Editorial

The role of aortic annular enlargement in the lifetime management of aortic stenosis patients

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Introduction

The management of aortic stenosis (AS) is rapidly evolving, with increasing complexity and, at times, convolution. With the advent of transcatheter aortic valve replacement (TAVR), including valve-in-valve (ViV) techniques, we are managing this disease in a broader population of patients over longer portions of their lives. The course of a patient's lifetime valve management is set by the first intervention, which determines the options for reintervention if that is eventually required. We must not forget that surgical aortic valve replacement (SAVR) and TAVR are not the only tools in the toolbox: aortic annular enlargement (AAE) is a crucial component of lifetime management of some AS patients, as it represents the best opportunity to create the largest platform going forward. Perhaps the bigger question is: who should get AAE, and when?

We have long known that prosthesis-patient mismatch (PPM) after SAVR is associated with increased long-term morbidity and mortality. These risks seemingly amplify for patients who go on to ViV TAVR later in life (1). Although TAVR valves may have equivalent-to-superior early hemodynamics, they are not immune to PPM. There is an estimated PPM rate of 12% after TAVR, which is associated with significantly higher mortality and rehospitalizations at 1 year (2). Ternacle *et al.* found the rate of body mass index (BMI)-adjusted severe PPM to be 23.6% and 5.7% for the SAVR and TAVR cohorts, respectively, when analyzing patients from the PARTNER 2A trial and PARTNER 2 SAPIEN 3 Intermediate Risk registry (3). Not every patient will require a ViV TAVR later in life, but perhaps, we should at the initial evaluation leave ViV TAVR on the table, rather than limiting options to a redo-SAVR, which may be suboptimal in a frailer, older patient. The annulus will never be bigger than we leave it after the initial SAVR, thus, this is the time to decide if AAE is required to optimize the patient for future interventions.

Despite the allure of AAE to prevent PPM, surgeons may be hesitant to perform AAE due to perceived additional risk (4). In one analysis, Mehaffey and colleagues reviewed nearly 189,000 Medicare patients in the Society of Thoracic Surgeons (STS) database who underwent aortic valve replacement (AVR) with or without coronary artery bypass graft. A very small subset of 2.9% patients underwent AAE, and this group had significantly higher short-term mortality. Though not statistically significant, there was a trend towards better long-term mortality at 3 years (5). However, this study was limited by a lack of information on the native annulus size, and the comparison may have been between patients requiring AAE versus those not requiring (or not undergoing) AAE. Other studies have shown no incremental risk of mortality or adverse events with AAE (6,7), suggesting the possibility of a volume-outcome relationship as has been seen with other cardiac operations. Dhareshwar *et al.* (7) found that raw operative mortality was higher in AAE patients compared to AVR without AAE; however, in multivariable analysis, AAE was not an

independent risk factor for operative death. Downstream benefits of AAE include potentially better hemodynamics, more left ventricular mass regression, and longer valve durability. In experienced hands, AAE by any technique (Nicks, Manougian, and Y-incision) has demonstrated improved mid-term survival (8), which may be in part explained by these benefits.

Standardizing labeled valve sizes and measurements would enable a better understanding of what annular area we leave patients with after SAVR. Yang and colleagues described an annular area reduction of 40–60% in patients with a normal native aortic annulus undergoing AVR without AAE, because the true inner diameter of the bioprosthetic valve is 5–7 mm smaller than the labeled valve size after implantation (9). AAE is not binary—as we know, there is an array of techniques that have varying impacts on the post-enlargement annular dimensions. Cadaveric models predict increases of 1.3, 1.3, and 2.7 prosthesis sizes for the Manougian, modified Bentall, and aortoventriculoplasty techniques. No significant change in prosthesis size was observed with the Nicks procedure (10), while the Y-incision technique enlarges the annulus a median of three valve sizes (9). The degree of annular enlargement required and surgeon familiarity with each technique should play a role in determining which AAE technique is selected. Another benefit of AAE in the era of transcatheter ViV possibilities is the ability to place a prosthetic valve with the inner diameter matching or exceeding the native annulus, while optimizing coronary positioning for future ViV TAVR or coronary access, if needed.

Conclusions

Though the waters of AAE might not be clear yet, we do believe there is a definite role for AAE in select patients. We need to set the annulus and the patient up for a lifetime of success, which means considering AAE early at the index SAVR, if PPM is a real risk. We are likely not enlarging enough annuli for fear of elevated short-term risk. The relative short-term risk can be minimized with good training, mentorship, and experience in a given surgeon's hands. As the volume of AAEs grows, perhaps short-term outcomes will improve as more surgeons master the nuances of a procedure that many seldom perform. The keys will be recognizing which patients will encounter PPM in their lifetime and to normalize AAE for these patients, in order to balance the risks and benefits of this operation.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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