

## **Retrograde Transpopliteal Angioplasty for Superficial Femoral Artery Occlusion, Technical Point of View**

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**Abstract:** The retrograde transpopliteal approach and transpedal approach have proved to be a reliable alternative vascular access in patients not suited for transfemoral intervention. The aim of the study is to evaluate the retrograde approach for recanalization of long segment occlusion of superficial femoral artery in cases with chronic lower limb ischemia from a technical point of view. Seventeen patients were included in this study with chronic lower limb ischemia due to long segment occlusion of superficial femoral artery. A technical success was achieved in 14 cases and poor results in 3 cases. Hence transpopliteal approach is considered to be a good alternative for recanalisation

**Key words:** Retrograde Transpopliteal Approach • PTA • Recanalisation • Subintimal angioplasty

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### **INTRODUCTION**

Percutaneous transluminal angioplasty (PTA) of the superficial femoral artery (SFA) was first pursued by Dr. Charles Dotter in 1964 [1]. Since then, PTA of the SFA and nearby vessels has evolved significantly. The SFA is a frequent target of atherosclerotic disease predominantly in the proximal section near the bifurcation to the deep femoral artery and in the distal section where the adductor muscles tend to compress the artery [2]. The most common approach to PTA of the SFA is the contralateral retrograde approach [3]. The primary advantages of this technique are ease of arterial access and vascular access management. Long-segment occlusions can also be alternatively approached with antegrade common femoral artery access [4]. This approach can be cumbersome to obtain vascular access especially in obese patients, those with combined iliac and femoral lesions [3-5] and high take off of the superficial femoral artery [3, 5]. Superficial femoral artery recanalization in such difficult cases could also be performed with popliteal artery access [5] and pedal artery access [6, 7] as well as for graft prosthesis in the groin which raises the risk of complications [8, 9]. The advantages of such approaches include higher success rates due to the soft fibrous cap noted at the lower end of the SFA occlusions. The retrograde transpopliteal approach and transpedal approach have proved to be a reliable alternative vascular

access in patients not suited for transfemoral intervention [1-4, 7, 10]. The disadvantages include a significant learning curve for the novice operator and difficult vascular access management [11, 12].

**Aim of the Study:** To evaluate the retrograde approach for recanalization of long segment occlusion of superficial femoral artery in cases with chronic lower limb ischemia from a technical point of view.

**Patients and Methods:** Seventeen patients were included in this study with chronic lower limb ischemia due to proximal long segment occlusion of superficial femoral artery (SFA) where ipsilateral antegrade access could not be done and exclusion criteria including those with mid SFA lesions or SFA occlusion with more than 5 cm distal to its ostium. Data was collected in 24 months between years 2012 & 2014.

**Patient Assessment:** All patients were assessed symptomatically with intermittent claudication or critical limb ischemia. Any possible risk factor was accurately analyzed, the ankle-brachial index (ABI) was assessed and a color-Doppler ultrasound (USCD) was carried out. A pre-procedural computed tomography-angiography (CTA) was performed to achieve a complete anatomical overview of the proximal and distal SFA diameters, length of the occluded segment, morphology and diameter of the

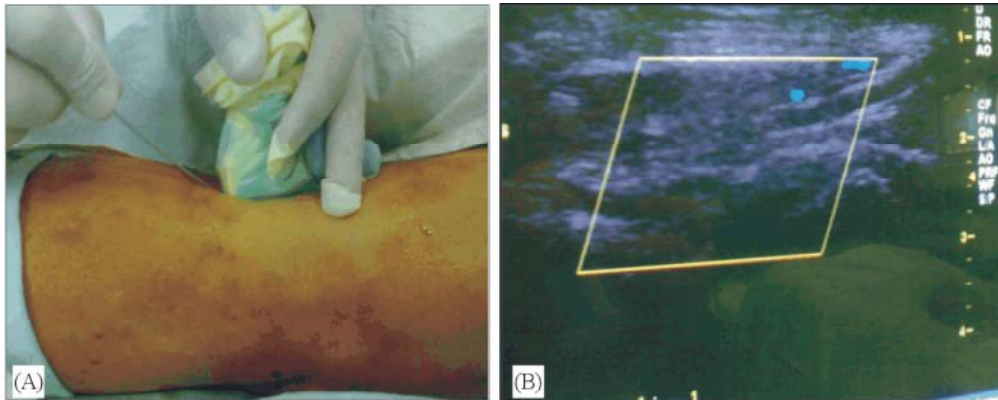


Fig. 1: A. popliteal puncture under US guidance B. successful needle puncture.

popliteal artery (PA), distal run-off and patency of the tibial and peroneal arteries. Routine preoperative preparations for endovascular intervention were started three days before the procedure including complete blood picture, coagulation profile and serum creatinine level.

Pre-procedural medications in the form of good hydration and clopidogrel 300 mg loading dose were given then 75 mg/day thereafter. Statine 40 mg, hydrocortisone hemisuccinate, antihistaminics, antiemetic were given just before commencement of the procedure.

**Technique:** All the procedures were done in the angi-suite of Kasr Alaini hospital with the patients in supine or prone position according to access under local anesthesia. Under sterile conditions and proper local anesthetic infiltration, a retrograde contralateral common femoral artery puncture was done under fluoroscopic guidance and eight French (8-F) cross-over introducer-sheath (Cordis) was positioned, followed by intra-arterial injection of 3000-5000 I.U. of heparin and angiographic images were obtained.

Then, with the patients in prone position and the popliteal area kept under sterile condition, the knee was flexed and medially rotated to achieve a good approach to the popliteal area. The puncture of the popliteal artery (PA) was done either under ultrasound (US) (Fig. 1) or fluoroscopic guidance with an 18-G needle advanced into the lumen of the PA. Once the needle tip reached the correct position within the artery, a 0.035 inch/180cm (Cordis) or V.18 (Boston Scientific) angled tip glide wire was advanced and a 6F introducer-sheath inserted.

Angiographic images were obtained and 3000-5000 units of heparin given intra-arterially. If the endoluminal recanalization was not possible because the guidewire tended to slide into the subintimal space, therefore a subintimal recanalization was performed. Once the

obstructed segment was crossed, the guidewire introduced via the popliteal access was guided into the lumen of the 8-F femoral introducer sheath and advanced through the hemostatic valve. If this maneuver was not successful, a snare loop was then advanced from the femoral introducer and the tip of the guidewire was snared and pulled out through the introducer. At this step both tips of the guidewires (one at the popliteal access and the other exits through the valve of the crossover sheath) were anchored in position to maximize wire tension. Therefore, providing firm rail road for the balloon to be pushed across the lesion.

All the patients underwent a predilation for a better evaluation of the diseased arterial segment and for a better selection of the stent length and to reduce the risk of arterial dissection using an appropriately sized balloon catheter. Self-expandable stents were deployed if there were residual lesions, elastic recoil or arterial dissection, landing 0.5 cm above and below the lesion, followed by a post-dilation with a balloon diameter 1 mm smaller than the nominal diameter of the stent. A control angiogram was done to visualize the flow within the SFA and in the leg, to evaluate SFA patency and to exclude the presence of thrombo-embolic material at the level of the leg distal vessels (Fig. 2 & 3). The popliteal access was closed with a manual compression for 5 to 10 minutes and then with a compressive bandage kept in situ for 12 hours. The femoral access was closed with the help of a closure device, or with a manual compression for 15-30 minutes. All patients were prescribed a daily dose clopidogrel 75 mg/day thereafter to be taken indefinitely post-procedure. All patients are examined for immediate radiological and clinical success in the form of restoration of straight inline flow, restoration of peripheral pulse, disappearance of pain and regain of warmth and good capillary circulation.

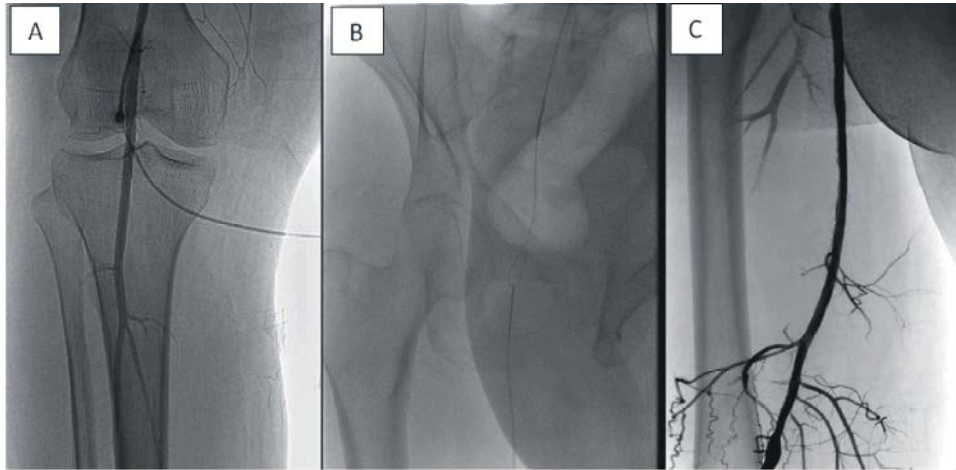


Fig. 2:

- A. Retrograde right popliteal access
- B. Snaring of guide wire from contralateral approach
- C. Successful revascularization of right SFA.

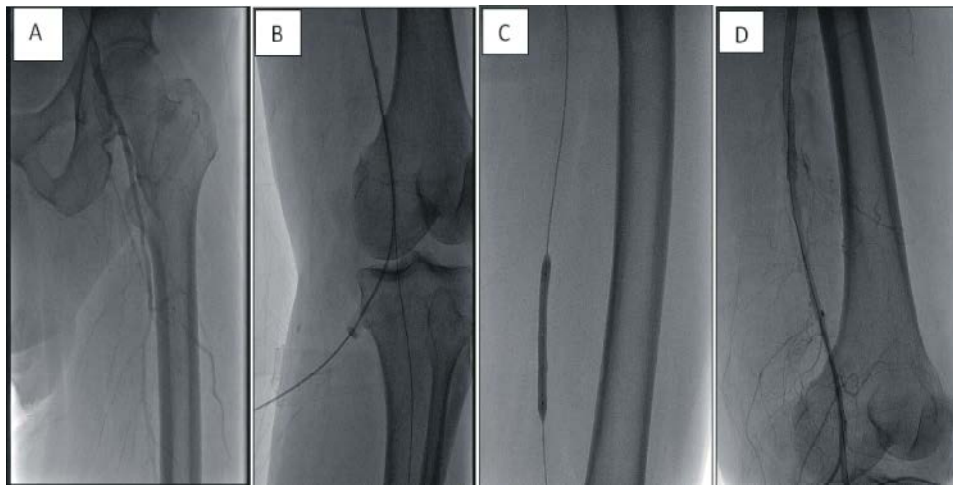


Fig. 3:

- A. Retrograde right femoral access shows complete occlusion of left SFA.
- B. Successful left popliteal access.
- C. Dilatation was undertaken using balloon catheter 6×80 mm (POWERFLEX Cordis balloon catheters).
- D. Successful revascularization of left SFA by retrograde popliteal access.

## RESULTS

Occlusion is defined as absence of flow in a segment or multiple segments (multiple occlusions) anywhere along the length of SFA. Total occlusion of SFA is defined as occlusion of SFA from its take off to the point where it crosses the medial cortex of the popliteal surface of the femur to become the popliteal artery.

Technical success was defined as restored patency with no stenosis greater than 30% as per reporting standards. A poor result was defined as

improvement in patency but with stenosis greater than 30% whilst failure was defined as no change in patency.

A technical success associated with immediate clinical success was achieved in 14 SFA recanalization cases (82.4%) and poor results in 3 cases (17.6%). Recanalization time ranged between 40 and 90 minutes (mean, 65±25 min).

Balloon dilatation alone was done in 6 cases (diameter was 6mm and length ranged from 60 to 80 mm).

Self-expandable stents were deployed in 11 cases after balloon predilatation (diameter was 6mm and length ranged from 100 to 150 mm).

Concerning the frequency of gender, 11 were males and 6 were females. Mean age in years was 63.2, mean ABI was 0.4 and mean length of lesion in mm was 193.5. 4 patients presented with incapacitating claudication, 10 patients presented with rest pain and 3 patients presented with minor tissue loss.

Only one case of subclinical popliteal hematoma that was resolved conservatively and another with small popliteal artery aneurysm for follow up and 2 cases complicated by SFA dissection that was controlled by stent implantation. Moreover, no arterio-venous fistulas were seen. The period of hospitalization of the patients treated with the retrograde approach ranged between 3±1.5 days.

## DISCUSSION

Transpopliteal angioplasty of femoral lesions has been demonstrated to be a useful alternative to antegrade transfemoral angioplasty [13] increasing the number of femoral artery occlusions considered technically feasible for angioplasty by about one-fifth [14]. However, it remains a relatively infrequently used technique, possibly as a result of unreliable concerns regarding puncture site complications [15].

The present study confirms transpopliteal angioplasty as a reliable alternative especially in proximal SFA occlusions and it was successful in 14 out of 17 cases included (82.4%).

In a study done by Noory *et al.* [16], 56 patients (43 males, 13 females with mean age 59 years) with Rutherford category (2 to 5) were treated by retrograde transpopliteal access to complete the procedure. In all interventions balloon angioplasty was performed and stenting was done in 40 cases.

The present study included 11 males and 6 females and the patient's age varied between 48 and 85 years with a mean of 63.2 years and Rutherford 3 to 5. Balloon angioplasty was done in all cases (17 limbs) and stenting was carried out in 11 cases.

Evans *et al.* [17] performed transpopliteal angioplasty on 83 patients using single retrograde approach via duplex guidance with initial technical success reaching 84.1%. Tokuda *et al.* [18] compared sheathless retrograde transpopliteal approach to 4-6 F sheath insertion and found no significant difference with technical success reaching 90%.

However, in our study, double antegrade and retrograde approach was done and either ultrasound or fluoroscopic guidance was used for retrograde puncture with initial technical success reaching 82.4%.

According to the current study, transluminal angioplasty was initially attempted and if it didn't succeed, subintimal angioplasty was then performed. However, Spreen *et al.* [19] performed intentional subintimal angioplasty for SFA long occlusions using transpopliteal approach in 11 patients with routine stenting and technical success reaching 83%. Broutzos *et al.* [20] as well performed intentional subintimal angioplasty in 24 patients with technical success reaching 91.7%.

In our study, two cases had complications at the popliteal puncture site (one was subclinical hematoma and the other was small aneurysm, 11.8 %).

This correlates with study done by Yanagita *et al.* [21] on 63 patients with 8 patients (12.7%) having popliteal puncture site complications (6 hematomas and 2 arteriovenous fistulas).

## CONCLUSION

Retrograde transpopliteal approach is to be thoroughly considered for revascularization of long SFA lesions/occlusions if antegrade approach is inaccessible.

Double antegrade and retrograde approach helps to provide firm rail road for the balloon to be pushed across the lesion.

It is better to perform intentional subintimal angioplasty as it carries higher technical success.

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