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The open retrograde approach as an alternative for failed percutaneous access for difficult below the knee chronic total occlusions—A case series

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ABSTRACT

Retrograde puncture via patent pedal vessels can be attempted in failed antegrade approach for infrapopliteal long chronic total occlusion. However in cases where the pedal vessels are unable to be visualized via duplex ultrasonography or fluoroscopy an open approach offers an additional option to a vascular surgeon for successful recanalization. Our case report highlights 3 cases where successful hybrid open retrograde approach was able to achieve recanalization of long chronic total occlusion.

PRESENTATION OF CASES: The three cases in our series presented with critical limb ischaemia. All three cases had undergone duplex imaging of the affected arterial system. As the antegrade approach to cross the lesion failed a retrograde approach was attempted in all 3 cases. However when the usual modality of retrograde puncture via the use of ultrasound or fluoroscopy failed we proceeded with an open approach.

DISCUSSION: Retrograde approach usually offers a better chance of successfully crossing a chronic total occlusion lesion. However puncturing a distal vessel successfully and traversing a catheter or guidewire across proves to be a challenge. An open approach offers an additional pathway for puncturing the target vessel when duplex imaging or fluoroscopic guidance fails.

CONCLUSION: Open approach is usually attempted as a last resort by many endovascular surgeons. However procedural time, contrast and radiation usage could have been cut short in cases where the distal target vessels pose a technical challenge for approach via a percutaneous method.

1. Introduction

Critical limb ischaemia (CLI) needs straight line blood flow to the foot for adequate revascularization. Five-year follow up on CLI revascularization with either an endovascular or open surgery—first approach showed that both methods had equivalent limb salvage rates and amputation-free survival in properly selected cases [1]. Success rate for endovascular treatment of infrapopliteal stenosis is up to 100% but failure rate for occlusion-type lesions ranges from 20 to 40% [2,3].

Our case report highlights three patients who underwent successful recanalization of long tibial chronic total occlusion (CTO) for tissue loss using a hybrid procedure of below knee angioplasty and open retrograde access. Iyer et al. first described this open exposure of pedal vessels and subsequent direct open puncture of pedal arteries as an alternative approach for failed percutaneous antegrade access [4].

2. Methodology

All three cases underwent an open cutdown surgical approach of the artery at the foot and direct needle cannulation of the target tibial vessel. Attempt was initially made of cannulating the artery percutaneously using a retrograde approach either under ultrasound or fluoroscopic guidance. The failure of percutaneous angiographic retrograde approach was due to either a poor fluoroscopic window despite adequate contrast instillation proximally or poor visualization of patent lumen within the target vessel with the ultrasound approach because of heavy wall calcification. The adjunct use of intra-arterial nitroglycerin to relieve vasospasm and improve flow for distal puncture was also unsuccessful.

3. Case 1

A 29-year old male chronic smoker (10 pack years) with a negative vasculitis screen presented with a three-week history of poor healing of a right third toe ulcer. An arterial duplex ultrasound and

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Fig. 1. CTA imaging of below knee vessels.

CT Angiogram (Fig. 1) found that the anterior tibial artery (ATA), which was the target angiosome vessel, was occluded. Segments of the plantar artery were also occluded. The angiographic images of the distal posterior tibial artery (PTA) (Fig. 2) were suggestive of underlying Buerger's disease.

The patient underwent a tibial angioplasty. An attempt to reopen the ATA antegradely resulted in the guidewire traversing subintimally in the mid ATA and was unable to re-enter the true lumen distally. Retrograde attempt with fluoroscopy was technically difficult as the visible target dorsalis pedis artery (DPA) was too small. An ultrasound guided approach could not find a sufficient patent lumen. In view of poor imaging quality from both techniques but with a potential target distal DPA, a decision was made for an open approach.

As the patient had preoperatively undergone a popliteal nerve block, the skin overlying the DPA was cut longitudinally for 3 cm (Fig. 2b). The artery was identified but not dissected out and looped as traditionally performed. The surrounding tissue around the vessel provides a stable platform for direct puncture. Using the transpedal/micropuncture 4 Fr needle kit (Angiodynamics Inc., NY) the DPA was punctured and back bleeding was obtained. A V18 (0.018") (Boston Scientific, MA, USA) wire (Fig. 2c) was used to traverse the occluded point of the distal ATA supported with a 2.6 Fr angled CXI (Cook, Bloomington, USA) catheter. The wire was retrieved via an antegradely passed Berenstein 2 catheter (Angiodynamics Inc., NY) at the proximal ATA (transluminally). Subsequently an antegradely passed CXI catheter was passed just proximal to the puncture point of the DPA and the V18 wire was retrieved. The puncture point was closed with a 7/0 prolene stitch. A PT2 0.014" (Boston Scientific, MA, USA) wire was passed antegradely and passed beyond the puncture point and into the tarsal branch of the DPA. A 0.014" 2 mm × 80 mm Nanocross (EV3, Covidien, Plymouth, USA) balloon angioplasty was performed across the puncture followed by 0.014" 2.5/3.0 mm tapered balloon (EV3, Covidien, Plymouth, USA) to the ATA (Fig. 3). Check angiogram revealed good run off to the DPA and the metatarsal artery and a palpable DPA was present. He underwent a third toe ray amputation with good bleeding from the raw edges of the wound. Patient was subsequently placed on double antiplatelet therapy, a statin and was advised to stop smoking. During his routine follow up in the clinic (8 weeks post angioplasty) the wound had healed and he still had a palpable DPA.

4. Case 2

A 62-year old female with end stage renal failure on haemodialysis, diabetes, hypertension and hyperlipidaemia, presented with a 3-week history of left fourth toe wet gangrene. Duplex imaging and on table angiogram (Fig. 4) revealed PTA and ATA occlusions but ATA reconstituted distally by the peroneal artery (main run off). Plantar arch was also incomplete. Vein mapping showed no suitable conduit for bypass.

An antegrade angioplasty of the ATA was attempted with multiple wires and supporting catheters and balloons, which proved unsuccessful. The vessel wall was moderately calcified and an attempt at retrograde percutaneous technique using an ultrasound also failed. As the patient was already under regional anaesthesia (popliteal nerve block), DPA was exposed by surgical cutdown and directly punctured with a 4F micropuncture set (Angiodynamics Inc., NY). A 2.6 Fr angled CXI (Cook, Bloomington, USA) crossing catheter over a V18 (Boston Scientific, USA) wire was used to guide the wire transluminally towards the proximal ATA, where it was snared with 4 Fr Berenstein 2 (Angiodynamics Inc., NY) catheter. The angled 2.6 Fr CXI (Cook, Bloomington USA) catheter was then inserted antegrade up to the retrograde puncture point at which point the v18 wire was exchanged with an antegrade PT2 (0.014" Boston Scientific) guidewire to traverse into the DPA. The puncture point was closed with 7/0 prolene stitch (Ethicon, USA). Post dilatation with a 0.014" balloon angioplasty showed significant recoil (>50%) at the DPA. A Maris deep (Medtronic MN, USA) niti-