Commentary: Limiting paravalvular regurgitation after TAVR: Is better understanding of imaging the solution?

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Central Message

Multidetector computed tomography will allow better understanding of aortic valve anatomic characteristics for a more individualized approach to transcatheter aortic valve replacement.

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The rate of paravalvular regurgitation (PVR) after transcatheter aortic valve replacement (TAVR) has improved significantly since the landmark trials that compared first-generation TAVR with surgical aortic valve replacement (SAVR) in high-risk surgical patient populations.^{1,2} Moderate or severe PVR is associated with a 2- to 3-fold increase in mortality; however, the clinical influence of mild PVR is less clear.^{1,3} Subsequently, PVR has significantly been reduced with the advent of third-generation balloon and self-expanding valves. In the largest series to evaluate the third-generation SAPIEN 3 valve (Edwards Lifesciences, Irvine, Calif) in an intermediate-risk patient population, PVR greater than moderate was present after TAVR in 3.8% of patients at 30 days and in 1.5% at 1 year (in contrast to the 0.4% rate seen with SAVR). Mild PVR was present in 39.8% of patients who had undergone TAVR, in contrast to the 3.8% rate seen with SAVR.⁴

Intuitively, the low rate of PVR in SAVR would be expected to result from resection of the calcified aortic valve leaflets and débridement of the annulus. Regularly spaced sutures fasten the valve prosthesis to the decalcified, newly compliant annulus, minimizing leak. The ability of current TAVR valves to limit PVR in the noncompliant, calcified annulus is a result of improved procedural planning with imaging, better procedural technique, and the sealing skirts or wraps of the latest generation of prostheses. Multiple detector computed tomography (MDCT), now a standard of care, has improved the sizing of TAVR valves, which was previously limited by 2-dimensional echocardiography. MDCT has reduced the risk of major complications, namely annular rupture, coronary obstruction, and PVR. Time-resolved 3-dimensional MDCT has the ability to define the anatomic complexity of the stenotic aortic valve, giving detail beyond that which is currently being used in routine clinical practice.

In their study reported in this issue of the *Journal*, Pollari and colleagues⁵ measured calcium volume at the device landing zone with MDCT to predict PVR. In their multivariate model, total calcium had a modest effect (odds ratio, 1.08). A calcium volume greater than 1079 mm² predicted at least mild PVR, albeit with low sensitivity (53%). Eccentric, nonuniform calcium distribution was not assessed as a risk factor for PVR, and this factor may prove informative in addition to the total calcium volume. Overall, the greatest determinant of PVR in the multivariate analysis was transcatheter valve type, with the lowest risk seen with the SAPIEN 3 balloon-expandable valve (odds ratio, 0.23).

Attempts to identify anatomic risk factors for TAVR complications are not new. Condado and colleagues⁶ confirmed individual anatomic risk factors for PVR (left ventricular outflow tract nontubularity, annular calcification, and low annular cover index, which was defined as the difference between the prosthetic valve area and the annular area, divided by the prosthetic valve area), and these were used together in a model to predict PVR and landing zone complications with balloon expandable valves.⁶ The improved performance of the model relative to the individual characteristics themselves highlights the complexity of the annulus and the need to consider multiple factors when choosing valve type, size, and implantation technique.

Although the report of Pollari and colleagues⁵ may not be the end of the story for PVR, it remains a positive and important contribution to our understanding of this problem. Further minimizing PVR will require more detailed analysis and understanding of a multitude of annular and leaflet anatomic characteristics, and MDCT gives us this opportunity. As TAVR is expanding to a low-risk, younger patient population, future work should be directed toward the better definition of the anatomic and patient characteristics best treated with different valve technologies. It becomes increasingly important to individualize decision making for the management of aortic stenosis, be it for those undergoing TAVR or SAVR.

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