

CASE REPORT

CLINICAL CASE

The RASE Technique for Extraction of a Protruding Aorto-Ostial Coronary Stent



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ABSTRACT

BACKGROUND Significant protrusion of an aorto-ostial coronary stent into the aortic root may complicate transcatheter aortic valve replacement (TAVR) by increasing the risk of valve-stent interaction, TAVR balloon rupture, or stent deformation. Safe management strategies remain poorly defined.

CASE SUMMARY An 84-year-old man undergoing pre-TAVR evaluation was found to have ostial right coronary artery disease; this was treated with percutaneous coronary intervention, resulting in 7-mm stent protrusion into the aorta, precluding safe TAVR. After heart team evaluation, the patient underwent intentional stent fracture, reverse hairpin-assisted guidewire re-entry, and controlled snare-assisted extraction of the protruding stent (termed the RASE technique [reverse hairpin-assisted avulsion and stent extraction]). Successful staged TAVR was later performed.

DISCUSSION This case describes a novel guidewire-controlled technique for safe extraction of a protruding aorto-ostial stent, enabling definitive transcatheter valve therapy.

TAKE-HOME MESSAGES Aorto-ostial stent protrusion may preclude safe TAVR and requires multimodality assessment and heart team planning. The RASE technique may facilitate safe and controlled extraction of the protruding stent segment. (JACC Case Rep. 2026;■:109087) © 2026 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

HISTORY OF PRESENTATION

An 84-year-old man with a history of chronic kidney disease, multivessel coronary artery disease, and severe symptomatic aortic stenosis was referred for coronary angiography as part of pre-transcatheter aortic valve replacement (TAVR) evaluation.

Coronary angiography demonstrated patent left internal mammary artery (LIMA)-to-left anterior

descending artery (LAD) bypass graft, patent prior left main-into-left circumflex coronary artery stents, and new severe ostial right coronary artery (RCA) stenosis (Figure 1). After heart team discussion, a staged strategy of ostial RCA percutaneous coronary intervention (PCI) followed by TAVR was recommended.

The patient subsequently underwent ultra-low contrast intravascular imaging (IVUS)-guided PCI of

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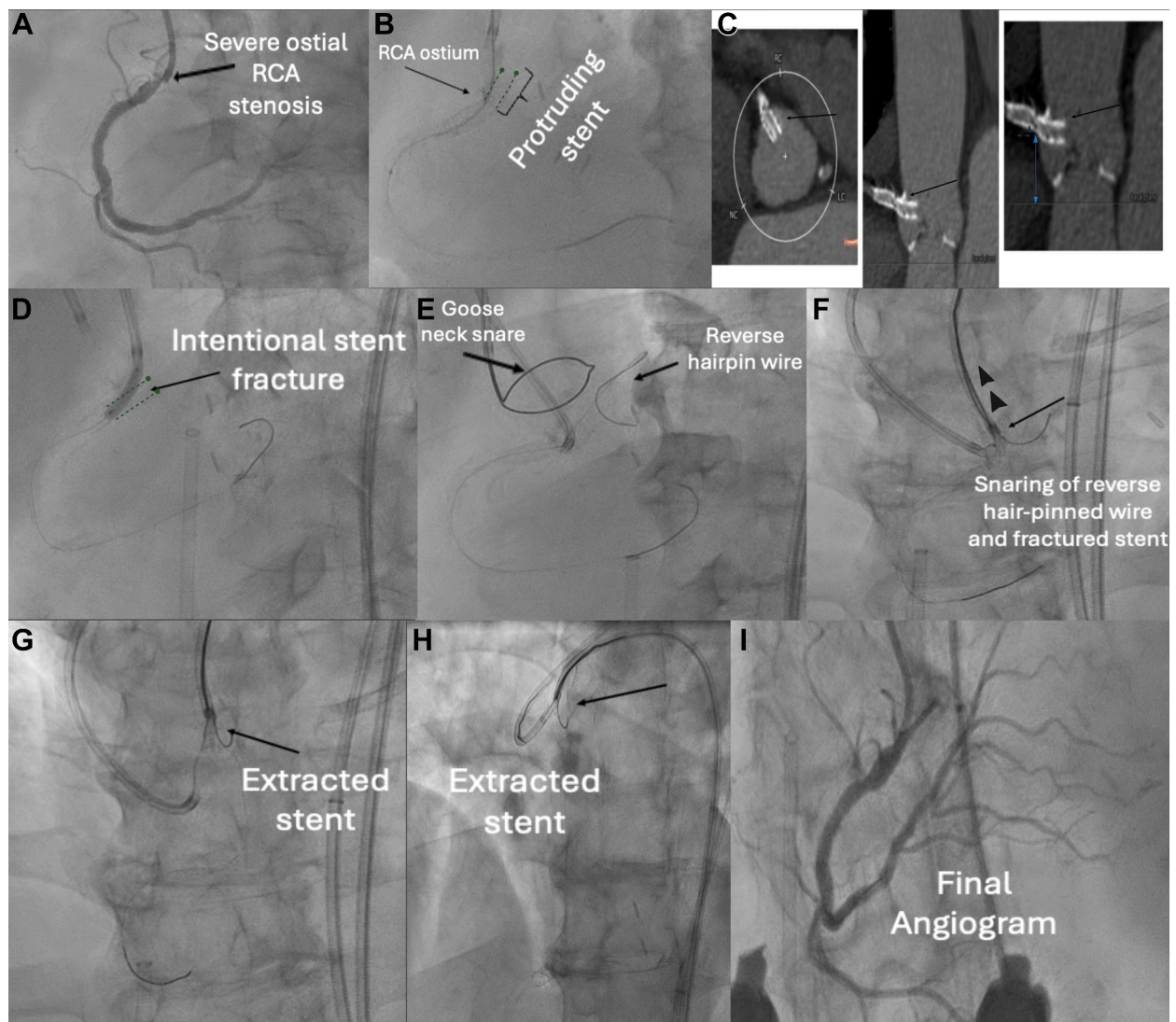
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**ABBREVIATIONS
AND ACRONYMS****DLMC** = dual-lumen
microcatheter**IVUS** = intravascular
ultrasound**PCI** = percutaneous coronary
intervention**RASE** = reverse hairpin-
assisted avulsion and stent
extraction**RCA** = right coronary artery**RW** = reverse hairpin wire**TAVR** = transcatheter aortic
valve replacement

the ostial-proximal RCA. Both pre- and postintervention IVUS was performed. Final angiography demonstrated TIMI flow grade 3; however, 7 mm of the stent was noted to protrude into the aorta (**Figure 2**). During attempted post-PCI IVUS assessment, guidewire and guide catheter position was lost, and re-engagement of the true ostial stent lumen was unsuccessful despite multiple attempts. As a result, further ostial stent optimization was deferred, and the

TAKE-HOME MESSAGES

- Aorto-ostial stent protrusion is a clinically significant problem in patients undergoing TAVR and requires careful preprocedural assessment.
- A novel guidewire-controlled extraction strategy using reverse hairpin re-entry and snare-assisted avulsion (RASE technique) may allow safe and effective management of this challenging scenario.

VISUAL SUMMARY The RASE Technique for Extraction of a Protruding Aorto-Ostial RCA Stent

(A) Angiogram demonstrating severe ostial RCA stenosis. (B) Fluoroscopic evidence of protruding aorto-ostial RCA stent. (C) Computed tomography showing aorto-ostial stent protrusion. (D) Intentional balloon fracture of the protruding stent segment. (E) Fluoroscopic demonstration of goose neck snare and reverse hairpin wire ready to be snared. (F) Snaring of reverse hairpin wire and fractured stent segment. (G and H) Stent extraction. (I) Final angiogram. RCA = right coronary artery.

procedure was terminated with the patient symptom free and hemodynamically stable.

PAST MEDICAL HISTORY

The patient's medical history included severe symptomatic aortic stenosis, heart failure with reduced ejection fraction (ejection fraction: 49%), coronary artery disease notable for prior hybrid revascularization with LIMA-to-LAD bypass and staged PCI of left main into left circumflex, hypertension, chronic kidney disease, and abdominal aortic aneurysm with subsequent endovascular repair.

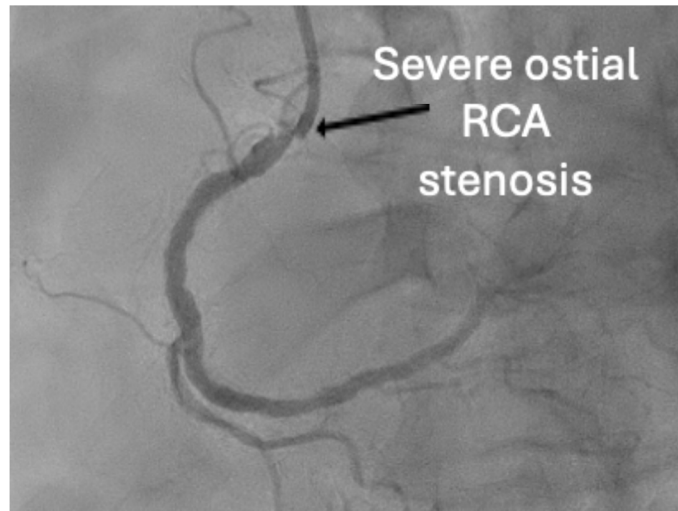
INVESTIGATIONS

Post-PCI pre-TAVR computed tomography revealed 7-mm protrusion of the ostial RCA stent into the aortic root (**Figure 3**), raising concern for interaction with the TAVR delivery system and risk of balloon rupture or stent deformation during TAVR. After multidisciplinary heart team evaluation and consideration of both surgical and percutaneous options, the patient was referred for repeat catheterization to optimize the aorto-ostial stent before TAVR.

MANAGEMENT/INTERVENTION

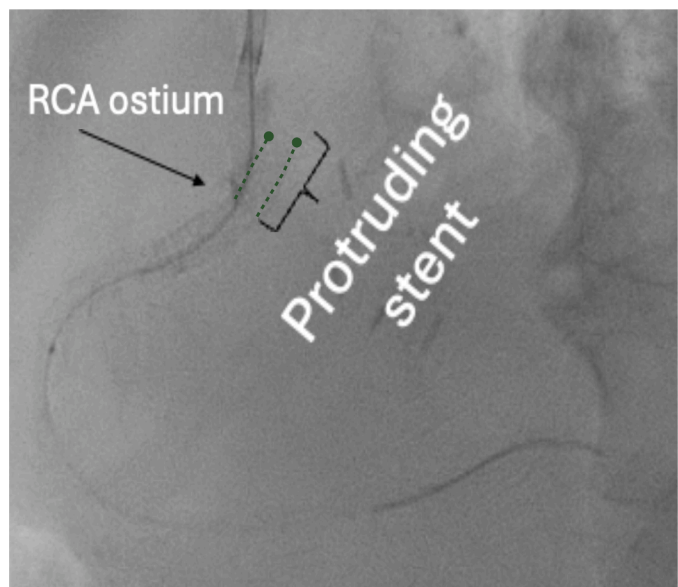
The patient was brought back to the catheterization laboratory 20 days after initial intervention with stable renal function. Bifemoral 7-F arterial access was obtained under ultrasound guidance using micropuncture technique. A 7-F JR4 guide and a 20-mm Amplatz goose neck snare was advanced into the aortic root (**Figure 4**). A second 7-F JR4 guide catheter was used to nonselectively engage the RCA. A coronary guidewire was airtailed through the side struts of the protruding stent, and coronary angiography was performed (**Video 1**). Next, the stent was intentionally fractured through the side struts with serial high-pressure noncompliant balloon inflations (**Figure 5**). Following adequate separation and fracture of the protruding stent, a dual-lumen microcatheter (DLMC) with a reverse hairpin wire (RW) (300-cm Pilot 200, Abbott) was advanced over the primary coronary guide wire as a system as previously described.¹ The DLMC with the RW was advanced into the mid-RCA. The DLMC was then retracted into the guide catheter and the RW

FIGURE 1 Coronary Angiogram Demonstrating Severe Ostial RCA Stenosis (Arrow)



RCA = right coronary artery.

FIGURE 2 Fluoroscopic Demonstration of Protruding Aorto-Ostial RCA Stent (Green Dotted Lines)

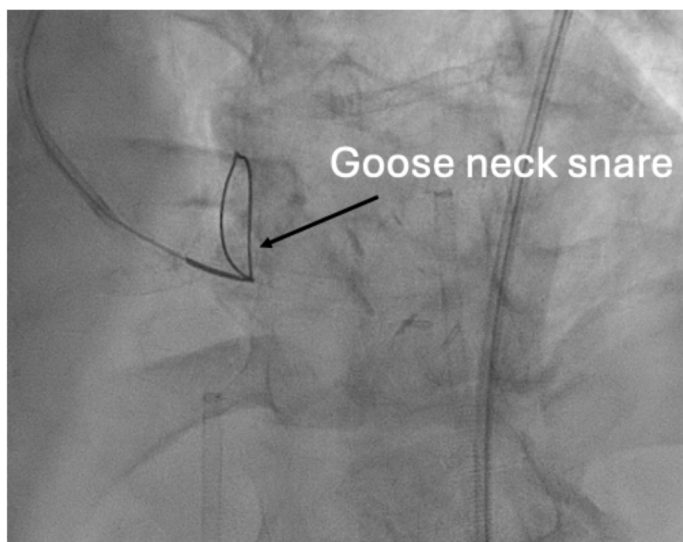


RCA = right coronary artery.

FIGURE 3 Computed Tomography Demonstrating 7-mm Protrusion of the Aorto-Ostial RCA Stent (Arrows)

CT demonstrating 7mm aorto-ostial protrusion of the
RCA stent (Black arrow)

CT = computed tomography; RCA = right coronary artery.

FIGURE 4 Fluoroscopic Demonstration of Goose Neck Snare (Arrow) in the Aortic Root

manipulated using reverse hairpin maneuver, allowing retrograde redirection into the true lumen of the stent and subsequent externalization into the aorta (Video 2). Figure 6 shows a schematic illustration of procedural steps.

This technique established stable safe guidewire control of the fractured stent segment. Both the reverse hairpin wire and the protruding stent fragment were then captured using the snare. With the system stabilized over the guidewire rail, the snare was cinched, and controlled traction was applied, resulting in successful avulsion and extraction of the protruding stent segment without embolization (Figure 7A to 7D).

We term this approach the RASE (reverse hairpin-assisted avulsion and stent extraction) technique—a novel method that facilitates controlled extraction of a protruding aorto-ostial stent by maintaining continuous wire access across the stent during fracture and retrieval, thereby reducing the risk of systemic embolization of the fractured stent fragment—which differs from approaches in other

case reports in the literature.² Despite the absence of formal bench testing, the steps of the RASE technique are grounded in established interventional principles and represents a first-in-human innovation, introducing a novel guidewire-controlled paradigm for stent extraction.

After extraction, IVUS-guided balloon angioplasty of the remaining ostial portion of the RCA stent was performed with a 4-mm noncompliant balloon. Repeat stenting was not required. Postintervention IVUS and angiogram (Figure 7E) showed a widely patent and well-apposed ostial RCA stent with no residual extension into the aorta.

OUTCOME AND FOLLOW-UP

The patient tolerated the procedure without complications. He subsequently underwent successful TAVR 4 weeks later with a balloon-expandable valve without complications or interaction with the ostial RCA stent. At the 5-month follow-up, he remained clinically stable.

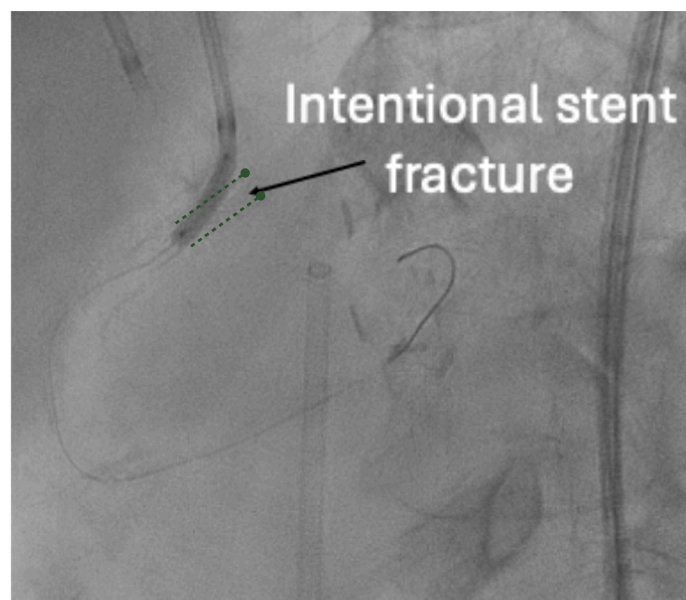
DISCUSSION

This case highlights an important and under-recognized complication of aorto-ostial coronary stenting—excessive stent protrusion into the aortic root—which may preclude safe TAVR (and is also associated with in-stent restenosis and stent thrombosis).³ Multimodality imaging, particularly computed tomography, plays a critical role in identifying this issue and guiding management.

Prevention of stent protrusion at the index procedure is preferred, via techniques to include real-time IVUS guidance,⁴ WALPO (wire in aorta for localization and protection of the ostium),⁵ Ostial PRO positioning system (Merit Medical)⁶ for precise stent positioning, or Flash Ostial system (Ostial Corp)⁷ for flaring of protruding stents in the aorta.

The key innovation in the present case is the use of a guidewire-controlled safe extraction strategy to prevent stent fragment embolization. The RASE technique integrates 3 essential components: 1) intentional stent fracture via side-strut balloon dilation, 2) reverse hairpin-assisted guidewire re-entry into the true stent lumen, and 3) snare-assisted avulsion and extraction of the protruding aorto-ostial stent over a stabilized wire rail (Video 3). The central principle underlying this approach is

FIGURE 5 Fluoroscopic Demonstration of Intentional Side Strut Stent Fracture (Arrow) Using a Noncompliant Balloon

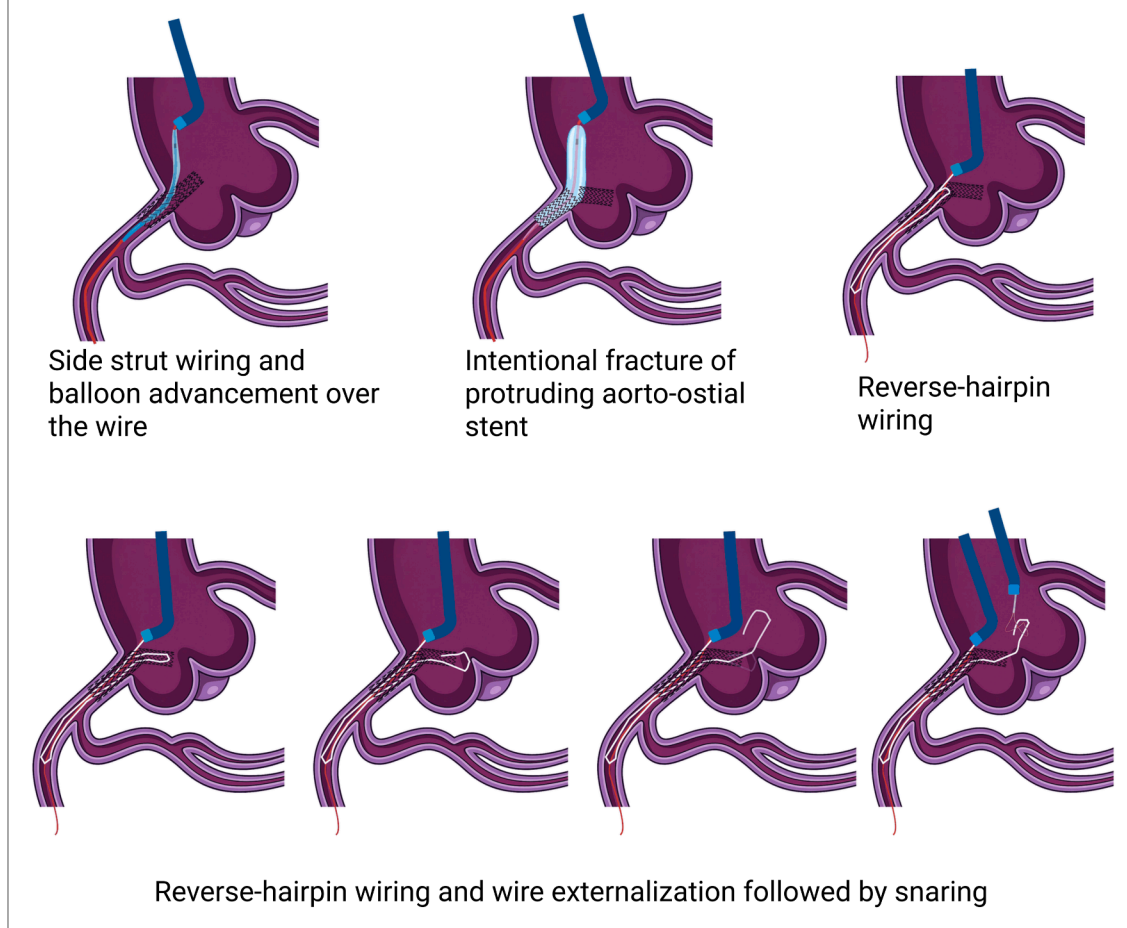


Green dotted lines demonstrate the protruding aorto-ostial RCA stent. RCA = right coronary artery.

maintenance of continuous guidewire control across the fractured stent fragment, which enables a controlled extraction vector and reduces the risk of stent embolization. Previously described conventional snare-based extraction techniques² lack this stability and may result in unpredictable movement or systemic embolization of the stent.

The RASE technique may be particularly useful in complex aorto-ostial anatomy where conventional snaring alone may be insufficient or unsafe. However, it should be reserved for experienced operators, as potential pitfalls of the RASE technique extend beyond dual vascular access and include risk of coronary dissection, acute vessel closure, and aortic root injury during traction. Intentional stent fracture may also carry a risk of embolization if wire control is not maintained. Additional concerns include device entrapment within stent struts and difficulty with re-entry into the true stent lumen in distorted fractured portion of the stent.

In selected high-risk cases, adjunctive embolic protection strategies may also be considered during

FIGURE 6 Schematic Illustration of RASE Technique

stent extraction, particularly when there is concern for unstable guidewire control throughout the procedure. Devices such as the ONO device may theoretically provide additional cerebral and systemic embolic protection during stent extraction. However, an important limitation is the requirement for additional arterial access, which may increase procedural complexity and vascular complication risk, particularly in elderly patients with significant peripheral arterial disease or prior vascular interventions.

CONCLUSIONS

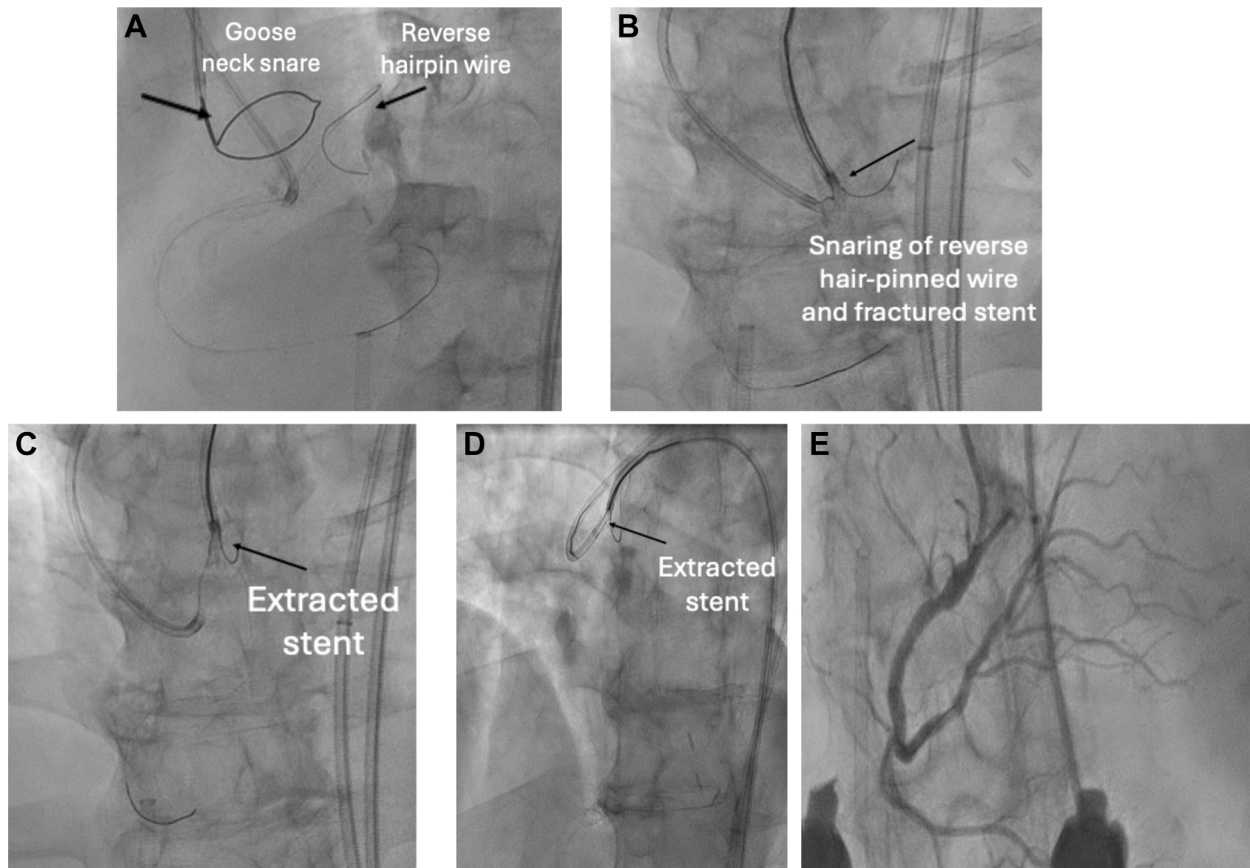
Significant protrusion of an aorto-ostial coronary stent may preclude safe TAVR. The RASE technique provides a simple, reproducible, guidewire-controlled

strategy for extraction of the protruding stent segment, restoration of a flush coronary ostium, and facilitation of follow-on definitive valve therapy.

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Dr Filho declares consulting fees, proctor fees (CTO complex coronary intervention), and speaker honoraria from Boston Scientific. Dr Truesdell declares consulting/speaking fees/honoraria from Abiomed, Chiesi, Getinge, and Zoll. Dr Cilia declares speaker/consultant fees from Abiomed, Abbott, Boston Scientific, and Terumo. All other authors have reported that they have no relationships relevant to the contents of this paper to disclose.

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FIGURE 7 Snaring, Avulsion, and Extraction of the Protruding Stent Segment

(A) Fluoroscopic demonstration of goose neck snare and reverse hairpin wire (black arrows). (B) Fluoroscopic demonstration of snaring of reverse hair-pinned wire and fractured stent (black arrow). (C) Fluoroscopic demonstration of stent extraction after controlled traction is applied to snared wire and fractured stented segment (black arrow). (D) Fluoroscopic demonstration of extracted stent segment in the ascending aorta. (E) Final angiogram.

REFERENCES

- Filho EM. Reverse Wire Technique for Angulated Side Branches. *Cardiac Interventions Today*. September/October 2021. <https://citoday.com/articles/2021-sept-oct/reverse-wire-technique-for-angulated-side-branches>
- Leibundgut G, Bilal Iqbal M, Ungureanu C, et al. Excessive ostial stent protrusion: evaluation of management strategies and clinical outcomes of the side flap technique. *Catheter Cardiovasc Interv*. 2026;107(6):1884–1898. <https://doi.org/10.1002/ccd.70545>
- Damarkusuma A, Mota P, Patel B, Oommen M. Consequences and management of excessive ostial stent protrusion: a case report. *Interv Cardiol*. 2024;19:e04. <https://doi.org/10.15420/icr.2023.34>
- Fairley SL, Hordern M, Arshad M, et al. Real-time IVUS guided (RTIG) ostial stenting: a step-by-step guide. *JACC Case Rep*. 2026;31(6):106346. <https://doi.org/10.1016/j.jaccas.2025.106346>
- Leibundgut G, Kovacic M, Cocoi M, Rinfret S. Interventional applications for an ostial protection guidewire-the WALPO technique. *Catheter Cardiovasc Interv*. 2024;104(7):1447–1451. <https://doi.org/10.1002/ccd.31274>
- Fischell TA, Saltiel FS, Foster MT, Wong SC, Dishman DA, Moses J. Initial clinical experience using an ostial stent positioning system (Ostial Pro) for the accurate placement of stents in the treatment of coronary aorto-ostial lesions. *J Invasive Cardiol*. 2009;21(2):53–59.
- Nguyen-Trong PKJ, Martinez Parachini JR, Resendes E, et al. Procedural outcomes with use of the flash ostial system in aorto-coronary ostial lesions. *Catheter Cardiovasc Interv*. 2016;88(7):1067–1074. <https://doi.org/10.1002/ccd.26613>

KEY WORDS intravascular ultrasound, percutaneous coronary intervention, stents

APPENDIX For supplemental videos, please see the online version of this paper.