



Future directions on aortic valve-sparing operations

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Aortic valve-sparing operations should be key part of the surgeon's armamentarium to treat patients with aortic root and ascending aortic aneurysms (1). Whilst a useful addition to the surgeon's capability, there remain a number of unresolved problems. To start, more longitudinal outcomes from multiple centers are needed, not only to demonstrate their reproducibility, but also to determine the limitations of these approaches (1). We believe that in patients with aortic root aneurysms and normal or near normal aortic cusps, the results are entirely dependent on the surgeon's competence. The manuscripts in these two issues of *The Annals of Cardiothoracic Surgery* have repeatedly emphasized the importance of meticulous operative technique with whichever type of reconstruction. Technical details, such as having the cusps coapting within the aortic root, well above the nadir of the aortic annulus and with adequate areas of the cusps touching each other during diastole, is one of the most important aspects of these procedures (2). The relationship between the cusp area and the area of the aortic orifice in diastole will have to be better defined in the future, as this affects the size of the graft used for the reconstruction (2). Intuitively, one would assume that using a smaller graft would offer more cusp tissue for coaptation, but it would also cause the cusps to prolapse and more plications of the free margin would be necessary (2). In addition, smaller aortic orifices would be associated with less mechanical stress on the cusps during diastole. Thus, determining the correct size of graft to use for the

reconstruction is not as simple as one may assume, and it may play an important role in the durability of the cusps after aortic valve-sparing operations (3).

The native semilunar valves (aortic and pulmonary valves) have sinuses of Valsalva and for this reason alone, one must assume that sinuses are important for the function of these valves. The authors of this essay disagree on this issue. Tirone David's view is that commercially available Valsalva grafts are not a correct reproduction of the native aortic root, because the anatomy of semilunar valves are such that the three cusps are attached to the ventricles along a scalloped shape structure that evolves within a cylinder, and this cylinder contains three bulges that are called aortic sinuses or sinuses of Valsalva (4,5). Reimplanting the aortic valve into a spherical structure such as the Valsalva graft is likely to deform the aortic annulus and affect leaflet coaptation and long-term durability (6). Gebrine El Khoury's view differs and he has been using Valsalva grafts, but he tailors it to fit the patients' aortic valve and frequently plicates the spherical space along the sub-commissural triangles to make the graft more tubular in those areas. Further basic studies have to be conducted to examine this issue because the shape of the graft used to reimplant the aortic valve may be important for the durability of the aortic cusps (3).

Aortic valve-sparing operations were initially developed for patients with aortic root aneurysms and tricuspid aortic valves. However, a high proportion of patients with aortic

root or ascending aortic aneurysms have bicuspid aortic valves. The alignment of the cusps in bicuspid aortic valve appears to be important for the long-term outcomes after aortic valve-sparing operations, that is, cusps aligned at 180° probably are the best for durability of the repair (7). Although the group from Brussels believe they can realign the commissures close to 180° in most patients with incompetent bicuspid aortic valves when using the reimplantation technique, this is not supported by others (7,8). This is, yet, another area that needs further investigation.

How bad do the cusps have to be before we decide not to do these aortic valve-preserving operations in patients with aortic root aneurysms? The decision in elderly patients is not difficult, but in young ones these operations compete with the Ross procedure when a mechanical valve is not desirable. Cusp prolapse due to elongation of the free margin can be satisfactorily managed with plication along the nodule of Arantius, and it does not seem to affect durability of the repair during the first two decades of follow-up (1,3). Large fenestrations can be managed with a small segment of pericardial patch, or a double layer of a fine expanded polytetrafluoroethylene suture along the free margin of the cusp (2). Blocks of calcium, scarring or infectious vegetations or tumors can be resected and patched, but the durability of the repair is sub-optimal and probably inferior to what the Ross procedure can provide in a young adult or a bioprosthetic aortic valve in an older patient. The search for an ideal patch material to replace valve tissues remains elusive, but we must continue searching.

Lastly, the normal aortic root is elastic and expands and contracts during the cardiac cycle. These movements appear to be important to optimize opening and closure of the aortic cusps and to minimize the mechanical stress they are subjected to. That is one of the reasons remodeling of the aortic root is functionally superior to reimplantation of the aortic valve, but it does not address the issue of annular dilatation, a common finding in patients with aortic root aneurysm associated with genetic syndromes and incompetent bicuspid aortic valves. Adding a subaortic annuloplasty is likely to render a stiff aortic annulus, in a similar fashion as reimplanting the aortic valve into a Dacron graft. Thus, although it may sound like panacea, a compliant graft would be ideal for aortic valve-sparing operations.

“Perfection is not attainable but if we aim for it, we may reach excellence.”

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Footnote

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

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