Popliteal Versus Tibial Retrograde Access for Subintimal Arterial Flossing with Antegrade–Retrograde Intervention (SAFARI) Technique

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WHAT THIS PAPER ADDS

The SAFARI technique is a safe and feasible option for patients with infrainguinal chronic total occlusion (Trans-Atlantic Inter-Society Consensus (TASC) II C and D). The posterior tibial (PT) artery or dorsalis pedis (DP) artery as the retrograde access is a good choice when using the SAFARI technique. First, DP/PT access may decrease procedure time. Second, and most important, DP/PT access is an acceptable technique in patients with anatomic or other issues that preclude or make popliteal access difficult.

Objective: This study aimed to ascertain differences in benefit and effectiveness of popliteal versus tibial retrograde access in subintimal arterial flossing with the antegrade–retrograde intervention (SAFARI) technique.
Methods: This was a retrospective study of SAFARI-assisted stenting for long chronic total occlusion (CTO) of TASC C and D superficial femoral lesions. 38 cases had superficial femoral artery lesions (23 TASC C and 15 TASC D). All 38 cases underwent SAFARI-assisted stenting. The ipsilateral popliteal artery was retrogradely punctured in 17 patients. A distal posterior tibial (PT) or dorsalis pedis (DP) artery was retrogradely punctured in 21 patients, and 16 of them were punctured after open surgical exposure.
Results: SAFARI technical success was achieved in all cases. There was no significant difference in 1-year primary patency (75% vs. 78.9%, $p = .86$), secondary patency (81.2% vs. 84.2%, $p = .91$) and access complications ($p = 1.00$) between popliteal and tibial retrograde access. There was statistical difference in operation time between popliteal (140.1 $\pm$ 28.4 min) and tibial retrograde access with PT/DP punctures after surgical vessel exposure (120.4 $\pm$ 23.0 min, $p = .04$).
Conclusion: The SAFARI technique is a safe and feasible option for patients with infrainguinal CTO (TASC II C and D). The PT or DP as the retrograde access after surgical vessel exposure is a good choice when using the SAFARI technique.

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INTRODUCTION

Endovascular therapy has been increasingly applied to patients with Trans-Atlantic Inter-Society Consensus (TASC) C and D femoral popliteal lesions due to the development of endovascular techniques (such as subintimal angioplasty) and tools (re-entry devices and stents, among others).[1] Numerous studies have shown acceptable patency rates for endovascular treatment of advanced infrainguinal lesions compared with femoral–popliteal bypass.[2–4]

Subintimal angioplasty (SIA) is an effective method in the recanalization of long and chronic superficial femoral artery (SFA) occlusions.[5,6] A meta-analysis of SIA revealed a technical success rate of 86%, with a 1-year primary patency rate of 56% and a limb salvage rate of 89%.[7] The study demonstrated that the outcomes for SIA are good and should be considered as an alternative to surgical bypass. However, the success rates of SIA for long chronic total occlusion of SFA remain suboptimal. SIA failure commonly results from an inability to re-enter the true lumen of the artery and repeated attempts can extend the subintimal channel, which may result in more severe ischemia due to disruption of vital collateral vessels.[8,9]

The subintimal arterial flossing with antegrade–retrograde intervention (SAFARI) technique described by Spinosa et al.[10] is a way of addressing this problem when there are no re-entry devices. In the SAFARI technique, retrograde subintimal recanalization is performed until the subintimal space created by the antegrade approach is reached. The distal guidewire is then manipulated into the antegrade sheath or catheter to create a ‘‘flossing’’-type guidewire access. Therefore, angioplasty and/or stenting can be performed over the guidewire. Popliteal artery (PA), distal

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anterior tibial artery (AT), distal posterior tibial artery (PT), or dorsalis pedis artery (DP) are typically used for distal retrograde access. The PA as the retrograde access has been mentioned in many studies,[11–14] but reports on tibial/pedal vessel at the ankle/foot for retrograde access are few.[15–18] When popliteal access is not suitable for patients who cannot be placed in prone or in lateral decubitus positions for popliteal puncture, or patients whose PA was visualized to be superimposed on the vein, with the possibility of puncture under ultrasound guidance, the tibial artery near the ankle may be chosen for retrograde access.

In this report, we appraise the results of the SAFARI technique to treat TASC C and D superficial femoral lesions. We ascertain differences in benefit and effectiveness of popliteal versus tibial retrograde access in SAFARI for TASC C and D SFA occlusions.

PATIENTS AND METHODS

A retrospective study of SAFARI-assisted stenting for long chronic total occlusion of TASC C and D superficial femoral lesions was carried out. All the patients' infrapopliteal segments were patent with at least one or both tibial vessels run off to the ankle. Exclusion criteria were as follows: acute limb ischemia, chronic total occlusion of the PA, and proximal trifurcation vessels.

Between April 2007 and June 2011, 38 cases (23 TASC C lesions and 15 TASC D lesions) underwent SAFARI-assisted stenting for long chronic total occlusion of the SFA. The patients comprised 17 men and 21 women, with a median of 80.5 years (interquartile range: 17.25). Twelve patients had claudication affecting lifestyle (Fontaine grade IIb), 17 had rest pain (Fontaine grade III), 5 had ulceration, and 4 had gangrene (Fontaine grade IV). The ankle brachial index (ABI) was 0.23 ± 0.15. The population demonstrated a marked comorbidity profile (Table 1). Fifteen patients were judged to be at prohibitively high risk for operative intervention.

All patients underwent detailed diagnostic imaging prior to their endovascular intervention using duplex ultrasound and/or computed tomography angiography. All patients also had digital subtraction angiography before endovascular intervention. The mean length of the femoral artery occlusion was 25 cm ± 12 cm (range 18–38 cm). Except for the occlusion located in the superficial femoral artery, 21 patients had combined ipsilateral infrapopliteal arteries occlusions, seven patients had combined ipsilateral iliac artery stenosis, and two had combined ipsilateral iliac artery occlusions. Seven patients had a SFA occlusion that was flush with the bifurcation of the common femoral artery, with a patent deep femoral artery.

TREATMENT

Procedures

At the start of the procedure with the patient in a supine position, 80–100 units/kg of unfractionated heparin was intravenously administered. Heparin anticoagulation was maintained throughout the procedure with an activated coagulation time of 250–300 seconds. If the operating time exceeded 1 hour, half the dose of initial heparin was given. After 2 hours, one-quarter dose of initial heparin was given. After 3 hours, one-quarter dose of initial heparin was given.

Among seven patients who had a superficial artery occlusion that was flush with the bifurcation of the common femoral artery, and among nine with combined ipsilateral iliac artery stenosis or occlusion, the procedure was started by retrograde catheterization of the contralateral femoral artery. Antegrade catheterization of the ipsilateral femoral artery was carried out in other patients. Then, a preprocedural digital subtraction angiogram was performed to evaluate the status of the occlusion and the distal outflow

Table 1. Associated comorbidities of the cohort.

	I. Retrograde PA access under US ($n = 17$)	II. Retrograde PT/DP access ($n = 21$, 16 with surgical vessel exposure; 5 with percutaneous retrograde access)	p Values
Ischemic heart disease	9 (52.94%)	14 (66.67%)	.509
Hypertension	10 (58.82%)	15 (71.43%)	.502
Dyslipidemia	14 (82.35%)	20 (95.24%)	.307
Diabetes mellitus	11 (64.71%)	15 (71.43%)	.734
Chronic renal insufficiency	3 (27.27%)	5 (23.81%)	.709
Sequel of cerebral infarction	2 (11.76%)	3 (14.29%)	1.000
Pulmonary dysfunction	1 (5.88%)	5 (23.81%)	.197
Obesity	2 (11.76%)	10 (47.62%)	.034
Cigarette smoking	6 (35.29%)	13 (61.90%)	.191
Current	2	4	
Former	4	9	
Baseline Fontaine class			
IIb	8 (47.06%)	4 (19.05%)	.087
III	7 (41.18%)	10 (47.62%)	.752
IV	2 (11.76%)	7 (33.33%)	.148

Note. Obesity means body mass index ≥30. Pulmonary dysfunction means chronic obstructive pulmonary disease. PA = popliteal artery; PT/DP = posterior tibial artery/dorsalis pedis artery; US = color Doppler ultrasound.