CASE REPORT

Retrograde approach to coronary chronic total occlusion via an occluded saphenous bypass graft: a case report

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Introduction

Retrograde coronary intervention of chronic total coronary occlusion remains challenging. Despite evolving techniques and accumulating experience, it has a failure rate of approximately 12.5%, in-hospital morbidity of 2–5% and a mortality rate of 1% (1–3). Most retrograde approaches access the distal cap of the chronic total occlusion (CTO) from a collateral branch arising from the contralateral coronary, a neighboring branch of the ipsilateral coronary, or a patent bypass graft (2). We describe a successful retrograde intervention of chronically occluded right coronary artery ostium via an occluded vein graft using existing stents in the graft as landmarks.

Clinical Presentation

The patient, a 55-year-old man, presented with Canadian Cardiovascular Society (CCS) class III angina of 2 months duration refractory to maximal medical therapy. The past cardiac history was significant for coronary artery bypass surgery (CABG) 5 years previously, including a saphenous vein graft (SVG) to the distal right posterior descending coronary artery, a vein graft to a third obtuse marginal artery, and a left anterior mammary graft to the mid-left anterior descending artery (LAD). The patient had percutaneous interventions on three different occasions to the vein graft to the right coronary artery (RCA). The vein graft was initially stented 2 years prior to presentation. A second percutaneous coronary intervention (PCI) 2 months afterwards placed two stents in the proximal and mid vein graft. A third intervention performed 5 months prior to presentation required re-stenting of the proximal and mid graft for in-stent restenosis, and treatment of a severe de novo lesion at the distal vein graft anastomosis. Repeat stenting was performed with three drug-eluting stents. The remainder of the coronary anatomy was notable for high-grade proximal disease of the LAD and occlusion of the circumflex and right coronary arteries. Bypass grafts to the obtuse marginal and LAD were patent. Despite satisfactory initial angiographic results, maximal anti-angina therapy including (nitroglycerin, ranolazine and beta blockers) and compliance to dual antiplatelet therapy, the patient experienced recurrent CCS class III exertion angina 2 months after the third SVG PCI procedure.

Functional Assessment, Diagnostic Angiography, and Decision Process

Adenosine stress-perfusion magnetic resonance imaging (MRI) revealed severe reversible perfusion defects involving the basal-mid inferoseptum and entire inferior wall,
consistent with severe inducible myocardial ischemia in the RCA distribution. No evidence of infraction was noted. There was preserved left and right ventricular systolic function with normal ventricular dimensions and wall thickness. The left ventricular ejection fraction was 60%. (Fig. 1).

On the basis of these data, we planned a retrograde PCI of the ostial RCA lesion via the saphenous vein graft. The pre-PCI scout angiograms unexpectedly revealed complete occlusion of the saphenous vein graft during the 5-month interval between the previous angiogram studies and the planned intervention (Fig. 2). The distal RCA was visualized faintly from left-to-right collaterals. A retrograde approach from the left coronary system was unfavorable due to the lack of suitable collaterals and the risk of jeopardizing more than one territory. We elected to perform retrograde intervention of the chronically occluded RCA via the occluded vein graft.

**Figure 1.** Cardiac MRI demonstrating; inferior wall ischemia (area outlined by the two yellow arrows).

**Figure 2.** Preintervention angiogram: (A) Injection of the aortic root, showing ostial occlusion of the RCA. (B) The saphenous vein graft to the right coronary artery is occluded at its origin. Asterisks indicate prior stents within the vein graft.
Interventional Procedure, Final Result, and Follow-up

An eight French 55 cm sheath was placed in the right femoral artery for retrograde access. A six French 55 cm sheath was placed in the left femoral arterial access for initial visualization of the distal RCA via the left-to-right collaterals, and subsequent antegrade access and wire exteriorization. Bivalirudin antithrombin therapy was used in addition to aspirin and clopidogrel. A six French multipurpose A1 guide was shortened and spliced using a portion of five French sheath as previously described for retrograde access (4,5). A 0.014” Pilot 200 guidewire was directed across the proximal SVG occlusion. Supported by a Corsair channel dilator (Asahi, Aichi, Japan), the Pilot 200 was directed into to the distal SVG using the existing stents as landmarks to define the course of the vein graft. The Pilot 200 was then replaced with a 0.014” Fielder FC wire, which was advanced through the ostial RCA occlusion into the aortic root (Fig. 3A). The Corsair was advanced into the aorta, and the Fielder FC replaced with a 0.014 × 335 cm Viper Advance wire. The Viper Advance wire was snared and exteriorized using an 18 × 30 mm Ensnare (Fig. 3B) delivered through an antegrade six French JR4 guide from the left femoral access. PCI to the RCA was then done over the exteriorized wire using 2.5 × 20 and 3.0 × 20 mm (Trek, Abbott Vascular, Abbott Park, IL) balloons and two-2.75 × 18 mm everolimus (Xience V, Abbott Vascular) eluting stents were placed serially. After the second stent was deployed, the vessel was interrogated using intravascular ultrasound (IVUS). This showed a residual ostial residual stenosis. The retrograde equipment was withdrawn and replaced with a 300 cm Prowater antegrade wire because of bias caused by the retrograde guide catheter made interrogation of the ostium very difficult over the exteriorized wire. A 3.0 × 8 Everolimus (Xience V) drug-eluting stent was finally deployed to the ostium of the RCA in an antegrade fashion (Fig. 4A and B). Follow-up IVUS interrogation of the RCA showed fully expanded ostium. No balloon dilation was performed within the SVG, and the SVG remained occluded at the conclusion of the case. There was normal flow in the distal vessel with no evidence of distal embolization. The total fluoroscopic time was 83.6 min while procedure time was 3 h. The total radiation dose was 3565 mGy Air Kerma. Approximately 420 mL of contrast was used. The two 55 cm sheaths were replaced with 10 cm sheaths, which were in turn removed 2 h after stopping bivalirudin.

The patient’s symptoms improved, with complete relief of angina. Cardiac markers remained normal, prompting discharge from hospital the following day. The patient remained asymptomatic during follow-up. Approximately 10 months after the index procedure, the patient underwent a stress nuclear study. He exercised for 6 min using the Bruce protocol and achieved a maximal heart rate of 140 beats/min. Cardiolite perfusion imaging showed an ejection fraction of 54% by gated examination. There was no evidence of myocardial ischemia on either electrocardiogram tracings or imaging. The patient remained asymptomatic 1 year after the retrograde intervention.

Figure 3. (A) Guidewire and channel dilator positioned at the RCA ostium after retrograde crossing of ostial chronic occlusion. (B) Snaring of Viper advance wire with tri-loop snare prior to exteriorization.
Percutaneous revascularization of chronic coronary occlusions continues to gain popularity and acceptance despite its inherent risk and complexity. Techniques have improved with the increasing availability of microcatheter channel dilators and the development of subintimal dissection and luminal reentry strategies (5,6). The retrograde approach to CTO initially used septal collateral channels to access the distal bed of occluded vessel (3,4). Since that time, many cases have been reported using different patent vessels to gain access to the occluded one. A recent review by Karmpaliotis et al. (7) reported use of a retrograde approach in 46% of cases after failure of an initial anterograde approach. Patent bypass grafts were utilized for retrograde access in 8% of these cases. No published series have mentioned using an occluded bypass graft to perform a retrograde procedure.

In cases where an antegrade guide catheter cannot engage the target coronary ostium, the preferred technique involves snaring the retrograde wire from the aortic root into the antegrade guide, followed by PCI over an exteriorized wire. The Tri-loop Ensnare 18 × 30 mm Endovascular system is much more effective and faster than conventional gooseneck snares (3). Our case demonstrates that an exteriorized guidewire not only provides excellent support, but may also subtly distort the angle of the proximal coronary origin relative to the aorta. This distortion renders optimal ostial stent placement difficult, especially when the two guide catheters interact with each other, coupled by the exteriorized wire. After fully dilating the lesion and stenting the proximal RCA segment, adequate coverage of the ostium required a switch to a conventional antegrade guidewire approach.

The utilization of an occluded vein graft to access the occluded RCA distinguishes this report from other cases in the literature, which used patent bypass grafts, even in the setting of tandem chronic occlusions. (8). Intervention of chronic saphenous vein grafts is not recommended in the 2011 PCI guidelines (9) due to low success rates, high complication rates and poor long-term patency rates. However, this recommendation is based upon studies that used the revascularized vein graft as the principal conduit for distal coronary perfusion (10,11). The previous stents within the occluded vein graft were important landmarks, helping the retrograde gear to remain within the vessel architecture. As with any chronic occlusion, distal coronary visualization by contralateral injection also improves the probability of success. The risk for distal embolization is reduced by avoiding balloon dilation within the vein graft. Long-term patency of the vein graft is not relevant when the vein graft is used as a conduit for retrograde PCI equipment, as the ultimate intent is restoration of perfusion through the native coronary artery. The contrast and radiation consumption during this case were consistent with previous summaries of retrograde technique (11). In our opinion, the demonstration of ischemia and myocardial viability by MRI and the presence of CCS class III angina despite optimal medical therapy, prior CABG, and prior conventional vein

Figure 4. (A) Reconstructing of the right coronary artery using three drug-eluting stents. (B) Antegrade injection after removal of retrograde gear, with floppy wire in place.
Conclusion

An occluded saphenous vein graft can be a useful means to access the distal coronary bed, enabling delivery of retrograde PCI equipment. This approach is more favorable when the course of the graft can be determined. Under suitable conditions, this technique could be used to enhance a retrograde technique for complex revascularization of chronic total occlusions.

Conflict of Interest

None declared.

References

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