Case Report

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Critical stenosis of left main coronary artery as a late presentation after transcatheter aortic valve replacement: A case report and review literature

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Summary

Transcatheter aortic valve replacement (TAVR) is an alternative treatment for selected patients with severe aortic valve stenosis who are at high risk for conventional surgery. Critical stenosis of left main coronary artery as a late complication after TAVR is quite rare.

Keywords

Transcatheter aortic valve replacement, left main coronary artery stenosis.

Case description

A 76-year-old female with a history of coronary artery disease and previous non-ST elevation myocardial infarction (NSTEMI) in September 2020 was treated conservatively without coronary angiography and intervention. She also had a history of diabetes mellitus, hypertension, cerebral transient ischemic attacks in 2017, and severe symptomatic aortic stenosis. She was evaluated in an outpatient setting for her worsening exertional dyspnea for the last 4 months, and her severe degree of aortic stenosis and mildly reduced systolic function of left ventricle were confirmed. She was deemed at high risk for surgical aortic valve replacement, with a Society of Thoracic (STS) score of 15%. She was admitted on the 2nd of February 2022 for coronary angiography with possible coronary intervention and femoral transcatheter aortic valve replacement (TAVR). Transthoracic echocardiography demonstrated mild hypokinesia in anteroseptal and posterior wall of left ventricle with mildly reduced systolic function and estimated ejection fraction of 40% in addition to a picture of severe aortic stenosis (estimated aortic valve area of 0.80 cm^2 and indexed valve area of 0.50 cm^2/m^2). Electrocardiogram showed sinus rhythm with no conduction abnormalities. Contrast-enhanced computed tomography (CT) demonstrated annulus surface area and annulus perimeter of 347 mm^2 and 69 mm, respectively. The coronary ostia heights and sinuses of Valsalva dimensions were measured and found within the adequate measures (left coronary artery ostium height of 11.5 mm, right coronary artery ostium height of 13 mm, sinus of Valsalva dimensions of 31 mm, and aortic annulus diameter of 21 mm). The ratio of left leaflet length to coronary sinus height was of 0.8. A moderate calcification of aortic valve cusps was also reported on CT. Coronary angiography indicated non-flow limiting stenosis of left main coronary artery, severe stenosis of proximal left anterior descending (LAD) artery, a severe stenosis of ostium of left circumflex (LCx) artery, and mild disease of right coronary artery. After a successful angioplasty to proximal LAD artery with 1 drug-eluting stent (DES) and then during the attempt to recanalise proximal LCx, the patient had cardiac arrest with ventricular tachycardia, and then fibrillation ensued, requiring cardiopulmonary resuscitation (CPR) and defibrillation. Peripheral cardiopulmonary bypass was established emergently via the left common femoral artery and vein to stabilize the hemodynamic parameters facilitating the deployment of 23 mm Edwards Sapien 3 aortic bioprosthesis in a satisfactory position (Figure 1). The revascularization of LCx coronary artery completed with the insertion of 1 DES. The final angiographic picture of coronary arteries and bioprosthetic valve showed patent left main artery and a thrombolysis in myocardial infarction (TIMI) 3 flow in LAD and LCx arteries and good position of bioprosthetic aortic valve with minimal leak (Figure 2). She was transferred to coronary intensive care unit, and peripheral cardiopulmonary bypass was discontinued in the evening and extubated next day morning. Her stay in hospital went smooth, and she was discharged home after 3 days. Her symptoms markedly improved during her outpatient follow-up.

Figure 1. Stages of valve deployment during transcatheter aortic valve replacement. A- Aortography, B- Predeployment position of an Edwards Sapien 3 valve guide by Valve balloon marker (red arrow), C-Final optimal position of deployed valve.

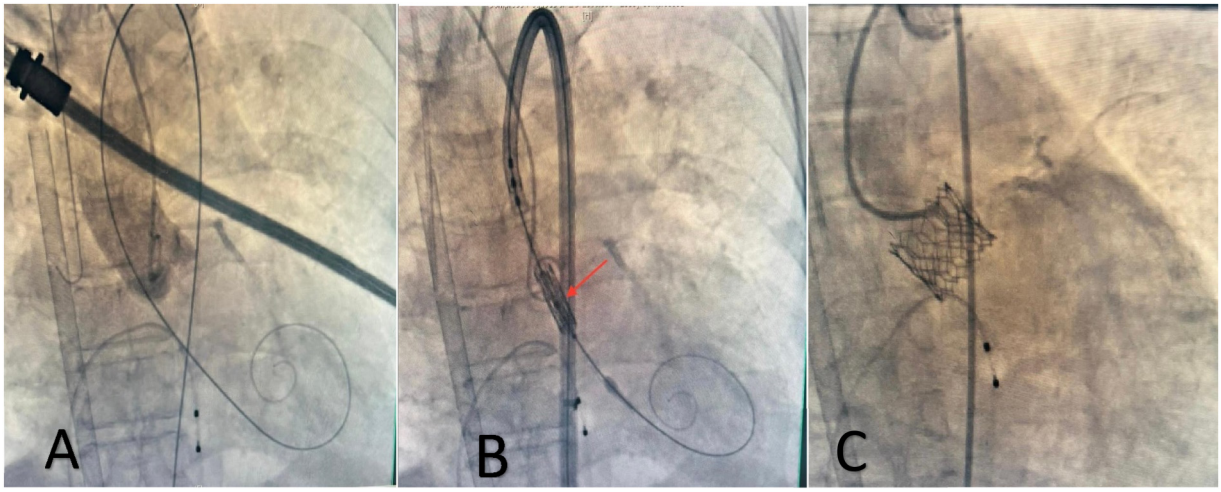


Figure 2. Final picture after percutaneous coronary intervention of LAD and LCx with DES (green thin arrows) and transcatheter aortic valve replacement (TAVR) with S3 bioprosthetic valve (red thick arrow). Patent LM (black thick arrow). LM – left main coronary artery. LAD – left anterior descending coronary artery, LCx- left circumflex coronary artery, S3 valve– Sapien S3 bioprosthetic valve, DES- Drug eluting stent.

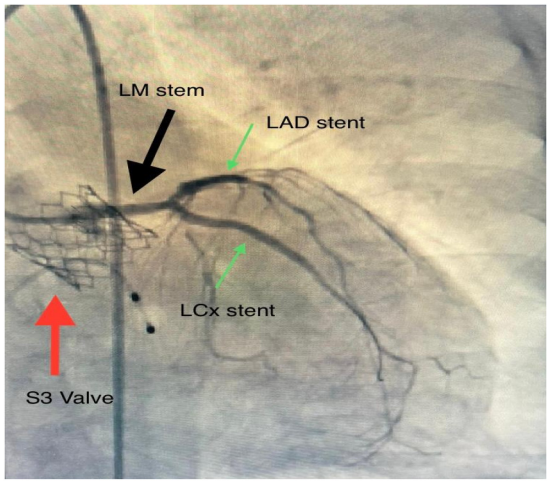
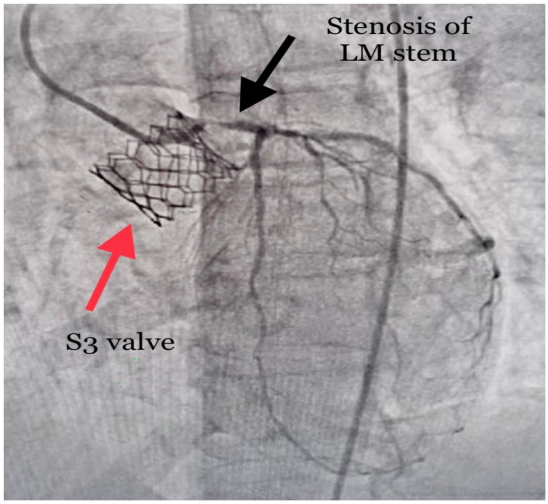
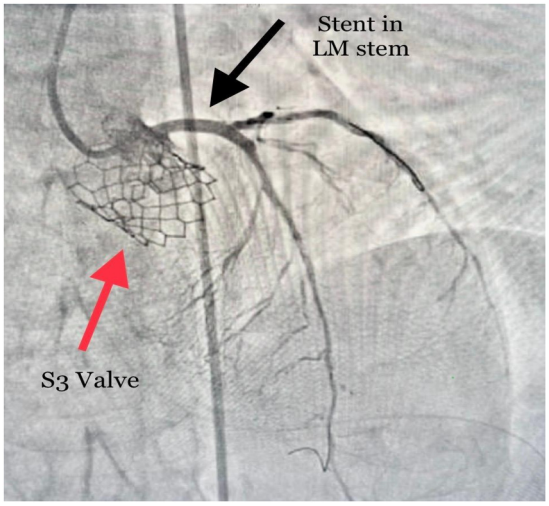


Figure 3. Severe stenosis of left main coronary artery stem (black arrow). LM – left main coronary artery, S3 valve- Sapien S3 bioprosthetic valve.



In the beginning of May 2022, she was admitted with picture of NSTEMI complicated with cardiac arrest due to ventricular fibrillation requiring CPR and defibrillation. She was intubated and rushed to catheterization laboratory (Cath Lab). Coronary angiography from right femoral access revealed a critical stenosis of the left main stem (Figure 3) and patent previous stents. During coronary angiography, she became hypotensive, and an intraaortic balloon pump was inserted using left femoral access. Left main stem disease was treated with a single DES from proximal LAD artery all the way to the ostium of left main artery. Coronary angiography revealed good result with TIMI 3 flow (Figure 4), and this was confirmed with intravascular ultrasound. The hemodynamic parameters of the patient improved toward the end of the procedure, and the intraaortic balloon pump was removed

Figure 4. Final picture post left main coronary artery stent (black arrow). LM- left main coronary artery, S3 valve-Sapien S3 bioprosthetic valve (Red arrow).



inside Cath Lab. There was no immediate complication. Patient was extubated next morning and discharged home after 2 days in good condition. Her LDL level was 1.3 mmol/L and her HBA1c was 6.

Our case reported a critical stenosis of left main coronary artery that was detected 3 months after successful transcatheter implantation of bioprosthetic aortic valve and treated with stent deployment in left main stem with successful recanalization. This as a late presentation is considered a rare complication and should be considered in patients with previous history of TAVR.

Discussion

TAVR is a minimally invasive procedure that has emerged in the last decade and was approved for selected patient with severe degenerative aortic valve stenosis. In 2021, the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS) recommended TAVR under class IA for severe aortic stenosis in older patients (>75 years) or in those who are at high risk (Society of Thoracic Surgeons-Predicted Risk of Mortality: STS-PROM/European System for Cardiac Operative Risk Evaluation: EuroSCORE II >8%) or unsuitable for surgery.[1] Being less invasive in character did not stop the variety of complications that may occur during and after TAVR including fatal and nonfatal one. Coronary artery obstruction during or immediately after TAVR is a rare complication, and the incidence rate reported from large TAVR Registries and the PARTNER Trial is between 0% and 1.2%.[2] The clinical manifestation of this complication occurs immediately in 88% of patients, and in few cases, a migration of the aortic valve with subsequent obstruction is described within the initial 48 h after implantation.[3] First case of coronary obstruction during TAVR was reported by Webb et al. in 2006.[4] In Brazilian TAVR registry, coronary obstruction occurred in 3 out of 418 TAVR cases (0.72%).[5] In 87% of cases, the left coronary artery is the most commonly involved. The anticipation of coronary obstruction as a possible complication of TAVR can be made based on the anatomical information derived from CT angiography including sinus of Valsalva dimension of less than 28 mm and coronary ostium height dimensions (distance between the aortic annulus and the coronary ostia) of less than 10 mm.[6] Additional risk factor which might be an additional useful predictor of coronary occlusion during TAVR is the ratio of leaflet length to coronary sinus height of greater than 1 which was reported in a case report by Spina et al.[6] Another case report by Okuyama et al. revealed that the ratio of more than 1 was also associated with acute coronary obstruction after TAVR in the absence of the other classical risk features.[7] Other risk factors not related to CT angiographic measures are being a female gender, the use of balloon expandable prosthesis, TAVR with valve in valve technique as a treatment for bioprosthesis dysfunction, and significantly calcified native leaflets. The presence of one or some of these risk predictors can explain the possible mechanism through which coronary obstruction may happen during or after TAVR. A poorly positioned bioprosthesis can cover the coronary ostium, whereas low-lying coronary ostium patient can be the cause of obstruction in properly positioned valve. The bulky calcification of native leaflets can be the base of obstruction by occupying part or whole coronary ostium either by leaflet displacement or by fragmented calcium dibres as reported by Saia et al. [8] Other less likely mechanisms include leaflet avulsion and migration into the ostium, as well as an extending hematoma near coronary ostia.[9] Clinical manifestation of such devastating complication can range from severe persistent hypotension and malignant ventricular arrhythmias up to cardiac arrest. Immediate action is always needed, and emergent percutaneous coronary intervention (PCI) is considered the treatment of choice. The PCI was required in 33 of 44 patients (75%) who experienced acute coronary occlusion during TAVR in a large registry study of more than 6500 TAVR procedure, and it was successful in 81.8% of cases.[2] In some reports, a residual compression was observed after deployment of stent in left main coronary artery which can be explained either by the resistance exerted by the struts of the bioprosthetic valve stent or by the calcified native leaflet. Some researchers suggested overcoming this compression through the use of second and/or even a third stent with a greater radial

force in order to improve the stent expansion if needed.[10] Other authors recommended a coronary protection strategy in patients with preexisting high-risk features for coronary obstruction that may mitigate the risk of such adverse events through the use of undeployed stent in respective coronary artery over guide wire that can be expanded when blood flow in the coronary artery is compromised.[11]

Ramirez et al. reported a case of very late occlusion of the right coronary artery (RCA) by a direct flow aortic valve 6 months after successful TAVR in a patient presented with STEMI, and he was treated with PCI to RCA. However, the patient passed away after few hours.[12]

In our case, we postulated that a possible delayed migration of the bioprosthetic valve caused a degree of stenosis of the left coronary ostium through its struts. At the time of presentation, a microthrombus or calcified debris led to a critical stenosis of the left main coronary artery. Fortunately, our patient responded well to immediate PCI with DES to left main coronary stem. Up to our knowledge, this is the second case report of late presentation of coronary stenosis 3 months after TAVR.

Conclusion

Coronary obstruction during or immediately after TAVR is rare but results in catastrophic complications. Critical stenosis of left main coronary artery as a late presented complication after TAVR is quite rare and should be considered in patients with previous history of TAVR.

Authors' contributions: JA conceived the idea for the case report. OM wrote the paper. AA, ZB, and RA provided the editorial input. All authors were involved in managing the patient bedside.

Consent: Written/verbal informed consent was obtained from the patient to publish this report in accordance with the journal's patient consent policy.

Conflicts of interest: There are no conflicts of interest.

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