Transcatheter aortic "valve-in-valve" for degenerated bioprostheses: Choosing the right TAVI valve

Enrico Ferrari

Cardiovascular Surgery Department, University hospital of Lausanne, CH-1011, Lausanne, Switzerland

Corresponding to: Dr. Enrico Ferrari. Cardiovascular Surgery Department, Centre Hôpitalier Universitaire Vaudois (CHUV), 46, rue du Bugnon, CH-1011 Lausanne, Switzerland. Email: enricoferrari@bluewin.ch.

Abstract: Bioprosthetic aortic valve replacement is the treatment of choice for patients over 65 years of age suffering from aortic valve disease, and for younger patients with contraindications to long-lasting anticoagulation. Despite several technical improvements to reduce the risk of structural valve degeneration (SVD), the risk of SVD still exists, in particular for hemodialysis patients and patients under 60 years of age at surgery. Redo open heart surgery is the treatment of choice in case of valve degeneration, but caries a higher surgical risk when elderly patients with comorbidities are concerned. In the last 5 years, transcatheter aortic "valve-in-valve" procedures represent a valid alternative to standard redo surgery in selected patients. Valve-in-valve procedures represent a less invasive approach in high-risk patients and the published results are very encouraging. Technical success rates of 100% have been reported, as have the absence of paravalvular leaks, acceptable trans-valvular gradients (depending on the size of the original bioprosthesis), and low complication rates. The current article focuses on choosing the correct transcutaneous valve to match the patient's existing bioprosthesis for valve-in-valve procedures.

Key Words: Aortic valve replacement; structural valve degeneration; transcatheter aortic valve implantation; valve-in-valve procedure

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Introduction

Aortic valve replacement (AVR) with cardiopulmonary bypass, cardioplegic arrest and aortic cross-clamping represents the treatment of choice for the treatment of aortic valve diseases and provides good operative outcomes and long-term results (1,2). Following standard international guidelines, patients over 65 years of age at surgery or younger patients with contraindications to the anticoagulation are candidates for the implantation of a bioprosthesis (3-5). Despite all attempts to decrease the incidence of leaflet calcification and structural failure, early structural valve degeneration (SVD) can occur. Redo valve surgery in the elderly with associated comorbidities is associated with a higher operative risk, increased hospital mortality, and increased complication rates (6). Transcatheter valve procedures through transapical, transfemoral and transaortic accesses can be performed in selected cases of degenerated aortic bioprostheses ["valve-in-valve" concept (VinV)] with surprisingly technical ease. Experienced centers employ this technique routinely with very good clinical results (7-16). Transcatheter aortic valve implantation (TAVI) prostheses routinely employed for VinV procedures are the balloon-expandable Edwards Sapien™ XT and the self-expandable Medtronic Corevalve®, whereas other CE-marked stent-valves are under evaluation. It is our experience that the Sapien™ XT valve seems to better adapt to commonly used bioprostheses during VinV procedure.

Technical aspects and results

Symptomatic patients with degenerated bioprostheses presenting with advanced age or severe comorbidities are good candidates for transcatheter VinV, whereas

Table 1 Inner diameter of aortic bioprostheses with corresponding suggested Sapien™ XT valve size

	Labelled size (mm)	Measured inner diameter (mm)	Suggested Sapien™ size (mm)
Sorin Biomedica MITROFLOW™	21	17	23*
	23	19	23
	25	20	23
	27	22	23
Edwards PERIMOUNT™ Magna Ease	21	18	23*
	23	21	23
	25	22	23
	27	24	26
St. Jude medical TRIFECTA™	21	18	23*
	23	20	23
	25	22	23
	27	24	26
Medtronic HANCOCK II™	21	18	23*
	23	20	23
	25	22	23
	27	24	26

*The suggested Sapien™ size will create high trans-valvular gradients. This option should be used only in inoperable patients

endocarditis remains a formal contraindication. Specific preoperative exams and cardiac imaging are not usually required, given that the size of the implantable TAVI-valve is pre-determined by the size of the pre-existing bioprosthesis. However, a risk of mismatch exists and one needs to take into consideration the real inner diameter of the bioprosthesis in order to implant the ideal Sapien™ XT valve (see *Table 1*): (I) the 23 mm Sapien™ valve implanted into a 21 mm size stented bioprosthesis is at risk for high trans-valvular gradients; (II) the 23 mm Sapien™ XT fits into a 23 mm and 25 mm bioprosthesis; (III) the 23 mm Sapien™ XT fits into the 27 mm Sorin Mitroflow™, whereas the 27 mm Trifecta™, Perimount™ and Hankock® require the implantation of a 26 mm Sapien™ XT.

During VinV procedures, angiography may not be necessary and the procedure can be performed under transesophageal echocardiographic and fluoroscopic control. Contrast is not required because the ring of the bioprosthesis is radiopaque and acts as a landmark. Regarding the positioning, the lower margin of the Sapien™ should remain 2-3 mm below the lower margin of the bioprosthesis in order to optimize the shape and the hemodynamic performances of the TAVI valve (17). The TAVI implantation follows the same sequence of steps for standard TAVI thereafter, with the exception that there is no need for a balloon valvuloplasty.

Concerning the results, published clinical data are very encouraging with a success rate of 100%, very low paravavular leak rates, and acceptable trans-valvular gradients as long as the pre-existing valve was 23 mm or larger. Patients with a degenerated 19 or 21 mm bioprosthesis have high residual trans-valvular peak gradients ranging from 30-40 mmHg (11,15,17). Thus, this option should be considered only for inoperable patients.

Conclusion

Results from aortic VinV series suggest that the technique produces very acceptable trans-valvular gradients in 23 mm and 25 mm degenerated bioprostheses, with absence of relevant leakage and a low rate of complications. Moreover, the aortic VinV is safe, does not require a specific preoperative cardiac imaging, does not require aortography and pre-ballooning, and can be performed in patients with chronic renal failure (low risk of postoperative kidney injury and low risk of embolization). In conclusion, the 23 mm Sapien™ XT seems to be the most useful TAVI valve because it fits within the majority of currently

used bioprostheses (23 mm and the 25 mm diameter). We suggest implanting large bioprosthesis during first-time standard AVR in order to prevent size mismatch in case of future VinV procedures.

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