JACC: CARDIOVASCULAR INTERVENTIONS VOL. 19, NO. 14, 2026

PUBLISHED BY ELSEVIER

EDITORIAL COMMENT

Reducing the Risk of Thrombotic Complications Following Valve-in-Valve TAVR

What Evidence Do We Need?

Matthew A. Cavender, MD, MPH,[a,b] Spencer Ng, MD[a]

Prior to the availability of transcatheter aortic valve replacement (TAVR), patients with failed surgical aortic valves required redo surgery that was associated with approximately 2-fold higher risk for morbidity and mortality.[1] As experience with TAVR increased and outcomes improved, it became apparent that placing a transcatheter aortic valve inside the failed surgical bioprosthetic aortic valve (valve-in-valve [ViV] TAVR) represented a viable treatment option.[2,3] Furthermore, ViV TAVR seemed to be associated with improved outcomes compared with redo surgery.[4]

ViV TAVR was quickly adopted as the preferred strategy for patients with failed surgical bioprosthetic valves among those with appropriate anatomy. In the United States, the Society of Thoracic Surgeons/American College of Cardiology TVT (Transcatheter Valve Therapy) Registry reported 305 ViV TAVRs between 2011 and 2013. However, 6 years later, more than 4,500 ViV TAVR cases had been performed.[5] During this time period, both balloon-expandable and self-expanding transcatheter valves became U.S. Food and Drug Administration approved for use in patients with failed surgical bioprosthetic aortic valves, resulting in treatment options that were minimally invasive and associated with better outcomes.

The need to treat patients with failed bioprosthetic valves will continue to increase over time. For many of these patients, especially those with significant comorbidities and advanced age, ViV TAVR offers a less invasive alternative to redo surgery, with lower early morbidity and mortality and shorter recovery. ViV TAVR does pose novel issues that require a thoughtful treatment approach. The implantation of a transcatheter heart valve inside a prior bioprosthetic valve can prevent full expansion of the TAVR frame, resulting in smaller effective orifice areas and higher residual gradients.[6] In addition, the placement of the replacement valve within a surgical aortic valve creates a space between the stent frame of the transcatheter heart valve and the leaflets of the transcatheter aortic valve, known as the neosinus.[7] This neosinus has complex flow patterns and increases the risk for thrombosis. Leaflet coaptation at higher positions and with greater tissue apposition, pinwheeling of valve leaflets, interaction with the pre-existing surgical posts and sewing rings, and potential commissural misalignment can all generate areas that increase the risk for thrombosis. Finally, short distances between the valve and coronary ostia and small residual aortic valve sinuses can result in stasis and decreased flow in the native coronary arteries (sinus sequestration). All of these factors increase the potential of thrombotic complications, including systemic emboli, ischemic coronary events, and valve thrombosis (**Figure 1**).

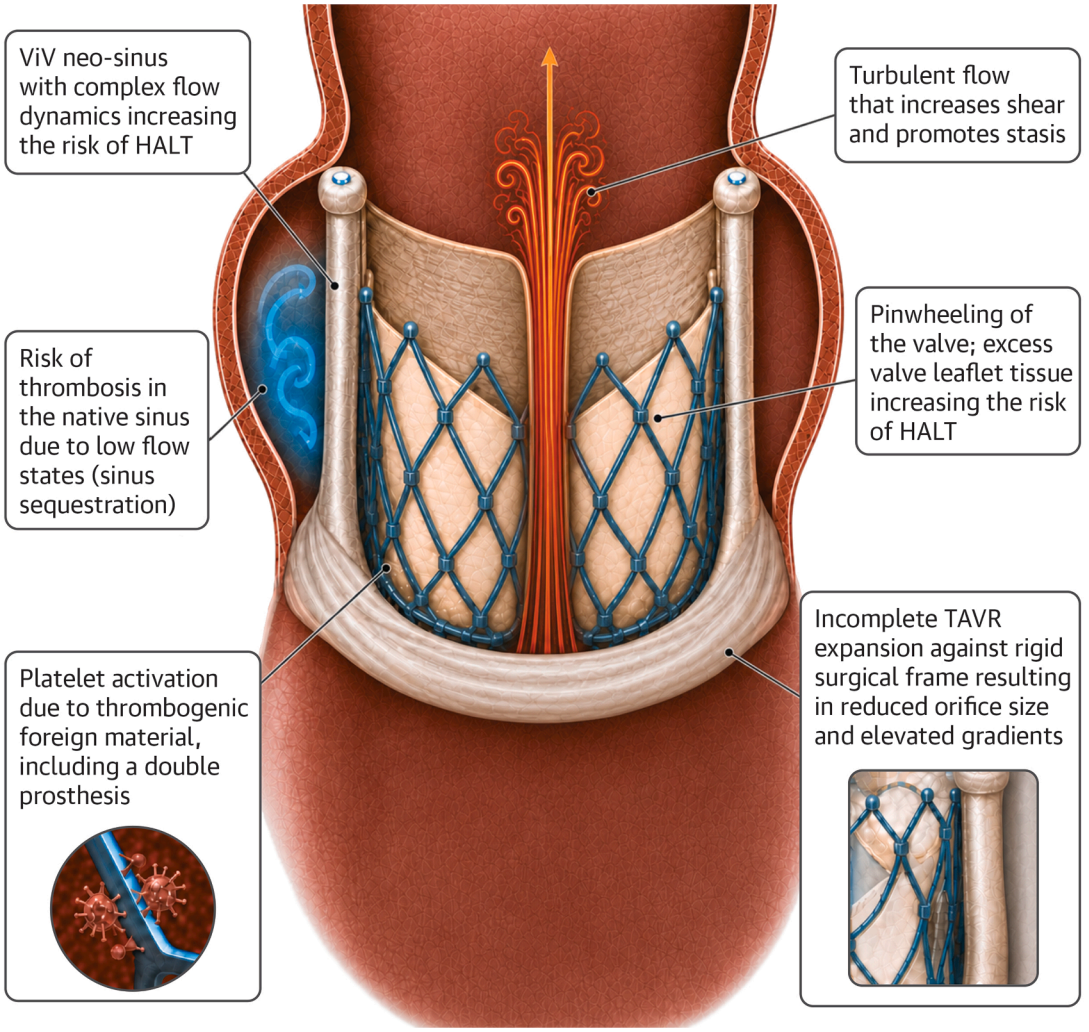
It is possible that patients who undergo ViV TAVR could benefit from an antithrombotic approach that differs from that used in other patients undergoing

From the [a]Division of Cardiology, University of North Carolina, Chapel Hill, North Carolina, USA; and the [b]UNC Clinical Research Alliance, Chapel Hill, North Carolina, USA.

The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the Author Center.

ISSN 1936-8798/$36.00 https://doi.org/10.1016/j.jcin.2026.06.010

FIGURE 1 **Potential Mechanisms of Increased Thrombotic Risk in Patients Undergoing Valve-in-Valve TAVR**



HALT = hypoattenuated leaflet thickening; ViV = valve-in-valve; TAVR = transcatheter aortic valve replacement.

TAVR. The 2020 American College of Cardiology/American Heart Association valvular heart disease guidelines note that valve thrombosis may be more frequent after ViV TAVR than after native-valve TAVR and suggest that selective short-term use of vitamin K antagonists can be considered in this population. Currently, the antithrombotic approach after ViV TAVR is largely extrapolated from patients undergoing TAVR for native valve disease and/or surgical aortic valve replacement. The GALILEO (Global Study Comparing a Rivaroxaban-Based Antithrombotic Strategy to an Antiplatelet-Based Strategy After Transcatheter Aortic Valve Replacement to Optimize Clinical Outcomes) trial evaluated rivaroxaban following TAVR, but this trial was terminated prematurely because of increased mortality, thromboembolic events, and bleeding in patients treated with rivaroxaban. However, there were significant reductions in subclinical leaflet thrombosis.[8] Similarly, the ATLANTIS (Anti-Thrombotic Strategy After Trans-Aortic Valve Implantation for Aortic Stenosis) trial demonstrated reduced hypoattenuated leaflet thickening (HALT) with apixaban but no improvement in clinical outcomes.[9] Patients undergoing ViV TAVR represented only approximately 5% of patients included in these trials. As such, there are scant data that are specific for patients undergoing ViV TAVR and little clarity on whether single antiplatelet therapy (SAPT), dual antiplatelet therapy (DAPT), or routine oral

JACC: CARDIOVASCULAR INTERVENTIONS VOL. 19, NO. 14, 2026
JULY 27, 2026:1940-1943

anticoagulation (OAC) best balances thrombosis prevention and bleeding risk.

In this issue of *JACC: Cardiovascular Interventions*, Ueyama et al[10] present data from the TVT Registry to characterize contemporary antithrombotic practice after ViV TAVR in the United States and its association with clinical outcomes. The investigators identified 18,414 patients who underwent ViV TAVR between January 2015 and March 2024 who did not have established indications for DAPT or OAC. Patients being discharged following ViV TAVR were grouped on the basis of whether they were treated with SAPT, DAPT, or OAC. Overall, 27.3% of patients were discharged on SAPT, 53.5% on DAPT, and 19.2% on an OAC-based regimen.

Over time, the investigators found that treatment patterns changed, with DAPT declining as SAPT became the predominant strategy. OAC-based therapy use was relatively consistent throughout. The investigators report surprising heterogeneity in practice-level variation, with the proportion of patients receiving each regimen at practices ranging from nearly 0% to nearly 100% at different centers. After adjustment for potential confounders using inverse probability of treatment weighting, neither DAPT nor OAC-based therapy was associated with significant differences in 1-year all-cause mortality, stroke, or bleeding when compared with SAPT.

These findings carry several important implications for current ViV TAVR practice. First, the marked variation in antithrombotic prescribing across U.S. operators and institutions highlights the underlying lack of evidence base for providers to make clinical decisions for these patients. ViV remains a data free zone in which clinicians are extrapolating and personalizing treatment regimens. However, the observed trend toward the predominant therapy being SAPT following trials that demonstrated the safety of this approach does demonstrate the responsiveness of the interventional community to clinical evidence. This suggests that high-quality, well-performed studies do in fact change clinical practice.

Second, the absence of detectable differences in 1-year mortality, stroke, and bleeding across SAPT, DAPT, and OAC-based therapy in this large registry analysis suggests that ischemic and bleeding events are largely similar irrespective of treatment. However, this data set cannot provide insight into ViV thrombosis, as there is no systematic computed tomographic imaging, which is needed to identify patients with leaflet thrombosis. In addition, detailed hemodynamic and echocardiographic data such as aortic valve gradients over time are not universally captured in the TVT Registry. Although the clinical impact of HALT and Hypo-attenuation affecting motion (HAM) is not yet fully known, there does seem to be an association between their presence and the risk for stroke and/or increased transvalvular gradients, which could result in early structural valve dysfunction and/or need for reintervention. These are precisely the outcomes for which OAC may be beneficial. Thus, equivalent 1-year clinical event rates do not exclude meaningful differences in long-term thrombotic risk and valve performance.

OAC use in this registry remained relatively uncommon, particularly in patients without pre-existing indications. This suggests that many operators remain unconvinced that the risk for thrombosis in ViV TAVR justifies routine anticoagulation. This may be related to the patient population, which is generally an elderly, frail cohort with higher baseline bleeding risk. The lack of an association between OAC and risk for death or stroke in OAC-treated patients, despite a large number of patients, suggests that any potential benefit may be on events such as HALT rather than clinical events such as death or stroke. However, it remains possible that some subgroups with high-risk features (very small surgical valves, high residual gradients, or certain valve designs) could be populations in which therapy theoretically could provide benefit.

The appropriate antithrombotic regimen following ViV TAVR will not be known without adequately powered randomized trials. This is exactly the type of question for which a pragmatic clinical trial, potentially even using the TVT Registry as a platform for randomization, would be ideal. Until such randomized evidence is available, the present work supports a pragmatic, individualized approach to antithrombotic therapy after ViV TAVR. For most patients, particularly those without extreme hemodynamic compromise or very small prior prostheses, SAPT appears to be a reasonable default treatment strategy. At the same time, consideration of OAC may be appropriate in patients with anatomical or hemodynamic features suggestive of high thrombosis risk (small prior surgical valve size, significant constraint of the transcatheter valve, elevated postprocedural gradients, or prior leaflet thrombosis) provided that bleeding risk is acceptable. Ultimately, as ViV TAVR becomes an integral component of lifetime valve care, it is imperative that we develop specific treatment strategies on the basis of well-designed, randomized clinical trials to determine the optimal antithrombotic therapy in patients treated with ViV TAVR.

FUNDING SUPPORT AND AUTHOR DISCLOSURES

The authors have reported that they have no relationships relevant to the contents of this paper to disclose.

ADDRESS FOR CORRESPONDENCE: Dr Matthew A. Cavender, University of North Carolina, Burnett-Womack Building, 160 Dental Circle, CB #6075, Chapel Hill, North Carolina 27599, USA. E-mail: matt.cavender@unc.edu.

REFERENCES

1. Kaneko T, Vassileva CM, Englum B, et al. Contemporary outcomes of repeat aortic valve replacement: a benchmark for transcatheter valve-in-valve procedures. *Ann Thorac Surg*. 2015;100:1298–1304. https://doi.org/10.1016/j.athoracsur.2015.04.062

2. Webb JG, Mack MJ, White JM, et al. Transcatheter aortic valve implantation within degenerated aortic surgical bioprostheses: PARTNER 2 valve-in-valve registry. *J Am Coll Cardiol*. 2017;69:2253–2262. https://doi.org/10.1016/j.jacc.2017.02.057

3. Dauerman HL, Deeb GM, O'Hair DP, et al. Durability and clinical outcomes of transcatheter aortic valve replacement for failed surgical bioprostheses. *Circ Cardiovasc Interv*. 2019;12:e008155. https://doi.org/10.1161/CIRCINTERVENTIONS.119.008155

4. Tran JH, Itagaki S, Zeng Q, et al. Transcatheter or surgical replacement for failed bioprosthetic aortic valves. *JAMA Cardiol*. 2024;9:631–639. https://doi.org/10.1001/jamacardio.2024.1049

5. Carroll JD, Mack MJ, Vemulapalli S, et al. STS-ACC TVT registry of transcatheter aortic valve replacement. *J Am Coll Cardiol*. 2020;76:2492–2516. https://doi.org/10.1016/j.jacc.2020.09.595

6. Tuzcu EM, Kapadia SR, Vemulapalli S, et al. Transcatheter aortic valve replacement of failed surgically implanted bioprostheses: the STS/ACC registry. *J Am Coll Cardiol*. 2018;72:370–382. https://doi.org/10.1016/j.jacc.2018.04.074

7. Cahill TJ, Kirtane AJ, Leon M, Kodali SK. Subclinical leaflet thrombosis and anticoagulation after transcatheter aortic valve replacement: a review. *JAMA Cardiol*. 2022;7:866–872. https://doi.org/10.1001/jamacardio.2022.1591

8. Dangas GD, Tijssen JGP, Wohrle J, et al. A controlled trial of rivaroxaban after transcatheter aortic-valve replacement. *N Engl J Med*. 2020;382:120–129. https://doi.org/10.1056/NEJMoa1911425

9. Collet JP, Van Belle E, Thiele H, et al. Apixaban vs. standard of care after transcatheter aortic valve implantation: the ATLANTIS trial. *Eur Heart J*. 2022;43:2783–2797. https://doi.org/10.1093/eurheartj/ehac242

10. Ueyama HA, Gleason PT, Vemulapalli S, et al. Trends and outcomes of antithrombotic strategies for valve-in-valve TAVR: the STS/ACC TVT registry. *JACC Cardiovasc Interv*. 2026;19(14):1927–1939.

KEY WORDS anticoagulation, antiplatelet, antithrombotic, TAVR, valve-in-valve TAVR