



The antegrade dissection and re-entry technique as preparation of intravascular ultrasound guided re-wiring

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Abstract

Although the antegrade dissection and re-entry technique (ADR) with Stingray system is one of the procedures for percutaneous coronary intervention (PCI) of chronic total occlusion (CTO), it has some risk of side-branch occlusion. This article reports a CTO case in the left circumflex artery successfully treated with combination use of ADR subintimal tracking and intravascular ultrasound (IVUS)-guided re-wiring without side-branch occlusion. Antegrade approach with single-wire and parallel-wire technique was failed. Retrograde approach through ipsilateral collateral was also failed. Therefore, the ADR was attempted and Stingray wire crossed through at the distal site of posterolateral (PL) branch. To avoid PL branch occlusion, IVUS-guided re-wiring to the true lumen was attempted. Finally, the CTO lesion was recanalized without any complication and 1 year follow-up angiography had good result. ADR as preparation of IVUS-guided re-wiring might be one of the useful procedures for those complex CTO cases.

Keywords Chronic total occlusion · Intravascular ultrasound · Complications · Hybrid revascularization

Introduction

Percutaneous coronary intervention (PCI) of chronic total occlusion (CTO) has been developing with the novel techniques and devices [1–5]. The antegrade dissection and re-entry technique (ADR) with Stingray system is one of the techniques for subintimal tracking procedure to simplify and potentially improve antegrade recanalization success [6]; however, that has some risk of side-branch occlusion and subsequent myocardial infarction [7]. On the other hand, intravascular ultrasound (IVUS)-guided re-wiring technique is also one of the intentional re-wiring techniques after wire migration into subintimal space. However, it has the potential risk of enlarging the subintimal space causing the failure of the wire cross [8]. In this paper, we report a CTO case successfully recanalized without side-branch occlusion with combination use of ADR subintimal tracking and IVUS-guided intentional re-wiring.

Case reports

A 62-year-old male with a history of diabetes, dyslipidemia, and hypertension, presented with chest pain on effort. Stress myocardial scintigraphy showed the posterolateral wall ischemia of left ventricle. Coronary angiogram revealed blunt-type CTO in mid-left circumflex artery (LCX) and ipsilateral collateral was found (Fig. 1). He was admitted our hospital and revascularization for the CTO lesion was attempted.

At first, we performed angiogram of right coronary artery (RCA) to check the collaterals for left coronary artery (LCA). However, there was no interventional collateral for LCA from RCA. An 8-Fr. XB 3.5 guiding catheter (Brite tip, Cordis, OH) was engaged in the LCA, and antegrade approach was attempted. A guide wire (XT, Asahi Intecc, Nagoya, Japan) was advanced by IVUS guided at CTO entrance, because the lesion was stumpless. However, the wire was advanced to the subintimal space, and parallel-wire technique with double lumen catheter was attempted. Although second wire (Gaia 1st, Asahi Intecc) was advanced, it was also failed (Fig. 2). Therefore, retrograde approach was attempted at this time. Some guide wires (SION and XT-R, Asahi Intecc) were advanced to ipsilateral collaterals in atrial circumflex (AC) branch; however, guide

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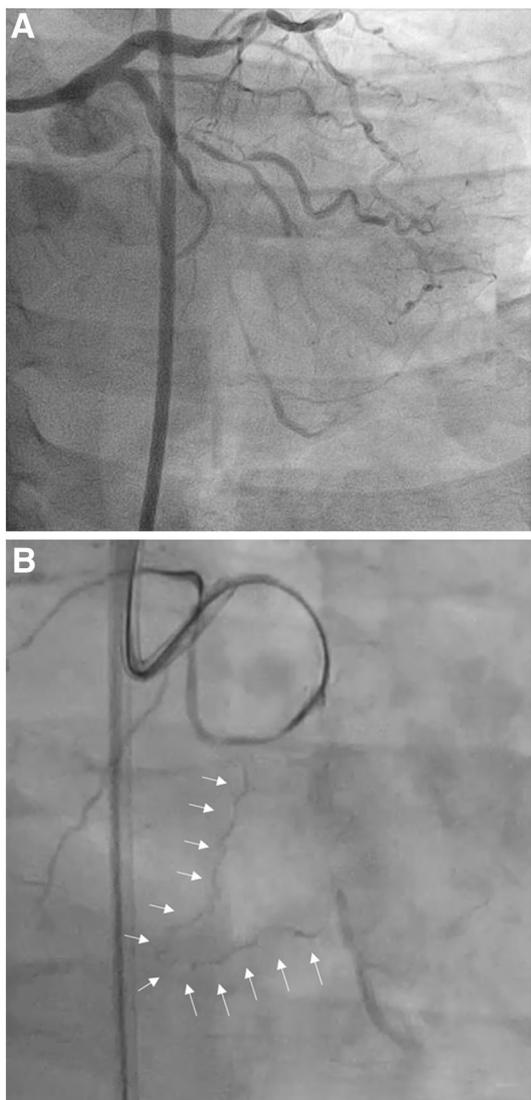


Fig. 1 Coronary angiogram. **a** Blunt type of chronic total occlusion in mid-left circumflex artery. **b** Tip injection from atrial circumflex branch and ipsilateral collateral (white arrows)

wire could not reach to the distal true lumen because of the tortuosity.

Therefore, ADR with Stingray system was attempted. CrossBoss catheter (Boston Scientific, MA) was entered to the subintimal space and advanced through the occlusion length (Fig. 3a), and then retracted leaving the guide wire past the occlusion. The Stingray balloon catheter was advanced and inflated up to 4 atm within the subintimal space (Fig. 3b), and the Stingray guidewire was tried to direct and exit through the luminal port with a direct

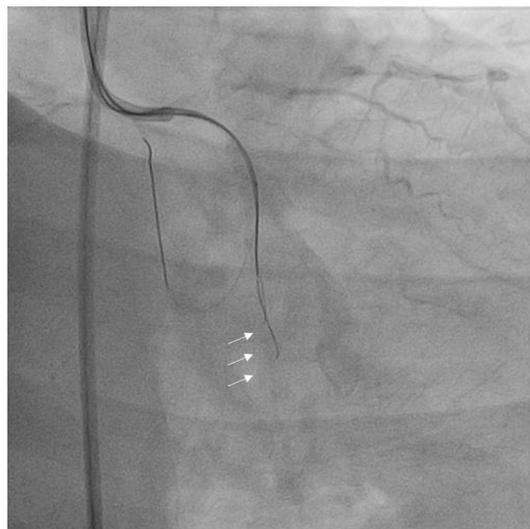


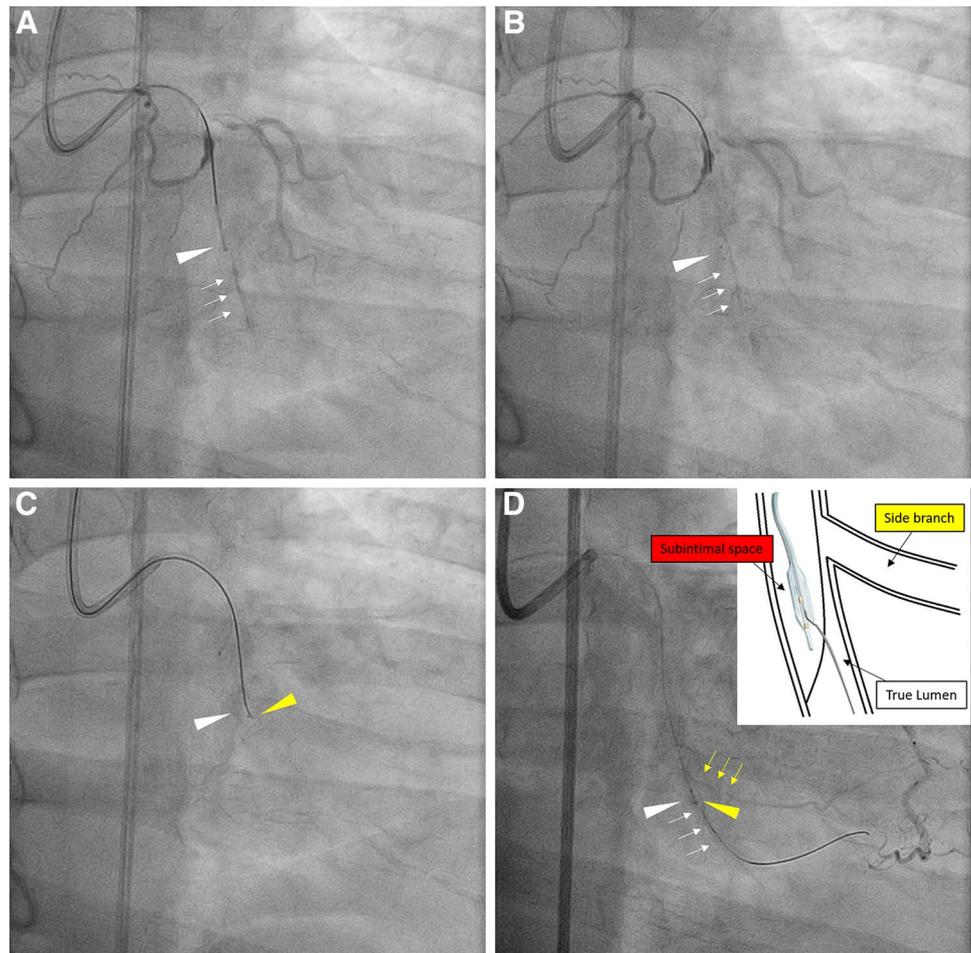
Fig. 2 Antegrade approach with parallel-wire technique. White arrows indicate the distal lumen of chronic total occlusion. Both of two wires were located at the right side from true lumen

puncture technique (Fig. 3c). However, it was failed at the puncture site, and the puncture site was changed to more distal site. Finally, the Stingray wire could be intentionally crossed through to distal true lumen at the distal site of posterolateral (PL) branch (Fig. 3d). IVUS image showed that the wire and IVUS catheter were located in the subintimal space at the ostium of PL branch (Fig. 4a). To avoid PL branch occlusion with stent implantation, IVUS-guided re-wiring was attempted and Confianza wire (Asahi Intecc) was intentionally crossed into the true lumen (Fig. 4b). Finally, two stents (Xience PRIME 2.5/38 mm and 3.0/33 mm) were successfully implanted and final angiogram showed swift recirculation of LCX CTO lesion without side-branch occlusion (Fig. 5a), and myocardial enzyme level, consequently, did not elevate at next day. One year follow-up angiography also showed that both LCX and PL branch had good flow without restenosis or occlusion (Fig. 5b).

Discussion

The success rate of CTO-PCI is still not high. Our previous study showed the overall success rate was about 90%, that including usage rate of retrograde approach in around 30% [2]. Moreover, IVUS-guided re-wiring technique is known as a last resort in antegrade approach; however, it has the potential risk of enlarging the subintimal space causing the failure of the wire cross [8], and the success rate is not so high even in highly experienced operator [2].

Fig. 3 The antegrade dissection and re-entry technique with Stingray system. **a** CrossBoss catheter and **b** stingray LP balloon catheter (white arrow head) were advanced into the subintimal space. **c** Failed first direct puncture and **d** succeeded fourth direct puncture with Stingray guidewire (yellow arrow head). The fourth puncture site located in distal from posterolateral branch (schema). White arrows indicate the distal main branch and yellow arrows indicate the side branch



ADR is also known as one optional technique when antegrade wire escalation is failed [9]. However, ADR has some limitations such as coronary perforation (0.4–14.3%) or periprocedural myocardial infarction because of side-branch occlusion (2.4–16.0%) [10]; especially, distal shift of Stingray guidewire puncture site is frequently observed, and that increases the risk of side-branch occlusion.

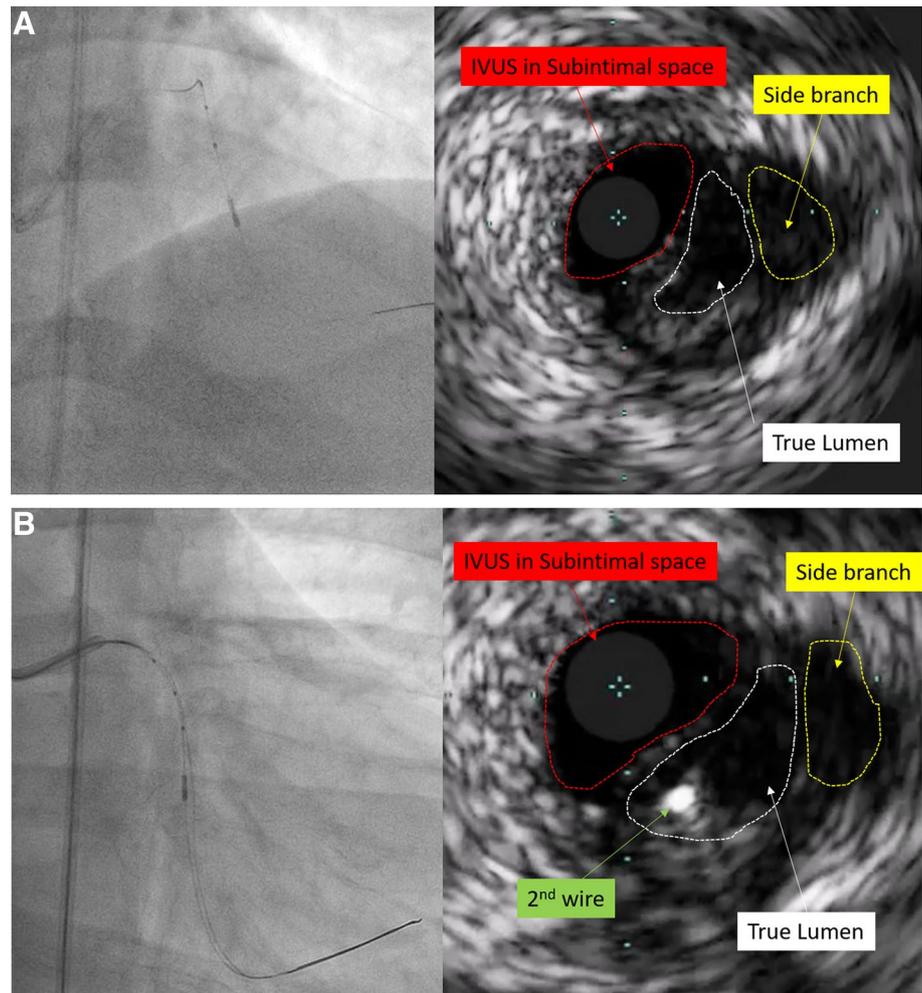
In this case, ADR was attempted as preparation of IVUS-guided re-wiring after antegrade guide wire cross failure. Although subintimal tracking with ADR technique was success, both angiography and IVUS images showed that the Stingray guidewire had crossed at the distal point from PL branch. When stent was implanted in this subintimal space, the PL branch would be occluded and myocardial infarction would be occurred. Therefore, IVUS-guided re-wiring should be attempted in this situation. Because the re-entry of subintimal space was already made by ADR and hematoma

was drained pressure to distal true lumen, the second wire navigation by IVUS guide was safely performed without enlargement of subintimal space. In this technique, guide wire of IVUS can stay distally, so IVUS system is more stable than the conventional IVUS-guided parallel wiring. This merit will facilitate the introduction of second wire to the true lumen successfully.

Although ADR technique is one of the best techniques to recanalize CTO lesion antegradely, it has limitation of side-branch occlusion. Therefore, in this situation that ADR puncture was succeeded at distal of major branch, this approach that IVUS-guided re-wiring after successful ADR puncture might be one of the way to recanalize the CTO lesion without side-branch occlusion.

CrossBoss Catheter is usually used as preparation for Stingray system in primary ADR procedure. However, in this case, CrossBoss catheter was not needed, because

Fig. 4 Intravascular ultrasound (IVUS) image from first wire: **a** first wire was located in the subintimal space (red circle) at the ostium of posterolateral branch (yellow circle). **b** Second wire was successfully advanced into the true lumen (green arrow)



microcatheter (Corsair) with wire placed in subintimal space could make enough space to advance Stingray balloon. Therefore, in Japanese style ADR procedure, Cross-Boss Catheter may not be needed.

Conclusion

The dissection and re-entry technique is an application of crossing wire in CTO cases. However, the subintimal tracking has some risk of side-branch occlusion. In these cases, IVUS-guided technique after ADR might be one of the useful procedures in CTO-PCI.

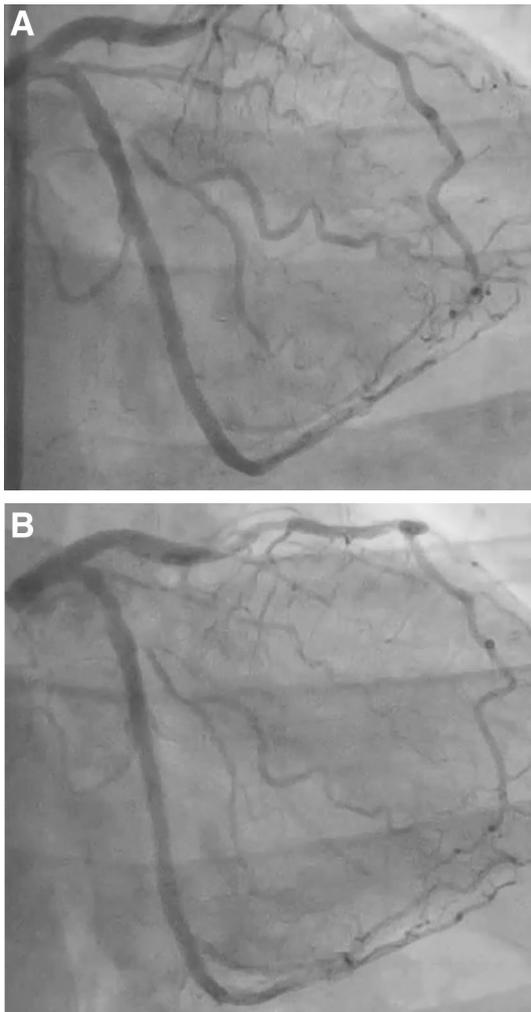


Fig. 5 **a** Final angiography and **b** 1 year follow-up angiography

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