EDITORIAL

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Aortic Valve-Sparing operations

BACKGROUND

Aortic valve-sparing procedures have become a key advancement in cardiac surgery, offering a promising solution for patients with aortic root aneurysms, dissection, and other related conditions. These procedures aim to preserve the native aortic valve, preventing the need for valve replacement while still addressing the underlying aortic pathology. This editorial explores the scientific principles, evolution, advantages, challenges, and prospects of aortic valve-sparing interventions.

When aortic root dilatation or aneurysm occurs, the aortic valve can become incompetent, or the aorta can be at risk of rupture. Aortic root aneurysms often result from syndromic genetic conditions such as Marfan syndrome, Ehlers-Danlos syndrome, non-syndromic such as ACTA2 mutations and bicuspid aortic valve disease, or can be acquired due to hypertension, atherosclerosis, and other causes. These conditions may lead to aortic regurgitation or dissection, both of which threaten the structural integrity of the aortic valve.[1] These genetic disorders result in the need for intervention in a younger population. Traditionally, these conditions were corrected with Bentall procedure which includes root and aortic valve replacements with a mechanical or biological valve.

AORTIC VALVE-SPARING PROCEDURES: THE EVOLUTION

The concept of aortic valve-sparing procedures emerged from two features: 1- it is an aortic wall disease with a preserved and a stable aortic valve; 2 -the recognition that preserving the native valve could confer better long-term outcomes compared to valve replacement.

The first successful attempts at aortic valve-sparing surgeries were documented in the 1980s and 1990s, particularly with the development of the David procedure.[2] The key types of aortic valve-sparing procedures are the Aortic Root Reimplantation (David Procedure) and the Aortic Root Remodeling (Yacoub Procedure). The main distinction between both procedures is that in Yacoub procedure the aortic annulus is not corrected. To address this situation Schaffers developed a stitch and Lansac

developed an exterior ring that reduces the aortic annulus. In the modern era both procedures achieve excellent long-term results.[3] Isolated aortic valve repair technics have been established too and can achieve good long term outcomes if there are adequate leaflets tissue.[4]

SCIENTIFIC RATIONALE FOR VALVE PRESERVATION

Aortic valve-sparing procedures rest on the scientific understanding that the native valve, if preserved in a structurally sound aortic root, may offer better long-term hemodynamic performance compared to prosthetic valves. The preservation of the native valve:

1. Avoids Prosthetic Valve Complications: Prosthetic valves, whether mechanical or bioprosthetic, come with long-term complications such as the need for lifelong anticoagulation (in the case of mechanical valves) or the potential for valve degeneration and failure (in the case of bioprosthetic valves). By preserving the native valve, these issues can be circumvented.[5]
2. Better Hemodynamic Performance: Native aortic valves provide superior hemodynamic performance compared to prosthetic valves, resulting in lower gradients and better cardiac output, which is particularly important in young, active patients.
3. Reduced Risk of Endocarditis: Aortic valve-sparing procedures reduce the risk of prosthetic valve endocarditis, a serious complication that can occur with valve replacement surgeries.[6]
4. Improved Quality of Life: Preserving the native valve often is often associated with an overall improvement in the patient's quality of life.

OUTCOMES AND CHALLENGES

The outcomes of aortic valve-sparing surgeries have been generally favorable, with low rates of valve-related complications and a high rate of long-term survival free of reoperation.[2] Despite their advantages, there are some challenges as these procedures are technically demanding, needed a careful patient evaluation and selection. The success of valve-sparing procedures depends on: 1- quality and quantity of available leaflet tissue; 2- Skills and aptitude of the surgeon.[7] The techniques of aortic valve repair and aortic valve annulus restriction have been finely developed and are slowly spread over the surgical community. This may explain why of the predicted 80% reparable aortic valve regurgitation only 15-20% are repaired in USA and Europe. Studies have demonstrated that patients who undergo valve-sparing procedures for aortic root aneurysms or dissections experience improved survival rates and fewer reoperations compared to those who undergo valve replacement.[8]

FUTURE DIRECTIONS AND INNOVATION

The future of aortic valve-sparing procedures lies in spreading the surgical technique, by training and mentorship to reach the pool of candidates who can benefit from these interventions. Key areas of ongoing research include:

- Minimally Invasive Approaches: With the increasing focus on minimally invasive surgery, there is ongoing research into less invasive methods for performing valve-sparing procedures. These approaches could reduce recovery times and complications while maintaining the effectiveness of the surgery.[9]
- Improved Imaging and Diagnostics: Advances in imaging techniques, such as 3D echocardiography and CT angiography, have improved the ability to assess the suitability of aortic valve-sparing surgery. These tools allow for more precise preoperative planning and better identification of patients who are suitable candidates for these procedures.
- Genetic and Molecular Insights: As the molecular basis of aortic valve disease becomes clearer, it may be possible to better predict which patients will benefit most from valve-sparing procedures. Additionally, targeted therapies aimed at stabilizing the aortic root and preventing its dilatation may further enhance the success of these procedures.
- Long-Term Data Collection: While short- and medium-term outcomes of valve-sparing procedures are promising, long-term data are still required to fully understand the durability of valve preservation. Large-scale, multi-center registries and studies will help clarify the longevity and risks of valve-sparing interventions.

CONCLUSION

Aortic valve-sparing procedures represent a significant advancement in cardiac surgery, offering patients a chance to retain their native valve and avoid the long-term complications associated with valve replacement. With education, surgical training, continued research, refinement of surgical techniques, and the development of advanced diagnostic tools, the future of aortic valve-sparing surgery holds the potential to expand the benefits of this procedure to a larger patient population, improving outcomes and quality of life.

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