KOWLOON WEST CLUSTER 九龍西醫院聯網

GROWING AND SUSTAINABLE APSCV IR 2024

18th Annual Scientific Meeting of Asia Pacific Society of Cardiovascular and Interventional Radiology

# Salvaging inadvertent subintimal stenting with subintimal stenting, a case report

Eugene Sean Lo, Stephanie Cheri Woo, Lik Fai Cheng
Department of Diagnostic and Interventional Radiology, Princess Margaret Hospital, Hong Kong

## Introduction

- **Subintimal angioplasty (SIA)**, also known as subintimal arterial flossing with antegrade-retrograde intervention **(SAFARI),** describes a vascular interventional technique whereby guidewires are passed into the **subintimal** space of occluded arteries for angioplasty and extraluminal stenting.
- This technique is usually employed for long **chronic total occlusions (CTO)**, to **circumnavigate heavily calcified plaques** not amenable to conventional intraluminal angioplasty[1].
- SIA has also been reported as a successful **salvage** technique for cases of **inadvertent arterial dissection or stent thrombosis**, with multiple accounts of successful salvage in coronary artery dissections and femoral in-stent thromboses [2, 3].
- SIA has also been increasingly described and employed in the lower limb for the treatment of **peripheral vascular disease (PVD) for long segment TASC II C/D** categories [4]. In lower limb PVD, antegrade access via a suitable femoral access site and retrograde access via a below-the-knee artery is concurrently employed for more effective dissection into the subintimal space and more accurate luminal re-entry. Specific re-entry devices (such as OUTBACK®) facilitate luminal re-entry and are increasing in popularity with promising data in primary stent patency (up to 92.3% at 12 months)[4].
- Familiarity with subintimal techniques allows the interventionist to handle aforementioned complications of stent thromboses, inadvertent dissections and chronic long vessel occlusions.

## Case Description

- 59 year old male with PVD and previous angioplasty and multiple right lower limb bridging stents
- CT angiogram for persistent claudication showed **malalignment** of a right common femoral artery-proximal superficial femoral artery (CFA-pSFA) stent and mid-SFA stents, with **inadvertent subintimal placement of the distal end of CFA-pSFA stent.**
- **Total occlusion** of the SFA stents occurred due to the aforementioned stent malalignment.
- A summary of prior stent positioning is presented in figure 1.

**Fig. 1. Summary of stents positions from repeat angioplasty and stenting**

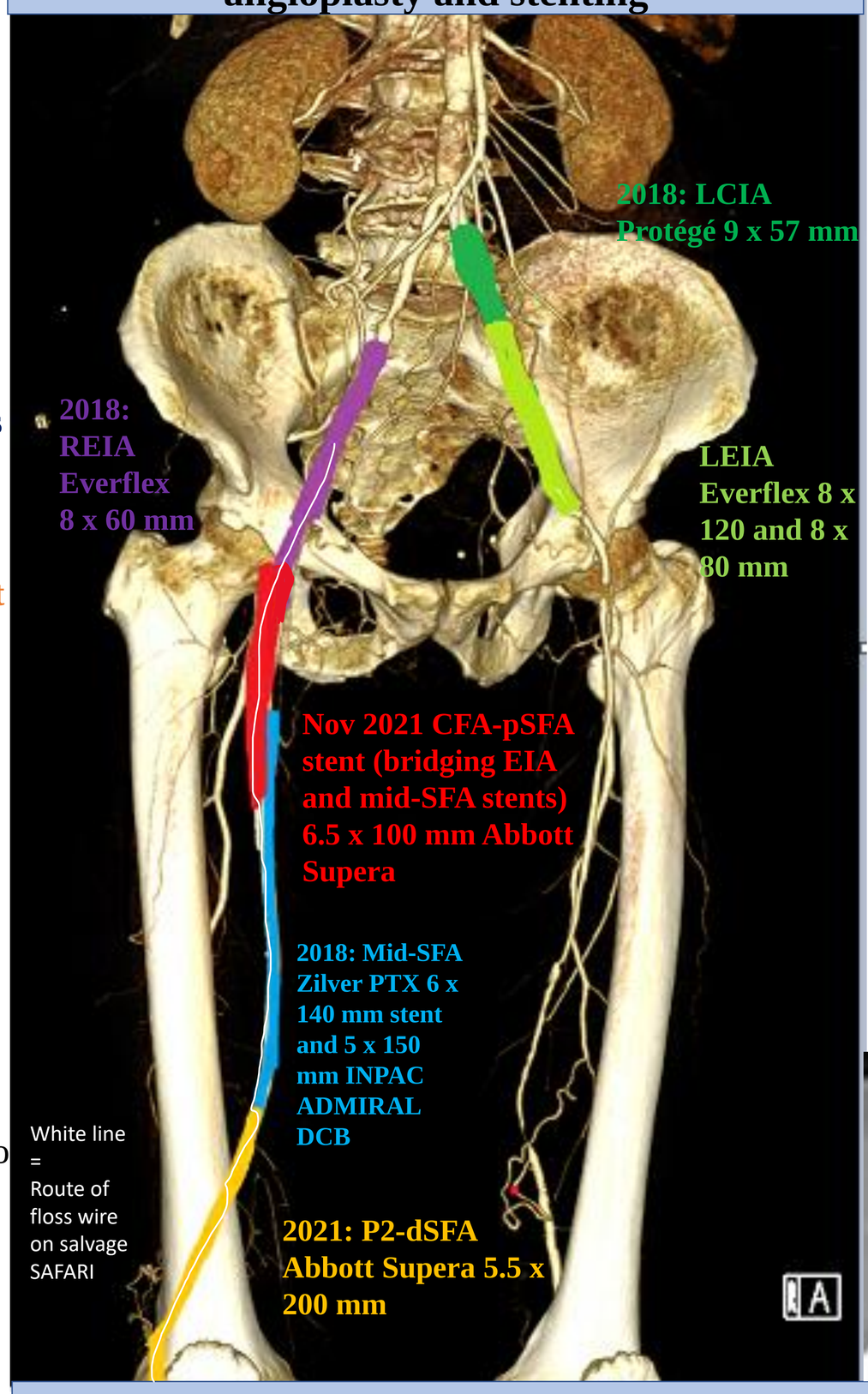


**Fig. 2. DSA in 2021 of CFA-pSFA to mid-SFA bridging-stent showed apparent alignment and patency after deployment on frontal projection**

**Fig. 3. CT (2022) done for claudication shows subintimal position of distal margin of right CFA-pSFA stent and malalignment with midSFA stent resulting in in-stent thromboses (left: axial, right: sagittal reformatting)**

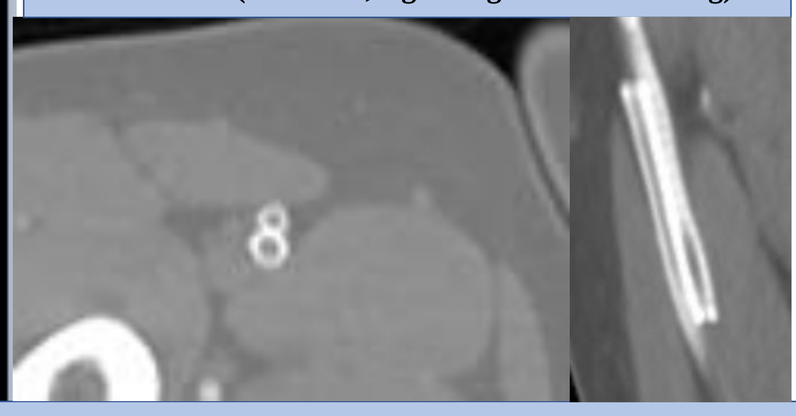

**Fig. 4. Repeat Angioplasty with SAFARI**


4A: Crossover wire from left femoral access, tip within right CFA-pSFA stent with failure to advance. 4B: Retrograde wire was passed from posterior tibial artery intraluminally through occluded P2-dSFA Abbott stent, subintimal space outside Zilver SFA stent, back into intraluminal occluded CFA stent, establishing a floss wire. Position was confirmed by IVUS. 4C: After floss wire was established, angioplasty of the intraluminal-subintimal-intraluminal wire tract was performed with subsequent stenting at the SFA, double-barrel exclusion of mid-SFA Zilver stent (4D and E) with completion angiogram showing significant restoration of flow between CFA-pSFA stent and other SFA stents.

## Discussion

Review of the aforementioned case provides a good discussion for **how to prevent inadvertent subintimal entry and stenting.** Steps which may reduce the chance of this happening include:

1. Careful attention on the behavior of the guide-wire as the **guidewire tip more freely rotates** in the **intraluminal position** as opposed to when manipulated within the subintimal (potential) space.
2. **Careful assessment for margins of bridging stents** and for **any suboptimal contrast flow** during placement. On retrospective review a very subtle stepping of the bridging stents can be seen on AP view. Routine **biplane imaging** to confirm both AP and lateral alignment is also suggested.
3. **Intravascular ultrasound** can be a helpful adjunct to **confirm subintimal or intraluminal** positioning, though comes with operator dependence and a learning curve

The IVUS images from this patient's salvage angioplasty are presented in figure 5 with brief introduction on the adjunctive capabilities of IVUS.

Several **methods to establish a floss wire with SAFARI technique once retrograde wire meets the antegrade wire. They include:**

1. **A nitinol snare system that allows wire entrapment for advancement into subintimal space**
2. **Balloon dilatation of the subintimal space from retrograde access for increased subintimal capaciousness for antegrade wire entry.**
3. **A catheter at the antegrade lumen, with manipulation of the retrograde wire tip into the catheter lumen, securing the wire before advancement into the subintimal space.**




Fig. 5A: IVUS allows adequate sizing of a vessel for proper selection of catheters and stents. Fig. 5B: IVUS image showing echogenic guide-wire in the intraluminal space. Fig 5C. IVUS image showing echogenic guide-wire in the subintimal space. 5D: IVUS assessment of the stent can detect stent mal-alignment, improper sizing or, inadvertent subintimal entry.

## Conclusion

We report a case of prior inadvertent right distal CFA subintimal stent placement with resultant SFA stent occlusion in a contiguous stent-system of right lower limb. Techniques for optimizing initial stent placement and preventing inadvertent stent placement are discussed. A salvage procedure with SAFARI technique for stent bridging and double-barrel exclusion of right middle SFA occluded stent are described.

References:
1: Cheng, L. F. (2015). HA Convention 2015. In *Hospital Authority*. Retrieved from https://www3.ha.org.hk/haconvention/hac2015/proceedings/downloads/MC5.1.pdf.
2. Duterloo D, Lohle PNM, Lampmann LEH. Subintimal double-barrel restenting of an occluded primary stented superficial femoral artery. *Cardiovasc Intervent Radiol*. 2007;30(3):474-476.
3. Capretti G, Mitomo S, Giglio M, Carlino M, Colombo A, Azzalini L. Subintimal crush of an occluded stent to recanalize a chronic total occlusion due to in-stent restenosis. *JACC: Cardiovascular Interventions*. 2017;10(8):e81-e83.
4. Gandini R, Fabiano S, Spano S, et al. Randomized control study of the outback LTD reentry catheter versus manual reentry for the treatment of chronic total occlusions in the superficial femoral artery. *Catheter Cardiovasc Interv*. 2013;82(3):485-492.
5. Ying LH, Fan YS, Lu Y, Xu K, Li CJ. Intravascular ultrasound guided retrograde guidewire true lumen tracking technique for chronic total occlusion intervention. *J Geriatr Cardiol*. 2018;15(2):199-202.