Sutureless aortic valve replacement with concomitant valvular surgery

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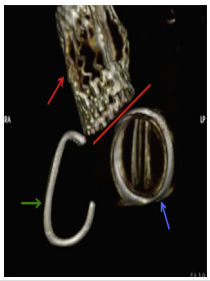
ABSTRACT

Objectives: Sutureless aortic valve replacement (SU-AVR) is an alternative technique to standard aortic valve replacement. We evaluated our experience with the Perceval SU-AVR with concomitant mitral valve surgery, with or without tricuspid valve surgery, and aimed to discuss the technical considerations.

Methods: From January 2013 through June 2016, 30 patients with concomitant severe mitral valve disease, with or without tricuspid valve disease, underwent SU-AVR with the Perceval prosthesis in a single center.

Results: The mean age was 73.0 ± 6.6 years, ranging from 63 to 86 years, and 60% (n = 18) were male. Mean logistic EuroScore of the study cohort was 9.8 ± 4.6. Concomitant procedures consisted of mitral valve repair (n = 8, 26.6%), mitral valve replacement (n = 22, 73.3%), tricuspid valve repair (n = 18, 60%), tricuspid valve replacement (n = 2, 6.6%), and cryoablation for atrial fibrillation (n = 21, 70%). Median prosthesis size was 25 mm (large size). At 1 year, there were 2 deaths from noncardiac causes. One patient (3.3%) had third-degree atrioventricular block requiring permanent pacemaker implantation. Three patients (10%) had intraoperative supra-annular malpositioning of the aortic prosthesis, which was safely removed and reimplanted in all cases. Mean follow-up was 18 ± 4.5 for months (maximum 3 years). During the postoperative period, sinus rhythm restoration rate in patients who underwent the cryo-maze procedure was 76.1% (n = 16) at discharge. There was no structural valve deterioration or migration of the prosthesis at follow-up.

Conclusions: Perceval SU-AVR is a technically feasible and safe procedure in patients with severe aortic stenosis with good results even in the presence of multivalvular disease and atrial fibrillation surgery. (J Thorac Cardiovasc Surg 2018;■:1-9)



3D confirmation of relationship between aortic, mitral, and tricuspid valves in angio-CT.

Central Message

SU-AVR with concomitant valve surgery can be feasible and safe in elderly, high-risk patients with relatively low morbidity and mortality.

Perspective

SU-AVR can be used as an alternative treatment option to for "gray zone" patients with multiple valve disease. Performing concomitant valve surgery should not be considered a contraindication to SU-AVR. The sutureless strategy in concomitant valve surgery can simplify the management of high-risk, elderly patients.

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Aortic stenosis (AS) is still the most frequent valvular heart disease in adults, affecting approximately 2% to 7% of the population older than 65 years of age.[1,2] Aortic valve replacement (AVR) remains the gold standard for severe symptomatic AS in adult patients. In recent years, substantial technological advances have been made in the treatment of aortic valve disease. Specifically, transcatheter aortic valve implantation (TAVI) and sutureless aortic valve replacement (SU-AVR) have emerged as promising and useful alternatives to standard AVR in frail, elderly patients with high surgical risk.[3,4]

In a European multicenter experience with the sutureless Perceval valve (LivaNova, Saluggia, Italy), 40% of the study cohort were octogenarians.[5] A recent meta-analysis revealed that patients who underwent SU-AVR had significantly better survival rates at 1 and 2 years with lower

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Abbreviations and Acronyms

AF = atrial fibrillation
AMD = aorto-mitral distance
AS = aortic stenosis
AVR = aortic valve replacement
CPB = cardiopulmonary bypass
CT = computed tomography
LVOT = left ventricular outflow tract obstruction
MVR = mitral valve replacement
MVrep = mitral valve repair
PVL = paravalvular leak
SU-AVR = sutureless aortic valve replacement
TAVI = transcatheter aortic valve implantation
TEE = transesophageal echocardiographic

incidence of paravalvular leak (PVL) compared with TAVI.[4] In contrast to TAVI, SU-AVR requires excision of the aortic valve and complete decalcification of the aortic root to avoid PVL.[6] SU-AVR also facilitates aortic bioprosthesis implantation associated with shorter aortic crossclamp and myocardial ischemic times even in minimally invasive aortic surgery when compared with conventional AVR.[7] Furthermore, the sutureless design of Perceval combined with its flexible stent allows the valve to conform to physiologic movements of the aortic root. Indeed, there are studies showing sutureless aortic valves have larger effective orifice area than stented valves.[8]

In the elderly patient population undergoing AVR, moderate mitral regurgitation has been shown to be an independent risk factor for long-term mortality.[9] However, surgical intervention for moderate mitral regurgitation at the time of AVR remains a matter of debate. Due to procedural efficiency and reduced aortic crossclamp times, SU-AVR should be included in the decision-making process regarding the best surgical approach and may improve outcomes in patients with multiple valvular disease.[10] Several studies suggest that the presence of mitral valve disease or previous mitral valve surgery might limit the role of SU-AVR due to concerns related to alteration of the 3-dimensional geometry of the aortic root and left ventricular outflow tract (LVOT) and possible interference between the 2 left-sided valves at the level of aorto-mitral continuity. There is limited evidence in the literature regarding the validity of these concerns or how they might be managed technically.[10,11]

In our institution, moderate-to-severe mitral insufficiency and/or tricuspid insufficiency are surgically treated during AVR surgery. SU-AVR might provide important advantages in such cases by reducing operative times and facilitating AVR, but the feasibility and safety of this approach have not been validated. Therefore, we reviewed our outcomes with SU-AVR in concomitant mitral, with or without tricuspid, valve surgery.

METHODS

Our institutional ethical committee obtained approval for the use of these data. Between January 2013 and August 2016, 149 consecutive patients who underwent multiple valve surgery were identified. The cause of valvular disease was rheumatic in 79.8% (119/149) and degenerative in 20.1% (30/149) of patients (Figure 1). In this retrospective, observational cohort performed at a single-center, we identified 30 patients with severe AS who underwent SU-AVR with a Perceval prosthesis and concomitant mitral surgery. Twenty (66.7%) patients also had concomitant tricuspid regurgitation or stenosis. Preoperatively obtained cardiac gated multidetector computed tomography (CT) scans were evaluated to aorto-mitral distance (AMD). AMD was established during systole using the following technique: the coplanar aortic annulus image was obtained usually between 20° and 30° and then rotated until AMD was shortest from the aortic annular base to the midpoint of the fibrous trigones of the mitral valve, and the distance was recorded. Three-dimensional reconstruction images (system: CARTO3 system V4.3.5; software: CARTO Merge Plus; both from Biosense Webster, Diamond Bar, Calif) allow multiangle visualization of AMD at the right anterior oblique position (Figure 2). Over the study period, mechanical valves, stented bioprosthesis, and stentless biological valves were also implanted in the aortic position by the same surgical team. The clinical data were prospectively collected in our center's database.

The Perceval sutureless valve is a next-generation aortic bioprosthesis made of bovine pericardium within an elastic nitinol stent produced from nickel and titanium. Atraumatic collapsing by a dedicated delivery system allows rapid deployment of the valve within the aortic root without crimping of the bioprosthesis. The Social Security Agency in Turkey provided specific indications for Perceval implantation after Conformité Européenne mark approval of the device in 2013. In compliance with guidelines provided by the Social Security Agency, active endocarditis, bicuspid aortic valve, and aortic root enlargement exceeding 4 cm were considered contraindications for Perceval implantation.

Follow-up echocardiograms were obtained before discharge, at 1, 3, 6, and 12 months postoperatively and annually thereafter. Target international normalized ratio was 2.5 to 3.5 for 3 months if sinus rhythm was restored in patients with exclusively biological valve replacement.

Surgical Approach

All patients had an intraoperative transesophageal echocardiographic (TEE) evaluation. Standard median sternotomy and moderate hypothermic (32°C) cardiac arrest were performed for all procedures. Cardiopulmonary bypass (CPB) was initiated with ascending aorta and bicaval cannulation. Custodiol-HTK (Köhler Chemie GmbH, Bensheim, Germany) cardioplegia was administered for myocardial protection. The carbon dioxide diffuser was placed in the pericardial cavity, and carbon dioxide was delivered just before opening of the aorta until closure of aortotomy.

As suggested by Perceval implantation guidelines, the aorta was opened transversely approximately 3.0 to 3.5 cm above the level of aortic annulus. The native aortic valve was removed, and complete decalcification was performed. For mitral exposure, the left atrium was opened through Waterston's groove. The Memo-3D ring (LivaNova) was used in patients who underwent mitral valve repair (MVrep; n = 8). The remaining 22 patients underwent mitral valve replacement (MVR) using bioprostheses or mechanical valves. We carefully oriented one of the struts of the mitral bioprosthesis anteriorly almost midway between the lateral and medial fibrous trigones. This issue is specifically important for concomitant biological MVR due to bulky struts, which may create LVOT obstruction and/or prevent optimal positioning of SU-AVR. Thus, any issue that may cause malposition or inappropriate implantation of Perceval in the