Novel technique to tackle flush superficial femoral artery chronic total occlusion

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Context
Flush superficial femoral artery (SFA) occlusions often show hard, rounded, and eccentric plaque that pushes the guide-wire to go preferentially into the profunda femoral artery whenever a trial of angioplasty is carried out.
Aims
In this work, we evaluated a new bail-out technique to facilitate cannulation of flush SFA occlusion; we refer to it as 'profunda occluding balloon' technique.
Settings and design
This was a retrospective study that included patients with peripheral arterial disease admitted to the ward of Vascular Surgery Unit at Alexandria University Hospital between August 2019 and December 2020. All patients had chronic peripheral arterial disease Fontaine classification (IIb–IV). Multislice Computed Tomographic Angiography showed TASC II A/B/C femoropopliteal lesions with flush SFA occlusions. All cases had patent aortoiliac segment with good distal popliteal run off. Patients with acute leg ischemia or extensive foot necrosis necessitating amputation were excluded from the study.
Patients and methods
The new technique entails inflating a balloon in the profunda femoral artery in a fashion to create an ostium for the SFA. Then, a wire is forced into the SFA and the procedure continues as usual, tailored according to the lesion pattern.
Results
A total of 46 cases with flush SFA occlusions were included in the study. The traditional methods for SFA cannulation succeeded to cannulate the artery in 34 cases. Therefore, the new 'profunda occluding balloon' technique was tried in the other 12 cases. In 10 of them, the SFA was successfully cannulated; the technical success rate was 83%. For the remaining two patients who had technical failure, bypass surgery was resorted to. Among the 10 patients whom the new technique was used for, the guide-wire passed subintimally in eight of them with spontaneous re-entry at the popliteal run-off site, and in two patients, the guide wire was passed intraluminally.
Conclusions
This 'profunda occluding balloon' technique was shown to be a cheap maneuver with a high technical success rate for cannulating flush SFA occlusions. We encourage interventionists to use it as a bailout method in case other traditional approaches fail.

Keywords:
chronic total occlusion, flush superficial femoral artery occlusion, profunda femoral artery, profunda occluding balloon technique

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Introduction

Flush superficial femoral artery (SFA) occlusions often show hard, rounded, calcific, and eccentric plaque that pushes the guide wire preferentially into the profunda femoral artery (PFA) whenever a trial of angioplasty is carried. SFA flush occlusions having no stump proximally could be managed by retrograde contralateral, antegrade ipsilateral, or retrograde popliteal approaches [1]. Adjunctive measures may also include duplex ultrasound-assisted cannulation of the SFA [2]. Finally, a hybrid technique could be used by performing a cut-down on the common femoral artery (CFA) [3]. In this work, we evaluated a new technique to facilitate cannulation of flush SFA occlusion; we refer to it as 'profunda occluding balloon' technique.

Patients and methods

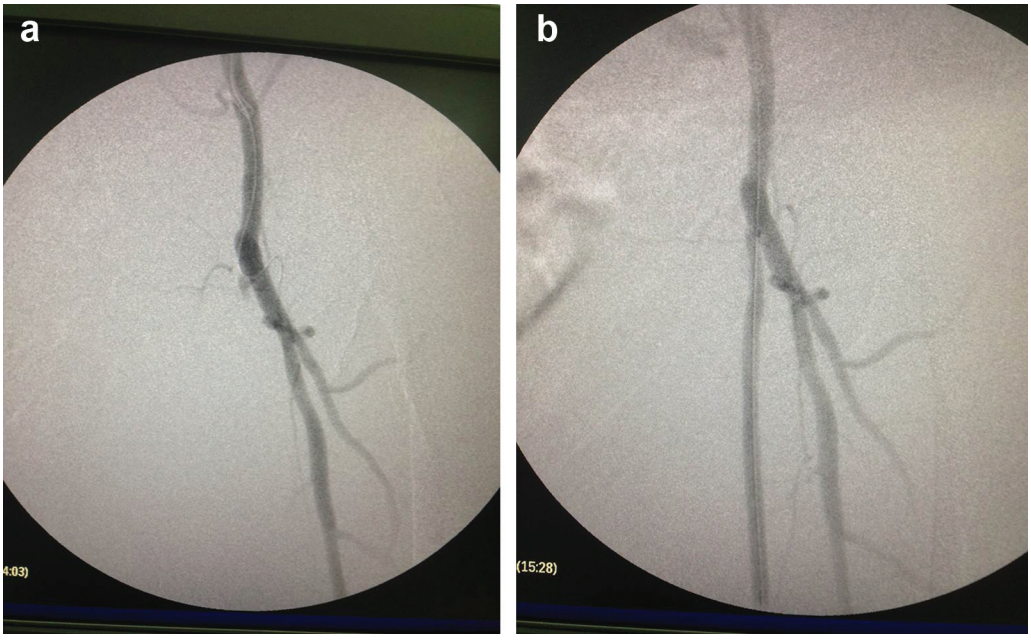
This was a retrospective study that included patients with peripheral arterial disease (PAD) admitted to the ward of vascular surgery unit at Alexandria University Hospital between August 2019 and December 2020.

This research was performed at the Department of Vascular Surgery, Alexandria University Hospitals and the Faculty of Medicine Helwan Vascular Surgery. Ethical Committee approval and written, informed consent were obtained from all participants. Inclusion criteria depended upon clinical examination, laboratory investigations, color duplex ultrasound, and multislice computed tomographic angiography. All patients had chronic peripheral arterial disease stages IIb–IV, according to Fontaine classification [4]. Multislice Computed Tomographic Angiography showed TASC II A/B/C femoropopliteal lesions with flush SFA occlusions [5]. All cases had patent aortoiliac segment with good distal popliteal run-off. Patients with acute leg ischemia or extensive foot necrosis necessitating amputation were excluded from the study.

All procedures were done under totally aseptic conditions under regional or general anesthesia. Initially, our approach is usually a retrograde contralateral, and if failed, then an antegrade ipsilateral or retrograde popliteal approaches are tried. In case all these trials fail, then our new 'profunda occluding balloon' technique is used as a bailout option. The new method entailed exchanging the sheath with an 8-F one onto the contralateral side. Then a contralateral II flush catheter (Boston Scientific Corporation, Boston, Massachusetts, USA) was introduced through the sheath over a Glide wire Hydrophilic Coated 0.035-inch stiff guide-wire (Terumo Interventional Systems, Somerset, New Jersey, USA) to cross-over to the ipsilateral side. Then a balloon over a V-18 control wire steerable 0.018-inch guide-wire (Boston Scientific Corporation) was passed into the PFA. While inflating this balloon, another V-18 0.018-inch buddy wire was passed through the contralateral catheter and forced into the flush SFA occlusion. After deflating and removing the PFA balloon, SFA angioplasty continued as usual either intraluminally or subintimally. A fundamental technical trick was to use a short (2 cm) balloon to position it into the PFA while keeping its proximal 3 mm in the CFA to create a 'virtual nipple' in the distal CFA; this allows the guide wire to probe the proximal SFA atherosclerotic cap. Another tip is to apply low pressure while inflating the occlusion balloon in the PFA, to avoid dissection in this delicate artery. No vascular closure devices were used, and manual groin compression was applied in all cases. Figure 1a and b shows an example of a case treated in the study.

Upon revising the patients' notes, all patients who had failure of SFA cannulation by any of the former traditional methods and had a trial of the new 'profunda occluding balloon' technique were assessed for success of SFA cannulation. Therefore, the study end points were determined intraoperatively depending on the ability to cannulate the SFA. Technical success was defined as the ability to cannulate the SFA by this new technique, whereas technical failure was defined as

Figure 1



(a) SFA before angioplasty. (b) SFA after angioplasty using the new technique. SFA, superficial femoral artery.

the inability to cannulate the SFA. The study did not put into account the result of balloon angioplasty accomplished finally. The study was approved by the Institutional Review Board of the University of Alexandria.

Results

A total of 46 cases with flush SFA occlusions were included in the study. The traditional methods used initially succeeded to cannulate the SFA in 34 cases. Therefore, the new 'profunda occluding balloon' technique was tried in the other 12 cases. In 10 of them, the SFA was successfully cannulated; the technical success rate was 83%. For the remaining two patients who had technical failure, bypass surgery was resorted to. Among the 10 patients whom the new technique was used for, the guide-wire passed subintimally in eight of them with spontaneous re-entry at the popliteal run-off site, and in two patients, the guide-wire passed intraluminally. The results and patency of the SFA angioplasty performed were out of context of this study.

Few complications were encountered during performing this novel technique. Two patients had hematomas at the site of contralateral puncture; both of them showed no active vasculature by color duplex ultrasound, and these were managed conservatively. Another case had localized PFA dissection; this was treated successfully by a 3-cm balloon inflated for 4 min into the artery. Neither arterial rupture nor SFA/PFA thrombosis was encountered.

Discussion

The idea of 'profunda occluding balloon' has risen from the difficulty we face in cannulating flush SFA occlusions using traditional methods. Of course, the use of a balloon to occlude the PFA added to the cost of the procedure. However, no major complications have been encountered in the PFA from this maneuver; the only patient who had dissection was thought to be owing to heavily calcific wall and likely enough he did not need stenting. The use of dedicated low profile balloons could be of value, an issue that needs to be studied.

Practically, different approaches could be adopted for the same technique. If the 8-F sheath was thought to be too big for the contralateral CFA, then the PFA balloon could be introduced through a 6-F sheath from the contralateral CFA [a RIM (Impress hydrophilic angiographic catheter, Merit Medical, Utah, USA) is used for cross-over], then the wire passed to cannulate the SFA is introduced through an ipsilateral or a brachial approach. However, all 10 cases done in the study were performed from the contralateral side using an 8-F sheath.

Traditionally, several approaches are there to tackle flush SFA occlusions. The conventional retrograde contralateral or antegrade ipsilateral approaches require at least a patent stump in SFA of 1 cm [1]. Duplex ultrasound-assisted cannulation of flush SFA has been described [2]. Again this technique necessitates a patent SFA stump to be present and a highly skilled ultrasound interventionist. The commonly used approach nowadays is the retrograde popliteal approach, which is not without complications. In the case of distal runoff at P2 or P3 segment, the patient could be forced to lie prone, a position which is not always feasible owing to patients' comorbidities. Furthermore, re-entry at the proximal SFA cap is not guaranteed and the guide-wire may sometimes dissect up to the external iliac artery, hence the need for a re-entry device may become essential, which adds to the cost of the procedure. Added to these risks, is the possibility of ruining the distal runoff segment if multiple trails were done. This may cause the future distal anastomosis of a bypass procedure to be either very difficult or constrain the surgeon to do a more distal bypass [6]. Lastly, in case a hybrid technique was performed, one should be aware of the higher risk of infection faced and the need for a hybrid or that increases the cost of the procedure [7].

Recently, a new technique has been mentioned to treat SFA occlusions without proximal stump. This entailed retrograde percutaneous direct puncture of the occluded SFA after failure of antegrade recanalization in cases with limited access to retrograde popliteal or tibial arteries. Once the wire passes into the CFA, the procedure then continues by conventional antegrade recanalization. This technique was successful to recanalize the SFA in eight of 10 cases performed [8].Given the initial success, we recommend the 'profunda occluding balloon' technique to be advocated as a bailout method for recanalization of the flush SFA occlusion with no proximal stumps, if other approaches fail. It is a cheap maneuver with a high technical success rate. However, more cases need to be performed to draw conclusions and compare the outcome with the other conventional methods.

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Conflicts of interest

There are n conflicts of interest.

References

1 Komshian S, Cheng T, Farber A, Schermerhorn M, Kalish J, Rybin D, *et al.* Retrograde popliteal access to treat femoropopliteal artery occlusive disease. J Vasc Surg 2018; 68:161–167.

2 Bernardo N, Maluenda G, Gonzalez M, Collins S, Gupta V, Bilyeu M, *et al.* Novel technique of duplex ultrasound guided cannulation of complete flush occlusion of SFA and bypass graft. J Am Coll Cardiol 2010; 55:216–246.

3 Hayes D, Dougherty M, Calligaro K. Management of flush superficial femoral artery occlusions with combined open femoral endarterectomy and endovascular femoral-popliteal angioplasty and stent-grafting. Ann Vasc Surg 2011; 25:19–23.

4 Nehler MR, Wolford H. Natural history and nonoperative treatment of chronic lower extremity ischemia. In: Rutherford RB, editor. Rutherford, vascular surgery. 6th ed. Pennsylvania: Elsevier Saunders; 2005. p. 1083.

5 Jaff M, White C, Hiatt W, Fowkes G, Dormandy J, Razavi M, *et al.* An update on methods for revascularization and expansion of the TASC lesion classification to include below-the-knee arteries: a supplement to the inter-society consensus for the management of peripheral arterial disease (TASC II): The TASC steering committee. Vasc Med 2015; 86:611–625.

6 Schmidt A, Bausback Y, Piorkowski M, Werner M, Bräunlich S, Ulrich M, *et al.* Retrograde recanalization technique for use after failed antegrade angioplasty in chronic femoral artery occlusions. J Endovasc Ther 2012; 19:23–29.

7 Zhou M, Huang D, Liu C, Liu Z, Zhang M, Qiao T, *et al.* Comparison of hybrid procedure and open surgical revascularization for multilevel infrainguinal arterial occlusive disease. Clin Interv Aging 2014; 9:1595–1603.

8 Igus B, Firat A. An alternative treatment of stump occlusion of the superficial femoral artery with percutaneous direct puncture followed by antegrade recanalization. Cardiovascular Revascularization Medicine 2020; 21: 779–784.