Bilateral Trans-Radial Percutaneous Coronary Intervention with Retrograde Approach for Chronic Totally Occluded Left Anterior Descending Artery

Cheng-An Chiu¹ and Chiung-Jen Wu²

Despite advances in new devices, equipment, and expertise, percutaneous coronary intervention (PCI) for chronic total occlusion (CTO) remains difficult and technically challenging. In recent years, development of the retrograde approach via intra-myocardial septal or epicardial collaterals has improved its success rate, even in cases of antegrade PCI failure. Most PCI experience for CTO was using femoral access, where the trans-radial (TR) approach is considered not suitable, due to there being less back-up support with smaller guiding catheters (5-6 Fr.), or the difficulty of taking contralateral coronary angiography. We present here a challenging case of left anterior descending CTO in a 49-year-old male smoker, in which the successful PCI was achieved via bilateral radial access and primary retrograde approach.

Key Words: Chronic total occlusion • Percutaneous coronary intervention • Trans-radial

INTRODUCTION

In recent years, successful percutaneous coronary intervention (PCI) of chronic total occlusion (CTO) of the coronary arteries has been achieved through improvement of guide-wires and supportive devices.¹,² In addition, successful CTO re-canalization has been demonstrated to relieve ischemic symptoms, improve left ventricular (LV) function, maintain tolerance for future contralateral coronary occlusion, and improve long-term survival.³,⁴ Nonetheless, although the development of new devices designed especially for CTO lesions has increased the success rate, PCI for CTO remains technically challenging.¹,⁵

Different strategies and techniques of the retrograde approach for CTO lesions have been reported to increase success rate.² However, despite studies showing that trans-radial coronary intervention (TRI) for CTO is feasible, it is generally considered not suitable for CTO lesions, due to the relatively poor back-up support of guiding catheters and the complex manipulation of TRI techniques.¹ We present herein a case of bilateral trans-radial PCI with retrograde approach for CTO of the left anterior descending artery (LAD).

CASE REPORT

A 49-year-old male, a smoker and hypertensive, presented with a three-month history of typical angina. He had positive treadmill exercise test and adequate LV systolic function by echocardiography. Coronary angiography done in January 2008, demonstrated single-vessel...
coronary artery disease (CAD) with double CTO in mid and distal LAD and presence of a long, diffuse lesion in the mid-distal LAD (Figures 1A, B). Intervention through trans-radial antegrade PCI to LAD failed at that time.

About 3 months later, the patient was admitted for elective PCI. A 6-Fr. BL 3.5 (Terumo, Japan) guiding catheter from the left radial artery was engaged in the left main stem (LM), while an 85-cm 7-Fr. AL1 (Terumo, Japan) guiding catheter, via right radial artery, was intubated into the right coronary artery (RCA). A Fielder FC hydrophilic wire (Asahi Intec, Japan) under a Quick-Cross 1.5-Fr. micro-catheter (Spectranetics Inc, USA) support, was advanced in a retrograde manner from the RCA through the septal branch to the LAD. The wire was exchanged with an intermediate wire (Asahi Intec, Japan) to pass the culprit CTO lesion and getting into the inner lumen of the 6F LM back-up catheter. A Maverick 3.0\textsuperscript{c180}/20-mm balloon (Boston Scientific Scimed, USA) was inflated in the distal portion of the LM catheter to anchor the retrograde wire (reverse anchoring balloon technique). The micro-catheter was then exchanged serially with Ryujin OTW 1.25 \times 10-mm (Terumo, Japan) and Sprinter OTW 1.5 \times 6-mm balloons (Medtronic Inc, USA), and the CTO at mid LAD was dilated via retrograde approach (Figure 1D).

Because of the second CTO lesion in the distal LAD, a Fielder FC wire was successfully passed in an antegrade manner, and the mid-to-distal LAD was dilated with Maverick 2.5 \times 20-mm and 3.0 \times 20-mm balloons (Boston Scientific, USA). Four Taxus Express 2.75 \times 24-, 2.75 \times 32-, 3.0 \times 32-, and 3.0 \times 24-mm stents (Boston Scientific, USA) were deployed from distal to proximal LAD, respectively. Post-stenting high-pressure dilation was performed with a Quantum Maverick 3.0 \times 20-mm balloon (Boston Scientific, USA) at 14-30 atm. Post-stenting intra-vascular ultrasound study (IVUS, Galaxy 2, Boston scientific, USA) demonstrated good apposition of the deployed stents (Figures 2A, B).

**Figure 1.** (A) Left anterior oblique cranial view of the right coronary artery showed good collaterals from the posterior descending artery and posterolateral branches to the left anterior descending (LAD) branches. (B) Right anterior oblique (RAO) cranial view revealed double chronic total occlusion (CTO) of the mid and distal LAD, focal dissection was created by previous intervention. (C) Super-selective micro-catheter diagnostic imaging demonstrated good pathway for a retrograde approach. (D) Retrograde delivery of the Ryujin OTW 1.25 \times 10-mm balloon (white arrow) dilating the culprit lesion, under reverse anchoring balloon support with a Maverick 3.0 \times 20-mm balloon (black arrow) inside the left main catheter. (E) Final RAO cranial view after implantation of four consecutive Taxus Express stents. (F) Follow-up coronary angiography after 6 months. RAO cranial view showed no significant in-stent re-stenosis, but presence of an aneurysm in the mid-LAD.
Follow-up coronary angiography after 6 months revealed a focal aneurysm in the mid LAD without in-stent re-stenosis, which was proven by IVUS of a late-acquired incomplete apposition of the Taxus stent with mild-to-moderate neo-intimal hyperplasia (Figures 1F and 2C).

DISCUSSION

Among patients undergoing coronary angiography for known or suspected CAD, CTOs are present in approximately 30%. Several studies have demonstrated that successful re-vascularization of CTO compared with failed PCI confers a remarkable improvement in long-term survival and reduction in major adverse cardiac events. Despite the introduction of new devices for CTO (including guiding catheters and wires), treatment remains challenging and is associated with a relatively higher risk of complications (e.g., coronary perforation, rupture).

Recently, retrograde PCI through collateral channels was introduced as a new technique and developed, especially in Japan. The new technique considerably improved the success rate of CTO re-canalization to 83%, and even included patients with previously failed PCI. In most of the studies, including both antegrade and retrograde approaches for CTO, bilateral femoral access was generally recommended, but only a few studies reported femoral combined with radial or brachial access.

In this case report, bilateral trans-radial PCI for LAD CTO was successful with a primary retrograde approach, which provided another route for intervention. Theoretically, the back-up support of larger guiding catheters via femoral access is stronger than that of radial or brachial access. For the purpose of trans-radial retrograde approach requiring stronger back-up support, we introduced an 85-cm 7-Fr. AL1 guiding catheter via “high-radial” access (about 5 cm above the wrist joint). Moreover, trans-radial PCI for CTO lesions has been improved much by recent advancement of PCI technology and in combination with different devices, including short-length 7-Fr. guiding catheters, deep-seating engagement, child-in-mother (5-in-6, or 5-in-7) technique, drilling Tornus catheter or channel dilator, catching retrograde wire, anchoring balloon, and reverse anchoring balloon techniques.

The diagnostic angiogram revealed several collaterals, and we chose the relatively straight and visible one, because the obscure or screw-like collaterals were difficult for wiring, which might result in complications (ex., coronary perforation, rupture). In addition, we should choose the collaterals somewhat far away from the culprit CTO because the distance can serve as a “buffer zone” for advanced torque and wiring. For smooth and supportive retrograde wiring, we usually choose hydrophilic wires with soft and tapered tips, like Filelder FC and XT (Asahi Intec, Japan), under support of a small-size over-the-wire balloon catheter or a smaller-size microcatheter. Nonetheless, successful retrograde PCI for CTO could only be achieved with several sophisticated techniques, even in this era of modern devices.
IVUS follow-up revealed late-acquired incomplete stent apposition (LAISA). Recently, many studies demonstrated a relatively higher incidence of this phenomenon in the DES era, and the main mechanism was expansion of the external elastic membrane area (positive vessel remodeling) without changes in plaque and media.\textsuperscript{8-10} Several predictive factors for LAISA have been mentioned, including longer stent or lesion length, unstable angina, primary stenting in acute myocardial infarction, CTO, and the absence of diabetes.\textsuperscript{10} Although some studies mentioned the possibility that late stent thrombosis and acute myocardial infarction might be caused by LAISA,\textsuperscript{8,9} others reported no relevant events at 12 months clinical follow-up.\textsuperscript{10} Accordingly, the patient who is asymptomatic should be recommended lifelong dual anti-platelet treatment and be kept under close clinical follow-up.

In conclusion, this kind of challenging case, in which successful retrograde PCI for CTO of the LAD was conducted via bilateral radial approach, has never been reported in Taiwan. Bilateral radial approach may be considered an alternative access route for future CTO intervention.

REFERENCES