The Egyptian Journal of Hospital Medicine (October 2021) Vol. 85 (2), Page 4317-4322

Ipsilateral Retrograde Balloon Angioplasty of Flush Lesions of Superficial Femoral Artery Occlusion

Hany Abd El Momen Abd El Fatah, Ahmed Abd El Raouf Mahdy
Departments of Vascular Surgery and Cardiovascular Medicine, Faculty of Medicine, Al-azhar University
Corresponding author Hany Abd El Momen Abd Elfatah , **Email:hadydayman@gmail.com**

ABSTRACT

Background: For almost 50 years, endovascular treatment has been used to treat chronic limb ischemia. The retrograde contralateral "crossover," antegrade ipsilateral, or retrograde popliteal techniques may be used to treat superficial femoral artery occlusions. There were early drawbacks to the retrograde technique, thus it was used as an emergency alternative. **Objective:** This study aimed to investigate efficacy and safety of ipsilateral retrograde balloon angioplasty for flush lesions of superficial arterial blockage.

Patients and methods: This prospective cohort study was carried out at Sayed Galal Hospital and Al-Hussein Hospital through the period from August 2018 to August 2021. This study included 50 individuals with peripheral arterial disease (PAD). Interventional study was conducted on flush lesions of superficial femoral artery occlusion.

Results: A significant difference between patients who achieved patency and who did not achieve patency (regarding BMI, dyslipidemia, cardiac diseases and postoperative ABI).

Conclusion: Retrograde balloon angioplasty of flush lesions is a reliable procedure for superficial femoral artery occlusion handling with relatively low rate of complications.

Key words: Popliteal approach, retrograde superficial femoral artery revascularization, superficial femoral artery flush occlusion.

INTRODUCTION

Since atherosclerosis is a systemic disease, a substantial percentage of patients with chronic coronary artery disease (CAD) have associated cerebrovascular disease, lower extremity artery disease (LEAD), or both. The term peripheral artery disease (PAD) is used to include all vascular sites, including carotid, vertebral, upper extremity, mesenteric, renal, and lower extremity vessels [(1)]. PAD is the third leading cause of cardiovascular morbidity after myocardial infarction and stroke. Both knowledge and treatment of PAD have improved dramatically in recent years. The superficial femoral arteries (SFA) and its complex lesions and occlusions are two of the most common arteries in the lower extremities affected by atherosclerotic symptoms [(2, 3)]. The main advantages of endovascular revascularization are the low complication rates, ranging from 0.5% to 4.0% and high technical success rates (even in long occlusions) approaching 90% and an acceptable short-term clinical outcome [(4)].

In the SFA and popliteal artery (PA), therapy may be hindered by the long lesions, high calcium content, and unique dynamic stresses. Treatment of a flush SFA obstruction with endovascular means is a tough endeavor. Numerous projections are required to pinpoint the SFA's origin, since the wire is prone to being trapped in the deep femoral vein [(5, 6)]. The groin-to-diaphragm stent might become obstructed or fractured as a result of this kind of treatment. A proper degree of compression may reduce the diameter of veins in both the superficial and deep networks, although this does not occur in all people [(7)].

In the majority of cases, the SFA occlusions are recanalized intraluminally or subintimally using an antegrade or retrograde femoral approach. In the case of failure, a retrograde popliteal access (RPA) is an alternative. As a last option, the retrograde popliteal procedure has its own set of limitations [(8, 9)]. However, recent developments have made this strategy more enticing. It was indicated as a first alternative for patients with common and/or SFA stenosis, excessive obesity, tandem iliac and/or SFA lesions, or RPA lesions, rather than as a last resort surgery [(10, 11)]. When the retrograde popliteal technique was first introduced, it was considered a "back-up" choice because of the risk of arteriovenous fistulas, dissections, pseudoaneurysms, haemorrhage and hematoma [(12)].

Received: 1/9/2021
Accepted: 2/10/2021

Aim of the study: This study aimed to investigate efficacy and safety of ipsilateral retrograde balloon angioplasty for flush lesions of superficial arterial blockage.

PATIENTS AND METHODS

This prospective cohort study was carried out at Sayed Galal Hospital and Al-Hussein Hospital at the period from August 2018 to August 2021. This study included 50 individuals who sought for medical advice and admitted with clinical features of lower limb ischemia with flush lesions of superficial femoral artery. Each patient was given signed permission to participate in this research.

Inclusion criteria: Patients having the angiographic criteria of flush SFA occlusion and are able to give informed consent.

Exclusion criteria: Patients with acute thromboembolism, trauma, or autoimmune disorders. Patients with associated CFA (**common femoral artery)** lesions or a CFA bifurcation level greater than the upper margin of the head of femur, and those with a contraindication to endovascular intervention such as contrast allergy and inability to give informed consent.

Interventional technique: Endovascular procedures were performed in a specialized angiographic suite under local anaesthesia, sterile draping, and continuous monitoring. All patients who had not been on DAPT for at least a week received a loading dose of aspirin 300 mg combined with clopidogrel 150 mg two hours before intervention. CFA access was acquired in all patients for a retrograde contralateral "crossover" approach (5F, 11 cm long introducer sheath; "Input," Medtronic). Selective common iliac arteriography and/or digital subtraction angiography were used to detect the lesions. Heparin was given intravenously to keep the active clotting time between 200 and 250 seconds.

Despite multiple attempts with various guidewire/support catheter combinations, the inability to move the guidewire over the SFA obstruction antegradely prompted conversion to a retrograde PA method. The femoral sheath was attached to the skin, and the patient was placed prone. Sterile draping and exposing of the popliteal fossa were carried out. PA was examined in transverse section under USG guidance, and a puncture (distal P2 or proximal P3 segment) was done using a micropuncture needle in a medial to posterolateral orientation, at an angle of 45°-60° with the skin surface, taking care to prevent popliteal vein puncture.

A 5F femoral sheath was introduced after fluoroscopy established the correct position of the wire, followed by angiography of the PA and infrapopliteal arteries. Following evaluation of the distal SFA, the blockage was navigated from its distal end using a hydrophilic 0.035-inch needle "A 4F MPA diagnostic catheter or a percutaneous transluminal angioplasty (PTA) balloon catheter supports a Terumo glidewire. In all patients, intraluminal negotiation of the SFA CTO was attempted with catheter assistance utilising various guidewires ("Radiofocus," Terumo; "Magic torque, V-18," Boston Scientific). If intraluminal negotiation failed, subintimal tracking of the wire was attempted.

After successfully crossing the CTO, the intraluminal location of the catheter tip was verified with contrast injection, and angioplasty was conducted retrogradely from the popliteal access site itself with nominal pressure inflation for 2 minutes. In the event that angioplasty was insufficient or there was a flow-limiting flap/dissection, 5F compatible self-expanding peripheral stents ("Everflex," Medtronic) were employed. A 5F femoral sheath was used in all patients, which was the preferred approach for all retrograde operations (angioplasty and stenting). After the angiography, the popliteal sheath was removed and manual compression for 10 minutes was done, followed by a nonocclusive pressure bandage for a day.

Attempts were tried to safeguard the ostium in those who had a patent profunda femoris artery (PFA) that was supplied distally by collaterals. Before transferring the patient to the prone position, a 0.018" PTA wire ("V18," Boston Scientific) was inserted into the PFA via the contralateral crossover CFA access, followed by an appropriately sized PTA balloon ("Sterling, Boston Scientific") "Boston Scientific) implanted in the ipsilateral PFA and extending into the CFA. To prevent plaque transfer or embolization into the patent PFA, the SFA and PFA balloons were inflated in a "kissing" form at the same time. Due to budget restrictions, PTA of significant concomitant ipsilateral iliofemoral lesions with approximately congruent artery sizes was done using the same balloon used for SFA angioplasty. Good antegrade flow was maintained up to the PA and BTK [Figure 4a] and [Figure 4b]. After 2–4 weeks, significant concomitant BTK lesions (n = 03) were treated in phases using an ipsilateral antegrade femoral approach.

Post-procedural treatment included DAPT (tablet aspirin 150 mg + clopidogrel 75 mg) for 12 weeks,

followed by aspirin 150 mg for the remainder of the period. Cilostazol was continued in patients with severe BTK disease. Diabetes, hypertension, dyslipidemia, smoking, and sedentary lifestyle were all advised to seek aggressive risk factor management therapy.

The wound care protocol was followed correctly. Before being released, all patients received a clinical examination the day after procedure (after the compression bandage was removed) and duplex imaging of the access site. Conservative amputations of the gangrenous foot were done after the formation of a definite line of demarcation. All patients were clinically assessed, and their ABI was measured at regular intervals (weekly for a month, fortnightly for three months, and then at six and twelve months).

Individuals with ischemia symptoms or access site edema were the only ones who had duplex imaging of the target lesion and the access site. All patients were clinically assessed, and their ABI was measured at regular intervals (weekly for a month, fortnightly for three months, and then at six and twelve months). Individuals with ischemia symptoms or access site edema were the only ones who had duplex imaging of the target lesion and the access site.

The study's end points were the technical success rate of popliteal puncture (defined as successful Doppler-guided popliteal puncture and sheath placement), the technical success rate of retrograde revascularization (defined as fluoroscopy guided successful wire negotiation across the occlusion and angioplasty with residual stenosis 30%), puncture site complications, and limb salvage (defined as avoidance of a major amputation above the level of the ankle joint).

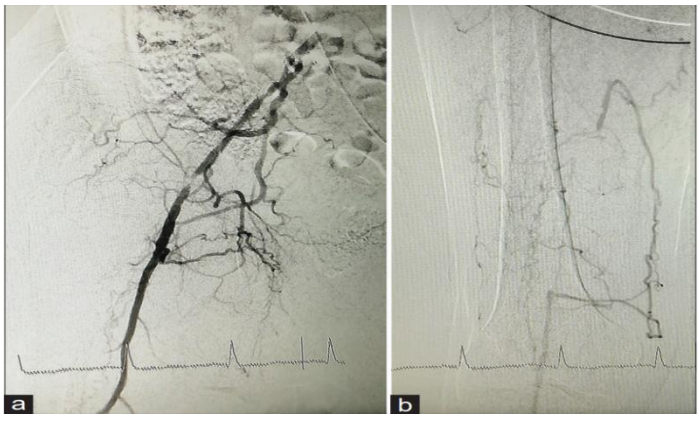

Figure (1): (a and b) Digital subtraction angiography revealed flush chronic total occlusions of the Rt. Superficial femoral artery with collateral reconstitution of the mid-superficial femoral artery and the popliteal artery (P1 segment) with significant ipsilateral lesions in the common femoral artery and the external iliac artery.

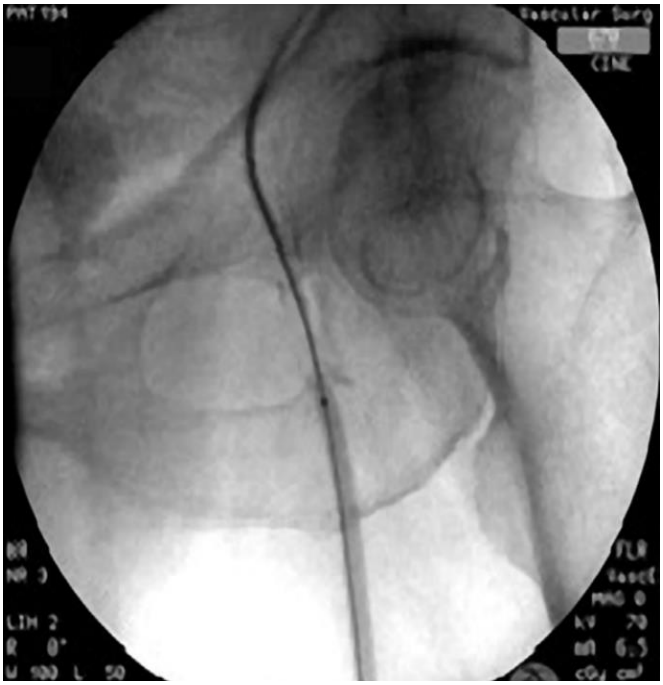

Figure (2): Endovascular ipsilateral antegrade revascularization with balloon dilatation of a flush SFA obstruction.

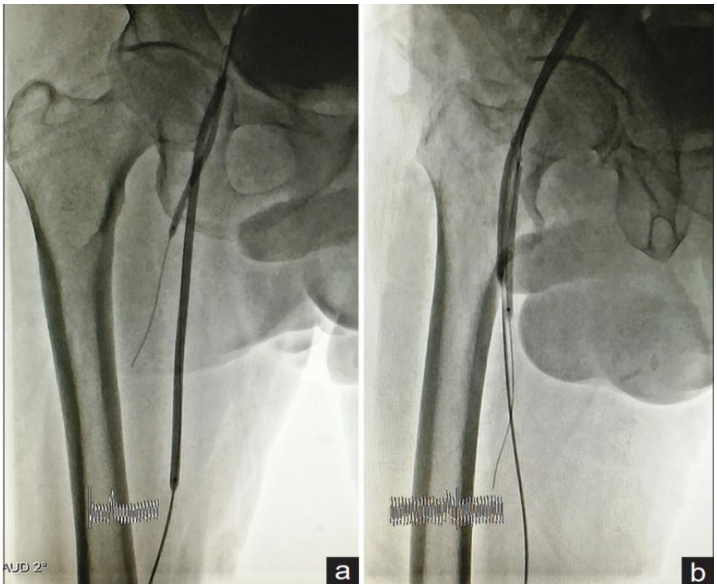

Figure (3): (a and b) Percutaneous transluminal angioplasty of concurrent ipsilateral iliofemoral lesions employing the same superficial femoral artery balloon while "kissing" the superficial femoral artery and profunda femoris artery balloons.

Ethical approval:

The study was approved by the Ethics Board of Al-Azhar University and an informed written consent was taken from each participant in the study. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Statistical analysis:

Data were analyzed using IBM Statistical Package for the Social Sciences, version 24 (SPSS Inc., Chicago, IL). Numerical data were described as mean, standard deviation, while qualitative data were described as number and percentage.

RESULTS

Table 1. Baseline characteristics

	All patients (n=50)
***Age** (years)*	60.4 ± 6.82
***BMI** (kg/m^2)*	27.55 ± 2.64
***Sex**, n (%)*	
Male	29 (58%)
Female	21 (42%)
***Comorbidities**, n (%)*	
Hypertension	29 (58%)
DM	45 (90%)
Dyslipidemia	32 (64%)
Smoking	36 (72%)
Cardiac diseases	4 (8%)

58% of the patients were males with mean age of 60.4 ± 6.82 years. Regarding comorbidities, 90% of patients were diabetic, 58% were hypertensive, 72% were smoker, 64% with dyslipidemia and only 8% with cardiac diseases.

Table 2. Clinical presentation

	All patients (n=50)
***Clinical presentation**, n (%)*	
Foot gangrene	13 (26%)
Heel infective gangrene	5 (10%)
Rest pain	6 (12%)
Sole infective gangrene	4 (8%)
Toe gangrene	17 (34%)
Toe infective gangrene	5 (10%)

The majority of patients (34%) had toe gangrene, with foot gangrene (26%) being the most common clinical presentation.

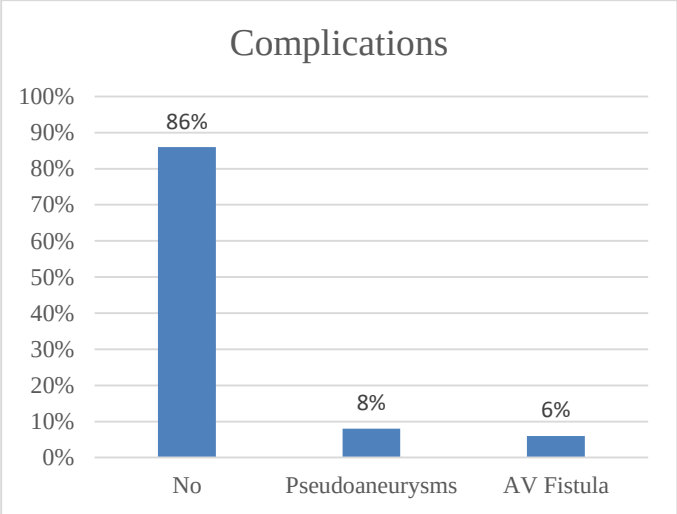

Figure (4): Pseudoaneurysms and AV fistula.

In terms of problems, pseudoaneurysms were detected in 8% of the patients, while arteriovenous fistulas were found in 6%. Overall, the incidence of problems was modest (14 %).

Table 3. Follow up

	All patients (n=50)
6-months Patency	
Yes	41 (82%)
No	9 (18%)
1 year Patency	
Yes	39 (78%)
No	11 (22%)

At six months, the primary patency rate was 82 percent, and at one year, it was 78 percent.

Table 4. Patient characteristics according to 1 year patency

	Patent (n=39)	***Not (n=11)***	***P***
***Age** (years)*	59.61 ± 5.8	62.7 ± 5.49	.121
***BMI** (kg/m^2)*	27.22 ± 2.54	29.18 ± 3.71	**.048**
***Sex**, n (%)*			
Male	23 (59%)	6 (54.5%)	.793
Female	16 (41%)	5 (45.5%)	
***Comorbidities**, n (%)*			
Hypertension	20 (58%)	9 (81.8%)	.070
DM	34 (90%)	11 (100%)	.211
Dyslipidemia	22 (64%)	10 (90.9%)	**.035**
Smoking	26 (72%)	10 (90.9%)	.114
Cardiac diseases	1 (2.6%)	3 (27.3%)	**.007**
Ankle brachial index			
Pre	0.502 ± 0.061	0.488 ± 0.077	.529
Post	0.731 ± 0.039	0.615 ± 0.012	**<0.001**

There was a significant difference between patients who achieved patency and who did not achieve patency

(regarding BMI, dyslipidemia, cardiac diseases and postoperative ABI).

DISCUSSION

Our research comprised 50 patients. The participants' average age was 60.4 years, with a standard deviation of 6.82 years. The average body mass index (BMI) was 27.55 kg/m^2. Males made up 58% of the population, while females made up 42%. These findings are close to a recent study by **Eleissawy *et al.* [13]** as mean BMI was 24.5 kg/m^2 and males represented 76%. Mean age was more than our results as it was 72 years with SD of 7.5.

Hypertension was found in 58% of included subjects, DM represented 90%, dyslipidemia reached 64%, 72% were smokers and 8% suffered from cardiac diseases. Different to our study in **Eleissawy *et al.* [13],** hypertension was found in 80% of subjects, DM represented 44%, 44% were smokers. Many patients (48%) suffered from cardiac diseases. Similar to our study **Singh *et al.* [14]** reported that the patients' mean age was 61 years, with a standard deviation of 12. The vast majority of them (78%) were guys. Thirty-three percent of the patients had hypertension, and 22% had diabetes. Hyperlipidemia was detected in 33% of the patients, whereas coronary artery disease was discovered in 28%.

We reported that (34%) had toe gangrene, with foot gangrene being the most prevalent clinical presentation (26%). Pseudoaneurysms were diagnosed in 8% of the patients, whereas arteriovenous fistulas were found in 6%. Overall, the number of difficulties was low (14 percent). Similar to our study **Abd El-Rhman *et al.* [15]** performed a close study on a similar patients regarding complication and age. Toe gangrene was found in 35% of patients followed by foot gangrene which was found in 25% of patients. **Dumantepe [16]** reported that rate of complications was less than our study and reached 7%.

At six months, the primary patency rate was 82 percent, and at one year, it was 78 percent. Similar to our study **Singh *et al.* [14]** reported that At 6 months and 1year post-intervention, the main patency rates were 93 percent and 80 percent, respectively. During the follow-up period, there were two in-stent restenosis and one occlusion that necessitated reintervention. After 18 months, the secondary patency rate was 93 percent. The research group had no fatalities. **Dumantepe [16]** reported that secondary patency rate was 96.4%. **Testi *et al.* [17]** reported that the approach also may fail in up to 20% of cases. **Dumantepe [16]** reported that it has become the recommended initial revascularization approach for patients with severe clinical disease and brief lesions because to its low associated morbidity and mortality, as well as its good technical success rates.

CONCLUSION

Retrograde balloon angioplasty of flush lesions is a reliable procedure for superficial femoral artery occlusion handling with relatively low rate of complications.

REFERENCES

1. **Steg P, Bhatt D, Wilson P *et al.* (2007):** One-year cardiovascular event rates in outpatients with atherothrombosis. JAMA., 297: 1197–1206.
2. **Fowkes F, Rudan D, Rudan I *et al.* (2013):** Comparison of global estimates of prevalence and risk factors for peripheral artery disease in 2000 and 2010: a systematic review and analysis. The lancet, 382 (9901): 1329-40.
3. **Dumantepe M (2017):** Retrograde popliteal access to percutaneous peripheral intervention for chronic total occlusion of superficial femoral arteries. Vascular and endovascular surgery, 51 (5): 240-6.
4. **Catalano M, Born G, Peto R (2007):** Prevention of serious vascular events by aspirin amongst patients with peripheral arterial disease: randomized, double-blind trial. J Intern Med., 261: 276–284.
5. **Schmidt A, Bausback Y, Piorkowski M *et al.* (2012):** Retrograde recanalization technique for use after failed antegrade angioplasty in chronic femoral artery occlusions. Journal of Endovascular Therapy, 19 (1): 23-9.
6. **Testi G, Ceccacci T, Paciaroni E *et al*.(2020):** Retrograde deep femoral artery access as bailout technique to rescue unexpected ostial occlusion during antegrade superficial femoral artery recanalization. Annals of vascular surgery, 66: 666-e7.
7. **H'ng M, Punamiya S (2014):** An innovative modification of the retrograde approach to angioplasty and recanalization of the superficial femoral artery. Diagnostic and Interventional Radiology, 20 (2): 164.
8. **Testi G, Ceccacci T, Cevolani M *et al.* (2019):** Femoral Balloon-Oriented Puncture for True Lumen Reentry in the Common Femoral Artery After Subintimal Retrograde Recanalization of Superficial Femoral Artery Ostial Occlusion: The FORLEE Technique. Journal of Endovascular Therapy, 26 (4): 490-5.
9. **Fanelli F, Lucatelli P, Allegritti M, Corona M, Rossi P, Passariello R (2011):** Retrograde popliteal access in the supine patient for recanalization of the superficial femoral artery: initial results. Journal of Endovascular Therapy, 18 (4): 503-9.

10. **Brountzos E, Moulakakis K, Avgerinos E *et al.* (2011):** Retrograde transpopliteal approach of iliofemoral lesions. Vascular and endovascular surgery, 45 (7): 646-50.
11. **Ye M, Zhang H, Huang X *et al.* (2013):** Retrograde popliteal approach for challenging occlusions of the femoral-popliteal arteries. Journal of vascular surgery, 58 (1): 84-9.
12. **Pappy R, Hennebry T, Abu-Fadel M (2011):** Retrograde access via the popliteal artery to facilitate the re-entry technique for recalcitrant superficial femoral artery chronic total occlusions. Catheterization and Cardiovascular Interventions, 78 (4): 625-31.
13. **Eleissawy M , Elbarbary A , Elwagih M *et al.*(2019):** Ipsilateral antegrade angioplasty for flush superficial femoral artery occlusion versus open bypass surgery. Annals of vascular surgery, 61: 55-64.
14. **Singh A, Prakash N, Kumar N *et al.*(2021):** Retrograde popliteal approach for endovascular revascularization of flush superficial femoral artery chronic total occlusion: A two-center experience. Indian Journal of Vascular and Endovascular Surgery, 8 (1): 42.
15. **Abd El-Rhman A , Yahia Z , Mohamady E (2020):** Assessment of the Endovascular Management of Flush Superficial Femoral Artery (SFA) Total Occlusion. Al-Azhar Medical Journal, 49 (2): 447-456.
16. **Dumantepe M (2017):** Retrograde popliteal access to percutaneous peripheral intervention for chronic total occlusion of superficial femoral arteries. Vascular and endovascular surgery, 51 (5): 240-246.

Testi G, Ceccacci T, Cevolani M *et al.*(2019): Emoral Balloon-O riented Punctu re for True L umen R ee ntry in the Common Femoral Artery After Subintimal Retrograde Recanalization of Superficial Femoral Artery Ostial Occlusion: The FORLEE Technique. Journal of Endovascular Therapy, 26 (4): 490-495.