Recanalization of a Coronary Chronic Total Occlusion by a Retrograde Approach Using Ipsilateral Double Guiding Catheters

Nae Hee Lee, MD, Jon Suh, MD, Yoon-Haeng Cho, MD, Hye-Sun Seo, MD, Jae-Huk Choi, MD, Moon-Han Choi, MD and Yang-Seon Ryu, MD
Division of Cardiology, Department of Medicine, Soonchunhyang University Bucheon Hospital, Soonchunhyang University College of Medicine, Bucheon, Korea

ABSTRACT

The retrograde approach through a collateral artery is now thought to improve the success rate of percutaneous coronary intervention (PCI) for coronary chronic total occlusion (CTO), and different kinds of strategies for this technique have been developed. However, the basic principles of PCI for CTO, such as firm back-up support with a guiding catheter and fine control of the guide wire, should be adhered to more strictly to succeed with this complex procedure. We present a case in which a CTO of the proximal left anterior descending artery was successfully opened by the retrograde approach through a collateral from the left circumflex artery, during which two guiding catheters were simultaneously used in the same coronary artery for the purpose of strong back up support for the retrograde device and fine control for the antegrade device. (Korean Circ J 2009;39:42-45)

KEY WORDS: Percutaneous transluminal coronary angioplasty; Coronary occlusion.

Introduction

The treatment of coronary chronic total occlusion (CTO) remains a therapeutic and technical challenge for interventional cardiologists. Due to the development of techniques and equipment for percutaneous coronary intervention (PCI) for CTO, the success rate of CTO-PCI is on the rise.1-5 Among the various PCI techniques for CTO, the retrograde approach through collateral channels is considered to be one of the most promising current techniques, and different kinds of strategies for the retrograde approach have been developed for successful CTO-PCI,6-9 since it was first introduced via a bypass graft.10 Because the retrograde approach is more complex, more difficult, and more time-consuming than the antegrade approach, the basic principles of coronary intervention for CTO11 must be adhered to more strictly in the retrograde approach than in the conventional antegrade approach. We present a case in which CTO of the proximal left anterior descending artery (LAD) was attempted by the retrograde approach through the left circumflex collateral artery, and the simultaneous use of two guiding catheters in the left coronary artery (LCA) was attempted for strong back-up support and better wire handling during the procedure, leading to its success.

Case

A 58-year-old man with effort angina was referred to our hospital for PCI for a CTO lesion after a failed attempt in another hospital. His coronary risk factors were diabetes mellitus, hypertension, and smoking. The resting electrocardiogram showed a poor R progression pattern in the precordial leads, and an echocardiographic examination showed hypokinesia of the apex with a mild decrease in the ejection fraction (53%). At the time of coronary angiography in another hospital 4 months previously, the proximal LAD had a CTO at the trifurcation site of the septal and big diagonal branch (Fig. 1A and B). The occlusion anatomy was not favorable, with a length of about 17 mm without a visible stump. The right coronary artery (RCA) was diminutive and diffusely narrowed from the proximal portion (Fig. 1C). The cause of the previous attempt’s failure was that the guide wire could not cross the occlusion correctly: it repeatedly entered the subintimal space distal to the CTO. We carefully reviewed the angiogram and found the continuous...
epicardial collateral connection between the distal LCX and distal LAD. Due to the poor morphology of the CTO (a relatively long occlusion length and no visible stump at the trifurcation site), and more importantly, the history of the previous failed PCI, it was decided that the second PCI attempt would be performed by the retrograde approach using the epicardial collateral artery from the distal LCX.

A 90 cm 7 Fr AL-1 guiding catheter (Cordis, Miami Lakes, FL, USA) was engaged to the LCA via the right femoral artery, and a 5 Fr JR-4 diagnostic catheter (Cordis) was also engaged to the RCA via the left femoral artery for the purpose of clear visualization of the distal CTO site. A Fielder FC wire (Asahi Intec, Nagoya, Japan) supported by a 150 cm Progreat microcatheter (Terumo, Tokyo, Japan) was successfully passed through the LCX epicardial collateral artery into the distal LAD. After the retrograde guide wire reached the distal part of the CTO (Fig. 2A), it was exchanged sequentially to a Whisper (Abbott, IL, USA), a Miracle 3 g (Asahi Intec), a Miracle 12 g (Asahi Intec), and finally a Conquest-Pro (Asahi Intec) wire in order to directly cross the CTO into the proximal true lumen (retrograde wire crossing technique). However, due to the long course and angulation over the retrograde pathway, the guide wires were not controlled correctly and repeatedly entered the false lumen (Fig. 2B). After several attempts of the retrograde wire crossing technique failed, we decided to attempt other retrograde approach techniques, such as the kissing wire technique or the controlled antegrade and retrograde subintimal tracking (CART) technique. However, because the length of the left main trunk was short and the Amplatz guiding catheter, which itself had poor controllability for a guide wire, was directed toward the LCX, control of the antegrade wire through this guiding catheter was very difficult in this situation. Thus, another 100 cm 6 Fr JL-4 SH (Cordis) was engaged into the LCA via the left femoral artery after removal of the right diagnostic catheter, while keeping the Amplatz guiding catheter located near the ostium of the LCA for better manipulability of the antegrade wire (Fig. 2C). An attempt was then made to pass the antegrade wire (Miracle 12 g, Conquest-Pro) into the distal true lumen by the guidance of the retrograde wire (kissing wire technique). After several attempts of this maneuver has failed (Fig. 2D), the CART technique was attempted. After the retrograde Whisper wire was located at the subintimal space of the CTO, retrograde ballooning using a 2.0 × 20 mm Ryujin balloon (Terumo, Tokyo, Japan) was performed at the CTO, including the site distal to the CTO, in order to create a connection between the distal true lumen and subintimal space of the CTO. Thereafter, the antegrade wire was manipulated and advanced along the deflated retrograde balloon that lay from the subintimal space of the CTO to the distal true lumen, and eventually the Miracle 12 g wire could be passed into the distal true lumen (Fig. 2E and F). Then, the previous 2.0 mm Ryujin balloon was reinflated in the distal LAD to anchor the passed antegrade guide wire to facilitate the antegrade passage of a pre-dilatation balloon (distal anchoring balloon technique; Fig. 2G). After the lesion was dilated sequentially, two Taxus stents (3.0 × 24 mm, 3.5 × 20 mm, Boston Scientific, Boston, MA, USA) were implanted, yielding a good final result (Fig. 2H). The patient was stable during and after the procedure, without an ischemic event, and uneventfully discharged 3 days after the procedure.

Discussion

The most common cause of the failure of PCI for CTO is the inability of the wire to cross the occlusion.12)13) Recently, the retrograde approach through the collateral channels was introduced to overcome this problem and several strategies and techniques for the retrograde approach have been developed, showing the efficacy and

Fig. 1. Baseline coronary angiography. A and B: left coronary angiography showed chronic total occlusion at the trifurcation site of the proximal left anterior descending artery. An epicardial collateral connection between the distal left circumflex coronary artery and distal left anterior descending artery was observed (arrow). C: the right coronary artery was diminutive and provided the collateral flow to the left anterior descending artery through the cornus branch.
feasibility of this technique for CTO intervention. Compared to the conventional antegrade approach, the retrograde approach requires a special step in which a retrograde guide wire with a balloon or microcatheter is passed through the collateral channels and reaches the distal site to the CTO. Thus, selection of a suitable collateral is required to succeed in this key procedure. Collaterals for retrograde access can be distinguished as epicardial or septal. Epicardial collaterals of moderate size are observed in about one-half the cases of CTO. However, those collaterals are very tortuous in many cases, which can make wire handling and advancement of a balloon catheter very difficult. In addition, tamponade may quickly occur, even in cases of small perforation. In contrast to epicardial collaterals, septal collaterals generally have a short course, and are more frequently seen.

Fig. 2. Retrograde approach for chronic total occlusion. A: a Fielder FC wire supported by a 150 cm Progreat microcatheter was successfully introduced distal to the chronic total occlusion. B: the retrograde wires could not puncture the proximal cap correctly and these wires repeatedly entered the subintimal space proximal to the chronic total occlusion (failed retrograde wire crossing technique). C: another guiding catheter (6 Fr JL-4 SH) was engaged into the left coronary artery for better manipulability of the antegrade wire, while keeping the previous Amplatz guiding catheter located near the left coronary artery ostium. D: the Kissing wire technique was unsuccessful. E, F: controlled antegrade and retrograde subintimal tracking (CART) technique was applied: after retrograde ballooning (2.0 × 20 mm) was performed at the chronic total occlusion site, including the site distal to the chronic total occlusion, the Miracle 12 g wire could be passed into the distal true lumen. G: the passed antegrade Miracle 12 g wire was anchored by the retrograde ballooning (arrow) in order to facilitate the antegrade balloon (double arrows) passage (distal anchoring balloon technique). H: final angiography after placement of two Taxus stents.
and less tortuous than epicardial collaterals. More importantly, perforation of the septal collateral does not pose a major risk of pericardial tamponade, which is in contrast to the epicardial collateral. Therefore, the septal channel is considered to be the most ideal retrograde access route. In our case, a continuous septal channel between the LAD and RCA could not be identified, and because the epicardial collateral connection between the distal LCX and the distal LAD had a long course with angulation, a left Amplatz guiding catheter was selected to provide a coaxial sufficient back-up support for collateral channel tracking which would enable the retrograde wire to reach the distal site to the CTO lesion without difficulty.

Among the different wire crossing techniques in the retrograde approach for CTO, the CART technique creates a connection between the subintimal space of the CTO lesion and the distal true lumen by retrograde ballooning, from the distal true lumen to the subintimal space of the CTO lesion, for antegrade passage of the wire. This technique is now regarded as a very effective method when other relatively simple retrograde techniques, such as the kissing wire technique or the retrograde wire crossing technique, are unsuccessful in retrograde-PCI. In this case, following a failed retrograde wire crossing technique, other techniques that required the manipulation of antegrade wire were required. However, in the setting of a short main artery and an Amplatz guiding catheter that itself had poor wire controllability for the LAD lesion and was directed toward the LCX, manipulation of the antegrade wire through this guiding catheter seemed to be very difficult, apart from the problem of the friction between the antegrade device and the retrograde device in the same catheter. Thus, a Judkins guiding catheter, which allowed good controllability of the antegrade wire for the LAD, was used simultaneously with the previous Amplatz guiding catheter, which allowed a strong back up support for the retrograde ballooning that was used for both the CART technique and the distal anchoring balloon technique in this case.

This successful procedure is the first reported case in which a difficult CTO was successfully opened by the retrograde approach using the CART technique via the ipsilateral epicardial collateral channel in the setting of double guiding catheters in the same coronary artery, suggesting that the application of the different strategies and techniques is required to succeed in this complex technique.

REFERENCES