Expanding the indication for sutureless aortic valve replacement to patients with mitral disease

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Objectives: To review our experience with sutureless aortic valve replacement (AVR) in the setting of concomitant mitral valve (MV) surgery and discuss the technical considerations.

Methods: Between January 2012 and March 2013, 10 patients underwent sutureless AVR with the Perceval prosthesis in the setting of concomitant mitral disease. Five patients underwent MV repair, 4 underwent MV replacement, and 1 had a previously implanted mechanical mitral prosthesis.

Results: The median age was 79 years and 7 patients (70%) were male. Median logistic EuroSCORE II was 6.2%. All valves were successfully implanted with no 30-day mortality. There was no residual aortic paravalvular leak. Two patients had from third-degree atrioventricular block requiring permanent pacemaker implantation. At a mean follow-up of 8 $\pm$ 4 months (range, 2-16 months), the overall survival was 80% with 2 non−valve-related deaths and the mean transaortic gradient and aortic valve area had improved to 11.1 $\pm$ 4.6 mm Hg and 1.5 $\pm$ 0.3 cm^2, respectively. There was no evidence of mitral dysfunction in any patient.

Conclusions: In our experience, sutureless AVR in the setting of concomitant mitral surgery is a feasible and reproducible procedure. Elderly patients undergoing multiple valve surgery present a higher operative risk, therefore extending the indication for sutureless AVR to patients with concomitant mitral disease could greatly benefit this specific population. (J Thorac Cardiovasc Surg 2014;148:1354-9)

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Sutureless aortic valve replacement (AVR) is an emerging alternative to standard AVR in elderly high-risk surgical patients. Potential advantages include shorter aortic crossclamp times and easier access for minimally invasive surgery. Several case series have shown good early clinical and hemodynamic outcomes with the use of sutureless prostheses.[1-3] However, despite promising initial clinical results, the indications for sutureless AVR are still being refined.[4]

Patients undergoing multiple valve surgery present a higher operative risk, partly as a result of prolonged periods of cardiopulmonary bypass and myocardial ischemia.[5] These patients could theoretically benefit from the reduction in crossclamp times associated with sutureless AVR. However, the presence of a previously implanted mitral prosthesis or the need for concomitant mitral valve (MV) surgery are generally viewed as contraindications to sutureless AVR, because of the potential risk of interference between the 2 valves at the level of the aorto-mitral continuity.

We assessed the hypothesis that sutureless AVR can be safely performed in patients requiring concomitant MV surgery. We review our experience with sutureless AVR in this setting and describe the technical considerations.

METHODS

Between June 2011 and May 2013, 120 patients with severe aortic stenosis underwent sutureless AVR using the Perceval S prosthesis (Sorin, Saluggia, Italy). Ten of these patients had concomitant MV disease.

The Perceval S sutureless valve is a new-generation aortic bioprosthesis and is composed of bovine pericardium mounted within a superelastic alloy frame. The device can be collapsed through a dedicated device and deployed using a specific delivery system.

Implantation of the prosthesis was approved by the Canadian Department of Health and Welfare (Ottawa, Canada) for each patient. Informed written consent was obtained from all patients and the study was approved by our institution's local ethics committee. All patients were prospectively followed at our center's dedicated Valve Clinic.

Statistical analyses were performed using Statistical Package for Social Sciences (SPSS) v20 (SPSS, Inc, Chicago, Ill). Continuous variables are presented as the median (range) and categorical variables are presented as the frequency (%). Operative mortality was defined as death occurring within 30 days of surgery or during the index hospitalization. Improvements in mean aortic gradient and aortic valve area were assessed with the Wilcoxon signed rank test.

Surgical Technique

The technique for implantation of the Perceval sutureless prosthesis has been described elsewhere[2,4] and is briefly summarized here. All procedures were performed via median sternotomy under moderately hypothermic

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Abbreviations and Acronyms
AVR = aortic valve replacement
LVOT = left ventricular outflow tract
MV = mitral valve
NYHA = New York Heart Association
TAVI = Transcatheter aortic valve implantation

(32°C) cardiopulmonary bypass and cardioplegic arrest. A transverse aortotomy was performed approximately 3.5 cm above the level of the aortic annulus. The native valve was removed and moderate decalcification of the annulus was performed to obtain a homogeneous circular surface. The aortic annulus was then measured and the appropriate prosthesis size was selected. During the study period, the extralarge prosthesis (27 mm) was not yet available. At this stage, standard left auriculotomy was performed and the MV was assessed. It was either repaired (n = 5) or replaced using a bioprosthesis (n = 4). After closure of the auriculotomy, the aortic annulus was resized to ensure consistency of the initial measurements. The sutureless valve selected was then guided into its correct position using a specific delivery system and three 4-0 polypropylene guiding sutures. These sutures were passed through the aortic annulus at the nadir of each aortic cusp. The valve was then deployed and the delivery system and sutures were removed. After deployment, a dedicated balloon was inserted into the prosthesis and expanded for 30 seconds at a pressure of 4 atm. Once correct positioning of the valve was confirmed, the ascending aorta was closed in a standard fashion. Concomitant tricuspid valve repair was required in 2 patients. Tricuspid repair was performed before sutureless valve deployment to avoid distorting the aortic annulus during exposure.

RESULTS

Patient Baseline Characteristics

The median age of the patients was 79 years (range, 73-85 years). Seven patients were male. The baseline characteristics of the patients are summarized in Table 1. Four patients were obese (body mass index >30 kg/m^2). Sixty percent of patients were in New York Heart Association (NYHA) class III or IV. Median logistic EuroSCORE II predicted mortality was 6.2% (range, 2.1%-16.4%). No patient had a permanent pacemaker before surgery. The median preoperative left ventricular ejection fraction was 60% (range, 35%-65%). The median preoperative pulmonary artery systolic pressure was 43 mm Hg (range, 36-65 mm Hg); 3 patients had severe pulmonary hypertension (>55 mm Hg). One patient had a 29-mm Carbomedics (Sorin) mechanical mitral prosthesis that had been implanted 21 years earlier. The mean transmitral gradient across the prosthesis was 3.1 mm Hg with an MV area of 2.8 cm^2. The median length of the aorto-mitral continuity, as measured by preoperative transesophageal echocardiography, was 11 mm (range, 8-14 mm).

Operative Details

The procedural details are summarized in Table 2. Successful implantation of the sutureless aortic prosthesis was achieved in all patients. Five patients underwent concomitant MV plasty and 4 underwent concomitant biological MV replacement. Other concomitant procedures included aortic commissuroplasty (n = 2), septal myectomy (n = 2), tricuspid valve repair (n = 2), maze radiofrequency procedure (n = 2), coronary artery bypass graft (n = 1), and atrial septal defect closure (n = 1). Seventy percent of patients received a medium-sized (23 mm) sutureless aortic prosthesis.

All patients who underwent MV repair received an annuloplasty. The first patient received a complete Carpentier-Edwards Physio ring (Edwards Lifesciences, Irvine, Calif); the remaining 4 patients received a partial Annuloflex ring (Sorin). Ring size was 34 mm and 36 mm in 3 and 2 patients, respectively. Other repair techniques included quadrangular resection (n = 2), chordal transposition (n = 1), and commissuroplasty (n = 2).

All patients who underwent MV replacement received a 27-mm bioprosthesis. One patient received a Perimount Plus valve (Edwards Lifesciences) and 3 received a Magna-Ease valve (Edwards Lifesciences).

Intraoperative redeployment of the sutureless aortic prosthesis was necessary in 4 patients. In 2 of these cases, the diameter of the aortic annulus was greater than 25 mm and both patients had to undergo aortic commissuroplasty to ensure a tight fit of the prosthesis. In the remaining 2 cases, there was supraannular malposition of the prosthesis. In the 4 patients requiring redeployment, the sutureless valve was easily removed using the χ-movement technique[6] and subsequently reimplanted. In 1 case, the aorta had to be reclamped and the heart rearrested to redeploy the prosthesis.

On the control intraoperative transesophageal echocardiograms, there were no cases of aortic paravalvular regurgitation. In addition, all patients showed aortic insufficiency of 1/4 or less and mitral insufficiency of 1/4 or less.

Perioperative Outcomes

There were no 30-day mortalities. No postoperative valve migration was observed and no patient had a stroke or myocardial infarction. During the postoperative period, 1 patient had bleeding requiring reoperation and 2 patients presented transient acute renal failure (>50% increase in the serum creatinine concentration). Postoperative delirium occurred in 40% of patients. Two patients had third-degree atrioventricular block requiring permanent pacemaker implantation. Eight patients received at least 1 blood transfusion (median, 2 red blood cell units per patient). The median postoperative intensive care unit length of stay was 4 days (range, 0-14 days).

The predischarge echocardiographic results are presented in Table 3. The mean aortic valve area increased from 1.0 ± 0.3 cm^2 (range, 0.6;1.8 cm^2) to 1.6 ± 0.4 cm^2

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