ESC European Society of Cardiology

European Heart Journal - Case Reports (2020) **4**, 1–5
doi:10.1093/ehjcr/ytaa298

CASE REPORT
Coronary heart disease

Rotational atherectomy through a coronary artery bypass graft after transcatheter aortic valve implantation: a case report

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Received 14 April 2020; first decision 5 May 2020; accepted 5 August 2020; online publish-ahead-of-print 23 September 2020

Background Aortic stenosis (AS) in the elderly is frequently associated with complex coronary artery disease. Rotational atherectomy (RA) in this clinical setting is challenging because coronary slow flow could lead to haemodynamic instability aggravated by the severe AS.

Case summary We present the case of an 83-year-old woman with symptomatic severe AS, mildly decreased left ventricular ejection fraction and history of coronary artery bypass grafting with right internal mammary artery (RIMA) to the right coronary artery (RCA) and left internal mammary artery to the left anterior descending artery and further percutaneous coronary intervention (PCI) to the circumflex. First, we performed a transcatheter aortic valve implantation (TAVI) to treat the severe AS. Because of persistent symptoms despite good result, we then performed RA of the native RCA through the RIMA with a Guidezilla® guide extension catheter.

Discussion A two-staged procedure of TAVI and PCI with RA of the RCA via RIMA was successfully performed. We decided to perform the PCI after the TAVI to allow a better haemodynamic tolerance of the complex coronary intervention. This procedure needs caution as the conduit is fragile and could be easily damaged during the RA. No data are available about feasibility and safety of RA through a native graft, but this could be a first step to consider it.

Keywords Percutaneous coronary intervention • Transcatheter aortic valve replacement • Rotational atherectomy • Case report

Learning points

- To demonstrate that in severe aortic stenosis (AS) patients with complex calcified coronary artery disease (CAD), transcatheter aortic valve implantation followed by complex percutaneous coronary intervention (PCI) could be an option.
- To understand that in PCI with rotational atherectomy (RA) in heavy calcified lesions using a guide extension catheter through arterial grafts is feasible and safe but needs careful preparation.
- In cases of combined severe AS and CAD, correction of AS first allows better haemodynamic stability during RA and should be considered.

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Handling Editor: Panagiotis Xaplanteris
Peer-reviewers: Kiran Sarathy; F. Aaysha Cader
Compliance Editor: Ross Thomson
Supplementary Material Editor: Peysh A. Patel

Introduction

Aortic stenosis (AS) in the elderly is frequently associated with coronary artery disease (CAD). Given the frequent complexity of CAD in the elderly with calcific AS, rotational atherectomy (RA) may be needed in some cases for coronary interventions.[1] Rotational atherectomy in patients with severe AS could be challenging because of the risk to develop slow-flow or no-reflow phenomena.[2] There are no reports on the safety and feasibility of elective use of RA through an arterial coronary graft. In patients with severe AS and indication for valve replacement, there is no consensus whether RA should be better performed before or after valve implantation.

Timeline

Day/month	Event
-3 months	Progressive shortness of breath (New York Heart Association III)
Day 1	First admission for recurrent dyspnoea, angina with heart failure
Day 2	• Transthoracic echocardiography: revealed severe aortic stenosis. Left ventricular ejection fraction 45% • Computed tomography showed an aortic valve area of 430 mm^2 and a perimeter of 74 mm
Day 3	Coronary angiogram showed chronic total occlusion of left anterior descending, right coronary artery with severe calcified stenosis, patent left internal mammary artery, and right internal mammary artery
Day 8	First procedure: right transfemoral transcatheter aortic valve implantation using ACURATE neo® M Aortic Valve System (Boston Scientific, USA)
Day 10	Patient discharged to home without complication
Day 32	Second admission because of recurrent angina and shortness of breath
Day 42	Second procedure: rotational atherectomy (burr size 1.25 mm) through right internal mammary graft using a guide extension catheter
Day 43	Discharge
6 months	Follow-up—free of symptoms

Case presentation

An 83-year-old woman was admitted to our institution for recurrent shortness of breath. Her past medical history revealed hypertension, CAD with coronary artery bypass grafting in 1998 with right internal mammary artery (RIMA) to right coronary artery (RCA) and left internal mammary artery (LIMA) to left anterior descending (LAD) artery with percutaneous coronary intervention (PCI) to circumflex artery during follow-up. The patient was taking ramipril, furosemide, clopidogrel, bisoprolol, and simvastatin. During the outpatient clinic follow-up, she developed progressive shortness of breath (New York Heart Association III) within the last 3 months. Finally, she came to emergency department with recurrent dyspnoea and angina. The physical cardiovascular examination revealed a mid-systolic ejection murmur that radiates to the carotid arteries, tachycardia, and clinical signs of heart failure.

Transthoracic echocardiography (TTE) showed severe AS (max velocity 4.1 m/s, aortic valve area 0.5 cm^2, mean gradient 42 mmHg) and mild mitral regurgitation. Left ventricular ejection fraction (LVEF) was 45% with inferior wall hypokinesia. Preprocedural computed tomography showed suitable percutaneous transfemoral access, an aortic valve area of 43 mm^2 and a perimeter of 74 mm. Coronary angiogram showed chronic total occlusion of both the LAD and RCA, with patent LIMA and RIMA to RCA and LAD, respectively, but importantly, a severe calcified RCA stenosis distally to the graft anastomosis (*Figure 1*). Society of Thoracic Surgery (STS) and EuroSCORE II were 5.5% and 6.39%, respectively. The case was discussed during the heart team meeting that concluded that porcelain aorta precluded conventional redo surgery.

First, we performed a percutaneous right transfemoral transcatheter aortic valve implantation **(**TAVI) under conscious sedation using the ACURATE neo™ M Aortic Valve System (Boston Scientific) bioprosthesis (Supplementary material online, *Video S1*). Post-TAVI TTE demonstrated an LVEF of 45% with same inferior wall motions abnormalities (WMA). The aortic mean gradient was 6.5 mmHg with a peak velocity of 1.7 m/s. There was mild paravalvular leak (PVL) with no pericardial effusion.

One month later, the patient still complained of angina and shortness of breath. The follow-up TTE showed inferobasal WMA with good transcatheter valve prosthesis function (mean gradient 4 mm Hg and mild PVL). We planned to treat the heavily calcified RCA using RA. Through a right radial access and using a 7/6 Fr Glide Sheath Slender® (Terumo, Japan), we selective engaged the RIMA using a 7 Fr 90 cm IMA guiding catheter. Then, we advanced a Finecross® MG (Terumo, Japan) microcatheter over an ASAHI SION blue® (ASAHI INTECC, Japan) coronary wire. Next, a 7 Fr Guidezilla® guide extension catheter (Boston Scientific, USA) was advanced up to the distal anastomosis of the RIMA-LAD graft (Supplementary material online, *Video S2*). Then, we switched for the Rotawire® floppy (Boston Scientific) to perform RA using a 1.25 mm bur with three short runs at 180 000 rpm (*Figure 2* and Supplementary material online, *Video S3*). After successfully debulking the lesion, we predilated with a 2.0 mm × 15 mm Emerge® semi-compliant balloon (Boston Scientific) and then we delivered a 2.5 mm × 18 mm zotarolimus-eluting stent Resolute Onyx® (Medtronic, USA) (Supplementary material online, *Video S4*). Finally, we optimized the stent deployment with using a 2.75 mm × 12 mm Pantera Leo® (Biotronik, Germany) non-compliant balloon.

The patient was discharged on the following day without any complications. At the 6-month follow-up visit, she was still free of symptoms.

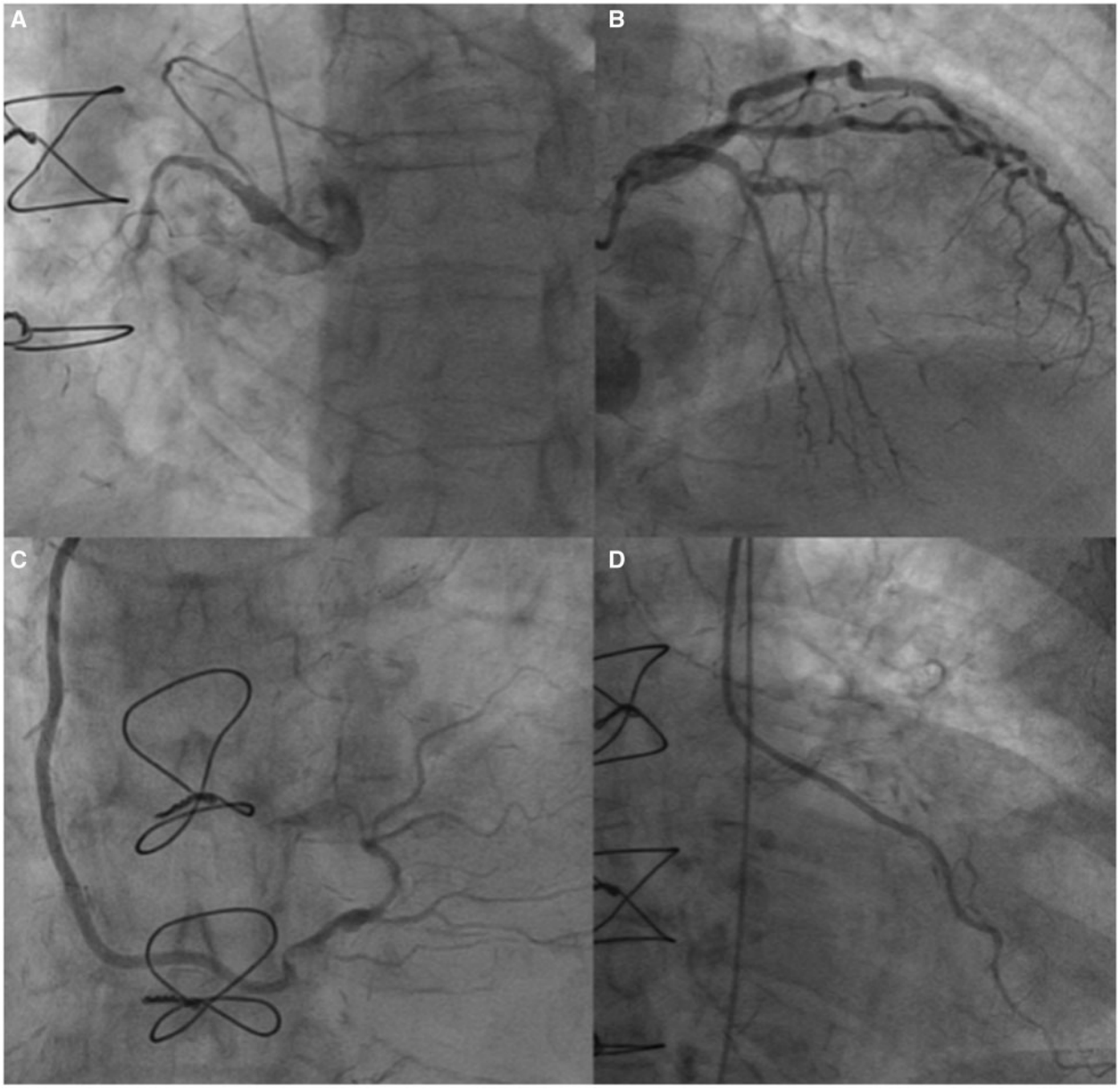


Figure 1 (*A*) Right coronary artery chronically occluded. (*B*) Left system with chronically occluded left anterior descending. (*C*) Right internal mammary artery to right coronary artery patent with severe calcified disease beyond anastomosis. (*D*) Left internal mammary artery to left anterior descending patent.

Discussion

Significant CAD is found in 40–75% of patients who undergo TAVI for severe AS.[3] In the elderly, although the association of AS and calcified CAD is frequent, its prognosis remains controversial.[4] Percutaneous coronary intervention for calcified lesions remains a challenge, primarily because of adverse plaque characteristics, which may result in device delivery failure, incomplete stent expansion, malapposition of stent struts, and subsequent restenosis.[5]

Given the frequent complexity of CAD, with high prevalence of calcified lesions in the elderly with AS, RA may be needed in significant proportion of cases to allow proper stent delivery and deployment.[1] In this case, we favoured the use of RA because the lesion was heavily calcified.

Revascularization of proximal lesions >70% is recommended before TAVI procedure, in the latest revascularization guidelines.[6] This recommendation is based on the fact that coronary access can be technically challenging after a TAVI and therefore, 'prophylactic' PCI could be useful.

Given the characteristics of CAD and the lack of clear recommendations for PCI in severe AS, caution is required when treating this high-risk population. Rotational atherectomy in the clinical setting

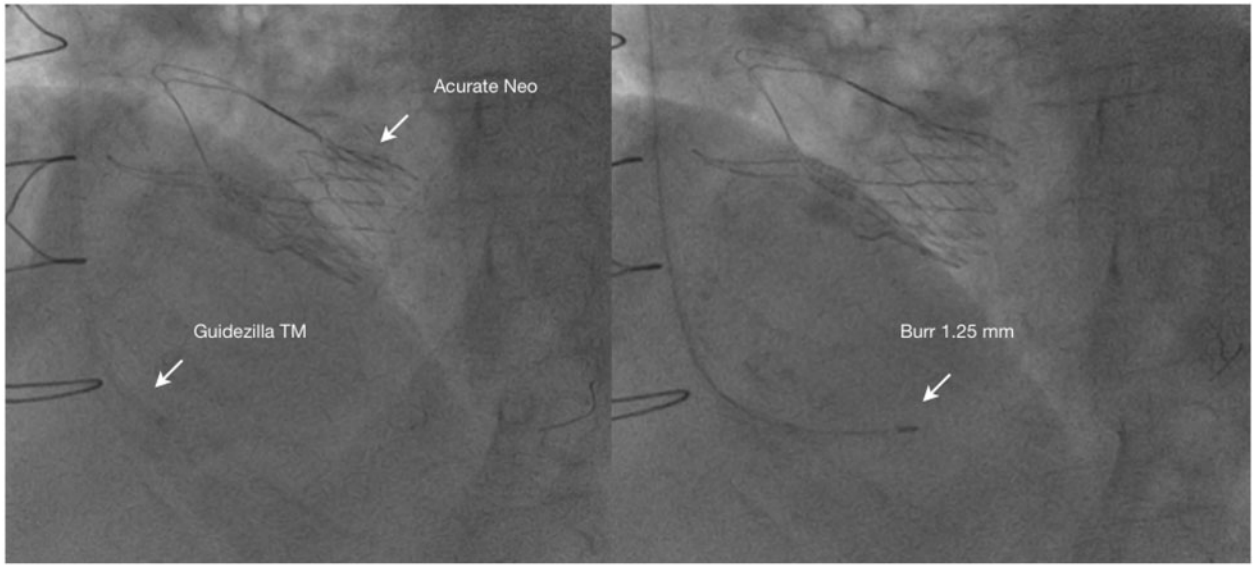


Figure 2 (*A*) Set up for rotational atherectomy via internal mammary artery: guide extension catheter (Guidezilla®) was taken further distally to the anastomosis of the graft—microcatheter was placed over a coronary wire to allow quick exchange for the Rotawire®. (*B*) Rotational atherectomy burr was then advanced through the guide extension catheter up to the lesion and atherectomy was then performed.

seems challenging because of the risk of coronary slow flow that can lead to haemodynamic instability, particularly in case of severe AS.[2]

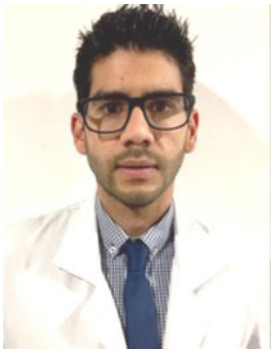
In this case, we decided to perform PCI following the AS treatment. Indeed, this allowed a better haemodynamic tolerance of PCI and the access route for the stent delivery was not interfering with the transcatheter heart valve prosthesis (stent delivery through the RIMA). We decided not to perform any viability study because the TTE showed hypokinesia in the RCA territory and the artery (RCA) was patent with focal disease. Initial symptoms were potentially attributable to AS or CAD. However, persistence of symptoms after AS correction in the context of severely diseased but patent coronary artery, were thought to be enough to justify upfront PCI without further ischaemia testing. Although the use of intracoronary imaging is considered almost mandatory in complex PCI cases, it could not be performed in this case because of financial issues.

To the best of our knowledge, there is no available data about feasibility or safety of RA through an internal mammary artery graft. Here we describe the first case of RA to a native coronary artery via an arterial coronary graft. This procedure needs caution as these conduits are fragile and could be easily damaged during RA steps [Dynaglide® (low-speed rotation) and atherectomy]. Therefore, our recommendation is to protect the graft using a guide extension catheter further distal to the graft anastomosis site. Due to manufacturer recommendations, a 1.25 burr was used via a 7 Fr guide extension catheter using a mother and child technique.

Conclusion

In patients with severe AS and complex calcified CAD, TAVI followed by complex PCI could be an option. Percutaneous coronary intervention with RA in heavily calcified lesions using a guide extension catheter through native arterial coronary graft is feasible and safe but needs careful preparation. In this specific setting, correction of AS first could be considered because this allows better haemodynamic stability during RA.

Lead author biography



Edgar Illescas is a Medical Doctor with specialty training in Interventional Cardiology at the National Institute of Cardiology in México. He had previous experience on management and leadership as a Chief Resident of Internal Medicine, Guatemalan 2014 and Chief Resident of Cardiology specialist in the National Institute of Cardiology 'Ignacio Chávez', México City 2017–2018. He had strong interest in research, currently undergoing a Master on Science (MSc) degree at the National Autonomous University of México, with five published papers in scientific journals. He had international training experience with short training periods in Children Hospital Boston 2008 and La Timone Hospital Marseille France in TAVI.

Supplementary material

Supplementary material is available at *European Heart Journal - Case Reports* online.

Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as Supplementary data.

Consent: The author/s confirm that written consent for submission and publication of this case report including image(s) and associated text has been obtained from the patient in line with COPE guidance.

Conflict of interest: none declared.

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