

hybrid management of valve in valve TAVI with coronary grafting¹Sasiharan Nadesan, ¹Olusan Adeogo*1University Hospitals Leicester, UK***Abstract:**

An 81-year-old woman with a history of aortic root replacement using a 23 mm Shelhigh homograft in 2004 was referred for elective transcatheter aortic valve implantation (TAVI) due to progressive symptoms of exertional dyspnoea (NYHA III), dizziness, and lethargy. She had multiple comorbidities, including severe coronary artery disease, prior breast, colon, and thyroid cancers, type 2 diabetes mellitus, osteoarthritis, and a history of multiple surgical procedures.

Imaging revealed a failing bioprosthetic aortic valve with low coronary heights (LMS 1.1 mm) and significant ostial LMS and LAD disease. Given her high surgical risk, she was deemed unsuitable for redo Bentall's procedure. A hybrid approach was planned involving left thoracotomy for LIMA-LAD grafting followed by transfemoral TAVI.

The procedure was successfully performed using a 23 mm Evolut FX valve. Post-deployment, balloon dilation was required due to under-expansion. The patient developed transient anterolateral hypokinesia, likely due to competitive flow between the LMS and LIMA graft, which resolved spontaneously. She was discharged in stable condition after one week.

Conclusion:

This case highlights the feasibility of a hybrid approach combining minimally invasive coronary bypass and TAVI in patients with complex anatomy and high surgical risk, including those with prior bioprosthetic valves and low coronary take-off.

Key words: Transcatheter Aortic Valve Implantation (TAVI), Valve-in-Valve, Bioprosthetic Valve Failure

introduction

Aortic valve stenosis is a chronic and progressive disease. Valve replacement surgery should be performed when indicated. Bioprosthetic valves have a failure rate of approximately 5–15% over a 10-year follow-up period. *Valve-in-valve* percutaneous intervention is an emerging treatment option for degenerating bioprosthetic valves. We present a case of a patient with low-lying coronary arteries who was managed with transfemoral transcatheter aortic valve implantation (TF-TAVI) within a failing bioprosthetic aortic valve, along with minimally invasive coronary artery bypass grafting. [1,2]

Case Report

An 81-year-old woman was referred from Derby General Hospital for elective transcatheter aortic valve implantation (TAVI) due to a failing aortic bioprosthetic valve. She reported progressive symptoms over the previous 12 months, including exertional breathlessness (NYHA Class III), lethargy, and dizziness. Her past medical history was extensive and included: Aortic root replacement in 2004 with a 23 mm Shelhigh homograft (biological conduit), Type 2 diabetes mellitus (on Metformin), Osteoarthritis (awaiting right total hip replacement and bilateral total knee replacements), Left breast cancer (on Letrozole), Previous thyroid and colon cancers, right foot crush injury requiring skin grafting, emergency subtotal laparoscopic cholecystectomy in 2021, hypothyroidism, childhood meningitis and Atrial flutter with left bundle branch block (LBBB) on Apixaban. She is an ex-smoker. She mobilized with two sticks indoors and used a wheelchair outdoors due to osteoarthritis. She was a former smoker. She was allergic to Telmisartan, Bendroflumethiazide, and Perindopril.

Corresponding Author: Sasiharan Nadesan, Email: sasiharan3@gmail.com,  <https://orcid.org/0000-0002-6174-8202>, Submitted March 2025, Accepted June 2025



This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License, which permits unrestricted use, distribution and reproduction in any medium provided the original author and source are credited

Her regular medication are Alendronic acid, Apixaban 5 mg BD, Aspirin 75 mg OD, Atorvastatin 40 mg OD, Bisoprolol 2.5 mg OD, Losartan 25 mg OD, Bumetanide 2 mg OD, Empagliflozin 10 mg OD, Esomeprazole 40 mg OD, Ferrous sulfate 200 mg OD, Letrozole 2.5 mg OD, Levothyroxine 125 mcg OD, Macrogol, Metformin 500 mg BD, Paracetamol 1 g PRN, Peptac liquid PRN, Senna 7.5 mg nocte, and Sertraline 50 mg OD. Her Height was 1.56 m and her weight was 77 kg

Investigations showed the following: Hb 124 g/L, WCC $7.4 \times 10^9/L$, Platelets $160 \times 10^9/L$, CRP 11 mg/L, Creatinine 76 $\mu\text{mol/L}$, eGFR 64 mL/min/1.73 m², INR 1.0, HbA1c 49 mmol/mol, BNP 3448 ng/L. CT Analysis: Annular area: 268.2 mm² (17.6 $\times$ 19.3 mm), derived diameter 18.5 mm, Perimeter: 58.4 mm, derived diameter 18.6 mm, LMS height: 1.1 mm, RCA height: 3.3 mm, STJ height: 24 mm, Sinus of Valsalva: 23 mm, Internal diameter: 18.4 mm, Outer diameter: 23.1 mm, Right CFA: 7.5 mm, Left CFA: 7.6 mm. The Pre-TAVI Transthoracic Echo (TTE) showed Peak velocity: 3.34 m/s, Peak gradient: 44.6 mmHg, Mean gradient: 24.0 mmHg, Aortic valve area (AVA): 0.39 cm², VTI ratio: 0.14, Stroke volume index: 26.8 mL/m²

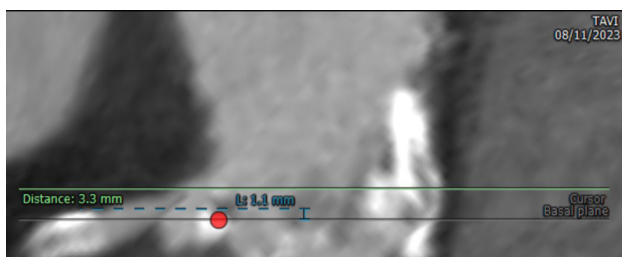


Figure 1: CT Aorta for TAVI showing low coronary heights

She had multiple admissions to the district general hospital over the past year with recurrent heart failure symptoms and was managed with intravenous diuretics. A TOE performed in February 2023 showed a transprosthetic peak velocity of 3.99 m/s, peak gradient 63 mmHg, mean gradient 37 mmHg, and AVA of 1.06 cm² by planimetry. There was also moderate-severe tricuspid regurgitation, a dilated LV (5.4 cm), and moderately impaired LV systolic function (EF ~40%).

Due to her low coronary heights and previous aortic valve replacement, she was initially referred for redo sternotomy and AVR. In February 2024, the cardiac surgeon reviewed her case and determined that a redo

Bentall's procedure would carry an unacceptably high risk of morbidity and mortality; thus, she was turned down for surgery.

She was admitted for an elective transfemoral (TF) TAVI under general anesthesia on 12/08/2024. Coronary angiography performed prior to the procedure revealed severe ostial left main stem (LMS) and proximal LAD disease, along with moderate mid-RCA disease. Given the very low coronary heights and significant coronary disease, the cardiothoracic surgeon offered to perform a thoracotomy with a LIMA graft to the LAD to facilitate TF TAVI.



Figure 2: Coronary angio of the left coronary

Hybrid Procedure was performed and the Pre-TAVI TTE: Peak velocity 3.34 m/s, PG 44.6 mmHg, MG 24.0 mmHg, AVA 0.39 cm², Bilateral CFA access (14F sheath right, 7F left), Wire-based pacing and the Invasive peak-to-peak gradient: 55.11 mmHg, mean gradient 43.17 mmHg

Following LIMA-LAD grafting via left thoracotomy, a 23 mm Evolut FX valve was successfully deployed. However, there was a significant residual peak-to-peak gradient (37.20 mmHg), indicating under-expansion. Post-dilation with an 18 mm Nucleus balloon was performed, resulting in improved hemodynamics with a final peak-to-peak gradient of 13.80 mmHg.

She tolerated the CABG well. After valve deployment, she developed transient anterolateral hypokinesia, likely due to competitive flow between the LMS and LIMA graft. This resolved within minutes. Repeat coronary angiography confirmed patency of the LMS, diagonal, and circumflex arteries, with competitive flow in the LAD.

Access sites (right and left CFA) were closed using two and one ProGlide devices, respectively. She remained an inpatient for approximately one week post-procedure and was discharged home from the surgical ward in stable condition.



Figure 3: Post TAVI fluoroscopy

Learning points of the procedure are that a hybrid procedure is feasible and safe in selected cases of valve-in-valve TAVI, especially in those with

very low coronary heights. Given the collaboration between cardiologists and surgeons, this highlights the importance of the ultimate hybrid team approach.

Abbreviations

TF TAVI -Trans femoral aortic valve implantation

Reference

1. Grondahl, B, Dhar, G. Valve in Valve in Valve. J Am Coll Cardiol Case Rep. 2019 Dec, 1 (4) 468–470. <https://doi.org/10.1016/j.jaccas.2019.08.020>
2. Rodriguez-Gabella T., Voisine P., Puri R., Pibarot P. and Rodés-Cabau J. : “Aortic bioprosthesis valve durability: incidence, mechanisms, predictors, and management of surgical and transcatheter valve degeneration”. J Am Coll Cardiol 2017; 70: 1013.