

Stumpless Ostial Right Coronary Artery Chronic Total Occlusion: Retrograde Approach

Sağ Koroner Arterin Ostial Güdüksüz Kronik Total Oklüzyonu: Retrograd Yaklaşım

ABSTRACT

Percutaneous coronary interventions of the coronary total occlusions, especially of the aorto-ostial lesions, pose challenges. Since antegrade wiring is not feasible in aorto-ostial chronic total occlusions, retrograde wiring remains the lone strategy. We present a successful case of stumpless ostial right coronary artery chronic total occlusion, which was successfully opened by retrograde wiring and externalization by snaring. Intravascular ultrasound was performed to comprehend the diffusely narrowed distal right coronary artery and the posterior left ventricular branch to guide the stenting strategy in percutaneous coronary intervention.

Keywords: Coronary total occlusion, intravascular ultrasound, ostial occlusion, percutaneous coronary intervention, retrograde crossing.

ÖZET

Koroner total oklüzyonların, özellikle aorto-ostial lezyonların perkütan koroner müdahaleleri zordur. Aorto-ostiyal kronik total oklüzyonlarda antegrad girişim (telleme-wiring) mümkün olmadığı için, retrograd girişim, tek strateji olmaya devam etmektedir. Bu yazıda, retrograd girişim ve snare yöntemi ile eksternalizasyon ile başarılı bir şekilde açılan güdüksüz sağ koroner arter ostial kronik total oklüzyon olgusunu sunmaktayız. Perkütan koroner girişimde stentleme stratejisini yönlendirmek için, diffüz daralma gösteren distal sağ koroner arter ve posterior sol ventrikül dalı anlayabilmek adına intravasküler ultrason yapıldı.

Anahtar Kelimeler: İnvasküler ultrason, koroner total oklüzyon, ostial oklüzyon, perkütan koroner girişim, retrograd geçiş

Chronic total occlusion (CTO) interventions are rapidly evolving in the last decade with the introduction of numerous new devices and techniques. With increasing operator expertise and new devices, the success rate of CTO interventions has increased up to 90%.^{1,2} The most common target vessel in CTO percutaneous coronary interventions (PCI) is the right coronary artery (RCA), which represents half of all CTO lesions in contemporary registries.³ Ostial RCA lesions are a challenging subset due to a lack of antegrade access or guide catheter support and heavy calcification, which is commonly observed. Stumpless ostial RCA CTO requires retrograde expertise due to the unavailability of antegrade wiring. Moreover, the operators should be cognizant of special techniques that are required for the externalization of retrograde wire.^{4,5} Therefore, in this report, we present a successful retrograde PCI of stumpless ostial RCA CTO using snaring for externalization of retrograde wire.

Case Report

A 46-year-old male presented with exertional angina. His coronary risk factor was hypertension with no familial history of coronary artery disease. On evaluation,

CASE REPORT

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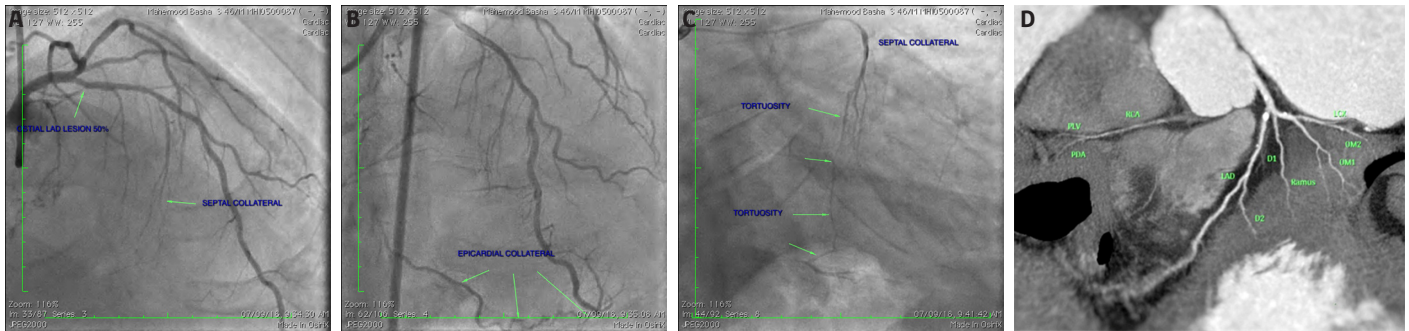


Figure 1. Baseline coronary angiography. (a) Angiographic image showing 30% ostial LAD stenosis. (b) LAD-RV branch epicardial collateral channels. (c) Tortuosity in CC2 septal collateral. (d) Computed tomography image showing stumpless ostial CTO of RCA with a CTO length of approximately 15 mm and absent calcium.

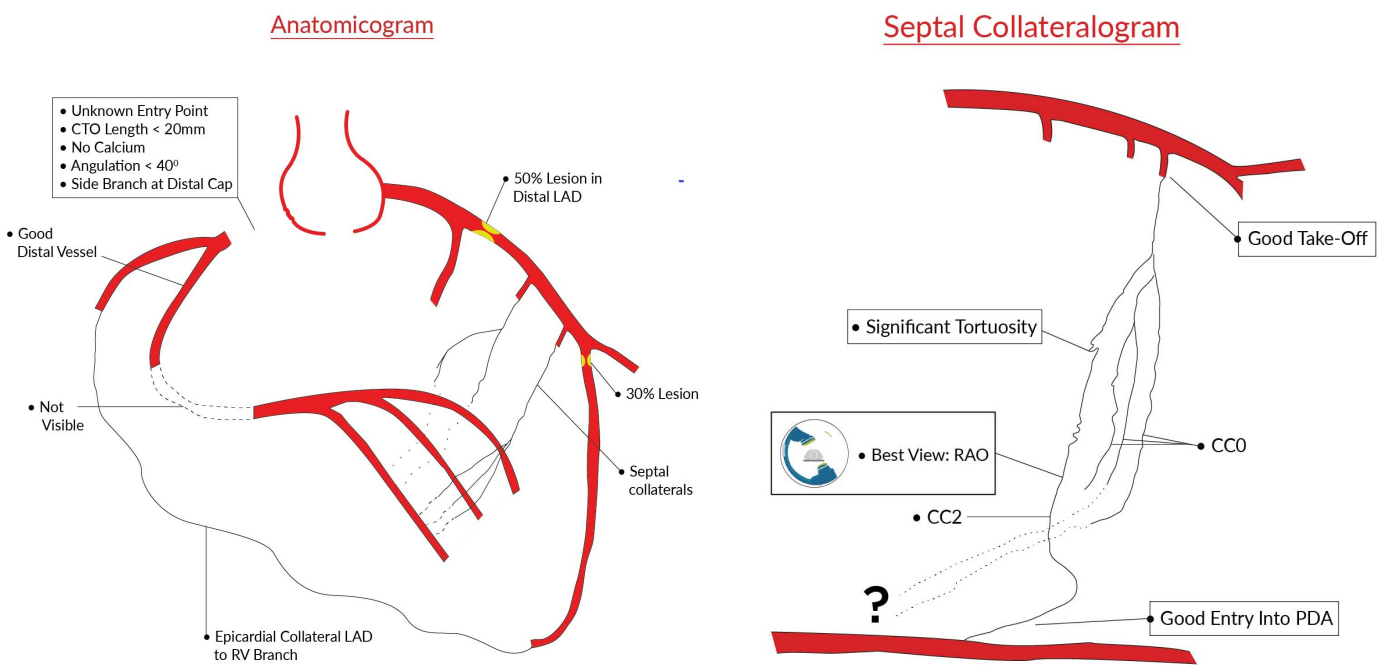


Figure 2. Pictographic depiction of coronary and septal collateral anatomy.

ECG and 2D-ECHO were normal, treadmill test was positive. A stress nuclear scan revealed inducible ischemia in RCA ter-

itory with more than 10% myocardium involvement. Coronary angiography revealed mild ostial disease in the left anterior descending artery (LAD) and left circumflex artery; RCA was not visualized despite performing an aortogram (Figure 1a). Septal and epicardial collateral channels connected from LAD to RCA (Figure 1b). Epicardial collaterals filling the right ventricular branch originated close to the RCA ostium (Figure 1c). Coronary computed tomography confirmed stumpless ostial CTO of the RCA with a length of around 15 mm and absent calcium (Figure 1d). Figure 2 depicts the pictographic representation of coronary and collateral anatomy.

Bifemoral access with two 7F Flexor Ansel guiding sheaths (Cook Medical, USA) was used. EBU 7F 3.5 guiding catheter is used to cannulate the left main coronary artery. Due to the absence of antegrade access because of the stumpless ostial RCA CTO, direct retrograde wiring is used as the

ABBREVIATIONS

CTO	Chronic total occlusion
ECG	Electrocardiogram
IVUS	Intravascular ultrasound
LAD	Left anterior descending
LCX	Left circumflex artery
PCI	Percutaneous coronary interventions
PLVB	Posterior left ventricular branch
PLVB	Posterolateral ventricular branch
PTCA	Percutaneous transluminal coronary angioplasty
RCA	Right coronary artery
TEE	Transesophageal echocardiographic

first strategy. Sion blue (Asahi Intecc, Japan) workhorse wire was parked in the distal LAD to counter any donor vessel emergencies. Caravel 150 (Asahi Intecc, Japan) microcatheter was tracked over another Sion blue wire into the third septal. A septal artery angiogram was performed to notify the tortuosity and entry angle of the septal artery into RCA. Due to proximal tortuosity, Sion wire with a 1 mm tip was used to navigate through septal collateral; however, it failed to cross due to severe tortuosity in the mid and distal septal collateral (Figure 3a). Wire was exchanged to Suoh-03 wire (Asahi Intecc, Japan), which crossed septal collateral into the posterior descending artery to RCA, followed by Caravel 150 (Figure 3b). To visualize the RCA anatomy, a coronary angiogram was performed through Caravel 150. Retrograde wire escalation from Fielder-XT guide wire (Asahi Intecc, Japan) to Gaia-2 guide wire (Asahi Intecc, Japan) was done as Fielder-XT guide wire could not navigate through the lesion. Gaia-1 guide wire (Asahi Intecc, Japan) crossed the lesion and advanced into the aorta, which was confirmed through two orthogonal view injections and wire flapping with systole and diastole (Figure 3c).

Navigating Gaia-1 wire into antegrade 7F JR catheter was attempted by changing the guide catheter position in two orthogonal views, i.e., LAO and RAO, which was not successful due to anterior takeoff of the RCA. After an unsuccessful attempt to advance the Caravel 150 catheter into the aorta, Gaia-1 was advanced further into the aorta, which went into the subclavian artery. Gaia-1 was snared with a 7F guide and 10 mm basket snare in the subclavian artery (Figure 3c), and the guide was moved over the snared wire until it was stabilized over the arch (Figure 3d). Caravel 150 was advanced into an antegrade guide catheter with balloon trapping of snared retrograde wire (Figure 3e). Caravel-150 was balloon trapped followed by wire exchange to RG3 guide wire (Asahi Intecc, Japan), which was externalized in the usual technique. Intravascular ultrasound (IVUS) was performed over RG3 guidewire to confirm true lumen crossing (Figure 3f).

Predilatation with 2.0 × 12 mm Maverick PTCA balloon (Boston Scientific, USA) was performed, and post predilatation check angiography revealed an occluded side branch. Hence-

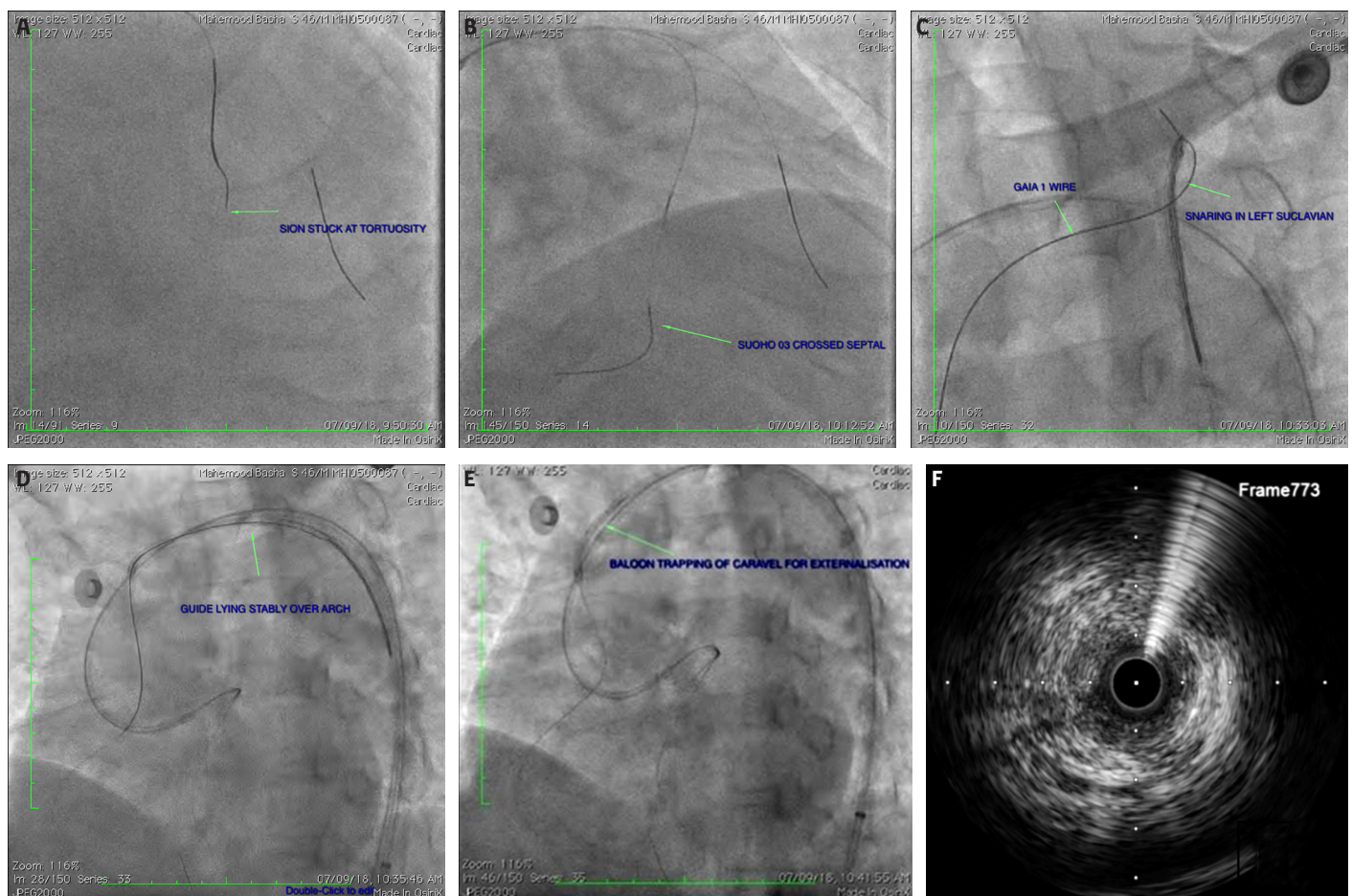


Figure 3. Angiographic and intravascular ultrasound images of the right coronary artery and ostium. (a) Sion wire stuck in septal collateral due to tortuosity. (b) Suoh-03 wire crossed septal collateral and advanced into the distal cap (c) Gaia-1 advanced into the aorta and snared into the left subclavian with basket snare. (d) The guide moved over the snared wire and stabilized over the arch. (e) Caravel-150 was balloon trapped for wire externalization. (f) IVUS showing RG wire through the true lumen.

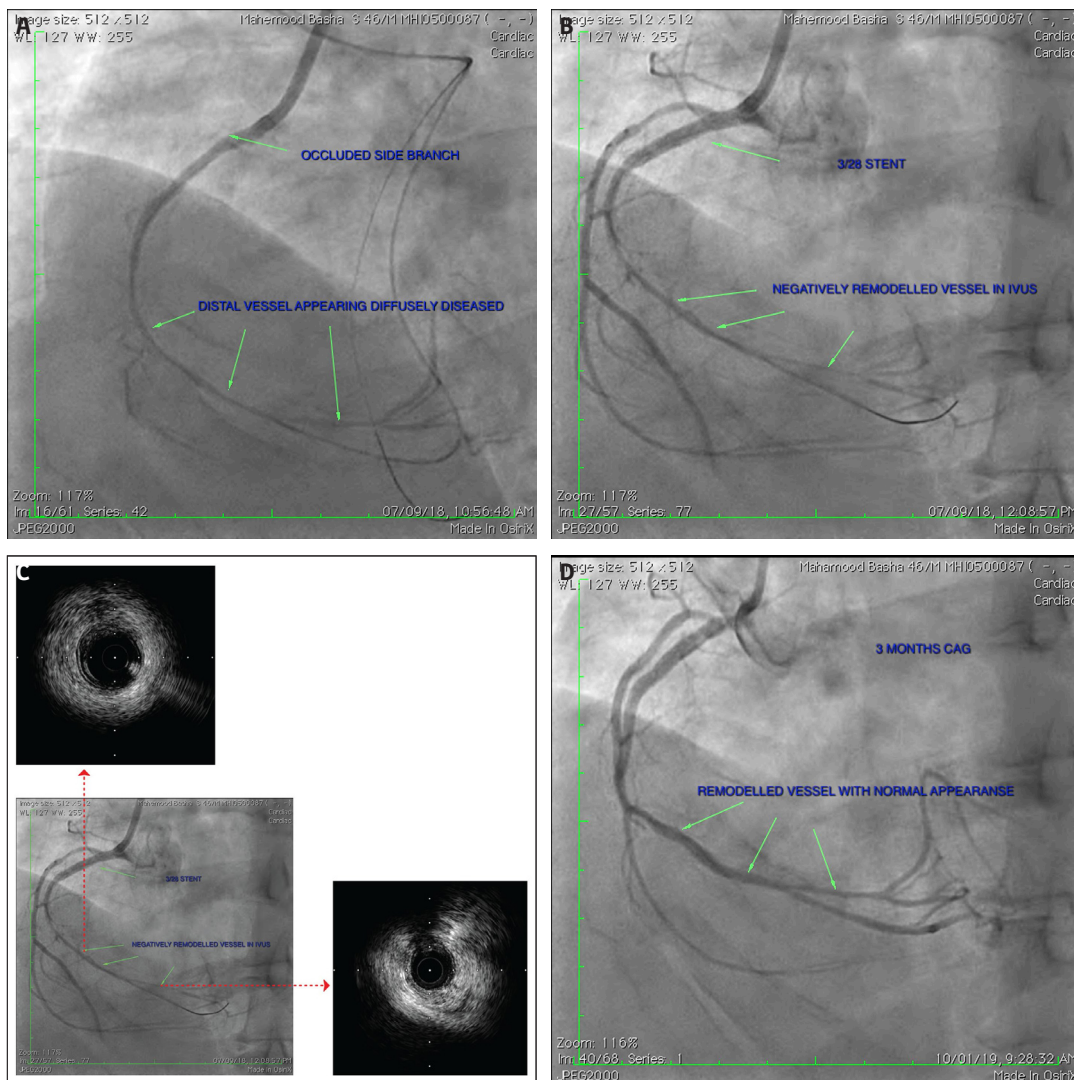


Figure 4. (a) Occluded side branch re-entered through Crusade double lumen catheter with a diffuse disease distal vessel. (b) Post-PCI angiographic image: Well-deployed stent and negative remodeling. (c) IVUS images showing negative remodeling in angiographically appearing diseased distal RCA and PLVB. (d) Post-PCI 3-month angiographic image showing positive remodeling of the vessel. Informed consent form was signed by volunteer/research participants.

forth, the side branch was re-entered with a Crusade double lumen catheter (Kaneka Corporation, Japan) and predilated with a 2.5 × 12 mm Maverick PTCA balloon (Boston Scientific, USA) (Figure 4a). IVUS analysis of angiographic diffused disease of RCA revealed negative remodeling, and not diffused disease (Figures 4a and b). Landing zones were chosen by IVUS, and a Promus Premier stent—3 × 24 mm—(Boston Scientific, USA) was deployed (Figure 4b). Final angiography showed diffused thin distal RCA and posterior left ventricular branch (PLVB), which was revealed as negative remodeling in IVUS; therefore, stenting was avoided (Figure 4c and d). A 3-month check coronary angiography performed revealed normal distal RCA and PLVB (Figure 4e).

Discussion

Stumpless ostial RCA CTO possesses different challenges

than CTOs in other parts of RCA due to the unavailability of an antegrade approach, an invisible CTO track, and frequent calcified lesions. Due to proximal cap ambiguity, moderate calcification, and varied length of the CTO lesion, most of the ostial RCA CTO procedures are challenging.⁶ Hence, retrograde wiring is the only available strategy.⁷ Although a valid strategic approach, retrograde recanalization requires considerable operator skills and is associated with intraprocedural complications, such as aortocoronary dissection, collateral perforation, and donor vessel ischemia.⁸ Therefore, to our knowledge, this is the first publication to report a successful case of IVUS-guided retrograde PCI of stumpless ostial RCA CTO using snare and balloon trapping techniques for wire externalization. Retrograde wire externalization in stumpless ostial RCA CTO needs a systematic approach for successful PCI completion, which is depicted in Figure 5 as a flow chart.

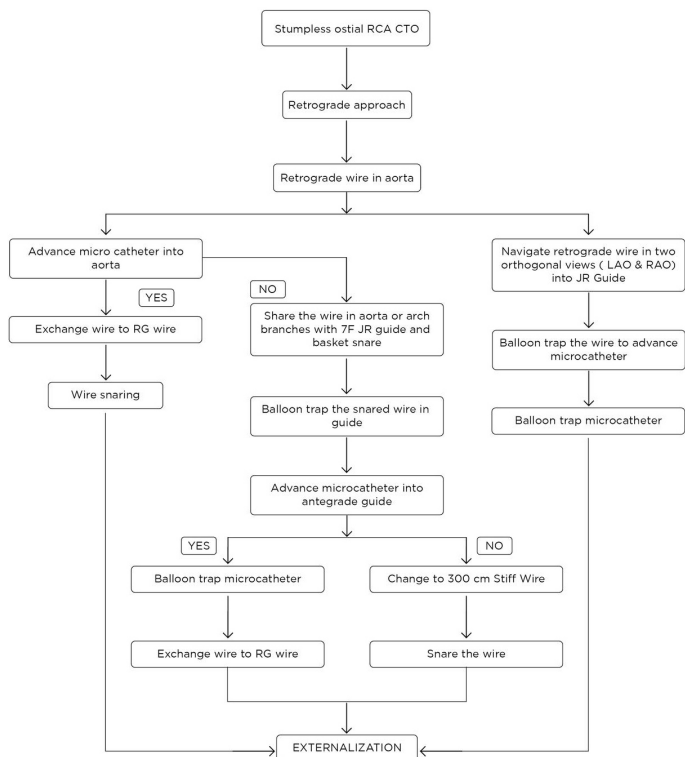


Figure 5. Wire externalization strategy.

Before attempting snaring technique, navigating the wire in two orthogonal views LAO and RAO into JR guide can be attempted in patients with normal RCA origin. If failed, snaring techniques can be employed either in the aorta or in arch branches, if the wire can be advanced. Caution should be employed during snaring of coiled wires as the pull force of the snare can uncoil the wire and complicate further the procedure. Hence, after wire snaring, instead of pulling the wire, it is advised to advance the guide catheter over the snared wire until it achieves a stable position in the arch, followed by switching the strategy to balloon trapping of the wire. Any snare can be employed (gooseneck snare or basket snare); however, the size should be decided based on the size of the vessel where snaring must be performed (Figure 5).

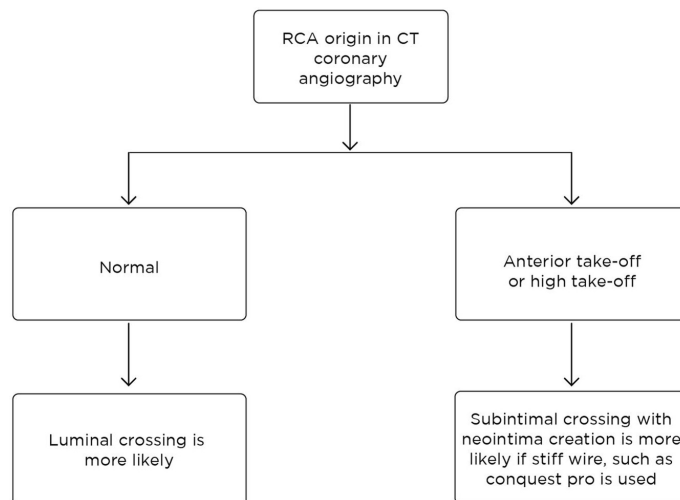


Figure 7. Computed tomography in ostial RCA CTO.

In all stumpless ostial RCA CTOs, computed tomography angiography is recommended to understand the length of the CTO and the relation of RCA origin with the aorta (normal, anterior, or superior takeoff). The type of RCA takeoff from the aorta should be understood before using stiff coronary wires, which may create "neo-ostium" during intervention (Figures 6 and 7).⁹ No data on neo-ostium behavior in the short and long terms are available. However, one available case report showed localized dissection extension into the aortic sinus without any clinical impact.⁷ Hence, IVUS to confirm wire position before predilatation helps in the re-strategizing procedure. If the wire is subintimal, antegrade true lumen re-wiring can be attempted with IVUS guidance.

Retrograde wire crossing in this case was done under fluoroscopic guidance as the length of CTO was short. Nevertheless, in CTOs with longer lengths, the transesophageal echocardiographic guidance can be used to confirm true lumen CTO crossing into the aorta.⁸ In case of heavily calcified lesions, resistant to penetrate by stiff wires (Conquest Pro 20 and Hornet 14) can be used.⁷

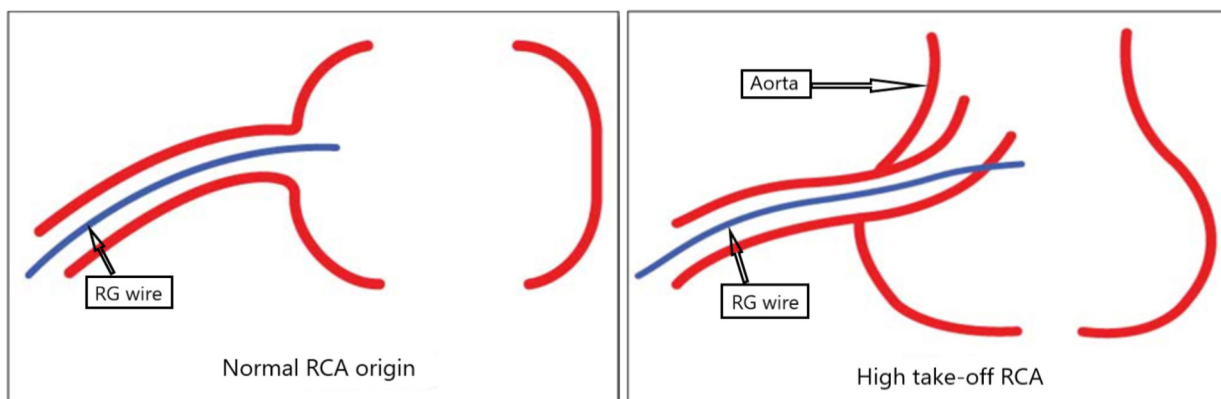


Figure 6. Outcome of coronary wire intervention with respect to the type of RCA takeoff.

IVUS plays a significant role in various steps in CTO PCI from wiring in CTO to selection of stent and optimization of stent expansion. IVUS is important in analyzing post-CTO lesions to differentiate disease versus negative remodeling. If IVUS shows negative remodeling, angiographically appearing diseased distal vessel should be intervened.^{10,11} In this case, a 3 month coronary angiography revealed positively remodeled and normal appearing distal RCA and PLVB, when compared with immediate post-PCI coronary angiography.

In stumpless ostial RCA CTO, retrograde wiring is the only strategy. Interventionists should be aware of all methods of wire externalization strategies for the successful completion of the procedure. IVUS aids in confirming retrograde wire position in the vessel and understanding disease versus negative remodeling in diffusely narrowed distal vessels; in cases of negative remodeling, stenting can be avoided.

Informed Consent: Written informed consent was obtained from the participants of this study.

Peer-review: Externally peer-reviewed.

Declaration of Interests: The authors declare that they have no competing interest.

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