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CASE REPORT

ADVANCED

CLINICAL CASE

Ping-Pong Guide Catheters to Facilitate Real-Time Intravascular Ultrasound-Guided Recanalization of Stumpless Chronic Total Occlusion

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ABSTRACT

Stumpless chronic total occlusion is associated with a higher failure rate of recanalization. Intravascular ultrasound (IVUS) is useful for identifying the entry point; however, 8-F guide catheters are necessary for real-time IVUS-guided wiring. This case reports the novel use of the "ping-pong" guide catheter technique to facilitate real-time IVUS-guided wiring for a stumpless chronic total occlusion. (**Level of Difficulty: Advanced.**) (J Am Coll Cardiol Case Rep 2019;1:792–5)

HISTORY OF PRESENTATION

A 79-year-old woman presented with symptoms of intermittent chest tightness. An electrocardiogram showed symmetric T-wave inversion at anterior and lateral leads. Coronary angiography indicated chronic total occlusion (CTO) at the left anterior descending artery (LAD) and a severe stenosis with ruptured plaque at the left circumflex artery. After initially using percutaneous coronary intervention (PCI) with a bare-metal stent at the left circumflex artery, the patient still reported chest discomfort. A second PCI was initiated via bilateral femoral access.

LEARNING OBJECTIVES

- In a case of stumpless CTO, real-time IVUS-guided wiring is helpful for locating the optimal entry point and avoiding inadvertent subintimal crossing, although it usually requires an 8-F guide catheter.
- The ping-pong guide catheter technique is an effective way to facilitate real-time IVUS-guided wiring. It does not require the rarely used 8-F guide catheter and also provides the flexibility to switch strategies during the PCI.

MEDICAL HISTORY

The patient's history included medical treatment for hypertension at local clinics for 10 years.

INVESTIGATIONS

The left coronary artery was engaged with the 7-F EBU 4.0 guide catheter (Medtronic, Dublin, Ireland).

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Informed consent was obtained for this case.

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Coronary angiography denoted severe stenosis from the ostium of the LAD and a blunt stump CTO at the proximal LAD with a septal branch arising from the occlusion (Figures 1A and 1B). The right coronary artery was engaged with the 6-F Ikari left 3.5 guide catheter (Terumo, Tokyo, Japan), and contralateral angiography revealed a very tortuous epicardial collateral channel from the right ventricular branch to the distal LAD (Figure 1C). A visible septal collateral channel could not be located (Figure 1D), and the antegrade strategy was therefore utilized. A Run-through floppy guidewire (Terumo) was put at the septal branch. A XT-R guidewire (Asahi INTECC Co., Aichi, Japan) with a Crusade double-lumen catheter (Kaneka Corporation, Tokyo, Japan) failed to cross the blunt stump CTO. Hence, a stiffer wire was required to penetrate the proximal cap of the CTO. This leads to the question, where is the ideal entry point of the CTO (Figure 2A)?

DIFFERENTIAL DIAGNOSIS

In the case of CTO with an ambiguous proximal cap, real-time intravascular ultrasound (IVUS)-guided wiring is useful in locating the entry point of the CTO and to avoid inadvertent subintimal crossing. However, this technique usually requires 8-F guide catheters, which were unavailable in the catheterization laboratory.

MANAGEMENT

The 6-F Ikari 3.5 guide catheter of the right coronary artery was re-engaged to the left coronary artery (ping-pong guide catheters). The IVUS (25-MHz Eagle

ABBREVIATIONS AND ACRONYMS

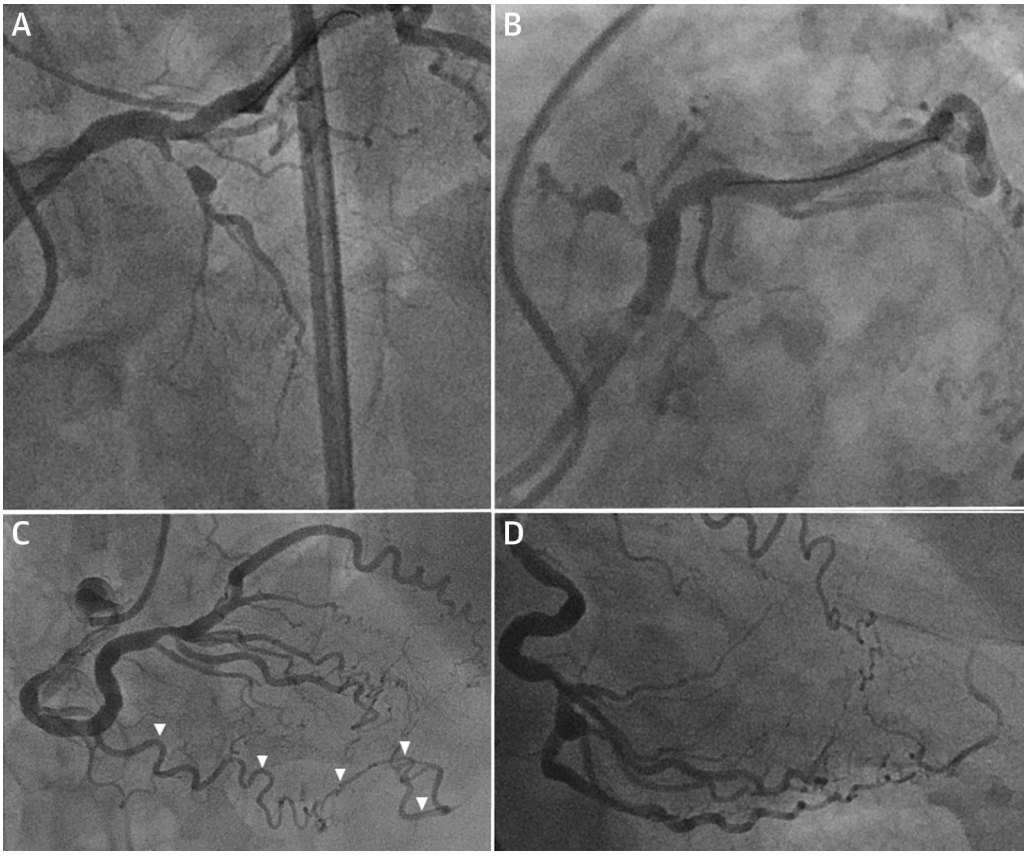
CTO = chronic total occlusion

IVUS = intravascular ultrasound

LAD = left anterior descending artery

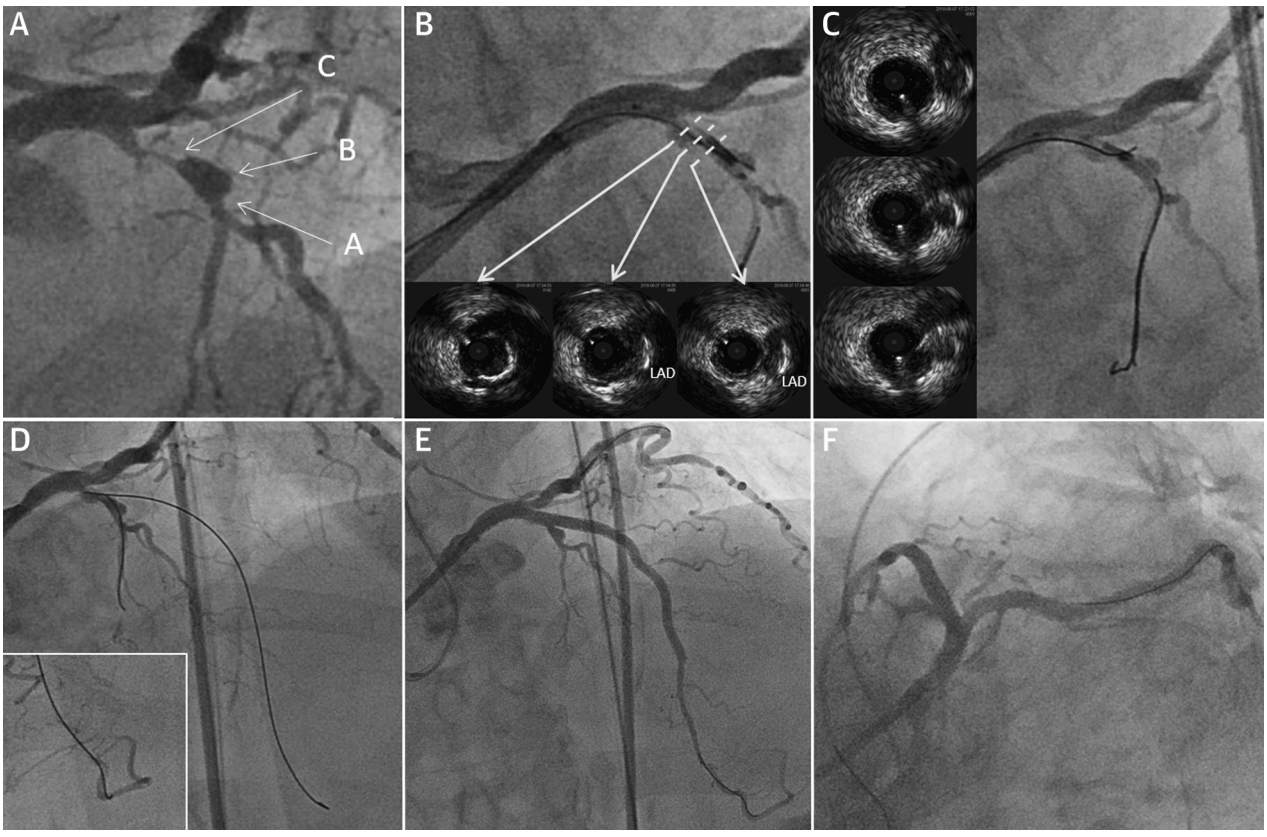
PCI = percutaneous coronary intervention

FIGURE 1 Bilateral Coronary Angiography



(A and B) Coronary angiography showing severe stenosis from the ostium of the left anterior descending artery (LAD) and a blunt stump chronic total occlusion at the proximal LAD with a septal branch arising from the occlusion. **(C)** Contralateral angiography showing a very tortuous epicardial collateral channel from the right ventricular branch to the distal LAD (indicated by **white arrowheads**). **(D)** No visible septal collateral channel could be identified.

FIGURE 2 Ping-Pong-Guided Catheter to Facilitate Real-Time IVUS-Guided Wiring



Identification of the optimal entry point. **(A)** Designation of 3 available candidates **(arrows, A to C)**. Manual pullback imaging reveals that the blunt stump-like lesion is actually an aneurysm of the septal branch. **(B)** The true chronic total occlusion segment is proximal to the aneurysm with calcification. Real-time intravascular ultrasound (IVUS) image guide confirms the Ultimate Bros 3 guidewire penetrating the proximal cap. **(C)** Manual IVUS from the septal branch to the left main shows the Ultimate Bros 3 guidewire penetrating the right entry site of the proximal cap of the chronic total occlusion. Control drilling allows the guidewire to reach the distal portion of LAD smoothly. Contralateral angiography ensures the location of the wire in the true lumen **(left lower corner, D)**. After balloon angioplasty and stenting, the stumpless CTO is recanalized successfully **(E, F)**.

Eye, Volcano Corp., Rancho Cordova, California) catheter was placed at septal branch via the 6-F Terumo 3.5 guide catheter. Manual pullback imaging revealed that the blunt stump-like lesion was actually an aneurysm of the septal branch (Figure 2A). The true CTO segment was proximal to the aneurysm with calcification. While the IVUS transducer position was maintained, the Ultimate Bros 3 guidewire (Asahi INTECC Co.) was slowly torqued to gain the proper orientation, avoiding the calcification as confirmed by the real-time IVUS image guide (Figure 2B). Finally, the Ultimate Bros 3 guidewire penetrated the proximal cap by a few millimeters. Manual IVUS imaging from the septal branch to the left main showed that the Ultimate Bros 3 wire had penetrated the proper entry site of the proximal cap of the CTO (Figure 2C).

The IVUS catheter was removed, and the Ikari guide catheter was re-engaged to the right coronary artery for contralateral angiography. Further advance of the guidewire by control drilling allowed the guidewire to smoothly reach the distal portion of the LAD (Figure 2D). Contralateral angiography verified the wire's location in the true lumen. After standard balloon angioplasty, 2 drug-eluting stents were deployed at the LAD and left main trunk, respectively. The final angiography showed no residual occlusion left in the LAD (Figures 2E and 2F).

DISCUSSION

The IVUS-guided wiring technique plays several roles in PCI for stumpless CTO. First, pullback from the side

branch allows identification of the position and morphology of the occluded ostium (1–4). Second, keeping the position of the IVUS at the junction of the CTO segment allows for a real-time imaging of the position and direction of the guidewire tip. This approach is helpful for the guidewire penetrating the proximal cap of the CTO. In case of inadvertent subintimal passage, it is helpful to reposition the guidewire or place another guidewire in the true lumen.

Despite the aforementioned advantages, the IVUS-guided wiring technique has limitations. To accommodate the IVUS catheter and microcatheter simultaneously, an 8-F guide catheter must be used. This is problematic because in most catheterization laboratories, the 8-F guide catheters are rarely used or are unavailable. Furthermore, exchanging a larger sheath and guide catheter without removing the concurrent guidewires in the coronary artery is a time-intensive and complex procedure. The 8-F guide catheter is incapable of simultaneously accommodating both a Crusade double-lumen catheter and an IVUS catheter. Also problematic is the increased risk of injury at the coronary artery ostium and bleeding risks of puncture sites from larger guide catheters. In the single lumen of a guide catheter, interactions between microcatheters, guidewires, and IVUS may cause displacement of one device when another is manipulated (5). In addition, an IVUS that is placed at the side branch only provides information on the proximal 2- to 3-mm portion of the CTO segment. To confirm the position of the true lumen distal to the CTO segment, contralateral coronary angiography is required.

In this case, the ping-pong guide catheter technique was used to overcome the aforementioned problems. After the initial failure of the antegrade attempt, the opposite 6-F guide catheter was reengaged to the left coronary artery. The 7-F and the 6-F ping-pong guide catheters are able to facilitate the IVUS-guided wiring technique and avoid the cumbersome procedure of exchanging the larger sheath and guide catheter. This method decreases the risk of loss of guidewire and provided the flexibility to switch the strategy during the PCI. The lumen of the 7-F plus 6-F guide catheter is larger than a single 8-F guide catheter and is therefore able to accommodate an IVUS catheter with larger microcatheters such as the Crusade (Kaneka) or Corsair (Asahi) simultaneously. It also decreases the interaction between the IVUS and the microcatheter (5). After IVUS confirmed the guidewire course in the true lumen, the IVUS catheter was removed and the 6-F guide catheter reengaged to the right coronary artery for contralateral coronary angiography, making it possible for the guidewire to enter the true lumen. After balloon angioplasty and stenting, the stumpless CTO was successfully recanalized.

FOLLOW-UP

The patient was pain free with normal left ventricular function as assessed by echocardiography at the 1-year follow-up.

CONCLUSIONS

Stumpless CTOs require more procedural time and result in a lower success rate due to the difficulty of locating a suitable entry point. The ping-pong guide catheter technique, facilitating IVUS-guided wiring, is safe and effective for recanalization of the stumpless CTO.

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KEY WORDS complex and high-risk coronary intervention, coronary artery disease, percutaneous coronary intervention