

EDITORIAL COMMENT

Debating the State-of-the-Art CTO PCI Is There Still Room for Discussion?*



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We have read the paper by Tiwana et al¹ in this issue of *JACC: Case Reports* with great interest. The investigators present a case of saphenous vein graft (SVG) failure following recurrent percutaneous coronary intervention (PCI), and they decided to recanalize the native right coronary artery (RCA), which was completely occluded from the ostium. Their procedure was great and successful.

As reported, the incidence of recurrent PCI for SVG failure is relatively high.² In the presented case,¹ the patient had undergone SVG PCI on 5 previous occasions, leading to the pursuit of recanalization of the native artery. Because of complete occlusion (flush occlusion) of the RCA ostium, its identification proved challenging. Consequently, a retrograde approach was chosen for the chronic total occlusion (CTO) maneuver to recanalize the native RCA. Using the retrograde position, Tiwana et al¹ used the knuckle wire technique with a polymer jacket guidewire and attempted to create a neo-ostium using the 20 grams force tip road with a tapered guidewire. Although unsuccessful in aortic penetration with electrocautery, they managed to cross the lesion with the second guidewire and achieved externalization. Drug-eluting stents were then implanted, and competitive flow from the SVG graft was eliminated by coiling, ultimately achieving TIMI flow grade 3 in the neo-ostial native coronary artery.

In the current era of CTO-PCI, the success rate has significantly improved to around 90% by using a hybrid approach, which involves a combination of antegrade, retrograde, and intentional dissection with re-entry techniques.³ In this particular case, engaging the guiding catheter to the native RCA was challenging because of complete occlusion. Therefore, the operators opted to create a neocarina retrogradely. During the procedure, knuckle wiring using a polymer jacket guidewire was performed. Although this technique was relatively safe, it carried the risk of losing side branches and potentially reducing the available vascular beds. To minimize the loss of side branches, the operators would consider using a technique called limiting antegrade subintimal tracking during the antegrade approach.⁴ After achieving externalization, the wire route could be further evaluated using intravascular ultrasound to ensure optimal positioning. If there was an opportunity to rescue any occluded side branches, the operators might have attempted antegrade wiring because the imbalance between the vascular bed and vessel diameter has the potential to result in reduced blood flow.

Making a connection from the subintima to the aorta was anticipated to be extremely challenging because of technical difficulties and the disparate physical properties of the involved tissues. The subintimal layer is relatively soft, whereas the histologic characteristics of the aortic wall are characterized by its hardness.⁵ To navigate guidewires successfully from the subintimal space to the aorta, a high level of penetrability is required. In some cases, operators may use techniques such as compressing the subintimal space with balloons to create rigidity, thereby reducing the force needed for penetration. However, in this particular case, the antegrade strategy was excluded, and a high penetration force was needed and used. The

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**ABBREVIATIONS
AND ACRONYMS****CTO** = chronic total occlusion**PCI** = percutaneous coronary intervention**RCA** = right coronary artery**SVG** = saphenous vein graft

20 grams force tip road with tapered guidewire was originally developed for the treatment of peripheral vascular disease, specifically designed to possess the necessary penetration power for traversing lesions.⁶ The electrocautery in cut mode with 50 W mediated with this guidewire would make the connection from the subintima to aorta. Generating high output with electrocautery mediating it has been increasing in clinical practice.^{7,8} However, the device that was electrified appears to have damage to its tip, seemingly caused by heat.⁹ A dedicated device¹⁰ has been developed and tested and is expected to be further refined based on electroporation principles, minimizing tissue damage in the future.¹¹ A new guidewire has been designed to replace high-power penetration with enhanced penetrability, characterized by its ability to penetrate effectively.¹² In upcoming cases, the use of these devices and combinations are expected to enhance the success rate and safety of the procedure.

In their report, Tiwana et al¹ used coiling of the SVG, resulting in diminishing competitive flow in the native coronary artery. In the context of coronary artery bypass graft, coiling the native artery is known to enhance graft flow and reduce competitive native flow, thereby contributing to procedural success.¹³ Following the same principle, coiling of the graft may be recommended to increase native flow, although further trials are needed to assess the procedural validity. Moreover, it is crucial to investigate why competitive flow persisted despite successful revascularization. Concerns arise regarding the

adequacy of the vascular bed and vascular blood flow. When the diameter of a graft vessel is larger than that of the recipient vessel, it has been shown to cause impeded blood flow and damage to endothelial cells, resulting in inadequate graft function.¹⁴ Furthermore, the long-term evaluation of stenting at the ostium is warranted. Currently, there is a shortage of specialized stents designed to accommodate the unique histologic characteristics of the circumferential muscle surrounding the right coronary artery ostium, which requires higher levels of compressive stress compared to other coronary arteries.¹⁵ The treatment outcomes have shown less favorable results, even with polytetrafluoroethylene-covered stents.¹⁶ However, the development of dedicated stent devices in the future may have the potential to improve outcomes in cases where intentional creation of a neocarina, as demonstrated in this study,¹ is performed.

This case report¹ can be considered as containing various discussions in the current field of CTO-PCI. Adding insights to each individual case is crucial for future research advancements.

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