Retrograde deep femoral artery puncture for the treatment of an iatrogenic dissection flap of the common femoral artery bifurcation

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ABSTRACT

The authors report on a diabetic patient with tissue loss, previously treated with a femoral-tibial bypass, which occluded shortly after construction. A combination of antegrade contralateral femoral and retrograde tibial access was used for revascularization. Angiogram demonstrated a dissection flap occluding the deep femoral artery flow, which was unable to be crossed from an antegrade approach. A retrograde deep femoral artery access was used to perform "kissing" angioplasty of the origins of the superficial and deep femoral arteries, thus successfully reestablishing flow to both vessels. This represents an unconventional endovascular technique that can be safely performed as a bailout maneuver. (J Vasc Surg Cases and Innovative Techniques 2020;6:648-52.)

Keywords: Retrograde; Deep femoral artery; Profunda femoris artery; Endovascular; Dissection

As endovascular techniques for peripheral artery disease (PAD) therapy evolve, so does the boundary of what is deemed technically feasible. With increasing PAD complexity, situations can arise that may not be able to be approached via standard therapeutic methodologies. The authors herein report percutaneous retrograde deep femoral artery (DFA) access to treat a common femoral artery (CFA) dissection. The complication occurred due to a high CFA reentry after a complex endovascular femorotibial intervention for critical ischemia. The patient provided consent for publication of this case report.

CASE REPORT

A 64-year-old diabetic woman presented with critical limb ischemia. She had undergone a right-sided DFA-to-posterior tibial artery bypass using great saphenous vein 5 months prior for severe ischemic rest pain and a nonhealing heel ulcer (Fig 1, *A*). Her ankle-brachial index (ABI) before the bypass was 0.29. Her bypass was complicated by a right groin wound infection, requiring surgical debridement and antibiotics. After the bypass her ABI was 1.07. Her rest pain improved briefly, but about 2 months after she experienced recurrence of severe symptoms. She also developed an ulcer between her second and third toes. Duplex ultrasound examination demonstrated an occluded bypass. Vein mapping showed suboptimal left great saphenous vein and bilateral small saphenous veins in size and length for bypass surgery. Angiography with revascularization was offered through retrograde left CFA access. Arteriography revealed patent right CFA and DFA with a flush superficial femoral artery (SFA) occlusion (Fig 1, *B*). The popliteal artery reconstituted at the knee joint, but all three runoff vessels were occluded (Fig 1, *C*). There was reconstitution of a markedly diseased posterior tibial artery and of a much healthier-appearing dorsalis pedis artery (DPA; Fig 1, *D*); pedal arch was patent.

Given the status of DPA and an intact pedal arch, retrograde DPA access was established (Fig 2, *A*) by using a micropuncture access set (Cook Medical, Bloomington, Ind), an 0.014" Hi-Torque Command guidewire (Abbott Vascular, Santa Clara, Calif) and an 0.014" Quick-Cross support catheter (Colorado Springs, Colo). An 0.035" glidewire was effectively used in crossing her occluded anterior tibialis artery (ATA), reentering at the popliteal level (Fig 2, *B*). The wire was then advanced subintimally throughout the occluded SFA with CFA reentry (Fig 2, *C*), then exteriorized through the left groin sheath. A percutaneous transluminal angioplasty balloon was then advanced in antegrade fashion from the left groin to her right foot. This balloon was used to advance an 0.014" wire into the right DPA and also for distal access-site endo-hemostasis. Intravascular ultrasound examination (Philips, San Diego, Calif) was used to adequately assess the disease extent and to size her vessels for an ideal intervention.

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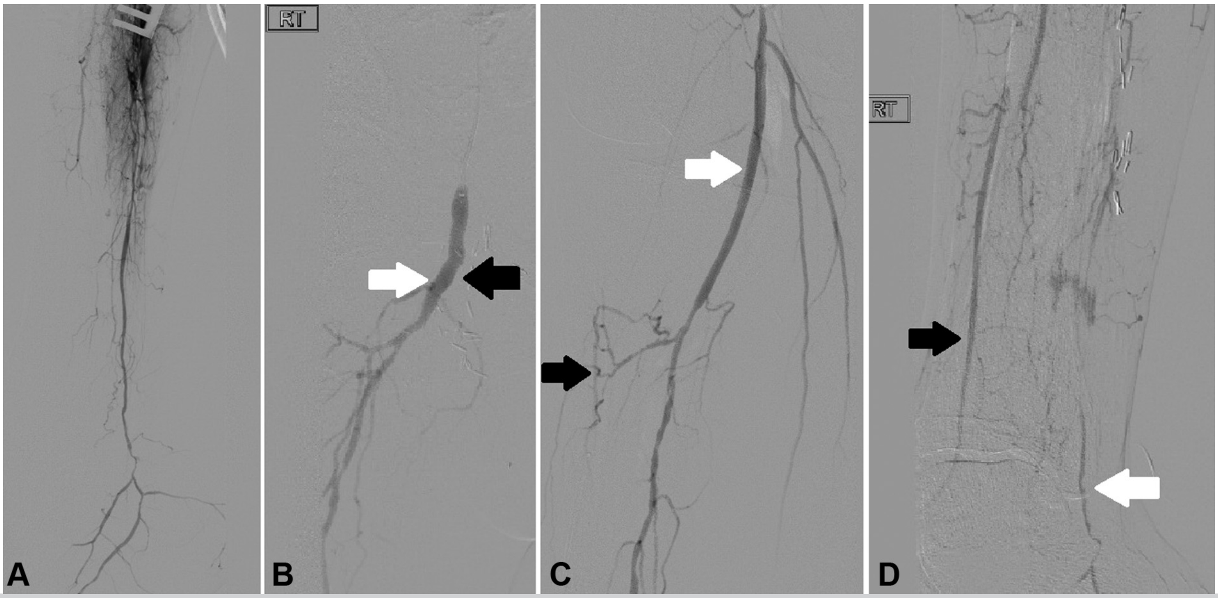

Fig 1. **(A)** Angiogram of the distal anastomosis of a deep femoral artery (DFA) to posterior tibialis artery vein bypass, depicting a highly diseased target vessel, with a critical stenosis at the ankle level. We believe that the severe atherosclerosis affecting this target tibial vessel was a possible explanation for the subacute failure of this bypass. **(B)** Right groin angiogram showing a widely patent DFA (*white arrow*) and a flush superficial femoral artery (SFA) occlusion (*black arrow*). **(C)** Preintervention right knee angiogram depicting reconstitution of the popliteal artery at the above-the-knee level (*white arrow*) and a complete anterior tibialis artery (ATA) occlusion soon after its origin (*black arrow*). **(D)** Preintervention right foot angiogram showing reconstitution of a severely diseased posterior tibial artery (PTA) (*white arrow*) and a much healthier in appearance ATA (*black arrow*).

Standard percutaneous transluminal angioplasty was performed for the entire ATA and femoropopliteal arteries (Fig 2, *D*). Two 4.5-mm × 120-mm stents (Supera, Abbott, Webster, Tex) were placed in the distal two-thirds of the SFA (Fig 2, *E*). A 6-mm × 80-mm stent (Protégé EverFlex, Medtronic, Minneapolis, Minn) was placed in the proximal SFA (Fig 2, *F*), achieving in-line flow through a widely patent ATA distally (Fig 3, *A-D*) but with DFA flow arrest (Fig 3, *A*). This was likely caused by high CFA luminal reentry in its lateral wall and not precisely at the SFA origin, thus creating a dissection flap that occluded the DFA origin (Fig 3, *E*).

Several unsuccessful antegrade attempts to cross the DFA were made. Ultrasound-guided, retrograde DFA access was obtained and an 0.014" wire was successfully crossed up to the level of the right external iliac artery (Fig 4, *A*). "Kissing" 4-mm × 80-mm percutaneous transluminal angioplasty balloons were placed across the DFA and SFA origin, the former from the retrograde DFA access and the latter from the left groin (Fig 4, *B*), achieving now brisk DFA and SFA flow (Fig 5). The DFA access-site was treated with external pressure and endo-hemostasis using a 4-mm × 80-mm percutaneous transluminal angioplasty balloon, now in an antegrade fashion. Completion angiography demonstrated no contrast extravasation.

Postoperatively, the patient reported ischemic pain resolution. Duplex ultrasound examination on postoperative day 1 revealed a patent femoropopliteal and ATAs, although a 1-inch hematoma was found in the area of DFA puncture with no pseudoaneurysm. She was eventually discharged to home on antiplatelet medication and in good condition. On 2-week follow-up, the patient reported continued ischemic pain resolution. Her ABI was 0.88 and a duplex ultrasound examination showed excellent flow throughout femoropopliteal and ATAs. Transcutaneous oxygen pressure measurements revealed an oxygen tension of 46 mm Hg at the dorsum of foot, indicative of adequate perfusion for wound healing. Her last clinic visit was on postoperative day 39, when she remained rest pain free, a palpable dorsalis pedis pulse could be felt, and a new Duplex ultrasound examination affirmed wide patency of her revascularized arteries.

DISCUSSION

The advent of endovascular therapies revolutionized PAD therapy. Although vein bypass remains the gold standard for long segment arterial occlusions,[1] treatment is always individualized, depending on multiple factors, such as age, comorbidities, or vein availability, resulting in many patients unable to undergo traditional bypasses. With continuing endovascular evolution, the boundaries of minimally invasive therapies continue to expand. Distal, retrograde crossing of lesions otherwise unable to be traversed in an antegrade manner has become a useful technique in the endovascular toolbox.[2-4] This is thought to be easier owing to the less organized distal atherosclerotic plaque. It is postulated that the proximal end of a lesion receives pulsatile, constant, antegrade arterial flow, causing plaque buildup at this end

Fig 2. **(A)** Retrograde distal access to the DPA demonstrating a widely patent distal anterior tibialis artery (ATA). **(B)** Antegrade balloon angioplasty of the entire ATA. **(C)** Wire passed in retrograde fashion from the ATA up the popliteal artery and then into the contralateral groin sheath. **(D)** ATA balloon angioplasty. **(E)** Placement of superficial femoral artery (SFA) interwoven stents. **(F)** Placement of laser-cut self-expanding stent in the proximal SFA.

disproportionately harder than its distal portion, which is spared the brunt of this constant flow. Its use is tempered by the challenge posed from small distal vessel calibers and the risk of needle damage.

Retrograde SFA distal access of flush occlusions poses several challenges, including the creation of an occlusive intimal flap if the reentry point is not precisely at the SFA origin. Yilmaz et al[5] reported two such cases of DFA occlusion caused by high CFA reentry after subintimal distal SFA recanalization. Even though current devices allow wire passage back to the true lumen through retractable needles (Pioneer [Philips, San Diego, Calif] or Outback reentry catheters [Cordis, Santa Clara, Calif]), we did not favor them due to the need for large-caliber sheaths for a relatively small DPA. Because we were unable to traverse the dissection from an antegrade direction, our options included open dissection repair vs retrograde access. We chose the latter given a hostile groin with severe scarring, having had recent surgery and debridement of an infected wound.

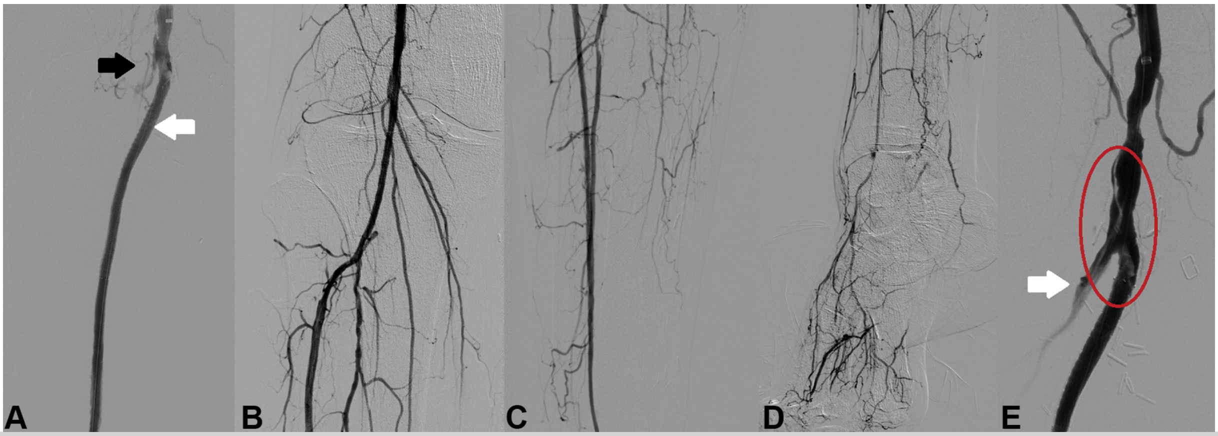

Fig 3. **(A)** Wide patency through the previously occluded superficial femoral artery (SFA) is demonstrated, but with flow arrest through the previously patent deep femoral artery (DFA). **(B)** Widely patent popliteal and anterior tibialis artery (ATA). **(C)** Widely patent ATA and peroneal arteries. **(D)** Foot angiogram demonstrating a patent ATA with posterior tibial artery (PTA) reconstitution from both the ATA as well as the peroneal artery collateral vessels. **(E)** Angiography demonstrates the common femoral artery (CFA) bifurcation. The red circle points out the dissection involving the origins of SFA and DFA, as well as the CFA.

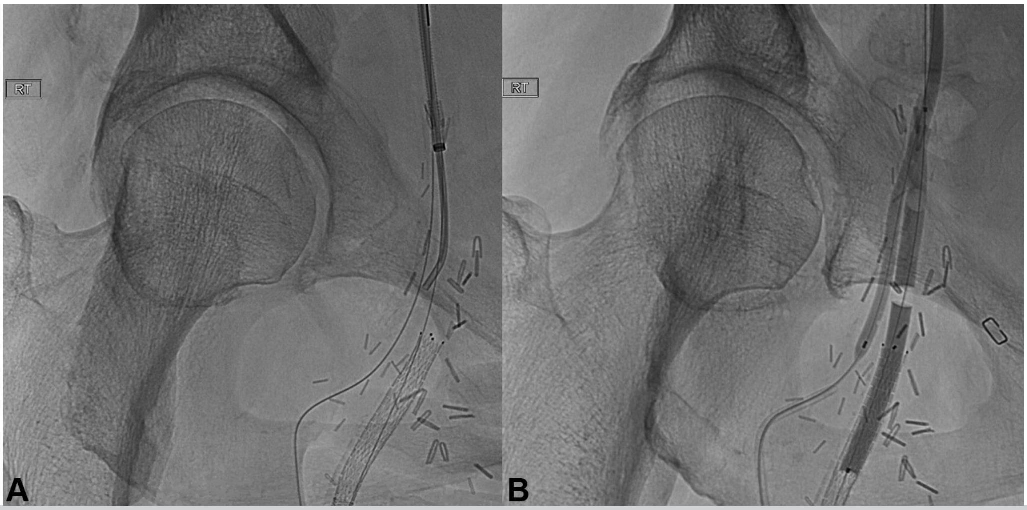

Fig 4. **(A)** Retrograde wire passage from the deep femoral artery (DFA) access up past the common femoral artery (CFA) and into the external iliac artery. Also seen is the wire passage in antegrade fashion from the CFA into the superficial femoral artery (SFA). **(B)** Kissing balloon angioplasty of the SFA and DFA origins.

Retrograde DFA access has been rarely described. Traditional access dogma recommends sites with underlying bony prominences that can provide support for external compression.[6,7] However, many have reported success with unconventional access-sites. Schmidt et al[3] described retrograde SFA access at the adductor canal for more proximal SFA lesions that were otherwise unable to be traversed in antegrade fashion.

Because retrograde DFA access was first described in 1990,[8] very few publications thereafter have detailed this technique. Fornaro et al[9] reported this access for treatment of a CFA dissection. Testi et al[10] described such access to treat a CFA dissection caused by a high CFA reentry. Zander et al[11] reported retrograde access through a large DFA collateral after an iatrogenic SFA rupture during antegrade revascularization attempt. We chose to perform a kissing balloon angioplasty of the CFA bifurcation to maintain in-line flow down both bifurcation limbs without stenting, Stents placed infrainguinally are prone to fracture owing to normal hip biomechanics. Furthermore, animal models have shown increased neointimal hyperplasia affecting stents in this location when compared to others.[12]

CONCLUSIONS

Percutaneous DFA retrograde puncture can be performed safely and effectively as a rescue maneuver for dissections involving the CFA bifurcation. This technique

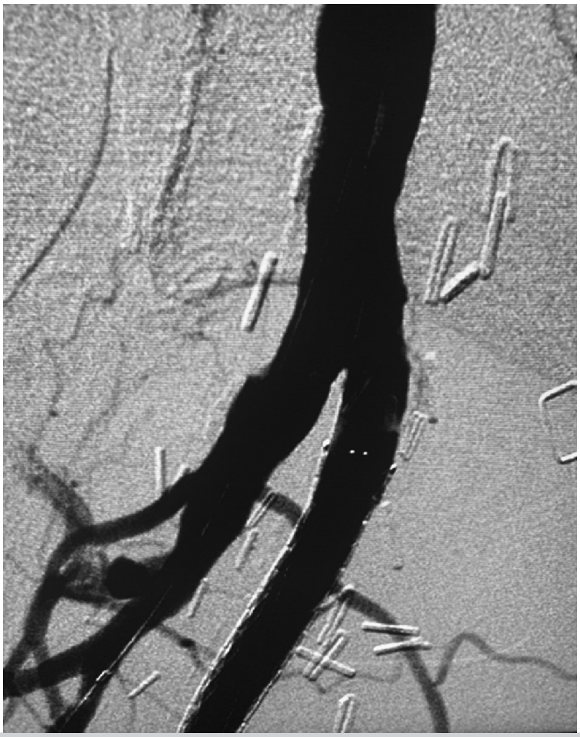

Fig 5. Postintervention angiography revealed wide patency of both deep femoral artery (DFA) and superficial femoral artery (SFA).

should be a useful ace-up-one's-sleeve in the arsenal of endovascular practitioners. Continued follow-up is needed to evaluate long-term outcomes of this technique.

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