

# The Utility of a Guideliner™ Catheter in Retrograde Percutaneous Coronary Intervention of a Chronic Total Occlusion With Reverse CART—The “Capture” Technique

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The hybrid approach to percutaneous treatment of chronic total occlusion (CTO) of coronary arteries requires both antegrade and retrograde skillsets. In the retrograde approach, wire externalization through the antegrade guide catheter often requires the use of a short donor guide catheter and a long (>150 cm) micro-catheter. Despite this there are occasions where the micro-catheter is unable to reach the antegrade guide catheter because of long collateral channels particularly when the retrograde limb involves a bypass graft. We report such a case where retrograde intervention was used to treat a right coronary artery (RCA) CTO in a patient with stable angina. The retrograde limb involved a saphenous vein graft to the native circumflex artery, which in turn provided collateral channels to the distal RCA. After performing reverse controlled antegrade and retrograde sub-intimal tracking (CART), the retrograde micro-catheter was only able to reach the mid RCA. To solve this, a Guideliner™ catheter was passed on the antegrade wire and successfully advanced over and “captured” the retrograde micro-catheter. Wire externalization was then completed and the RCA was subsequently stented with a good final angiographic result. This case illustrates a novel approach to completing wire externalization and provides a further indication for the role of the Guideliner™ catheter in treating CTOs. © 2013 Wiley Periodicals, Inc.

**Key words:** chronic total occlusion; retrograde PCI; reverse CART

## INTRODUCTION

Chronic total occlusion (CTO) of a coronary artery is identified in 15–30% of patients undergoing diagnostic angiography [1,2]. This complex lesion subset remains a strong predictor for referral for coronary artery bypass surgery (CABG) [2]. However, in patients with single vessel disease or those with multi-vessel disease and low/intermediate SYNTAX scores, percutaneous coronary intervention (PCI) should be considered [3]. Successful re-canalization of a CTO is associated with improved cardiac function and clinical outcome [4]. Historically, an antegrade only approach to CTO re-canalization is associated with a success rate of 60–70% [4]. However, in recent years there have been significant developments in techniques and equipment so that there now exists multiple intervention strategies. A “hybrid” approach to CTO intervention has been proposed with a treatment algorithm based upon initial angiographic evaluation of the coronary anatomy and

prompt progression to an alternative strategy in case of failure [5].

Retrograde PCI has rapidly evolved since its first description [6] and has enabled improved procedure

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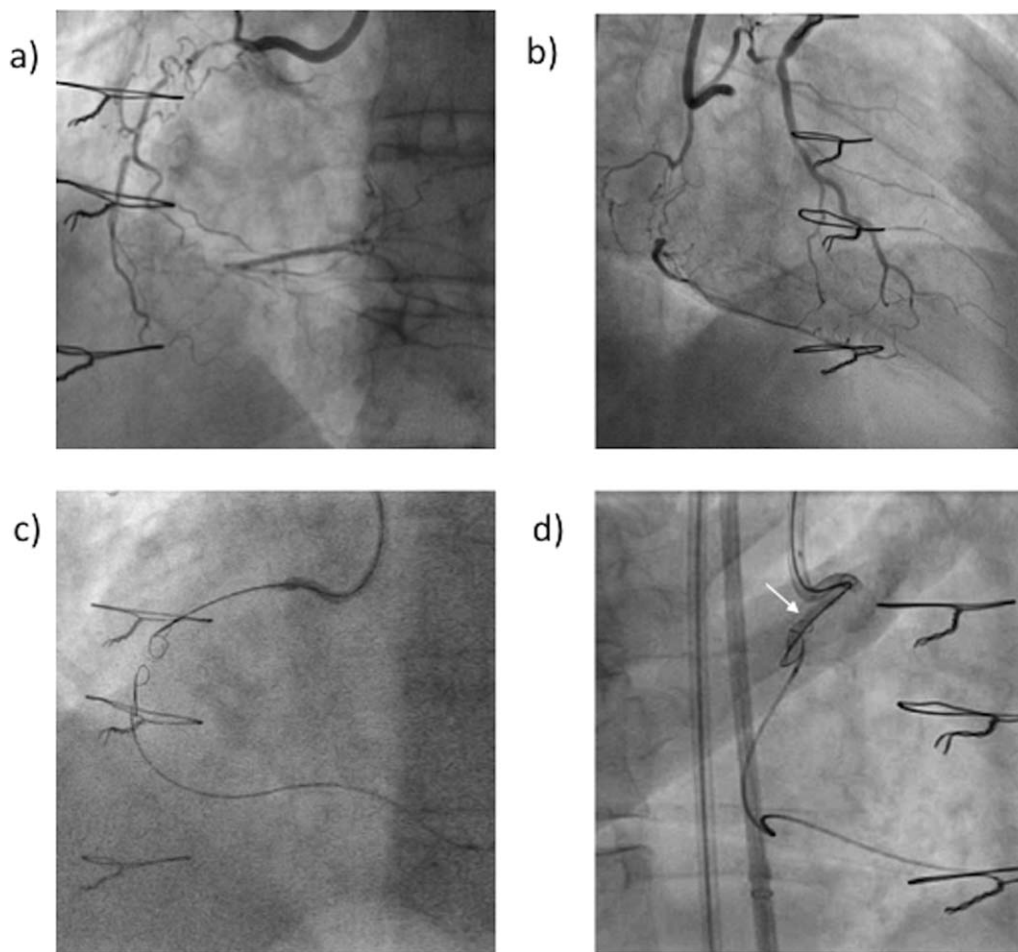
Conflict of interest: Nothing to report.

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Received 25 June 2013; Revision accepted 12 September 2013

DOI: 10.1002/ccd.25205

Published online 2 October 2013 in Wiley Online Library (wileyonlinelibrary.com)



**Fig. 1.** Top panel: Dual contrast injections demonstrating (a) occluded native RCA with ambiguous proximal cap and long occlusion length and (b) retrograde collaterals from distal Circumflex artery to distal RCA. Bottom panel: (c) sub-intimal tracking (knuckle technique) of both antegrade and retrograde wires with Corsair micro-catheter support; (d) antegrade sub-intimal space enlarged with a 2.5 mm × 15 mm compliant balloon inflation (marked with arrow).

success rate [7]. Reverse controlled antegrade and retrograde sub-intimal tracking (CART) involves sub-intimal entry of both antegrade and retrograde wires, with subsequent balloon expansion permitting communication through the previously occluded section [6]. A key step of the retrograde approach is wire externalization through the antegrade guide catheter. To enable this, a short (90 cm) retrograde (or donor) guide catheter may be required as well as a long micro-catheter (such as the 150 cm Corsair, Asahi Intecc.). Wire externalization usually requires the retrograde micro-catheter to enter the antegrade guide so that the wire can be exchanged to a long guidewire. However, there may be occasions where the micro-catheter is unable to reach the guide catheter and a long wire has to be used to wire the antegrade guide (either directly or by being

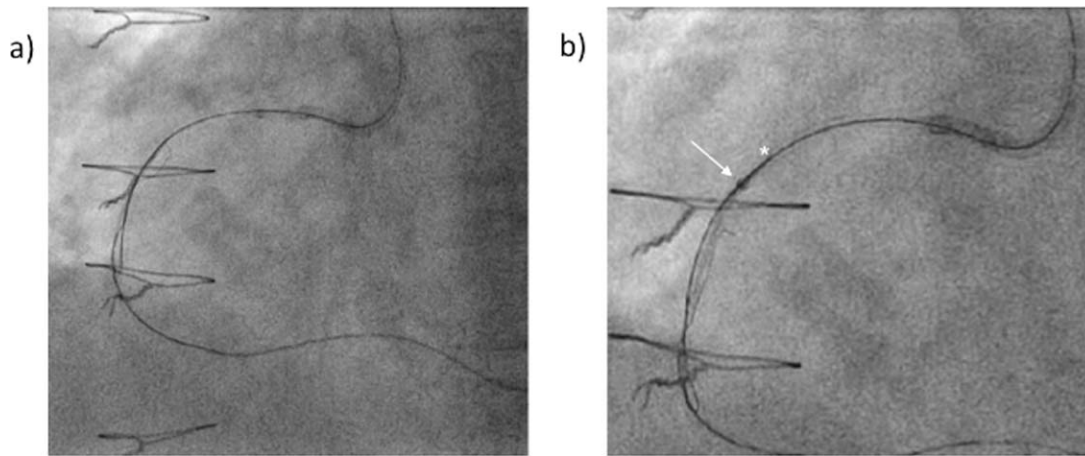
snared in the aorta). In this case report, we describe an alternative approach to wire externalization when the retrograde micro-catheter is unable to reach the antegrade guide catheter.

### CASE REPORT

A 73-year-old man, with recurrence of angina, was admitted to our tertiary center for elective PCI to a chronically occluded right coronary artery (RCA). He had prior history of CABG surgery with left internal mammary artery (LIMA) to left anterior descending (LAD) artery and saphenous vein grafts (SVG) to RCA and circumflex coronary arteries. Diagnostic angiography had showed a recent occlusion of the SVG to the RCA and a cardiac MRI scan demonstrated an inducible perfusion defect in the RCA territory.

Catheterization and Cardiovascular Interventions DOI 10.1002/ccd.

Published on behalf of The Society for Cardiovascular Angiography and Interventions (SCAI).



**Fig. 2.** (a) The retrograde wire and Corsair micro-catheter advanced into same plane as the antegrade wire at the mid-RCA level; (b) Guideliner™ catheter advanced antegradely to capture the retrograde Corsair micro-catheter (tip of Corsair catheter marked with \* and Guideliner™ tip marked with arrow).

The procedure was carried out via bilateral femoral artery access with 8 Fr 45 cm sheaths. The RCA was intubated with a standard length (110 cm) 8 Fr AR2 guide catheter and the SVG to circumflex was intubated with a short (90 cm) AL1 guide.

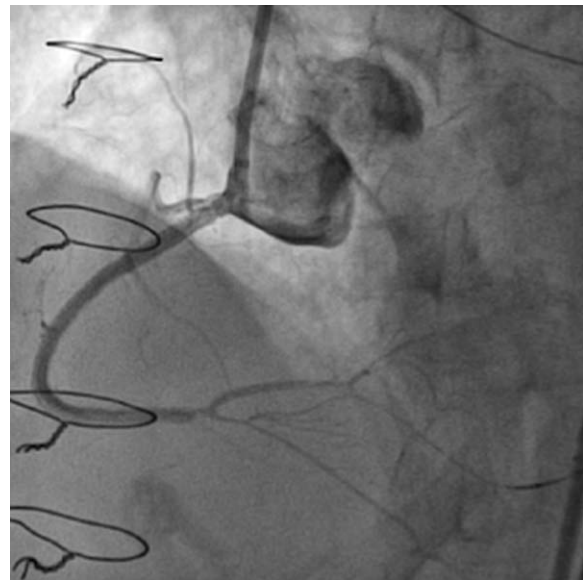
Dual contrast injections confirmed proximal long occlusion of the native RCA (Fig. 1a) and good retrograde interventional collateral channels from the native circumflex artery (Fig. 1b).

Due to ambiguity of the proximal cap and the long occlusion length (20 mm), a primary retrograde approach was chosen using the SVG to circumflex and collateral epicardial channels from the native circumflex artery.

A Sion wire (Asahi Intecc) and 150 cm Corsair micro-catheter (Asahi Intecc.) were advanced from the epicardial collateral channel to the distal RCA. The retrograde wire was exchanged to a Pilot 200 (Abbott Vascular), which was then “knuckled” (by forming a small loop and dissecting the sub-intimal/sub-adventitial plane) across the distal occlusion with Corsair catheter support (Fig. 1c).

A Fielder XT wire (Asahi Intecc.) was “knuckled” antegradely at the proximal occlusion site into the sub-intimal space with a 135 cm Corsair micro-catheter support (Fig. 1c). The antegrade and retrograde corsair catheters were advanced so that they were overlapping, which was confirmed in separate orthogonal planes. The antegrade sub-intimal space was enlarged by balloon inflation (2.5 mm × 15 mm) (marked with arrow in Fig. 1d). The retrograde wire and Corsair catheter were then successfully advanced into same plane as the antegrade wire at the mid-RCA level (Fig. 2a).

However, the long length of the retrograde limb from the SVG meant that the 150 cm Corsair was



**Fig. 3.** Final angiographic result following implantation of three drug eluting stents.

unable to reach the antegrade guide catheter despite the short (90 cm) contralateral guide catheter. To solve this issue, a 6 Fr Guideliner™ catheter (Vascular Solutions) was advanced antegradely and was able to successfully advance over and capture the retrograde Corsair catheter (Fig. 2b). The retrograde Pilot 200 was then exchanged for a 330 cm RG3 wire (Asahi Intecc.), which was then externalized. PCI was then completed antegradely on the RG3 wire and the vessel was stented from distal to ostium with three overlapping everolimus drug-eluting stents with a good final angiographic result (Fig. 3).

## DISCUSSION

Retrograde PCI with retrograde dissection re-entry techniques has improved the success of recanalization with of CTOs. The advent of the Corsair (Asahi Intecc.) channel dilator has further simplified collateral crossing [8]. A long 150 cm Corsair catheter is usually able to reach the antegrade guide catheter thereby enabling wire exchange to a long wire (e.g., 330 cm RG3 (Asahi Intecc.) or 335 cm ViperWire (Cardiovascular Systems Inc.)) and therefore wire externalization. However, in cases of long tortuous retrograde channels, particularly when also involving a graft, the Corsair catheter may be unable to reach the antegrade guide catheter. In this situation, potential solutions include exchanging for a long wire and using this to enter the antegrade catheter directly—although this can be difficult, particularly if the wire has to negotiate long segments of diseased artery. The long wire can also be snared in the aorta using standard snare devices delivered through the antegrade guide catheter. An alternative is to exchange the Corsair catheter for an over-the-wire or long rapid exchange balloon and perform retrograde angioplasty to allow passage of an antegrade wire.

We have demonstrated in our case report a third option utilizing the Guideliner™ (Vascular Solutions) mother-and-child catheter. This rapid-exchange device consists of a 20 cm soft flexible tube connected to a stainless-steel rod and can be used to deeply intubate a coronary artery to provide additional back-up support. This ability to extend the guide deep into the artery offers the solution of connecting the retrograde micro-catheter to the antegrade guide catheter. Providing the retrograde Corsair catheter is in the same tissue plane as the antegrade wire, the Guideliner™ catheter can be advanced over and “capture” the Corsair catheter. This technique may provide a simpler method for completing wire externalization than the previous options. Other advantages of the Guideliner™ system include circumventing the need for the retrograde wire to negotiate long sections of diseased artery; the ability to provide a scaffold for the artery by preventing collapse of space created by antegrade balloon inflation; providing

extra support to aid with stent delivery and reducing the need for contrast.

## CONCLUSIONS

Retrograde access is an important skill-set required for CTO PCI. When the retrograde limb involves a graft and/or tortuous collateral channels the retrograde Corsair catheter maybe too short to reach the antegrade guide catheter even with the use of a shortened donor guide. In this situation, advancing an antegrade Guideliner™ over the retrograde Corsair micro-catheter, the “capture technique,” facilitates wire externalization.

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