A surgical method for selecting appropriate size of graft in aortic root remodeling

Suk Jung Choo and Carlos M.G. Duran

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Twenty-two months earlier, this patient had undergone ligation of congenital bilateral CPAFs on a beating heart. Repeat cardiac catheterization was subsequently performed because of precordial pain and to exclude the possibility of aneurysm formation in a previously demonstrated dilated left main coronary artery that could result in thrombus formation and microembolization and to rule out the development of significant coronary artery disease in the meantime. The dilatation of the left main and proximal left anterior descending coronary arteries has since decreased.

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A Surgical Method for Selecting Appropriate Size of Graft in Aortic Root Remodeling

To the Editor:

We read with great interest the article by Morishita and colleagues [1] on appropriate graft sizing in aortic root remodeling. The difficulty in selecting the "appropriate" graft conduit size in valve-sparing root replacement procedures is due to several features unique to the aortic root, the most important of which is that the aortic root is a dynamic structure with variable elasticity and compliance. The aortic root distends with pressure in a nonlinear fashion, making estimations of the in vivo aortic root dimensions based on measurements obtained from the flaccid heart extremely difficult. Hansen and associates [2] demonstrated a 25% difference in radial distensibility of the static aortic wall between pressures of 0 and 120 mm Hg. Such studies point to the potential for a significant size mismatch that may occur between the native aortic root and the graft conduit using current methods. Attention should also be drawn to the authors' contention that "each commissure (of the aortic valve) corresponds to an apex of an equilateral triangle." Past studies have shown that the intercommissural distance of the left coronary sinus is clearly smaller than either that of the right or the noncoronary sinuses [3]. We have also made similar corroborating anatomic observations (unpublished observations).

Should the aortic valve be competent, a more reliable method is the measurement by transesophageal two-dimensional echocardiography of the aortic valve diameter at its base, which was shown in vitro by Swanson and Clark [4] to undergo fewer dimensional changes during the cardiac cycle. Our own work with sonometric crystals placed in the aortic root of sheep showed that although the area at the level of the commissures expanded 35%, the area at the base only changed 5% (unpublished observations). When aortic valve regurgitation is present, the length of the free edge of the smallest leaflet should be used, keeping in mind that this length is longer than the valve diameter. It is interesting that 500 years after the seminal work of Leonardo da Vinci, we still lack a precise knowledge of the elusive aortic root.

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To the Editor:

We thank Drs Choo and Duran for their comments. They have raised crucial points regarding our article [1]. The concept of root remodeling operations is to obtain appropriate coaptation of the aortic valve during diastole by tightening the dilated aortic root secondary to the aneurysm or dissection with a tube graft. In this operation, we aim not to copy the native aortic root, but to recreate the aortic root so that it produces maximal coaptation of the aortic valve [2]. We realize that the aortic root distends with pressure. Usually, the aortic valve remains competent, despite this distensibility. This phenomenon occurs at the expense of the width of the coaptation at the center [3]. The width decreases as the aortic root increases in diameter. The large redundancy of the coapting surfaces serves to keep the aortic valve from regurgitating. From this point of view, once, even in the flaccid heart, the diameter of the sinotubular junction is determined for the leaflets to meet at the center, the aortic valve will remain competent at various pressures. In addition, because the graft material is so stiff that the reconstructed aortic root does not expand despite high pressure, it is more likely that the leaflets will coapt centrally.

Another concern that Drs Choo and Duran address is that each intercommissural distance is not equal. However, we believe that the difference is so small that we can ignore it. For example, Sands and associates [4] reported that the percent of leaflet contribution to the total valve circumference was 34.3% in the noncoronary leaflet, 33.6% in the right coronary leaflet, and 32.2% in the left coronary leaflet. We have received similar criticisms, which have prompted us to conduct further studies. A comparison was performed between the predicted diameter obtained from our equation [1] and the measured one, using a molding technique [3]. A simple linear regression analysis showed a strong correlation between them. We plan to publish our results immediately after completion of this study.

Despite the considerable change in the sinotubular junction, the reason why we persist in determining its diameter is that the primary mechanism of this operation includes reducing the dilated sinotubular junction so that the aortic valve becomes competent. In patients with aortic valve regurgitation, information revealing appropriate graft sizing cannot be obtained easily

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