

Pericardial Patch Augmentation Is Associated With a Higher Risk of Recurrent Aortic Insufficiency



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Background. This study assessed early and late clinical outcomes in patients who underwent aortic valve repair or an aortic valve-sparing operation and investigated predictors for failure.

Methods. Of 227 consecutive patients who underwent aortic valve repair or a valve-sparing operation in our department between 2004 and 2016, 81 (36%) underwent aortic root replacement with or without cusp repair, 97 (42%) ascending aorta replacement with or without cusp repair, and 49 (22%) isolated aortic valve repair. Clinical and echocardiographic follow-up was complete.

Results. One patient (0.4%) died in-hospital. Mean clinical and echocardiographic follow-up was 69 ± 40 months (range, 1 to 147 months) and 53 ± 40 months (range, 1 to 147 months), respectively. Fifteen patients (6.6%) died during follow-up, with an overall 5-year survival rate of 94.4%. Recurrent significant (≥ 3) aortic insufficiency developed in 20 patients (8.8%), 17 of whom

underwent reoperation, with a 5-year freedom from reoperation rate of 88%. Predictors for recurrent significant aortic insufficiency or reoperation were greater preoperative aortic insufficiency (grade III to IV vs I to II; relative risk [RR], 1.97; $p = 0.023$), cusp repair (RR, 2.92; $p = 0.001$), higher European System for Cardiac Operative Risk Evaluation score (RR, 1.16; $p = 0.006$), and valve repair with pericardial patch augmentation (RR, 2.34; $p = 0.032$).

Conclusions. Aortic valve repair and valve-sparing operations can be performed with good early and late clinical outcomes. In our experience, however, the rate of recurrent aortic insufficiency was significant, especially in patients who underwent cusp augmentation with glutaraldehyde-treated autologous pericardial patch.

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Aortic valve (AV) repair and the AV-sparing operation provide alternative treatment for prosthetic AV replacement in carefully selected patients with aortic insufficiency (AI). We believe that such treatment should be considered when the estimated repair durability is at least equal to the estimated durability of valve replacement by a bioprosthesis. The AV-sparing operation includes root replacement by reimplantation or remodeling techniques, replacement of the ascending aorta down to the sinotubular junction (STJ) with an appropriate Dacron (DuPont, Wilmington, DE) graft diameter [1–4], and AV repair includes cusp repair with or without annuloplasty.

Root or ascending aorta replacement down to the STJ has traditionally been used in patients with dilatation of the aorta with normal AV leaflets and has been proven to be reliable therapy with excellent long-term results [5, 6].

During the past decade, this procedure was expanded to include patients with anatomic valve abnormalities, such as bicuspid aortic valve (BAV), unicuspid aortic valve (UAV), and also deformed or partially calcified tricuspid aortic valve (TAV) [7–10]. Recent studies have explored the influence of cusp repair on reimplantation procedures. One such study reported that cusp repair, in addition to the David procedure (reimplantation root replacement), negatively affected the midterm reoperation rate in patients with BAV but not in patients with TAV [11]. Another study showed no difference between patients who did and did not undergo cusp repair [12]. The aim of this study was to evaluate our experience regarding the influence of cusp repair on all types of AV

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repair and AV-sparing operations and to determine the predictors for recurrent AI after the surgical procedure.

Material and Methods

The Sheba Medical Center Institutional Review Board approved this study.

Patient Population

From February 2004 to June 2016, 227 consecutive patients in our department with varying degrees of AI underwent AV repair or an AV preservation operation. The anatomic structure of the AV was UAV in 11 patients (5%), BAV in 70 (31%), and TAV in 146 (64%). We excluded all patients who were diagnosed with acute or chronic dissection of the aorta. Preoperative, operative, and postoperative data were collected from our departmental database.

All clinical and echocardiographic follow-up was performed in our outpatient clinic. Patients lost to ambulatory follow-up were interviewed by telephone. Mean clinical follow-up was 69 ± 40 months (range, 1 to 147 months), and echocardiographic follow-up was 53 ± 40 months (range, 1 to 147 months). Clinical follow-up was completed by 100% of the patients and echocardiographic follow-up by 97%. The analysis included 1,282 patient-years of follow-up.

Surgical Procedure

The operations in all patients were performed through a median sternotomy. Standard cardiopulmonary bypass was established by cannulation of the aortic arch and the right atrium for venous return. Myocardial protection was achieved by using antegrade or retrograde cold blood cardioplegia, or both. The procedure in 81 patients (36%) who had aortic root aneurysm was replacement of the aortic root with or without cusp repair; either reimplantation using Gelweave Valsalva graft (Vascutek LTD, Renfrewshire, Scotland) or a remodeling procedure using a straight Dacron (DuPont, Wilmington, DE) tube. In 97 patients (42%) with aneurysm of the ascending aorta involving the STJ, replacement of the ascending aorta down to the STJ with a Dacron tube of appropriate size [13] was performed with or without cusp repair.

In 49 patients (22%) who did not need replacement of the aorta, only AV repair was performed with one or more of the following procedures:

- subcommissural annuloplasty that was first described by Cabrol and colleagues [14], and performed with Teflon (Chemours Company, Wilmington, DE) or autologous pericardial pledgeted polypropylene sutures;
- circular annuloplasty using Gore-Tex 0-0 suture (W. L. Gore & Associates, Inc, Flagstaff, AZ) [15];
- partial resection of the aortic cusps (due to fibrosis or calcification);
- cusp plication using 5-0 polypropylene stitch (Prolene; Ethicon, Somerville, NJ) to reduce the length of the free margin of the prolapsed aortic cusp [16, 17]; and

- cusp augmentation with glutaraldehyde-treated autologous pericardial patch when not enough native cusp tissue remained after resection.

Since 2010, cusp prolapse has been assessed by using the caliper (Fehling Instruments, Karlstein, Germany) as described by Schäfers and colleagues [17]. The caliper was set to achieve a minimum of 10 mm of effective height in patients with BAV and a minimum of 8 to 9 mm in patients with TAV. Patients were monitored intraoperatively with transesophageal echocardiography for evaluation of the surgical result.

Statistical Analysis

All statistical analyses were performed with SPSS 24 software (IBM Corp, Armonk, NY). Postoperative study end points were in-hospital death, complications (eg, cerebrovascular accident, transient ischemic attack, acute renal failure, atrial fibrillation, postpericardiotomy syndrome, sternal wound infection, sepsis, and permanent pacemaker implantation), recurrent aortic valve regurgitation, and reoperation on the AV. Values are expressed as mean \pm SD for continuous variables and as frequency and percentage for categorical variables.

Survival, recurrent aortic valve regurgitation, and reoperation on the AV were calculated by the Kaplan-Meier method. Comparison of recurrent regurgitation and reoperation rates between procedures (aortic root replacement, ascending aorta replacement, and isolated cusp repair, as well as between cusp vs no-cusp repair) was performed using the log-rank test. Multiple Cox regression analysis was performed to estimate the independent effect of baseline characteristics on recurrent regurgitation and reoperation. A *p* value of less than 0.05 was considered significant, with no correction for multiple testing.

Results

Patient demographics are presented in Table 1. The overall mean age was 48 ± 18 years, and 74% were men. Of the 178 patients who underwent aortic root replacement or ascending aorta replacement down to the level of the STJ, 61 (34%) also underwent AV repair. Marfan syndrome was diagnosed in 42 patients (18%); most of them had classic root dilatation, which was replaced during the operation. Preoperative echocardiographic findings showed that 40% of the patients had moderate or severe AI ($\geq 3+$).

Cusp repair was performed in 110 patients, and 117 underwent an AV-sparing operation without cusp repair. Patients who underwent cusp repair had more severe preoperative AI ($\geq 3+$; 50% vs 31%; *p* = 0.001) compared with those who underwent an AV-sparing operation without cusp repair. BAV or UAV was found in 36% of the patients, with increased incidence in patients who underwent cusp repair compared with those who did not (59% vs 14%, respectively; *p* < 0.001).

Concomitant procedures were performed in 50 patients (22%), and 39 (17%) required hemiarch or total aortic arch

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