

Original Research Article

Short term outcome of retrograde tibiopedal access in management popliteal and infrapopliteal disease

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ABSTRACT

Background: Aim was to evaluate the safety and efficacy of retrograde tibiopedal access after failed antegrade recanalization in patients with femero-popliteal and infrapopliteal occlusions.

Methods: This is a retrospective study including patients presenting with critical limb ischemia due to femero-popliteal and infrapopliteal occlusions for whom retrograde transpedal/tibial access was used after failure of antegrade approach at the vascular surgery unit in Kasr Al Aini hospitals in the period from June 2015 to June 2017.

Results: The study included 18 patients with a mean age of 64 years and male to female ratio 2.6:1. All patients presented with CLI (Rutherford category 4-6), all lesions were Trans Atlantic Society Consensus (TASC) II D, and Technical success was accomplished in 17 cases (94.4 %). In one case, failure to cross the target lesion via both antegrade and retrograde accesses occurred and the patient was immediately converted to an open surgery (popliteal tibial bypass). Complications included 2 puncture site hematoma that were managed conservatively; no AVF. There was no perioperative mortality. Primary patency was 81.25 % at 6 month.

Conclusions: retrograde tibiopedal access is safe and effective technique after failed antegrade recanalization in patients with popliteal and infrapopliteal occlusions.

Keywords: Infrapopliteal disease, Popliteal occlusion, Retrograde, Tibiopedal

INTRODUCTION

Chronic total occlusion (CTO) is considered as a challenge for interventionalists specially in peripheral arterial disease as antegrade passage of CTO has failure rate about 20 to 40 % particularly in complex femeropopliteal occlusive disease.¹

Pedal access was an appealing choice specially in these multilevel disease in critical limb ischemia (CLI) patients, Pedal access increased the success rate of peripheral intervention. However, there is scarce data about tibiopedal access in literature as regard the long term efficacy.²⁻⁴ In this study our aim to assess the role of tibiopedal access in limb salvage in CLI patients whom

antegrade attempts failed and assess the short-term patency.

METHODS

This is retrospective study which included all tibiopedal access cases that were done in the vascular unit in Kasr Al Aini Hospitals, Cairo University in Egypt between June 2015 and June 2017.

All patients presented with CLI, Rutherford categories 4, 5 or 6. Bypass surgery was not planned as a first choice either due to patient unfitness, foot infection or patient's refusal for surgery.

Authors' excluded the cases of primary amputation and non atherosclerotic arterial disease as vasculitis and Burger's disease. We did not try tibiopedal access in the patients with single tibial runoff except if it deemed that they are not good candidate for bypass surgery to avoid damage to the runoff.

Patients were consented for the intervention with its risks. Ethical committee approval was done. Antegrade recanalization was attempted first before usage of tibiopedal access but we did not use the reentry devices.

All patients received a loading dose of 300mg clopidogrel, the day before intervention. Initial anticoagulation with unfractionated heparin (5000IU), vasodilators as nitroglycerin as well as verapamil was used in all cases.

All lesions were initially tackled by a standard antegrade approach through femoral access. A 0.035" hydrophilic Terumo guidewire supported by a 4F angled glide catheter was used to cross the target lesion. If antegrade recanalization failed (negotiation time up to 30minutes) with inability to cross the lesion intraluminally or subintimally or failure of re-entry to the true lumen distal to the occlusion after subintimal recanalization, we used a retrograde tibiopedal access strategy to complete the procedure.

All tibial vessels, including the anterior tibial, dorsalis pedis, posterior tibial, and less commonly peroneal arteries, can be accessed in retrograde fashion. The patients lie in a supine position, the lower extremity was draped and one of the tibiopedal vessels was selected for access, Local anesthesia used at the proposed puncture site should be minimal to avoid compression of access vessel. Pedal access can be accomplished with the patient in the supine position. When attempting to use the dorsalis pedis approach, the foot should be placed in the plantarflexion position; eversion of the foot may be required in cases using a posterior tibial artery approach.

Access via a 21-gauge micropuncture needle, guided by fluoroscopy and/or road map and/or duplex. Following a successful cannulation by .0018 or 0.014 wire, support catheter (crossing) was inserted (sheathless technique) and we started to tackle the lesion distally either in intraluminal or subintimal planes, using a 300cm V-18 guidewire (Boston Scientific, Natick, Mass). In most cases, the V-18 wire easily crossed in subintimal plane created initially via the antegrade approach and re-enter into the true lumen. In some cases where the retrograde wire was unable to cross the lesion, or unable to re-enter the true lumen, a bidirectional balloon dilatation was performed until the retrograde wire comes in communication with the subintimal channel established previously through the antegrade approach (rendevous technique). After crossing, the retrograde wire was directed into the tip of the antegrade multipurpose catheter to facilitate its snaring to complete the procedure

in an antegrade manner, with PTA and selective stenting of the defined lesions.

So, using retrograde approach for crossing only, then completing the procedure in antegrade manner, this is to limit the mechanical barotrauma to the pedal vessel. Retrograde wire fixed in place by hemostat to allow body flossing which facilitate trackability of balloons. To achieve hemostasis, light external compression and antegrade gentle balloon dilatation to access vessel was done with an appropriate sized balloon and final angiogram via antegrade sheath was done to ensure proper hemostasis.

Postoperatively, the patients were maintained on clopidogrel (75mg/d) and acetylsalicylic acid (75mg/d) for 3 months, and then single anti-platelet therapy (acetylsalicylic acid) was prescribed. Follow up was done at 1, 3, 6 months post-procedural, by means of clinical evaluation, ABI and duplex ultrasonography.

Technical success was defined as successful guidewire passage via the occlusion aided by a retrograde pedal/tibial access with <30% residual stenosis after intervention. A technically successful tibiopedal puncture was defined as the performance of a retrograde procedure without causing local dissection, thrombosis or an arteriovenous fistula at the puncture site.

RESULTS

In a 24-month period, 200 patients with femero-popliteal and infrapopliteal disease underwent endovascular intervention; 30 patients (22 males and 8 females) out of 200 patients were mandated the use of retrograde tibiopedal access.

All patients had CLI Rutherford categories 4, 5 or 6. Bypass surgery was not an option as a first choice either due to unfitness, distal infection or patient's refusal to undergo surgery (Table 1).

Table 1: Lists the patients' demographics.

Variables	Number
Male patients	22
Mean age	64 (52-70)
Diabetes	83.3%
HTN	61%
Smokers	66%
IHD	66%
Previous stroke	11.1%
COPD	5.5%
Renal impairment	22.2%
Rutherford category	
4	17%
5	39%
6	44%

Access site: Distal PTA 44%, DPA 17%, ATA in 33% and peroneal artery in 15.5%.

Treated lesions and technical success: Technical success rate was accomplished in 95%. We used the in 90% of our cases help of road mapping in most of the cases.

In 2 cases, re-entry to the true lumen was achieved using bidirectional balloon dilatation via antegrade and retrograde accesses. In one case, failure to cross the target lesion via both antegrade and retrograde accesses occurred and the patient was immediately converted to an open surgery (popliteal pedal bypass).

Complications included 2 puncture site hematoma that responded well to conservative management and no cases were reported to have AVF between the pedal vessels at the final angiogram. During follow up period of 6 months, primary patency was 81.25% and limb salvage rate was 92%.

DISCUSSION

Tibiopedal access increased the successful recanalization in lower limb endovascular intervention particularly with help of micro catheters, small-profile balloons, and 0.014 or 0.018 inch systems. It was reported that no access failures in vessels with a diameter >1.5mm by quantitative angiograms. Tibiopedal access was originally described through open technique. However, with the advent of endovascular intervention, percutaneous access become popular method and preferred by most of vascular interventionalists which can be done directly in heavily calcified vessels based on fluoroscopic guidance, road mapping and can be aided by antegrade angiography from the femoral access site to identify the pedal/tibial vessel to be accessed.⁵

The size of tibial vessels poses the biggest challenge for the peripheral Interventionalist and access via duplex ultrasound guidance is recommended to achieve successful access because multiple attempts may contribute to significant bleeding, nerve compression or even compartment syndrome, 90% of cases in our study was done by fluoroscopic guidance and duplex US. The use of Duplex US may be the cause of increased technical success to 95%.⁶

Concerns related to retrograde pedal access, include puncture site hematoma, AVF, access occlusion. WE have not face a major complications in the tibiopedal access in our cases. This may be attributed to that we used the retrograde access without sheath with only wire and support crossing catheters. However, some authors tend to use 4F sheath in all of our cases without reporting any complication on final angiograms.⁷

Advantages of tibiopedal access; includes small diameter of tibial vessels increase the successful wire or catheter crossing through occlusion, less possibility of entering

side branch. It is believed that the most difficult portion of the occlusion is the proximal cap, while the distal cap is often softer and less difficult. Additionally, in cases of occluded short segment tibial or popliteal arteries, the pedal approach may offer a shorter arterial segment to cross with balloons or catheters than traditional ipsilateral or contralateral approaches. Tibio-pedal access also may be safer in obese patients in whom a groin approach may not be possible or who cannot be turned to a prone position for popliteal access and in patients having a hostile or infected groin as well and it could be used as the sole access for such patients. In our study, we spared only tibiopedal access after failure of antegrade approach first.⁶

However, there are some risks in using tibiopedal access as small-diameter vessels are prone to spasm and dissection, Vessels are often calcified. Additionally, approach near the ankle may cause considerable difficulty in sheath passage, because of the sharp angulations, long procedure time and excess contrast use. In this study , we made sure that there are good runoff tibial vessels to do the retrograde access and we recommend that single tibial runoff should not be used as an access for retrograde recanalization except if there is no alternative for the patient as it could jeopardize the future chance to do bypass surgery.⁷

The feasibility of this approach has been evaluated in case reports and series. Fusaro et al, have indicated the feasibility of retrograde pedal artery access for below-the knee percutaneous revascularization. Kawarada et al, have reported feasibility of the transpedal approach to cross occluded dorsalis pedis and paramalleolar posterior tibial arteries.⁸⁻¹⁰

In a recent study by Walker, pedal access was attempted after the antegrade route was deemed unsuccessful in 273 patients with CLI (Rutherford 4-6). All patients had occlusive lesions. Pedal access was successful in 96% of patients-54% via anterior tibial approach, 45% via posterior tibial approach, and <1% via peroneal access. The investigators reported no access failures in vessels with a diameter >1.5mm by quantitative angiograms. In 93% of patients with successful pedal access, microcatheters, small-profile balloons, and 0.014- or 0.018-inch systems were used with definitive therapy accomplished from femoral access. In 7% of patients, 4-F sheaths were placed initially in pedal vessels and upgraded to 6-F sheaths for definitive therapy. Technical success as defined by crossing the lesions was achieved in 93% of patients.¹¹

The technique, however, is not without difficulties and complications. Tibial vessels at the point of access can be too small to allow successful access into the lumen using the micropuncture needle. The tibial vessels are usually heavily calcified, which interferes with crossing the occlusion. In our opinion, this is the most important factor causing failed recanalization using the retrograde

pedal/tibial approach. Since arterial spasm at the access site is very common, the liberal use of vasodilators including nitroglycerine and papaverine is necessary during the procedure.^{7,12}

The possibility of arterial disruption with resultant thrombosis at the access site has been reported in the literature. Although rare, this is a devastating complication that can have a potential risk on the involved limb, especially when the access vessel is small. Consequently, some operators tend to use some techniques to decrease the risk of injuring the accessed tibial vessel. Gandini et al. used a 4-Fr sheath for pedal access.¹³ Botti et al, used only the 4-Fr introducer, which allowed passage of the 0.018-in wire but did not allow use of any adjunctive tools (such as catheters or balloons) to guide the wire through the occlusion.¹⁴ Fusaro et al, described a sheathless approach, introducing only a 0.018-in guidewire through the puncture needle for passing the lesion, thus avoiding the introduction of a sheath and keeping the access site as small as possible.⁹ The current Cook Medical Micropuncture@Pedal Access Set has a 4-Fr introducer with a 2.9-Fr inner diameter that allows passage of 0.018- or 0.014-in catheters or balloons as adjunctive tools for crossing the tibial occlusion.

The technique is relatively safe and feasible based on all reports in the literature to date. However, it only should be used for limb salvage in patients with critical limb ischemia, especially for those who have no feasible open surgical options due to prohibitive surgical risk, lack of suitable conduit, or patient reluctance to utilize the open surgical option.^{6,12}

CONCLUSION

The advent of retrograde tibiopedal approach to revascularize complex lesions in patients with CLI has proven to be feasible, safe, and favorably modifies the failure rate associated with the antegrade only approach. It is a feasible approach with potential immediate benefits that may increase its utilization. However, there is a learning curve involved with this interventional approach, and we will continue to gain further understanding of its ideal uses with time.

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