

## Chest Radiation: Another Sweet Spot for Transcatheter Aortic Valve Replacement

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The growth of transcatheter aortic valve replacement (TAVR) for the management of severe aortic stenosis continues to expand.<sup>1</sup> This procedure was initially approved in 2011 for use in inoperable patients.<sup>2</sup> Through careful study, TAVR has subsequently been evaluated in high-risk,<sup>3</sup> intermediate-risk,<sup>4</sup> and, finally, low-risk patients,<sup>5,6</sup> although approval for use has not yet been granted for the latter category. Because study and/or approval of TAVR now encompasses patients across the entire risk spectrum, the role of surgical aortic valve replacement (SAVR) needs to be reevaluated.

It is currently appropriate to consider SAVR for patients who require another surgical procedure in addition to aortic valve replacement.<sup>7</sup> Examples would be complex multivessel coronary artery disease that requires coronary artery bypass grafting or an ascending aortic aneurysm that requires aortic root replacement. However, multivessel coronary artery disease with a low SYNTAX (Synergy between PCI with Taxus and Cardiac Surgery) score (ie, focal stenoses) can be treated with percutaneous coronary intervention with good result.<sup>8</sup>

Among young patients (eg, <59 years) who require aortic valve replacement and can tolerate anticoagulation therapy, the choice of a durable mechanical valve may be appropriate.<sup>7</sup> However, a proportion of young patients are not appropriate for anticoagulation therapy for a variety of reasons; therefore, a tissue valve will still need to be considered. In these patients, it is debatable whether a surgical valve with a proven long-term track record would be preferred instead of a transcatheter valve with more limited follow-up data. Although

transcatheter valves are thought to have better hemodynamics and a lower incidence of patient prosthesis mismatch than surgical valves,<sup>9</sup> the PARTNER 3 (Placement of Aortic Transcatheter Valve) low-risk trial found that surgical valves were associated with a slightly lower mean aortic gradient and a slightly larger aortic valve area at 30 days and 1 year compared with transcatheter valves.<sup>6</sup>

Potential acute and long-term concerns that need to be considered with a transcatheter valve in a young patient include (1) valve deterioration, (2) paravalvular aortic regurgitation, and (3) need for a permanent pacemaker. Regarding the first issue, there has been some concern about TAVR leaflet thrombosis<sup>10</sup>; however, to date, with intermediate follow-up, this does not appear to be a significant clinical problem.<sup>11</sup> With current-generation devices, the rate of moderate to severe aortic regurgitation is quite low in a tricuspid aortic valve (0.8% with a balloon-expandable valve and 3.5% with a self-expanding valve).<sup>5,6</sup> The need for a permanent pacemaker is also low for a balloon-expandable valve (6.5%)<sup>6</sup> but remains high for a self-expanding valve (17.4%).<sup>5</sup>

Bicuspid aortic valves are frequently encountered among younger patients. These valves are often associated with higher eccentricity, extreme annular calcification, calcified raphe, and large size, which can increase the risk of moderate to severe paravalvular aortic regurgitation and thus compromise the long-term efficacy of valve replacement. Adverse valve characteristics can also increase the risk of annular rupture. Bicuspid aortic valves have been associated with more frequent conversion to surgery and lower device success.<sup>12</sup> Early generation balloon-expandable valves (eg, Sapien XT; Edwards Lifesciences) have been associated with higher rates of annular rupture and aortic root injury, whereas early generation self-expanding valves (ie, CoreValve; Medtronic) have been associated with higher rates of second valve implantation and moderate to severe paravalvular leak in bicuspid aortic versus tricuspid aortic valves.<sup>12,13</sup> However, no difference in these outcomes has been observed for bicuspid versus tricuspid valves with new-generation valves.<sup>12</sup> Accordingly, a careful assessment of the bicuspid valve/annular complex by TAVR-protocol computed tomography and echocardiography is mandatory among patients with a

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bicuspid valve being considered for TAVR. In a low-risk young patient with unfavorable bicuspid valve characteristics, surgery would still be preferred.

Patients with prior chest radiation represent a high-risk group with known poor outcomes from surgery. Patients with chest radiation undergoing open heart surgery have increased incidence of atrial fibrillation, stroke, and death compared with patients without chest radiation.<sup>14</sup> Moreover, patients with chest radiation continue to do poorly with increased long-term mortality. TAVR has been shown to be feasible in patients with aortic stenosis and prior chest radiation with good echocardiographic and clinical results.<sup>15</sup>

In this issue of the *Journal of the American Heart Association (JAHA)*, Zhang et al performed a careful and important study of patients with severe aortic stenosis and prior chest radiation.<sup>16</sup> They compared outcomes of patients who underwent SAVR versus TAVR at the Mayo Clinic. Each group had 55 patients. Compared with SAVR patients, TAVR patients were sicker, as represented by a higher Society of Thoracic Surgery estimated risk for 30-day mortality (5.1% versus 1.6%,  $P<0.001$ ). In the short term, TAVR was associated with a reduction in length of stay and lower incidence of atrial fibrillation compared with SAVR. The 30-day observed-to-expected mortality was lower with TAVR versus SAVR. However, readmissions were higher at 90 days, predominantly because of heart failure. Although heart failure exacerbations could have been caused by paravalvular aortic regurgitation, there was no statistical difference in this outcome at 6 months between treatment groups. This study is noteworthy because the investigators performed a careful inverse propensity-weighting analysis to compare SAVR with TAVR. Future studies will need to address the risk of readmission among patients with aortic stenosis and chest radiation who undergo TAVR.

In summary, we continue to move into an era that provides aortic stenosis patients with more treatment options. For some patients, SAVR remains an important option for the reasons stated. For the majority of patients, TAVR is a safe, effective, and expanding treatment for aortic stenosis. Based on the results of this study, aortic stenosis patients with chest radiation represent a sweet spot for the use TAVR.

## Disclosures

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