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ViViV TAVR for Severe Symptomatic Aortic Stenosis in a Degenerated Prior TAVR ViV: A Case Report

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Abstract

Background: Valve-in-valve-in-valve (ViViV) TAVR is rarely documented.

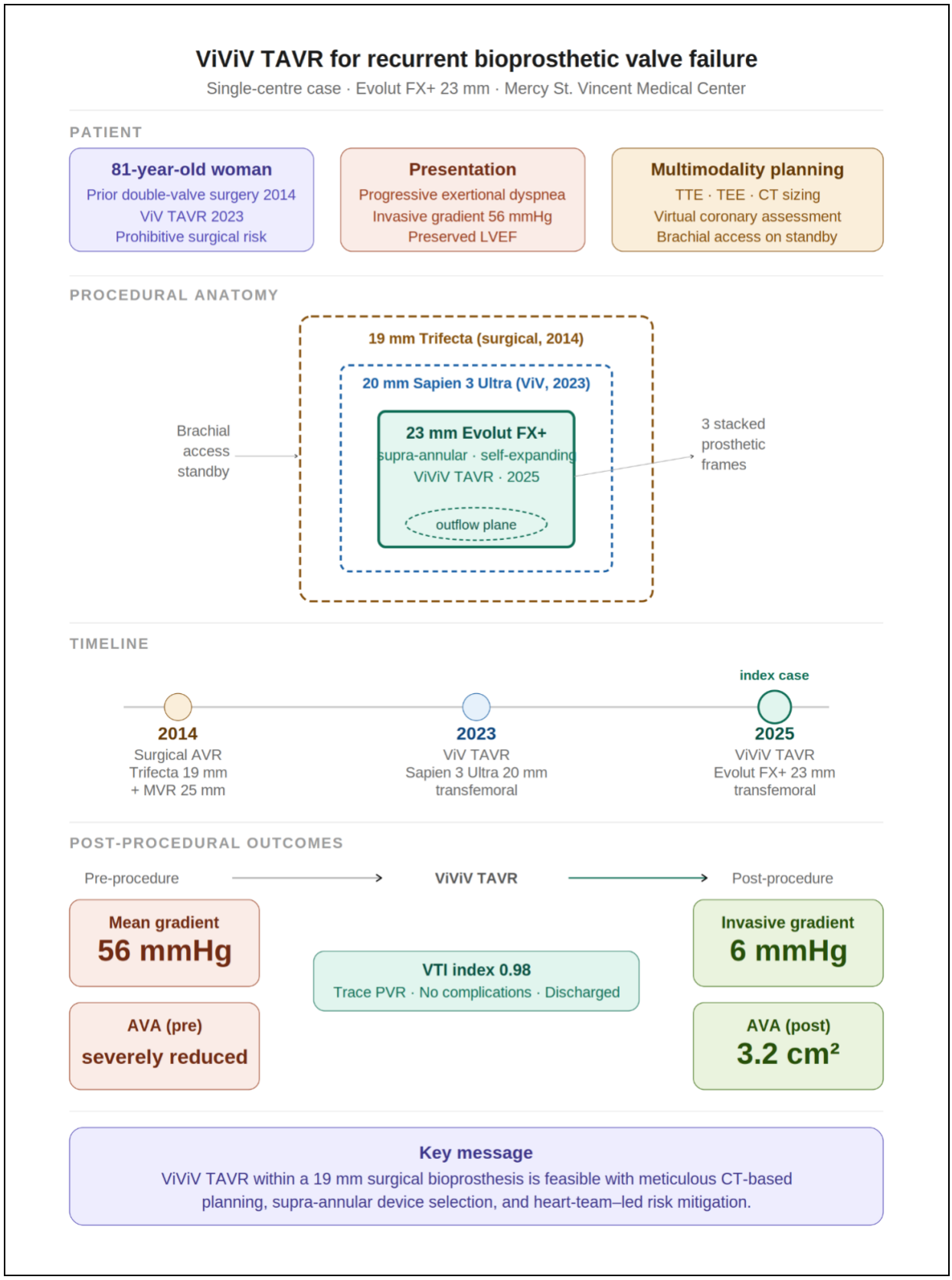
Case: An 81-year-old woman with a prior 19 mm Trifecta surgical bioprosthesis and 20 mm Sapien 3 Ultra ViV TAVR (2023) presented with severe recurrent aortic valve-in-valve stenosis. Heart-team evaluation deemed repeat surgery prohibitive. She underwent transfemoral ViViV TAVR with a 23 mm Evolut FX+. Post-procedural echocardiography demonstrated an AVA of 3.2 cm^2, invasive gradient of 6 mmHg, and trace paravalvular regurgitation. The patient was discharged without complications.

Conclusion: ViViV TAVR is feasible in selected patients with small surgical bioprostheses, yielding excellent hemodynamic outcomes with careful planning and device selection.

Keywords: ViViV TAVR; Valve-in-valve; Bioprosthetic valve failure; Redo TAVR; Evolut FX+; Small annulus

Introduction

Valve-in-valve (ViV) TAVR is an established strategy for degenerated bioprosthesis in high-risk patients, supported by TVT Registry data showing 5-year mortality of 43.1% and stroke rates of 10.5%, comparable to those of native TAVR [1]. Valve-in-valve-in-valve (ViViV) TAVR, however, remains extremely rare, with reports limited to isolated cases highlighting risks of elevated gradients, coronary obstruction, and patient–prosthesis mismatch when stacking multiple frames in a small aortic root [2,3]. We report successful transfemoral ViViV TAVR in a patient with a 19 mm surgical bioprosthesis and prior ViV TAVR, achieving excellent hemodynamic outcomes.


ViViV TAVR for recurrent bioprosthetic valve failure
Single-centre case · Evolut FX+ 23 mm · Mercy St. Vincent Medical Center
PATIENT
81-year-old woman
Prior double-valve surgery 2014
ViV TAVR 2023
Prohibitive surgical risk
Presentation
Progressive exertional dyspnea
Invasive gradient 56 mmHg
Preserved LVEF
Multimodality planning
TTE · TEE · CT sizing
Virtual coronary assessment
Brachial access on standby
PROCEDURAL ANATOMY
19 mm Trifecta (surgical, 2014)
20 mm Sapien 3 Ultra (ViV, 2023)
23 mm Evolut FX+
supra-annular · self-expanding
ViViV TAVR · 2025
outflow plane
Brachial access standby
3 stacked prosthetic frames
TIMELINE
index case
2014
Surgical AVR
Trifecta 19 mm
+ MVR 25 mm
2023
ViV TAVR
Sapien 3 Ultra 20 mm
transfemoral
2025
ViViV TAVR
Evolut FX+ 23 mm
transfemoral
POST-PROCEDURAL OUTCOMES
Pre-procedure
ViViV TAVR
Post-procedure
Mean gradient
56 mmHg
AVA (pre)
severely reduced
VTI index 0.98
Trace PVR · No complications · Discharged
Invasive gradient
6 mmHg
AVA (post)
3.2 cm²
Key message
ViViV TAVR within a 19 mm surgical bioprosthesis is feasible with meticulous CT-based planning, supra-annular device selection, and heart-team–led risk mitigation.

Case Presentation

An 81-year-old woman with prior double-valve surgery (2014) and ViV TAVR (2023) presented with progressive exertional dyspnea refractory to medical therapy. TTE, TEE, and CT confirmed degeneration of the transcatheter valve within the surgical bioprosthesis (Figure 1), with an invasive gradient of 56 mmHg, preserved left ventricular systolic function, and a layered anatomy posing risk for coronary obstruction (Figure 2). After multidisciplinary heart-team review and informed consent, including discussion of coronary obstruction, stroke, and bleeding risks, and the option of a second opinion, ViViV TAVR was selected as the only feasible option. CT-guided sizing and virtual assessment of the transcatheter valve-to-coronary distance confirmed suitability for a 23 mm Evolut FX+ (Figure 3). Brachial access was secured as a coronary protection contingency.

Under general anesthesia, right transfemoral access was obtained with a 14 Fr sheath (MANTA closure planned). After crossing the prior TAVR with a glide wire, positioning a Safari wire in the left ventricle, and predilating with an 18 mm balloon, the Evolut FX+ 23 mm was deployed with coaxial alignment under fluoroscopy with rapid ventricular pacing. Post-deployment echocardiography confirmed patent coronary arteries, trace paravalvular regurgitation, and no significant stenosis. Vascular closure was achieved without complication.

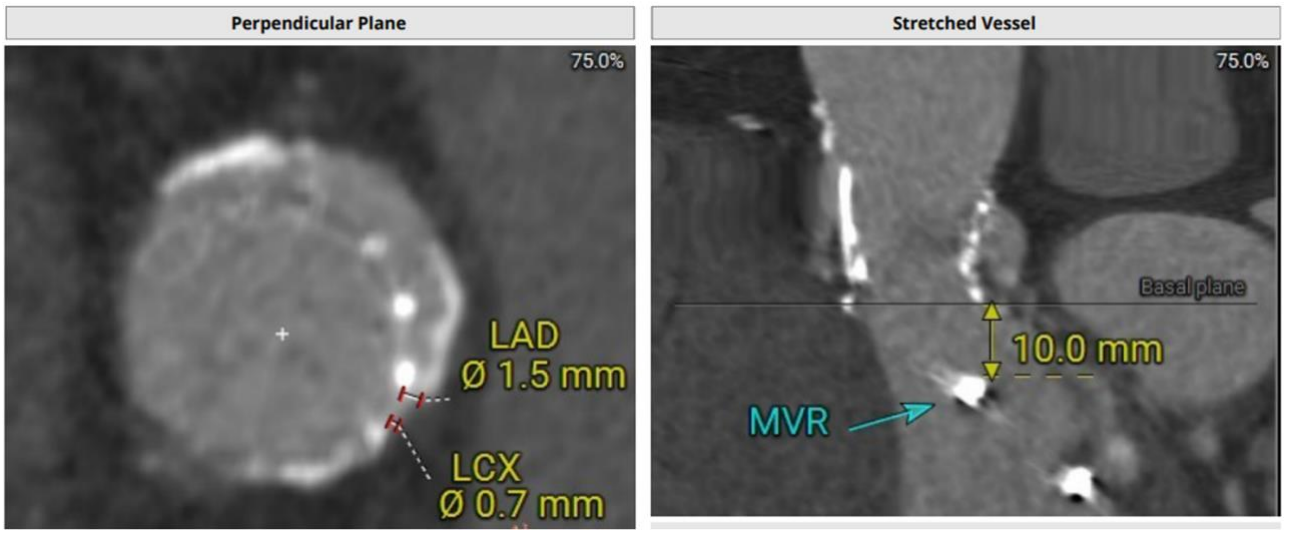


Figure 1: CT-derived anatomical assessment demonstrating the layered prosthetic anatomy.

Left panel: The LAD and LCX origins relative to the top of the Sapien 3 Ultra frame within the aortic wall, confirming adequate transcatheter valve-to-coronary distance for safe ViViV implantation.

Right panel: The bioprosthetic MVR stent post projecting into the LVOT approximately 10 mm below the basal plane, a key consideration for depth-controlled deployment of the third valve.

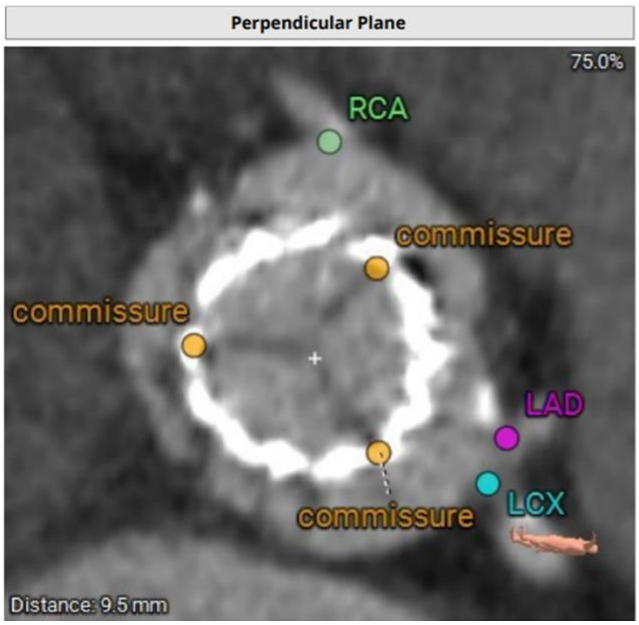


Figure 2: CT-based coronary obstruction risk assessment.

Left panel: The Sapien 3 Ultra frame in relation to the left and right coronary ostia, demonstrating the constrained anatomical margins that informed the need for brachial access as a coronary protection contingency.

Right panel: Virtual coronary markers — LCA (blue and purple) and RCA (green) — positioned beneath the respective coronary arteries to quantify the transcatheter valve-to-coronary distance and confirm safety thresholds were met.

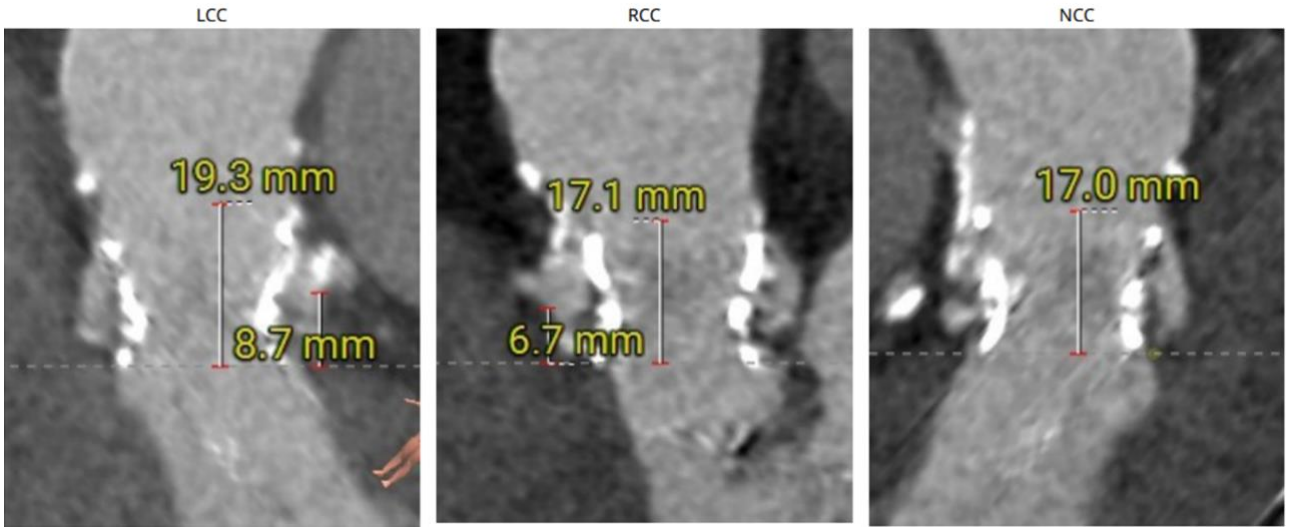


Figure 3: CT-derived sinus height measurements used for Evolut FX+ 23 mm sizing and deployment depth planning. Sinus heights shown left to right: LCC (left coronary cusp), RCC (right coronary cusp), NCC (non-coronary cusp). The virtual sizing confirmed sufficient sinus dimensions to accommodate the third valve frame without coronary compromise, supporting the selection of a supra-annular self-expanding device over a balloon-expandable alternative.

Timeline

Year	Event
2014	Surgical AVR (19 mm Trifecta) and MVR (25 mm Mosaic).
2023	Transfemoral ViV TAVR: 20 mm Edwards Sapien 3 Ultra.
2025	Transfemoral ViViV TAVR: 23 mm Evolut FX+ for severe valve-in-valve stenosis.

Discussion

Despite three superimposed valve frames within a 19 mm surgical bioprosthesis, post-procedural hemodynamics were exceptional — AVA 3.2 cm², VTI index 0.98, invasive pressure 6 mmHg — surpassing benchmarks typically anticipated in small-annulus ViV procedures [3,4]. The supra-annular self-expanding Evolut FX+ design was integral to this outcome, maximizing effective orifice area within the constrained geometry [5]. Meticulous CT-based planning, preparation for coronary protection, and depth-controlled deployment relative to the prior Sapien 3 Ultra and Trifecta frames mitigated the key procedural risks [6,7]. This case reinforces that heart-team–led ViViV TAVR can serve as a viable salvage strategy for patients at prohibitive surgical risk after multiple prior valve interventions [8,9].

Patient Perspective

The patient reported severe limitation of daily activities due to breathlessness prior to intervention. Following ViViV TAVR, she experienced rapid and substantial improvement in exercise tolerance. At follow-up, she described resuming activities previously precluded by dyspnea and expressed satisfaction with the outcome.

Conclusion

ViViV TAVR is feasible and can yield excellent hemodynamic and clinical outcomes in carefully selected patients with prior valve-in-valve constructs within small surgical bioprosthesis. Rigorous multimodality imaging, collaborative decision-making, and appropriate selection of self-expanding devices are central to success. Registry-level data are needed to define long-term durability in this growing population.

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