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EDITORIAL COMMENT

Transcatheter Aortic Valve Replacement in Extremely Large Annuli

(Over)expanding Bioprosthetic Technology to the Limits?*

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The rapid expansion of indications for transcatheter aortic valve replacement (TAVR) is attributed to technical improvements, operator experience, and extensive research in this field. Despite the growing advances, every technology is accompanied with its own limitations, one of which in the TAVR field is extensive large anatomic constitutions. According to the manufacturer's recommendation, the balloon-expandable SAPIEN 3 valve (S3; Edwards Lifesciences, Irvine, California) covers native annular areas from 338 to 683 mm^2. In contemporary practice, we are faced with only a few patients who appear to be unsuitable for a minimally invasive approach because of extensive large anatomic constitutions.

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In this issue of *JACC: Cardiovascular Interventions*, Tang et al. (1) present their multicenter retrospective data from 74 patients with large annuli (683.5 to 852.0 mm^2) undergoing TAVR with the 29-mm S3 valve treated at 16 centers within a time frame of 42 months. This is the largest series of this kind of TAVR patients (2,3). Procedural success was achieved in all patients, one-third of whom presented with any paravalvular leak (PVL; 0% severe and 6.9% moderate) on 30-day echocardiography, while the incidence of new pacemaker implantation was 6.3% (1). There are many reasons why the results of the present study are so important for the community.

First, the true prevalence of patients with this large anatomic annular dimension is unknown. In the present registry, there were only 1.3 patients per center per year with such large annuli undergoing TAVR. We do not know the number of patients with large annuli treated either medically or surgically at the participating centers, but it seems that the number was not large enough to trigger manufacturing of S3 valves >29 mm. Use of the larger self-expanding 34-mm CoreValve Evolut R prosthesis (Medtronic, Minneapolis, Minnesota), designed to be implanted in annuli up to 94.2-mm perimeter, is associated with lower post-procedural transvalvular gradients compared with the 29-mm S3 (4). In the present study, the overall mean perimeter was 96.8 mm, and 88% of the patients would have been outside the perimeter range of the 34-mm CoreValve Evolut R prosthesis. The safe use of the 29-mm S3 by overfilling the implantation balloon in the present study supports the use of this device in patients at high operative risk with large annuli.

Second, in one-third of patients, no balloon overfilling during S3 implantation was required. Although multidetector computer tomography was used in 92% of patients, measurement errors due to variation of the 2-dimensional aortic basal virtual ring (the gold standard for TAVR sizing) throughout the cardiac circle cannot be excluded (5). In the present study, annular dimensions were quantified on site, no core laboratory for multidetector computed tomographic measurements was available, and we do not know whether the measurements were confirmed by a

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second evaluator before TAVR. Likewise, nominal balloon filling in these cases might be related to the severity of valve calcification. Information in this regard is lacking in the present study.

Third, overall prosthesis undersizing of 10.9% by annular area and 14.7% by left ventricular outflow tract area was reported. Generally, compared with the early generations of SAPIEN prostheses, with the S3 significantly less oversizing (4% to 10%) is required to achieve no or mild PVL in more than 95% of patients, although extensive undersizing is still a key predictor of PVL (6–8). During overexpansion of the S3 prosthesis by adding 1 to 5 ml extra to the nominal balloon, as performed in the present study, prosthesis area increased from 660.48 to 730.57 mm^2 according to bench testing (3). Thus, contrary to the present study, calculation of prosthesis under- or oversizing in these patients should be based on volume-dependent derived S3 area. This explain the very low PVL rates in the study despite important "undersizing."

Fourth, among these particular patients, annular area equal or greater than left ventricular outflow tract area was associated with a PVL rate of 9.1%. This highlights the importance of evaluation and the critical role of left ventricular outflow tract dimensions for patients with large annuli. Whether higher prosthesis implantation is necessary in these cases needs to be evaluated.

Fifth, despite the acceptable hemodynamic results, in one-third of patients, balloon post-dilation was performed. The effect of balloon post-dilation is still controversial, and it has been linked to a higher risk for cerebrovascular events at mid-term follow-up (9). Furthermore, oversizing a balloon-expandable prosthesis itself seems to be related to a high risk for valve thrombosis (10). Unfortunately, the present study provides very short follow-up, making interpretation of the results in the context of prosthetic valve deterioration and longer term hemodynamic performance not possible.

Motivated to acquire new knowledge, we must consider that we still get through an unknown phase with this technology by treating patients with extremely large annuli. Tang et al. (1) should be congratulated for highlighting the technological possibilities of the third-generation balloon-expandable prosthesis in larger annuli beyond manufacturers' recommendations. It offers us as operators more certainty in this challenging subset of patients and gives us some important insights into prosthesis performance under these exceptional conditions. Considering the aforementioned limitations, long-term clinical and echocardiographic follow-up for the evaluation of valve durability in accordance with standardized definitions is eagerly waited, before offering this treatment option to younger patients or those at low operative risk.

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