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GUEST EDITORS' PAGE

The Future of Transcatheter Interventions

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Early clinical outcomes of transcatheter aortic valve implantation (TAVI) are now known to be at least equivalent (if not superior) to surgical aortic valve replacement (SAVR) regardless of risk score (1). In the next decade, it is inevitable that TAVI will be viewed as a viable alternative to SAVR in all patients regardless of age. Patients prefer TAVI over SAVR because it is performed using local anesthesia and requires only percutaneous access. Next-day discharge following TAVI is already a reality, and same-day discharge will soon be likely as we continue to simplify the TAVI procedure and improve device design (abolition of paravalvular aortic regurgitation and reduction in pacemaker implantation rate). Between 2007 and 2017, the number of TAVI procedures was close to 300,000 worldwide. With an aging population, demand for the procedure is predicted to increase exponentially to almost 300,000 implants per year by 2025 (2). Significant expansion in TAVI services will be required, and future training in interventional cardiology (and potentially cardiac surgery) will need to reflect the growing clinical need for structural interventions with an appropriate strategic expansion of TAVI operators.

Indications for TAVI have expanded, and we are now performing TAVI in progressively younger patients. Bicuspid aortic valve disease, which was previously an indication for SAVR, is becoming less of a technical concern. Valve-sizing algorithms and preprocedural imaging assessment have greatly improved; these advances, combined with latest-generation devices that incorporate polyethylene sealing skirts, enable uniform deployment, as well as dramatic reduction in the incidence of paravalvular aortic regurgitation (3). Next-generation TAVI devices are also being future-proofed with reduced valve height to facilitate coronary access in anticipation of the potential need for interventional treatment of ischemic heart disease.

Our surgical colleagues are now implanting bioprosthetic valves in increasingly younger patients, given the valves' enhanced durability and the clinical advantages of negating the need for warfarin anticoagulation. In preference to high-risk redo sternotomy for degenerated bioprosthetic valves, it is becoming increasingly clear that TAVI-in-SAVR is feasible in patients with surgical bioprostheses with or without a fixed sewing ring (4). Indeed, TAVI-in-TAVI is now feasible in patients requiring a second transcatheter procedure. TAVI is also an accepted treatment for severe native aortic regurgitation in those patients at high surgical risk. With increasing experience and advances in transcatheter heart valve design (including, but not limited to, sealing skirts, anchoring mechanisms, and larger valve sizes, with frequent oversizing in the absence of calcification), TAVI operators will soon develop the necessary expertise to treat native aortic regurgitation.

Percutaneous mitral balloon valvuloplasty has been the mainstay of treatment for rheumatic mitral stenosis for many years. However, in the past decade we have also come leaps and bounds in the transcatheter treatment of primary and secondary mitral regurgitation (MR). Different approaches, including edge-to-edge repair systems and percutaneous direct and indirect annuloplasty, have provided therapeutic options for patients denied surgery (currently

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approximately 50% of patients with MR). Although we are still in the early stages, partial reduction in MR versus complete abolition appears to confer favorable hemodynamic benefits that could in future be linked to better long-term outcomes. Transcatheter procedures for severe mitral annular calcification and failed mitral surgical prostheses (both valve in ring and valve in valve) are becoming increasingly common. Percutaneous techniques for tricuspid regurgitation are also in development, including edge-to-edge repair, annuloplasty, coaptation enhancement, and composite valve implantation (5).

In the past decade we have witnessed a paradigm shift in the treatment of valvular heart disease. Transcatheter heart valve interventions now provide a real alternative to surgery and are often the only treatment option for patients who would have died otherwise. Hundreds of thousands of patients worldwide have already benefited from this revolution, and transcatheter interventions are now set to overtake surgery as the default interventional treatment strategy for valvular heart disease. However, device costs remain an issue, particularly in regions with weaker health care services, and it is essential that transcatheter heart valve interventions are accessible and affordable to address the global burden of valvular heart disease.

We look forward to the development of next-generation transcatheter devices, which are likely to incorporate glutaraldehyde-free bioprosthetic leaflets to increase long-term TAVI durability. Routine use of embolic protection devices in younger patients undergoing TAVI will extend to percutaneous mitral procedures, and TAVI-in-TAVI is likely to become the new normal. Given the complexity of the mitral valve apparatus, transcatheter mitral procedures will likely evolve using a combination of edge-to-edge and annuloplasty devices, as well as transcatheter mitral valve replacement in patients who are anatomically suitable. The future looks rosy for patients with valvular heart disease as transcatheter interventions become more diverse and increasingly available.

AUTHOR DISCLOSURES

Dr. Redwood has served as a proctor for Edwards LifeSciences and MVRx Inc.; and has received speaker fees from Edwards LifeSciences. Dr. Prendergast has received unrestricted research and educational grants from Edwards LifeSciences; has received lecture fees from Abbott and Edwards Lifesciences; and has received consultancy fees and serves on the Scientific Advisory Board for Anteris. All other authors have reported that they have no relationships relevant to the contents of this paper to disclose.

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