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"Tip-In" Technique for Retrograde Chronic Total Occlusion Revascularization

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Abstract: Use of the retrograde approach significantly improves the success rate of chronic total occlusion (CTO) percutaneous coronary intervention. The most commonly applied retrograde technique is placing a guidewire just distal to the distal cap using collateral vessels, with subsequent retrograde crossing of the occlusive segment. This is followed by advancement of a microcatheter and externalization of a long guidewire to allow antegrade delivery of balloons and stents. However, there are occasions when a microcatheter or balloon cannot be delivered retrogradely through the occlusive segment, resulting in procedure failure. We describe the "tip-in" technique, which involves intubation of the retrograde guidewire with an antegrade microcatheter to allow successful revascularization of a CTO after failure to externalize.

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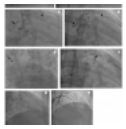
Key words: percutaneous coronary intervention, chronic total occlusion, retrograde

Coronary chronic total occlusions (CTOs) are common,[1] and successful revascularization has been associated with improvement in mortality,[2] left ventricular function,[3] and quality of life.[4] A major advancement in CTO percutaneous coronary intervention (PCI) techniques has been the introduction of the retrograde approach, which significantly increases procedural success.[5-7] The retrograde approach consists of several steps. First, a guidewire and microcatheter are advanced through a collateral vessel until they reach the distal cap. The CTO segment is subsequently crossed by the retrograde guidewire and advanced into the antegrade guide catheter.[8] The microcatheter is then advanced into the antegrade guide, followed by retrograde wire externalization.[8] However, sometimes the microcatheter fails to advance into the antegrade guide, hindering attempts at guidewire externalization. For such cases, we describe the "tip-in" technique, which entails advancement of an antegrade microcatheter over the retrograde guidewire so that subsequent antegrade wiring of the CTO segment can be predictably successful.

Case Report

A 72-year-old man with Canadian Cardiovascular Society class-III angina despite maximal medical therapy was referred for PCI of a left anterior descending (LAD) artery CTO. The CTO was calcific and long with an ambiguous proximal cap and a J-CTO score of 3. The distal vessel was filled by CC2[5] epicardial collaterals from a right ventricular (RV) branch (Figure 1A). Vascular access was established using bilateral femoral 7 Fr, 35-cm long sheaths. AL3 and XB3.5 7 Fr guides were (/files/5vo1.png)used to engage the right coronary and left main coronary arteries, respectively. Because of the proximal cap ambiguity, the initial strategy was retrograde approach using the epicardial collaterals. A Corsair catheter (Asahi Intecc) was advanced into the RV branch over a workhorse wire. A Sion guidewire (Asahi Intecc) successfully traversed the collateral vessel into the mid LAD and was advanced to the distal cap followed by the Corsair microcatheter. A Pilot 200 guidewire (Abbott Vascular) was used to puncture the distal cap, and subsequently crossed the CTO segment into the proximal LAD. We were able to advance the Pilot 200 guidewire into the antegrade left main guide catheter, but were unable to advance the Corsair or a balloon retrogradely through the distal cap (Figure 1B), in spite of anchoring the retrograde wire in the antegrade guide catheter (Figures 1C and 1D). We then performed the tip-in technique by advancing a Finecross microcatheter (Terumo Corporation) in the antegrade guide catheter and inserting it over the retrograde wire (Figure 1E). We were then able to advance the Finecross antegradely on the retrograde guidewire through the occluded segment to the distal cap (Figure 1F). The retrograde guidewire was exchanged for a RotaWire Floppy (Boston Scientific) and advanced through the Finecross into the distal LAD and rotational atherectomy was performed using 1.25 burr at 160,000 rpm (Figure 1G). The LAD was then stented with 3.0 x 32 mm and 2.75 x 38 mm Promus Premier stents (Boston Scientific), followed by postdilation with a 3.5 mm non-compliant balloon with excellent angiographic result (Figure 1H). The patient had no postprocedural complications and was angina free on follow-up.



Discussion

Inability to advance the retrograde microcatheter into the antegrade guide catheter can lead to procedural failure during CTO-PCI. We describe the novel "tip-in" technique to overcome this challenge. An antegrade microcatheter is advanced over the retrograde guidewire in the antegrade guide, allowing easy, predictable, and successful antegrade wiring by inserting a wire into the antegrade microcatheter.

During recent years, the technical and procedural success rates of CTO-PCI have improved dramatically, reaching or exceeding 90%.[6,7,9-11] This is due in large part to improvements in technique and equipment, with the retrograde approach being a major contributor.[7-10,12,13] In the present case, a primary retrograde approach was used due to proximal cap ambiguity.The guidewire successfully crossed the CTO segment and was advanced into the antegrade guide catheter. However, the Corsair microcatheter could not follow despite anchoring the retrograde guidewire within the antegrade guide with a balloon. Externalization was not possible because the Pilot 200 guidewire was of short length and standard-length guide catheters were also used. Possible next actions included: (1) antegrade wiring using the retrograde guidewire as a marker; (2) attempts at retrograde crossing using a different microcatheter or an over-the-wire balloon; and (3) uncrossing the CTO and recrossing using a long guidewire that could then be externalized. Antegrade wiring can be cumbersome, time consuming, and unsuccessful, and the success of retrograde lesion crossing with different equipment is also uncertain. Uncrossing the CTO is not optimal, because recrossing attempts may fail.

In the present case, we demonstrate use of the novel tip-in technique to solve the above conundrum. This technique involves advancement of an antegrade microcatheter over a retrograde wire. This is usually accomplished by having the retrograde wire at the outer curve of the guide, located at the aortic arch, and advancing the antegrade microcatheter without manipulation to “intubate” the retrograde wire. By shear physics, the tip of the retrograde wire and the tip of the antegrade microcatheter always meet at the same point on the outer curvature, which makes the maneuver very easy to accomplish. We suggest using the Finecross as the antegrade microcatheter since it has a relatively larger internal diameter and therefore allows easier “intubation” of the retrograde wire. This maneuver is extremely easy and (at most) may take only several attempts. The main method of confirming a successful maneuver is by the behavior of the antegrade microcatheter as it is advanced on the retrograde wire. Once the tip-in technique has been successful, the antegrade microcatheter is then advanced on the retrograde wire as far as possible; after removal of the retrograde wire, an antegrade wire can easily be advanced without the need for manipulation. The case is then completed with routine antegrade ballooning and stenting of the occluded segment. The tip-in technique shares similarities with the “rendezvous” technique,[14] in which the retrograde guidewire and microcatheter are advanced into the antegrade guide catheter, followed by intubation of the retrograde microcatheter with an antegrade guidewire.

The [illegible]ons. It may not always be possible to advance a retrograde wire into the desired location in the antegrade guide. Also, adv[illegible]o may fail, but could be facilitated by using a tapered, straight-tip, retrograde guidewire at the outer curvature of the ante[illegible]ss (Terumo) microcatheter. Even after successful tip-in maneuvers, the antegrade microcatheter might not cross the CTO[illegible]egrade CTO wiring techniques. Finally, this technique requires use of an additional microcatheter, which increases the cost of the procedure.

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Conclusion

In summary, the novel tip-in technique facilitates successful completion of a procedure in cases where the retrograde microcatheter could not be advanced into the antegrade guide catheter.

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