

Correspondence

Impact of subintimal plaque modification (SPM) technique on failed intervention of coronary artery chronic total occlusion



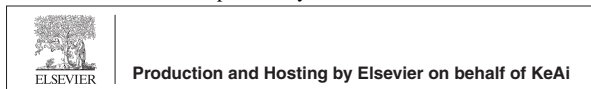
To the editor:

The intervention of chronic total occlusion (CTO) of coronary artery is the last castle to be conquered in coronary intervention.¹ With the development of techniques and guidewires, even in high-volume centers, the failure rate of CTO is still 10%–15%. Vo MN et al² described a “subintimal plaque modification” (SPM) that involves use of antegrade and retrograde dissection reentry techniques to treat “balloon-un-crossable” coronary lesion in 2014. The Subintimal Tracking and Reentry (STAR) technique is not suitable for routine use during CTO percutaneous coronary intervention (PCI). SPM is also called STAR without stenting, which can be used as a bailout strategy in CTO PCI when standard crossing attempts fail. Typically, SPM technique is performed as balloon dilation of the subintimal space through the CTO segment.^{3,4} The contrast is injected to the subintimal space through anterograde and retrograde access, creating a false lumen that facilitates staging and, in the extension definition, is also known as the SPM technique. Herein we reported a case about SPM technique in failed intervention of CTO, in this case we repeated coronary angiography to acquire the images which showed the impact of SPM technique on this failed CTO case after one-year follow-up. In particular, in this case, we “created” a new channel with normal flow from the proximal of the left anterior descending (LAD) to the distal true lumen, even though this new channel was actually a false lumen in the medium with

the outlet to the distal true of LAD. Importantly, the patient showed significant relief of angina symptoms during the 1-year follow-up, suggesting that SPM technique can improve health and quality of life in patients with CTO failure.

A 55-year-old male patient was admitted to Fuwai Hospital on April 23, 2019 due to exertional angina for 6 months. Coronary angiography showed triple vessel disease (TVD) with LAD CTO at the ostium. Even though we strongly suggested him to receive CABG operation, he rejected it and insisted on receiving PCI treatment. After discussion within the team of interventional cardiologists and cardiac surgeons, we performed PCI for him due to the evidence of myocardial ischemia even under optimized medical treatment on April 23, 2019. We chose the retrograde strategy and reverse CART. We encountered great difficulties in trying to identify the ostium of occluded LAD during reverse CART even after a series of guidewire escalation technique and intravascular ultrasound (IVUS) checking for many times. Under IVUS guided, we speculated that maybe the “calcium wall” blocked the ostium of occluded LAD (Fig. 1A–D). Contrast agent was injected from retrograde access to performing calino during reverse CART and contrast agent was also injected from antegrade access, resulting in an obvious false lumen in the occluded LAD segment. There was dissection in the proximal of the first diagonal, we implanted one stent in the proximal of diagonal. Final angiogram from antegrade access resulted in a false lumen of proximal LAD, connecting the distal true lumen of LAD (Fig. 1E, F), the operation stopped with the total procedure time of 4 hours and high-dose radiation (nearly 5Gys) in the whole operation. The patient had no clinical manifestation related with radiation damage. We also monitored the patient's renal function 1–3 days after the operation and

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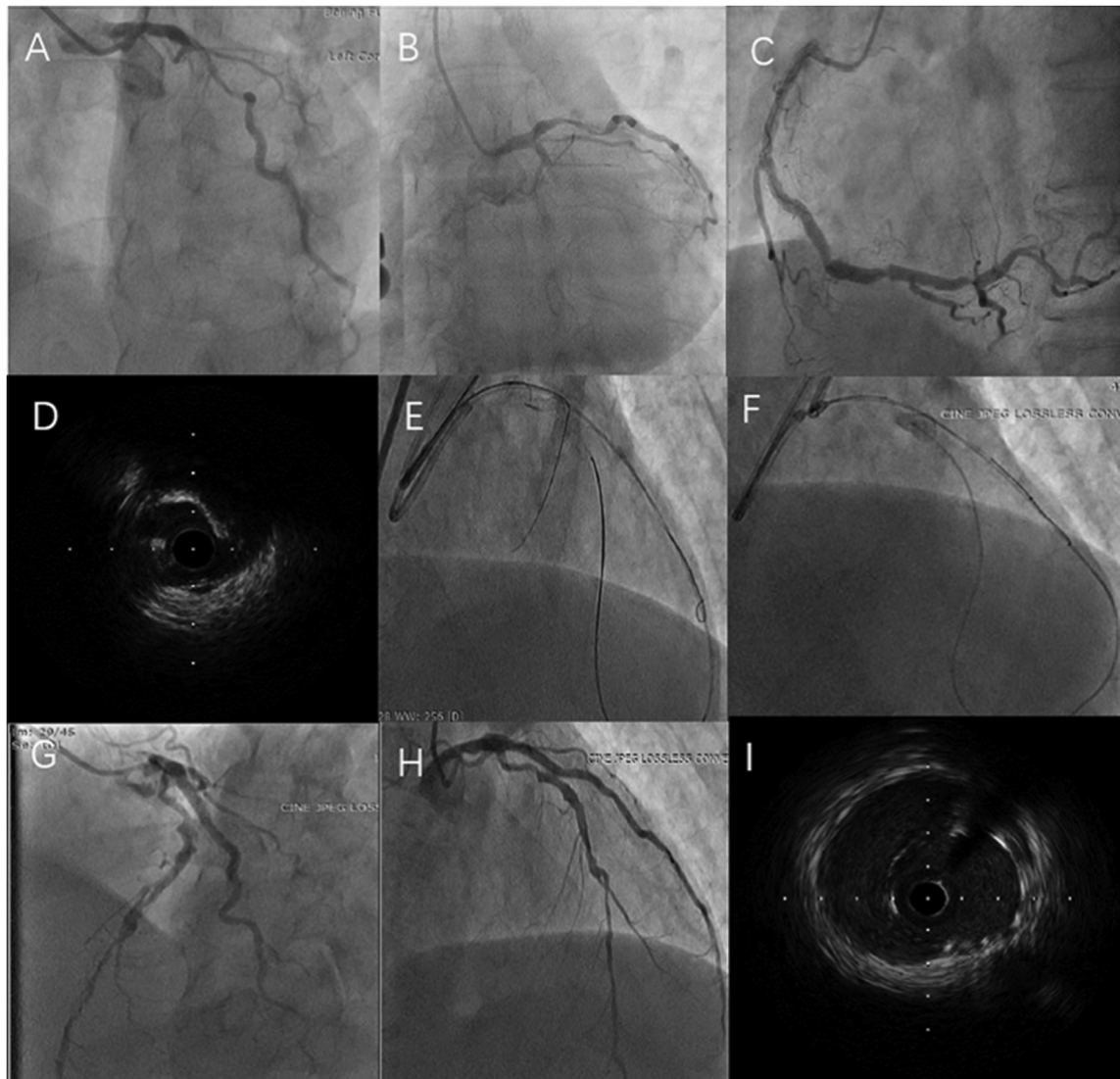


Fig. 1. First angiography (April 23, 2019) of index procedure showing triple vessel disease (TVD) with left anterior descending artery chronic total occlusion and ipsilateral epicardial collaterals from the first diagonal (A–C). IVUS checked for distal of diagonal to proximal of LM, showing calcific wall obstructed the ostium of occluded LAD, suggesting great difficulties to “puncture” across it even by using hard wires, whatever through antegrade or retrograde access (D). Contrast agent was injected from retrograde access to performing carlino during reverse CART and contrast agent was injected from antegrade access, resulting in an obvious false lumen in the occluded LAD segment (E–F). Repeating angiography (April 30, 2020) of the staged procedure one year later showing a new pathway for proximal LAD connecting the distal true lumen of LAD, with TIMI flow grade III (G–H). IVUS examination from the distal of diagonal to the proximal of LM revealed that the stent was severe malapposition near the ostium of occluded LAD, and false lumen was connecting true lumen of distal LAD (I).

the patient's serum creatine level kept stable in normal range. The total volume of contrast agent was 350 mL. During one-year follow-up period, the patient's symptom relief a lot. After one year, we repeated coronary angiogram for the patient on April 30, 2020. Surprisingly, in some extent, we “created” a new pathway for

proximal LAD connecting the distal true lumen of LAD, with thrombolysis in myocardial infarction (TIMI) flow grade III, and the diameter of proximal LAD was almost 3.0 mm (Fig. 1G, H). IVUS examination from the distal of diagonal to the proximal of LM revealed that the stent was severe malapposition near the ostium of occluded

LAD, and false lumen was connecting true lumen of distal LAD (Fig. 1I).

The strategies of CTO intervention include antegrade and retrograde access. The core techniques focus on guidewire escalation, Stingray, reverse CART etc.^{5,6} In our case, the routine technique such as guidewire escalation and reverse CART did not succeed. The most difficult point was to search the ostium of LAD through antegrade or retrograde access. Before stopping, SPM may be used to facilitate future success. SPM technique acted as an important element of the expanded hybrid algorithm. Four parameters are constantly being evaluated during the procedure: radiation dose, contrast volume, procedure time and risk of the remaining treatment options, to determine if the procedure needs to stop.^{7,8}

From the repeated angiogram images, we found that the ostium of the occluded LAD was z-shaped and abnormal, which was also the reason for the failure of reverse CART operation. We decided to make Carlino and inject contrast agent from both antegrade and retrograde to obtain a false lumen to achieve SPM. The procedure of Carlino was described as the following: the microcatheter was placed in the proximal fibrous cap, and < 1 mL of contrast agent was manually pushed at high pressure with a 2 cm³ Luer locking syringe. Calino should be used under fluoroscopy in a controlled manner to prevent the perforation from spilling contrast (purely sensory). In repeated angiography, we found that occluded LAD after SPM restored TIMI blood flow by connecting the proximal false lumen with the distal true lumen, and the patient's symptoms were significantly relieved. In our case, we demonstrated the positive effect of SPM on failed CTO cases.

Hirai T et al⁹ evaluated the impact of SPM on 138 failed CTO cases, which focused on the health status who received SPM after failed CTO interventional procedures (42.8%). They concluded that after one-month follow-up, SPM could improve the patients' health status quantified using the Seattle Angina Questionnaire Summary Score (SAQ SS). In the PROGRESS-CTO registry, 935 (20%) had a prior unsuccessful attempt. Of those 935 patients, 119 (13%) had prior SPM. The outcomes of 58 cases of SPM surgery and 60 cases of CTO PCI were analyzed. They concluded that repeat CTO PCI attempts after SPM are associated with high likelihood for successful revascularization with acceptable risks.¹⁰

In summary, our case showed the impact of SPM technology on symptom relief and quality of life improvement in cases where CTO interventions failed, suggesting that SPM technique could be used as an “investment” approach in some CTO interventions.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflicts of interest

None.

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