

# Non-ST-elevation myocardial infarction after complex percutaneous coronary intervention and transcatheter aortic valve implantation: a case report of bioprosthesis-related delayed coronary obstruction and its difficult diagnosis

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## Background

There is a high coincidence of significant coronary artery disease and severe aortic stenosis. Coronary revascularization should be performed prior to transcatheter aortic valve implantation (TAVI). We report a case of non-ST-elevation myocardial infarction (NSTEMI) after complex percutaneous coronary intervention (PCI) prior to TAVI, where differential diagnosis between coronary stent failure and bioprosthesis-related sinus obstruction was substantial.

## Case summary

A 79-year-old woman was re-admitted to the hospital 5 days after TAVI due to troponin-negative new-onset angina. She underwent complex PCI 3 days before TAVI and was not compliant to medications. Symptoms initially resolved after re-establishment of anti-hypertensive treatment. There were no signs of aortic bioprosthesis failure, paravalvular leak, or myocardial ischaemia. After 1 month, the symptoms re-occurred. Due to elevated troponins, myocardial ischaemia in electrocardiogram and new contractility disorders, NSTEMI was diagnosed. Because it was impossible to intubate the left coronary artery (LCA), cardiac surgery was performed. Calcified native coronary leaflet was pushed by the stent frame of aortic bioprosthesis towards LCA ostium causing its subtotal occlusion. Transcatheter heart valve (THV) was removed and the new surgical aortic bioprosthesis was implanted. Further hospitalization and 1-month follow-up were uneventful.

## Discussion

Pre-procedural assessment is crucial prior to THV interventions. Delayed coronary obstruction caused by the native leaflet is extremely rare and potentially fatal complication of TAVI. The diagnosis is difficult and high clinical suspicion is required to detect this pathology. Given our experience, the indication towards interventional or surgical repair should be established faster to avoid coronary ischaemia.

## Keywords

ACS • Case report • NSTEMI • TAVI • TAVR • SAVR

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## Learning points

- There is a high prevalence of coronary artery disease in patients with severe aortic stenosis, which makes its treatment and further patient management even more challenging.
- Coronary stent failure symptoms may manifest similarly to early and late transcatheter aortic valve implantation complications.
- Delayed coronary obstruction is an extremely rare, potentially fatal complication of transcatheter aortic valve implantation that requires high diagnostic vigilance, accuracy, and immediate treatment.

## Introduction

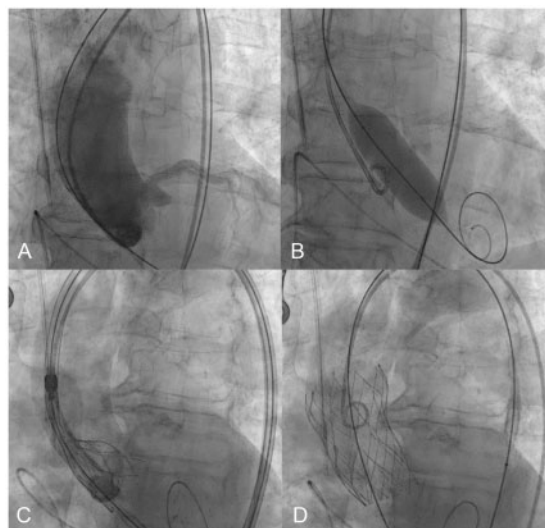
The prevalence of significant coronary artery disease (CAD) among patients with severe aortic stenosis (AS) ranges from 40% to 75%.<sup>1–3</sup> Recently, randomized controlled trials showed that transcatheter aortic valve implantation (TAVI) is non-inferior (with regard to its short-term safety and efficacy) to surgical aortic valve replacement (SAVR) and therefore may serve as first-line treatment option for patients with severe AS also in low-risk patients.<sup>4,5</sup> Current guidelines recommend coronary revascularization prior to TAVI, mainly due to the reason that percutaneous coronary access might be more challenging after implanting a stented bioprosthesis.<sup>6,7</sup> We report a case of late non-ST-elevation myocardial infarction after complex percutaneous coronary intervention (PCI) and consecutive TAVI, where accurate clinical assessment and differentiation between coronary stent failure and bioprosthetic valve-related sinus obstruction was pivotal to the treatment success and survival of the patient.

## Timeline

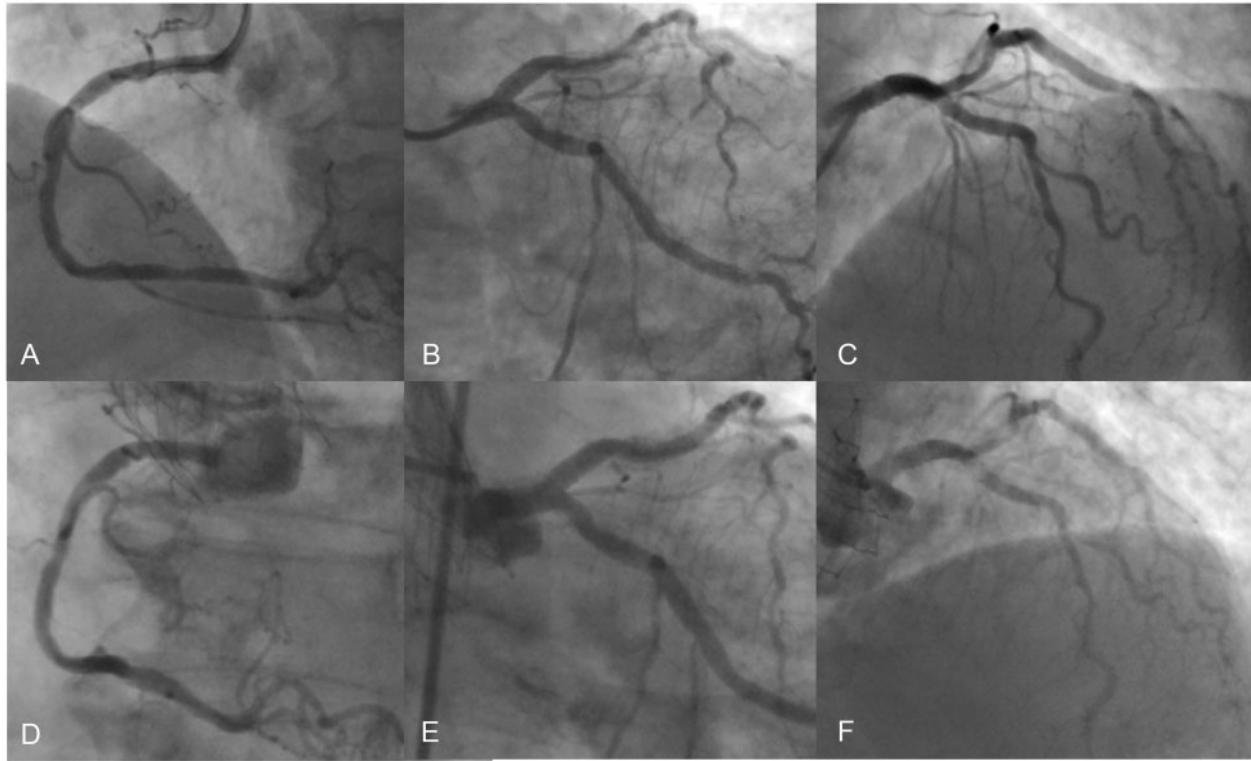
Day	Event
1	Complex percutaneous coronary intervention with drug-eluting stent implantation in proximal right coronary artery and two drug-eluting stents implantation in distal left main coronary artery towards left anterior descending artery.
4	Transfemoral transcatheter aortic valve implantation.
7	Hospital discharge number 1.
9	First re-admission to the hospital due to troponin-negative new-onset angina. Optimization of medical therapy and resolution of symptoms. No signs of aortic bioprosthesis failure, paravalvular leak, or myocardial ischaemia.
15	Hospital discharge number 2.
45	Second re-admission to the hospital due to troponin-positive onset angina with left ventricle global contractility disorders and signs of ischaemia in electrocardiogram. Diagnosis of non-ST-elevation myocardial infarction.
48	Cardiac surgery and final diagnosis of left coronary artery ostium subtotal obstruction by calcified native coronary leaflet pushed by the stent frame of aortic bioprosthesis. Surgical aortic valve replacement.
55	Hospital discharge number 3.
85	Uneventful 1-month follow-up.

## Case presentation

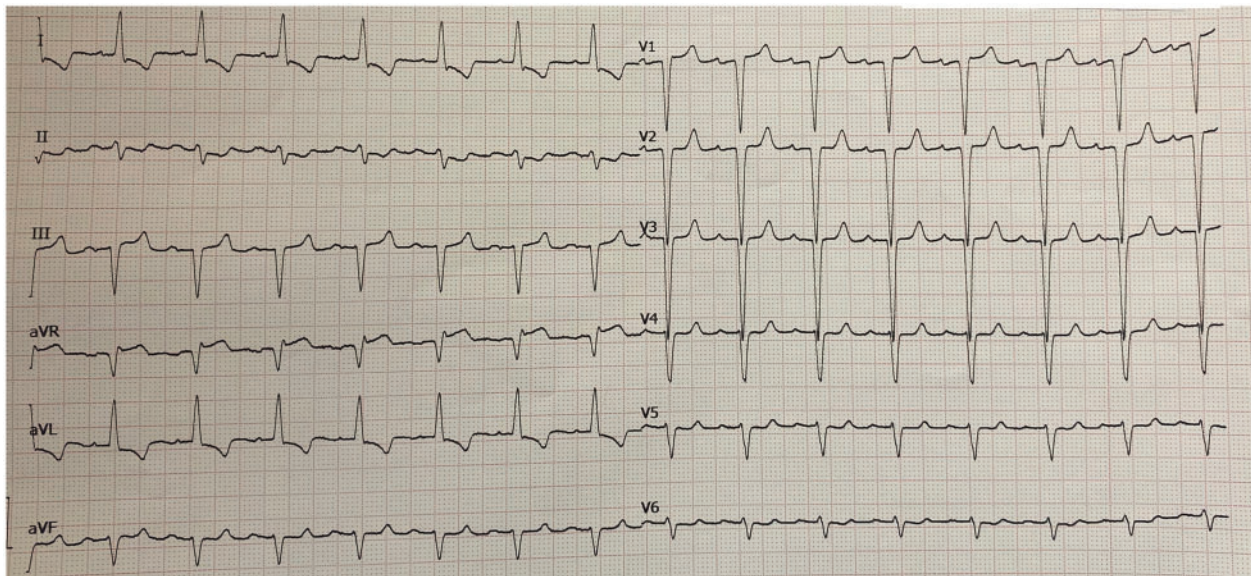
A 79-year-old female patient was re-admitted to the hospital 5 days after transfemoral TAVI (Figure 1 and Supplementary material online, Figure S1) due to dyspnoea and new-onset angina without elevated cardiac enzymes (Canadian Cardiovascular Society Class II). She underwent PCI with complex coronary revascularization (PCI of the proximal segment of the right coronary artery and subsequent PCI of the left main coronary artery towards left anterior descending artery) 3 days prior to TAVI (Figure 2A–C), however, she was not compliant to prescribed dual antiplatelet and anti-hypertensive therapy. Her past medical history included CAD, arterial hypertension, left ventricle hypertrophy, moderate chronic kidney disease, and chronic sideropenic anaemia. Transthoracic echocardiography (TTE) and stress magnetic resonance imaging were performed which did not show any signs of aortic bioprosthesis



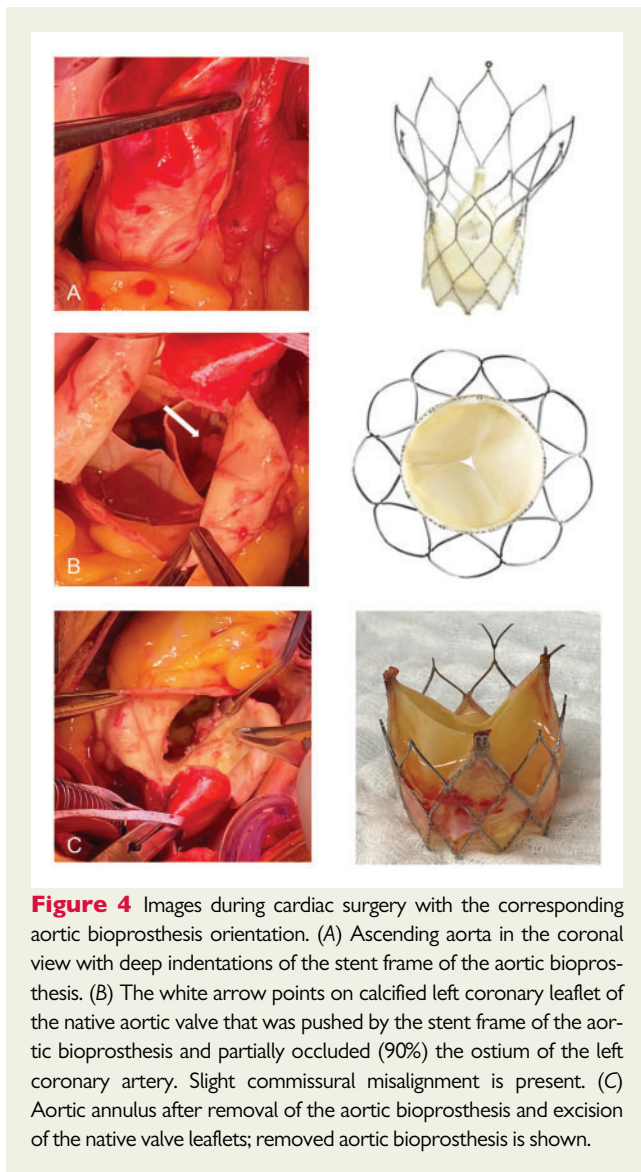
**Figure 1** Transcatheter aortic valve implantation. (A) Angiography of the aortic root with the 6 Fr Pigtail catheter. (B) Predilatation of the native aortic valve annulus with 20 mm non-compliant balloon. (C) Positioning and partial expansion of the self-expandable, high-frame aortic bioprosthesis with intra-annular leaflet position (29 mm, Portico Transcatheter Heart Valve, Abbott, Chicago, IL, USA). (D) Final result after the deployment of aortic bioprosthesis with optimal implant position and without procedural complications. There was no paravalvular leak, no conduction disorders, nor significant transvalvular gradient detected peri- and post-procedurally.



**Figure 2** Fluoroscopic images of coronary arteries. (A–C) Pre-transcatheter aortic valve implantation. (A) Right coronary artery in the left anterior oblique view after percutaneous coronary intervention of 70–80% lesion in the proximal segment with direct drug-eluting stent implantation and optimal result. (B) Left coronary artery in the spider view after percutaneous coronary intervention of 60–70% lesion in the distal left main coronary artery towards proximal left anterior descending artery with 2 × DES implantation (with use of provisional stenting technique) and optimal result. (C) Left coronary artery in the left anterior oblique cranial view. (D–F) Post-transcatheter aortic valve implantation. Decreased coronary flow in the left coronary artery; no signs of stent failure; unclear structure in the area of the left coronary sinus that disabled intubation of the left coronary artery. DES, drug-eluting stent; LAD, left anterior descending artery; LAO, left anterior oblique; LCA, left coronary artery; LMCA, left main coronary artery; PCI, percutaneous coronary intervention; RCA, right coronary artery; TAVI, transcatheter aortic valve implantation.

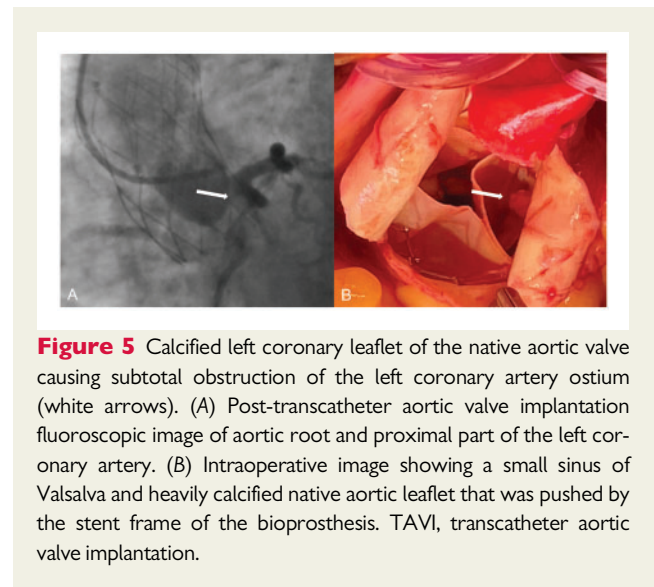


**Figure 3** Electrocardiogram. Sinus rhythm of 84 b.p.m., sinusogram, incomplete left bundle branch block with ST-segment depression in leads I, II, aVL, and V4–V6.



failure, paravalvular leak, or inducible myocardial ischaemia. The chest X-ray was comparable to the previous examinations. The patient was released home with instructions to comply with the prescription.

One month later, the patient represented with recurrent angina symptoms and was re-admitted to the hospital. She was haemodynamically stable with a regular heart rate, elevated arterial blood pressure (155/74 mmHg), and elevated cardiac enzymes (high-sensitivity troponin level fluctuated around 800 ng/L). An electrocardiogram (ECG) showed sinus rhythm of 84 b.p.m. with signs of myocardial ischaemia (Figure 3). TTE revealed normal valve function, but also showed impaired global contractility and mildly decreased left ventricular ejection fraction (LVEF = 40%). Non-ST segment elevation myocardial infarction was suspected and the patient was transferred directly to the catheterization laboratory. No signs of stent failure, such as underexpansion, undersizing, malapposition, or thrombosis, were seen during coronary angiography. However, the native left coronary leaflet was pushed towards the sinus of Valsalva,



potentially causing flow obstruction towards the left coronary sinus. This was the most plausible explanation for the patient's symptoms. Despite the use of multiple diagnostic catheters, it was not possible to intubate the left coronary artery (LCA) and perform selective contrast injection (Figure 2D–F). Subsequently, the patient underwent cardiac surgery with sternotomy and cardiopulmonary bypass (Figure 4). The calcified native left coronary leaflet was pushed towards the ostium of the LCA by the stent frame of the aortic bioprosthesis causing subtotal occlusion (Figure 5). The transcatheter heart valve (THV) was removed surgically, the calcified leaflets of the native aortic valve excised, and a new surgical aortic bioprosthesis was implanted (Perimount Magna Ease 21 mm, Edwards LifeSciences, Irvine, CA, USA). Pre-procedural ischaemic ECG changes resolved completely. Further post-operative course and the 1-month follow-up were uneventful. TTE revealed a preserved LVEF.

## Discussion

Coronary obstruction is a potential complication after TAVI that usually manifests as acute coronary syndrome immediately after the procedure.

A recent analysis suggests that this is more prevalent after balloon-expandable valve implantation.<sup>8</sup> Several factors may impact coronary access and can be categorized into anatomical (sinotubular junction dimensions, sinus height and width, leaflet length and calcification pattern, coronary take-off height, small annulus) and device-related factors (commissural alignment, skirt height, bioprosthesis implantation depth).<sup>9</sup> Pre-procedural assessment comprising exact risk evaluation, precise multimodal imaging, and proper planning are crucial prior to THV interventions.

Delayed coronary obstruction (including obstruction by the native coronary leaflet) is rarely reported (<0.2% incidence) but potentially fatal after TAVI with a high in-hospital death rate, especially in case of low coronary take-off.

It may occur after hours, days, or even weeks after the procedure and involves in over 90% of cases the LCA.<sup>10</sup> This is the second case of delayed coronary obstruction that we encountered in our institution. The first one was also triggered by a self-expandable aortic THV, but successfully treated with PCI and coronary stent implantation.<sup>11</sup>

Self-expandable valves are designed differently to balloon-expandable valves. Several centres tend to use self-expandable and retrievable THVs in patients with a low coronary take-off and/or small sinus of Valsalva. In case of ECG changes indicating myocardial ischaemia and new-onset angina during the implantation, these valves can be either repositioned or completely retrieved if necessary. Nevertheless, as these valves are more often used in high-risk situations, such observations might be more prone to a selection bias.

The diagnosis of bioprosthesis-related delayed coronary obstruction is difficult and high clinical suspicion is required to detect this pathology. Precise pre-procedural risk stratification and preparation of peri-procedural bail-out procedures are imminent factors for the success and the safety of a THV implantation. Importantly, the threshold towards interventional or surgical revascularization should be low to avoid chronic or acute coronary ischaemia.

## Lead author biography



Dr Piotr Nikodem Rudziński is an interventional cardiologist working in the Department of Coronary and Structural Heart Diseases, in the Cardinal Stefan Wyszyński National Institute of Cardiology in Warsaw, Poland. In his everyday practice, he works in the both clinical and investigational field. For the most part, he is dealing with interventional treatment of structural heart diseases and

coronary artery disease. At the time of case preparation, he performed a clinical fellowship in the Cardiac Surgery Department, in the General Hospital in Vienna, Austria, where the patient was admitted, diagnosed, and treated.

## Supplementary material

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

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**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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