Editorial

Patient selection for aortic valve-sparing operations

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Introduction

Valve-sparing (VS)-techniques were originally devised for aortic root aneurysms, without aortic regurgitation (AR). We realized that concurrent AR in the setting of normal leaflets can occur, and be remedied, by re-establishment of normal root dimensions.

Historically, AR has been considered a contraindication for VS-operations. Nonetheless, we have learned that residual AR after VS-operations is mainly related to misconfiguration of leaflets. Thus, while different techniques for VS-operations have been developed, techniques for cusp management have also had to be developed to address this common problem. For instance, elongation of leaflet free margins (FM) leads to cusp prolapse, with subsequent AR, which can be treated through FM-shortening, resolving the dysfunction.

The aortic root with its two borders, the ventriculo-aortic junction and the sinotubular-junction constitutes the native aortic valve (AV) stent or the functional aortic annulus (FAA). The FAA and FM represent a functional unit, intrinsically connected. Hence, deformation of one component can lead to deformation of the other. Therefore, the goal of reconstructive surgery (AV-repair) should be to recreate the optimal relationship between these elements.

Principles for successful repair

(I) Understanding the mechanism of AR: single or multiple lesions;
(II) Assessment of tissue quality and quantity.

Several factors must be considered:

Surgeon-related

Surgical experience will impact the selection of technique. The surgeon should be comfortable with AV assessment and root pathologies, and be able to predict a lasting repair. Thus, it's important to understand that replacing the aortic root can change the geometry of the valve and may require adjustment of the deformed leaflets, especially in cases of a large or asymmetric aortic root or technical errors during the procedure. It's also important to correctly assess geometric height (gH) and effective height (eH) and identify cusp lesions such as prolapse. Over time, one should learn how to address more complex lesions (multiple prolapses, cusp thickening, larger fenestration, cusp retractions).

It's helpful to spend dedicated time at a high-volume valve center to become familiar with a variety of pathologies. Previous mitral valve (MV) repair experience is also helpful, as similar repair principles are in play for the AV. Moreover, it's important to learn how to interpret the preoperative echo. The first-step of a successful repair is understanding the pathology and the mechanics of dysfunction.

Patient-related

Patient-related factors comprise age, comorbidities,

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requirement for concomitant procedures, patient wishes, along with an understanding of the different options for the patients' respective conditions. A root aneurysm in older patients may present with different characteristics than in younger patients. The AV is generally tricuspid, the root and the ascending aorta are dilated while the annulus is relatively normal. The root and valve may carry calcifications, which render repair more complex. Focal calcifications may be removed by enucleation. Hence, with proper patient selection, durable results can be achieved (1). Younger patients more often present with bicuspid-AV (BAV) and a dilated annulus.

Concomitant procedures are feasible, but the procedure should be performed in a timely manner. In cases of MV-replacement, the clinical advantage of sparing the AV may diminish over time, but if the MV can be repaired then VS should be considered as well.

Valve-related

In general, the ability to preserve a valve depends on the quality and quantity of available leaflet tissues. The relationship between valve orifice area and available valve tissue has to be favorable, to maintain or restore valve competency. Aortic annuloplasty can help decrease valve orifice area, improving the ratio of valve orifice area to available leaflet tissue, and thus valve-coaptation. Depending on valve phenotype, this annuloplasty can be selectively emphasized to improve the mobility of a less mobile cusp (2,3).

Severe AR, especially in tricuspid-AV (TAV), is an important predictor for failure (4). Sparing a severely dysfunctional valve doesn't yield the same long-term durability as repairing a normally functioning valve. Even if we have the tools to repair such valves, they should be approached with humility.

A prolapse doesn't constitute a contraindication to VS. A caliper may help with repair, through assessment of eH. Small fenestrations don't require repair if they don't contribute to AR. Larger, multiple or ruptured fenestrations will render the procedure more complex. However, data suggests that repair with patches or other techniques provides good outcomes (5). Leaflet thickening or retraction can be addressed by thinning, which will increase leaflet mobility and protect from long-term stenosis, particularly in BAV (6). In BAV, a gH of 20 mm is a good parameter to predict repair success.

Localized non-transmural calcifications can be removed without damaging the leaflets. However, the disease process can continue after repair, which may increase the risk of AV stenosis later (7).

Leaflet retractions are some of the more complex lesions to address with regards to quantity of tissue. Sparing a valve which lacks the necessary tissues is suboptimal, and pericardial patch augmentation in these circumstances does not provide long-lasting repairs. The cut-off value for gH has been recommended as 15–16 mm (8), which is reasonable to follow for TAV and BAV. However, in these patients, graft-size should also be smaller: 24 mm for remodeling, 26 mm for reimplantation.

In principle, all phenotypes should be considered for valve preservation. Commissural orientation in BAV can predict the degree of surgical complexity and long-term repair durability (3). The El Khoury classification (9) has taught us the different etiologies of AR and we know that type I and II have better freedom from reoperation than type III.

Conclusions

There are two major determinants for long-term durability after VS:

- Quality and quantity of available leaflet tissues; and
- Skills and aptitude of the surgeon to perform the optimal surgical technique and achieve perfect immediate results in regard to valve-coaptation and stabilization of the FAA, which also guarantees long-term durability (10).

Thus, any patient with pure AR should be considered for repair. In patients with isolated root aneurysm with a normal valve, special attention is required when resuspending the valve in the tube-graft to ascertain a correct configuration of the valve.

The debate regarding the best VS-technique is ongoing. Nonetheless, it's important for the surgeon to be comfortable with his chosen technique, and to understand the underlying principles of VS-operations.

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Footnote

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

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