Management of Superficial Femoral Artery Occlusion by Subintimal Arterial Flossing with Antegrade Retrograde Intervention (Safari) Technique Through Transpopliteal Approach

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ABSTRACT

Background: The subintimal arterial flossing with antegrade-retrograde intervention (SAFARI) technique improves technical success when initial antegrade attempts at recanalization have failed .The retrograde approach is effective for successfull recanalization of chronic total occlusion of critical lower limb ischemia. ***Aim of the work.*** *To assess the SAFARI Technique through transpopliteal approach to improve technical success for the performance of subintimal recanalization when there is failure to re-enter the distal true lumen or when there is a limited segment of patent distal target artery available for re-entry.* ***Patients and Methods:*** *The study was performed on 16 patients and 16 limbs with critical lower limb ischemia for whom percutaneous transluminal angioplasty has failed from antegrade approach then retrograde approach though transpopliteal access was used for recanalization.* ***Results:*** *By using SAFARI Technique,clinical success rate after the procedure which was detected by immediate regaining of the pulse or clinical improvement was 14 cases from 16 cases(87.5%).* ***Conclusion:*** *SAFARI TECHNIQUE* ***is an ideal line of intervention in failure of re-entry of subintimal angioplasty or limited patent distal part of arterial tree.***

Key words: *SAFARI-Transpopliteal -Recanalization –ISCHEMIA.*

INTRODUCTION

Subintimal angioplasty become an established percutaneous technique to overcome long and chronic arterial occlusions, it is also known as percutaneous intentional extraluminal recanalization (PIER) . Subintimal angioplasty or percutaneous intentional extraluminal recanalization (PIER) is a percutaneous, endovascular technique for recanalization of occluded arteries. Its minimally invasive nature may allow for treatment of CLI with reduced periprocedural risk[(1)].

subintimal arterial flossing with antegrade-retrograde intervention (SAFARI) technique can be useful for completing subintimal recanalization of tibial vesseles when there is failure to reenter the distal true lumen from an antegrade approach or when there is flush occlusion of one of tibials with patent distal part[(2)].

The popliteal approach is utilized for lesions that have failed the antegrade approach, flush occlusions of the superficial femoral artery or superficial femoral arteries that end in large collaterals which have a tendency to divert angioplasty wires into them. An antegrade approach to superficial femoral artery occlusions generally fails due to the inability to maintain an angioplasty wire within the true lumen of the vessel. Ostial superficial femoral artery and common femoral artery lesions may also be approached via the popliteal access provided that the popliteal artery is patent especially in patients with acute-angled terminal aortic bifurcations. Obese patients with large panniculus can be approached with the popliteal access to treat superficial femoral artery disease[(3)].

Strict contraindications to popliteal artery puncture include aneurysms of the popliteal artery and pathology of the popliteal fossa such as Baker's cyst[(3)].

PATIENTS AND METHODS

This study included 16 patients presented to the vascular department in Kasr Al Aini hospital and new Kasr alaini teaching hospital with critical lower limb ischemia (incapacitating claudication,rest pain or tissue loss) having

femoropopliteal occlusive diseases . With failure of antegrade approach,retrograde approach through the popliteal artery was used for recanalization by creating a single subintimal channel (SAFARI TECHNIQUE)

The procedure, possible complications, benefits, risks and other alternative interventions were all explained to the patients and an informed consent was obtained.

Methodology:

Clinical assessment through history taking and clinical examination was done for all patients including; age, gender and major risk factors for atherosclerosis including; Diabetes mellitus, smoking, hypertension and dyslipidemia.

Pre-procedural investigations were done to all patients in the form of routine laboratory tests,duplex scanning and ComputerizedTomographic Angiography(CTA) .

Selection criteria for this study:

Inclusion criteria:

1. Incapacitating claudication interfering with the work or life style.
2. Critical limb ischemia (ischemic rest pain, minor tissue loss, nonhealing ulcer or focal gangrene).
3. Patients with flush superfacial femoral artery occlusion or total occlusion of femoral artery in which subintimal angioplasty was performed but there is failure of re-entry .

Exclusion criteria:

1. Patients with stenosis of femoral artery or popliteal artery.
2. Patients with flush superfacial femoral artery occlusion or total occlusion of femoral artery in which subintimal angioplasty was performed with re-entry.
3. Proximal aorto-iliac disease or known intolerance to study medications or contrast agents.

Technique

- Proximal puncture sites was ipsilateral or contralateral common femoral artery or brachial artery.
- Distal puncture site was popliteal artery.

Technique of transpopliteal approach

The patient is first placed in a supine position and antegrade ipsilateral common femoral artery sheath or a contralateral retrograde access is placed . This access is secured in place and connected to a high-frequency pressure monitoring line for contrast injections. Visualization of the site to be treated may be afforded with this access. The patient is then turned and placed in a prone position on the angiography table and the popliteal fossa is prepared and draped. The femorotibial joint is the most reliable landmark determined fluoroscopically. An area 3–4 cm above this joint is then infiltrated with local anesthetic . Contrast is then injected into the previously placed common femoral artery access for direct fluoroscopic visualization of the popliteal artery during puncture**.**

The puncture needle is directed obliquely from medial to lateral then a 0.035-inch floppy guidewire is advanced into the popliteal artery over which a 6-French arterial sheath is placed. In addition to direct contrast visualization,Duplex can be employed to gain retrograde popliteal artery access taking in consideration not to transect the popliteal vein.

Once the occlusion is crossed, the wire needs to be snared from above using a microsnare that is inserted from the common femoral artery access .

Once wire access across the occlusion is established ,intervention is performed in the standard fashion,using Balloon angioplasty and stenting. This approach provides a body-floss configuration of the wire that may be needed to help its trackability through a heavily calcified lesion and to improve its pushability (SAFARI TECHNIQUE). After the intervention is completed, and the inline flow through the occluded segment is confirmed by angiogram,the retrograde introducer sheath is withdrawn and hemostasis is secured through digital compression for 5 to 10 minutes.

Procedural outcome:

The procedure is considered to be successful depending on the following:

Immediate success i.e. regain of pulse, revascularization warmth and disappearance of rest pain. Angiographic success defined as less than 30% residual stenosis measured at the narrowest point of vascular lumen.Further clinical improvement of the patients as healing of ulcer and appearance of line of demarcation.

Procedural complications:

Complications were divided into major and minor. Major complications included death, need for emergency surgery due to major bleeding or acute thrombotic occlusion . Minor complications

included hematoma, treated dissection, or peripheral emboli.

RESULTS

This study included 14 males (87.5%) and 2 females (12.5%)with ratio 7:1and the patient's age varied between 48 and 72 years with a mean of 60 years , 16 patients (100%) were diabetics,14 patients (87.5%) were dyslipidemic, 14 patients (87.5%) were smokers, 8 patients (50%) were hypertensive

Clinical presentation:

Table(1):Clinical presentation of the patients

Main presenting features	No.of patients	Percentage	Rutherford category
Rest pain	14	87.5٪	Rutherford 4
Non healing ulcer	-	-	-
Gangrene	2	12.5٪	Rutherford 5,6

Procedural data:

1) Access site ;

For antegrade access,The ipsilateral femoral approach was used in 4 (25%) limbs and the contralateral (crossover) approach was used in 12 (75%) limbs, retrograde approach through popliteal artery was tried in 16 (100%) cases,2 cases by duplex guidance and 14 cases under fluoroscopic guidance.(fig1,2,3,4,5)

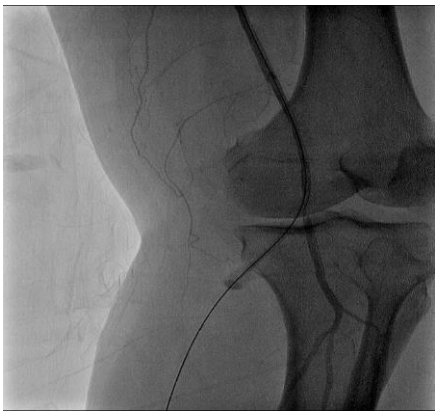

Fig. (1): Transpopliteal access using a 6F sheath

Fig. (2): Transpopliteal access using a 0.0035 inch wire

Fig. (3): Duplex guided transpopliteal access

Fig. (4): Transpopliteal access with contralateral femoral approach.

Fig. (5): Antegrade wire from contralateral access and retrograde wire.

2) Snaring:

Snaring from the antegrade access was used in 6 cases and the remaining 10 cases, the retrograde wire got out through the sheath or through a catheter from antegrade access.(fig 6).

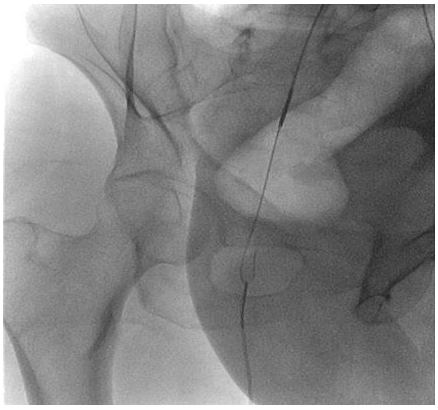

Fig. (6): Snaring of the wire from contralateral access.

3) Balloon angioplasty:

Balloon angioplasty was done in all cases (16 limbs).The balloon diameters ranged between 5 and 7 mm and the balloon lengths ranged between 60mm and 100mm. Inflation pressure ranged between 8 and 12 ATM. Inflation time ranged between 15 and 45 seconds.(fig 7,8)

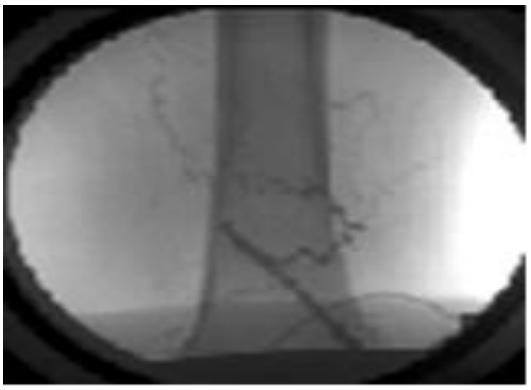

Fig. (7): Occlusion of the distal part of superficial femoral artery.

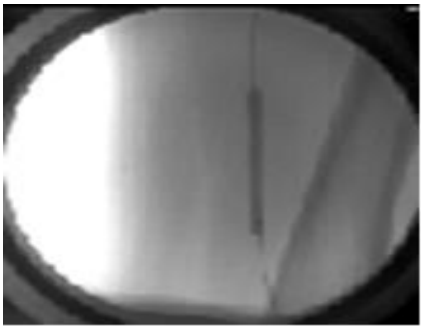

Fig. (8): Ballon dilatation of the occluded part of SFA.

4) Stent deployment:

Stenting was carried out in 10 cases.they were self expandable stents which were deployed due to residual stenosis more than 30% or recoil.All stent diameters were 6 mm and the lengths were 60mm in 6 cases,80mm in 3cases and 120mm in 1 case. (fig 9,10)

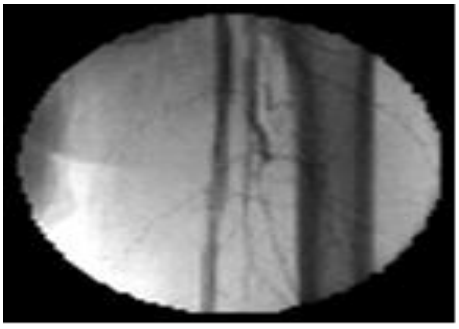

Fig. (9): Stenting of the middle SFA segment.

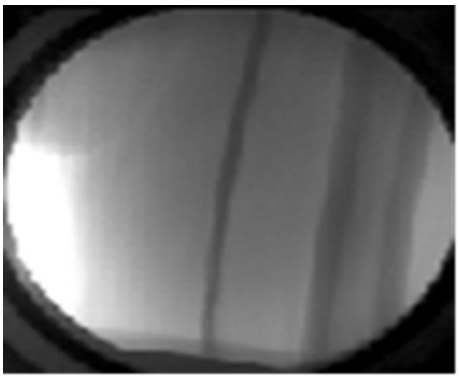

Fig. (10): Angiographic success after stenting without residual stenosis or recoil.

Clinical outcome:

In this study ,by using SAFARI Technique , clinical,technical and angiographic success rate after the procedure which detected by maintaining of straight in-line flow to the foot was 14cases from 16 cases(87.5%).the 2cases which failed was due to heavy calcification of the vessels with difficult crossing the lesions which was converted to open surgery due to lack of availability of other endovascular modalities as CTO catheters,Atherectomy devices or re-entry devices.

DISCUSSION

The "SAFARI" technique or subintimal arterial flossing with antegrade-retrograde intervention is a method for recanalisation of chronic total occlusions (CTOs) when subintimal angioplasty fails**(4).**

In study done by ***Noory et al,2009***,56 patients(43 males,13 females with mean age 59 years with Rutherford category (2 to 5) were treated with antegrade subintimal angioplasty with re-entry failure then the retrograde transpopliteal access was used to complete the procedure. in all interventions ballon angioplasty was performed and stenting was done in 40 cases (71.4%).(5) In the present study, included14 males (87.5%) and 2 females (12.5%)with ratio 7:1and the patient's age varied between 48 and 72 years with a mean of 60 years , 16 patients (100%) were diabetics,14 patients (87.5%) were dyslipidemic 14patients(87.5%) were smokers, 8 patients(50%)were hypertensive with Rutherford 4 to 6. Balloon angioplasty was done in all cases(16 limbs) and stenting was carried out in 10 cases.

SAFARI Technique can be useful for completing subintimal recanalization when there is failure to re-enter the distal true lumen from an antegrade approach . SAFARI Technique improves technical success in performance of subintimal recanalization.

Limb salvage rates are comparable with antegrade subintimal recalanization**(6).**

A study done by ***Zaitoun et al in 2009,*** reported an 81% primary angiographic success rate for the popliteal approach with no complication.(7). As regard to study of ***To¨ nnesen et al in*** **2003,** showed a cumulative patency rate of 43% at 1to 3 years. Reported complications of the technique were confined to hematoma formationat the puncture site in 4%.(8).Also as regard to study by ***Noory et al in 2009***, evaluated SFA recanalization failures from an antegrade approach, the transpopliteal retrograde puncture was successfully performed under fluoroscopic or ultrasound guidance in all cases with technical success (100%)**(5)**.

As regard to study done by ***Spinosa, et al in 2005,*** using SAFARI technique resulted in successful subintimal recanalization and creation of a straight-line flow to the foot in 21 limbs of 20 patients .The limb salvage rate with SAFARI was 90% (6).and in study done ***by Gandini,.et al in 2009,*** all patients with critical limb ischemia were successfully recanalized and had complete healing of the limb lesions .At 12 months follow up, all patients showed clinical improvement without major complications related to the procedure(9).As regard to study done by ***Tay, et al in 2012.*** The SAFARI technique improves acute technical success when initial antegrade attempts at recanalization have failed with technical success as high as 95.8%**(10)**. According to the study of ***Hua et al in 2013***, It reported that SAFARI technical success was achieved in all cases**(11)**. Comparing to this study ,by using SAFARI Technique, technical success rate after the procedure which was detected by immediate regaining of the pulse or clinical improvement as disappearing of rest pain , or appearance of line of demarcation or angiographic success was14cases from 16 (87.5%). The two cases which failed converted to open surgery due to lack of availability of modalities of intervention as atherectomy devices and re-entry devices.There was no any complications

Conclusion and Recommendations.

- SAFARI TECHNIQUE is an ideal line of intervention in failure of re-entry of subintimal angioplasty

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