stenosis followed by opacification of a dorsalis pedis artery and plantar arch, albeit with sluggish flow (d).

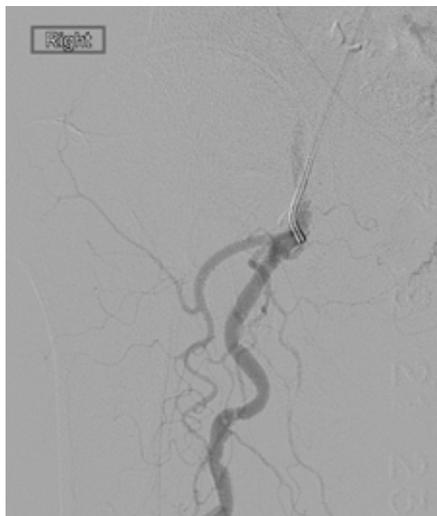


Figure 2. Difficult cannulation of the superficial femoral artery due to flush occlusion at its ostium with no nubbin and preferential tracking of the guidewire down the profunda femoris.

and reinserted antegradely for subintimal recanalization of the remaining SFA (Fig. 3e), successfully re-entering the true lumen of the popliteal artery (Fig. 4). The Glidewire was finally exchanged for a Rosen wire (Cook Medical, Indiana, USA), and the occluded segment was angioplastied with a 5×200 mm Admiral Xtreme balloon (Invatec, Roncadelle, Italy) (Fig. 5). The postprocedural angiogram showed satisfactory flow through the SFA into the popliteal artery (Fig. 6).

At follow-up two to three weeks later, the wet gangrene was drier and ray amputation was deemed unnecessary. The patient did not attend her subsequent appointment.

Discussion

SFA occlusions are generally managed by a retrograde contralateral (“crossover”) approach or an antegrade ipsilateral approach (2, 3). For the latter, an SFA stump of >5 mm is necessary (7). Although intraluminal recanalization of the SFA is preferred (5), there is a tendency for the wire to travel subintimally because of the convex contour of the cap at the upper end of the occlusion (2). Unfortunately, recanalization of a CTO using a catheter and guidewire alone is successful only 40%–60% of the time (5), and some practitioners will resort to utilizing a re-entry device rather than attempt a retrograde popliteal approach (4, 5).

The retrograde popliteal (“facedown”) approach is a type of subintimal arthroflissing with antegrade-retrograde intervention (SAFARI); it was first described by Tonnesen in 1988 (2, 3, 5–8). The main indications for this technique are a short SFA stump, flush occlusion or tandem CFA/SFA lesions, and failure of the antegrade approach (3, 7). It has been postulated that recanalization may be more successful given the less severe-

ly fibrotic/calcified thrombus when approached from the distal end (2).

In earlier studies, the major setback associated with the retrograde popliteal approach was the need to turn the patient prone and then supine again. This added to patient anxiety and was uncomfortable, particularly for those who were obese and had impaired respiratory function (2, 6). For the operator, it meant a prolonged procedure with a risk of dislodging the femoral sheath (2, 6). More recently, this technique was modified to accommodate an entirely supine posture by lifting the heel (1, 6) or flexing and medially rotating the knee (2). Another alternative not requiring the patient to be turned prone is the retrograde distal SFA access method (4). However, this makes it unsuitable for treating lesions below the adductor canal. Extrapolating from that article, we sought to puncture the SFA more proximally. As a slight deviation from the norm, we punctured directly into the atheroma primarily to facilitate access for antegrade recanalization.

Being the major vessel below the knee, repeated failed punctures could injure the popliteal artery and worsen limb ischemia (6). Numerous other complications have been cited, such as hematoma, pseudoaneurysm, iliofemoral dissection, occlusion of the profunda origin, vessel rupture, arte-

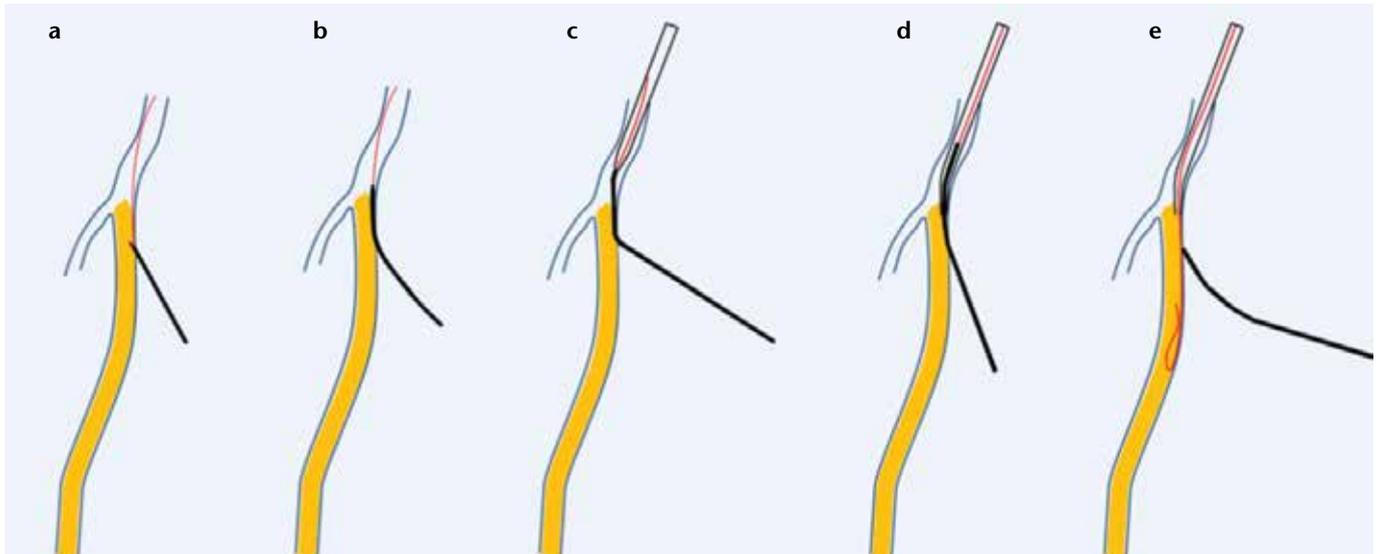


Figure 3. a–e. Retrograde puncture of the proximal superficial femoral artery (SFA) was performed at the level of the upper thigh (a). The dilator of the micropuncture set was then threaded over the mandrill wire and into the common femoral artery, allowing exchange for an angled Glidewire (b). Using a 4 F Ber 2 catheter for support, the Glidewire could be threaded through the sheath (c). The sheath was then “railroaded” over the Ber catheter and into the proximal SFA (d). The same Ber 2 catheter and Glidewire combination was later used for subintimal recanalization of the SFA (e).

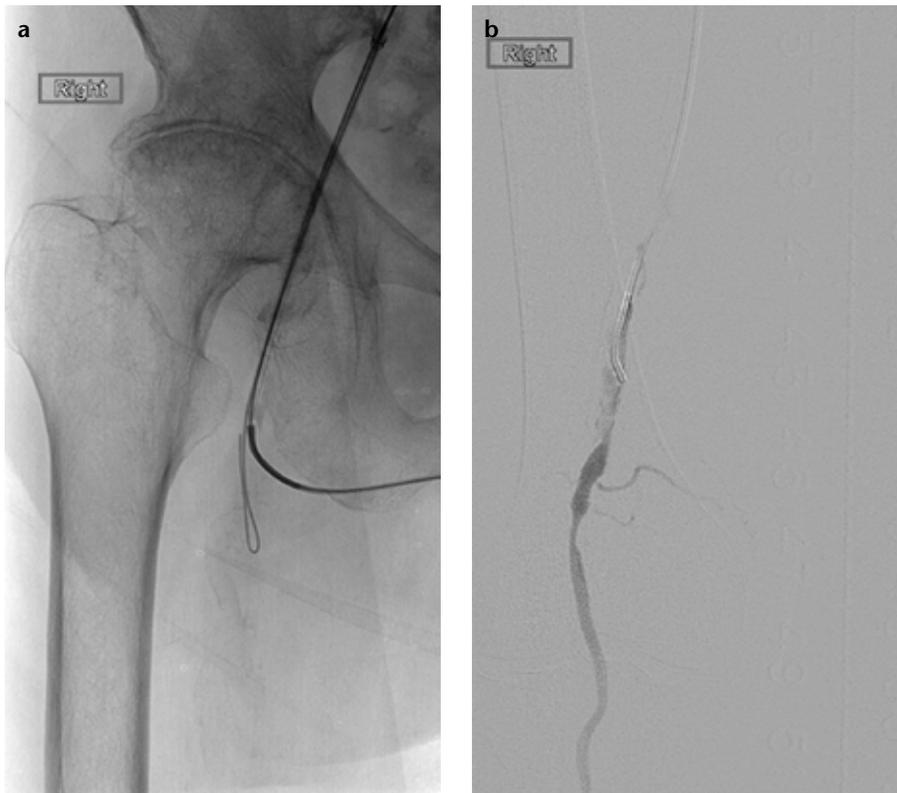


Figure 4. a, b. Subintimal recanalization of the superficial femoral artery was performed (a), eventually re-entering the true lumen just below the level of the adductor hiatus and confirmed with contrast injection (b).

riovenous fistula, and distal embolization (2–5). Complications reportedly ranged from 4.3% to 10.7% in one study, although these rates may have been related to the sheaths used, which were 5 and 6 F in size (6). To

reduce complications, we maintained a small access site (2), initially using a micropuncture needle before upsizing to a 4 F Ber catheter without a sheath. Furthermore, puncture was performed under ultrasound guidance (2, 3, 7).

After negotiating the guidewire through the occlusion, it may be threaded into the femoral sheath or snared out (2). Subsequent ballooning or stenting is preferably performed via the femoral end (4, 6). We adhered to these basic tenets. Schmidt et al. (4) recommended achieving hemostasis after the procedure by manually compressing or inflating a blood pressure cuff to suprasystolic pressure with or without additional inflation of an endoluminal balloon at the SFA puncture site. However, the latter may cause dissection and induce intimal hyperplasia. In our case, no bleeding occurred from the retrograde access site because of complete SFA occlusion, followed by apposition by the distal end of the sheath and then from a tamponade effect by the inflated balloons.

Conclusion

In conclusion, given our initial success, we believe that future retrograde recanalizations of the SFA in an entirely supine position may be advocated as a first-line treatment in select cases. A high SFA puncture, regardless of the presence of atheroma, could complement the antegrade groin puncture in accessing the SFA, particularly in the presence of a flush occlusion at its ostium.

Conflict of interest disclosure

The authors declared no conflicts of interest.

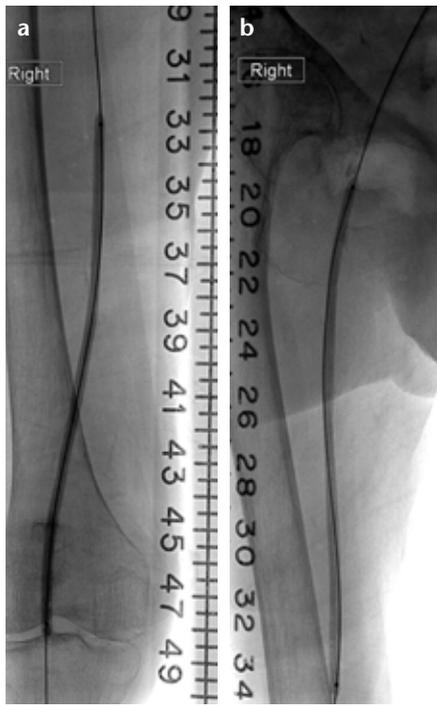


Figure 5. a, b. Overlapping balloon angioplasties were performed from the popliteal artery to the mid-superficial femoral artery (SFA) (a) and retracted proximally to include the common femoral artery (b). For the latter, the sheath had to be withdrawn slightly to allow for adequate angioplasty across the common femoral artery/SFA junction.

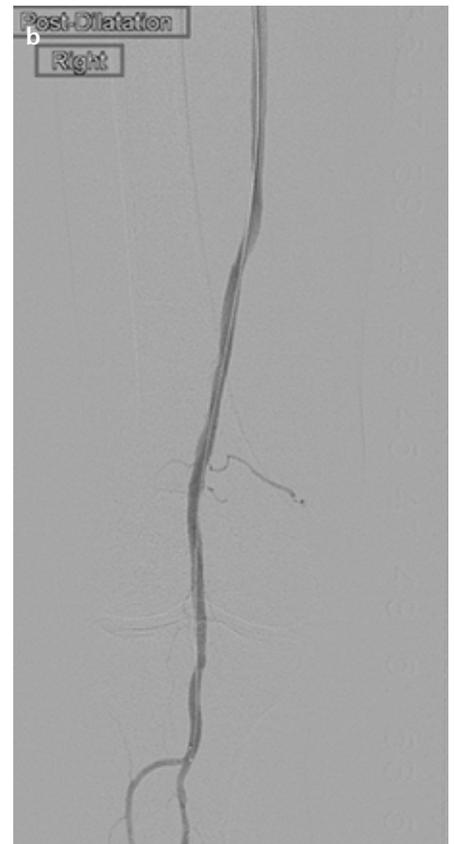
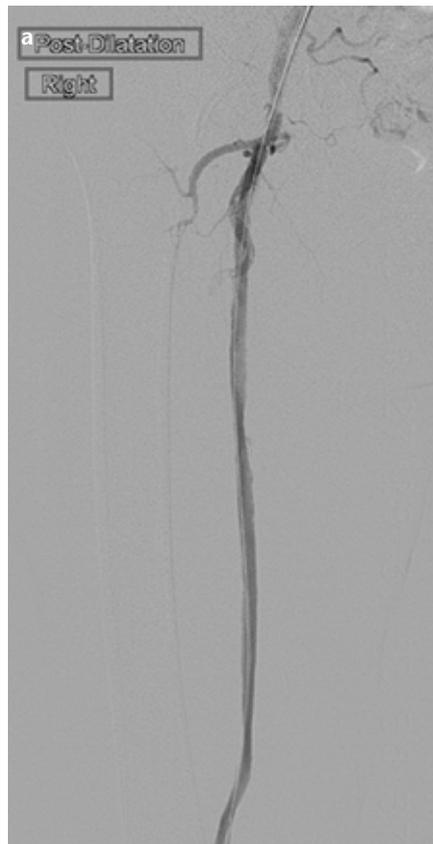


Figure 6. a, b. Postangioplasty results showing good flow through the superficial femoral artery (a) with preservation of flow into the below-knee vessels (b).

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