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Commentary: Lasting durable bioprosthetic valves: Truth or fiction

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CENTRAL MESSAGE

Recent advances in bioprosthetic valve technology will impact AVR practice. Understanding the factors that allow them to withstand deterioration may make them a more viable option for young patients.

Owing to the positive outcomes observed with the use of bioprosthetic valves (BPVs),[1] aortic valve replacement (AVR) has evolved tremendously in recent years, resulting from a quantum leap of industrial innovation and technical advancement.[2] As a result, younger patients are now offered BPVs rather than mechanical valves as a treatment for aortic valve disease. Thus, these patients enjoy less-invasive procedures, quicker recovery, and a life free of long-lasting anticoagulation therapy. Despite this improved outcome, BPVs' questionable durability in comparison with mechanical valves continues to be a primary concern, especially for younger patients. Fortunately, tissue technology continues to improve valve design to offer better durability, hemodynamic performance, and ease of implantation so that young patients have a low risk for the redo of AVR and better results if future valve-in-valve transcatheter aortic valve replacement (TAVR) is considered.[3]

Since the recently developed RESILIA INSPIRIS valve (Edwards Lifesciences, Irvine, Calif) has potential long-lasting durability, Sadri and colleagues' simulation study is timely and essential.[4] They performed an in vitro accelerated wear study, evaluated hemodynamic and leaflet kinematic profiles, and examined fluid flow with particle image velocimetry following one billion cycles. This allowed close examination of some of the critical factors affecting BPV durability. They compared the valve undergoing stress with naïve valves as controls to provide comprehensible results regarding durability affected by mechanical stress and how that would affect the hemodynamic profile following approximately 25 simulated years. RESILIA valves maintained their original flow characteristics after stress. The velocity and shear stress fields were similar between the control and study valves, indicating very good durability and hydrodynamic performance.

Currently, there is evidence of a significant relationship between hemodynamic performance and valve durability. While BPVs may have excellent hemodynamic characteristics early after implantation, when calcification ensues, stenosis can cause valve failure. Subsequently these valves demonstrate a reduction in orifice area and an increase in transvalvular gradients.[5]

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Late valve stenosis will lead to patient–prosthesis mismatch (PPM); any slight survival advantage achieved by avoiding mismatch in is crucial, especially as we start offering younger patients BPVs.[6] While factors that impact long-term durability, such as leaflet thrombosis and calcification, were not studied by Sadri and colleagues, their work presents great scientific value through exploring the effect of mechanical stress on durability and the development of late PPM.[7] By addressing how a valve tolerates mechanical stress over a long period of time, we can extrapolate how this may alleviate the impact of PPM after AVR.[8]

The expansion of available TAVR indications to intermediate- and low-risk patients has made the durability of BPVs more critical as younger patients are being offered TAVR. Without a more durable valve, this procedure makes future aortic valve prothesis interventions unavoidable. Thus, this study provides insight into how continued improvements in BPV design are crucial. The new RESILIA valve also has an expandable ring, allowing future valve-in-valve TAVR with larger prosthesis, thus mitigating the risk of PPM. Perhaps adopting the same technology and design to the commercially available TAVR prosthesis will increase its durability and further improve their hemodynamic performance.

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