European multicenter experience with valve-sparing reoperations after the Ross procedure

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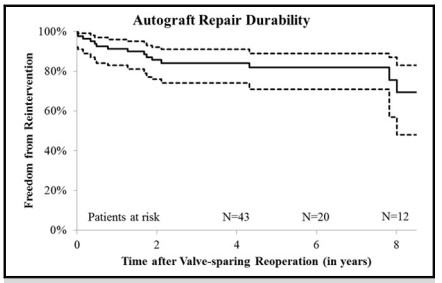
ABSTRACT

Background: Autograft valve preservation at reoperation may conserve some of the advantages of the Ross procedure. However, results of long-term follow-up are lacking. In this retrospective multicenter study, we present our experience with valve-sparing reoperations after the Ross procedure, with a focus on long-term outcome.

Methods: A total of 86 patients from 6 European centers, who underwent valve-sparing reoperation after the Ross procedure between 1997 and 2013, were included in the study.

Results: Reoperation was performed a median of 9.1 years after the Ross procedure in patients with a median age of 38.4 years (interquartile range: 27.1-51.6 years). Preoperative severe autograft regurgitation (grade $\geq$3) was present in 46% of patients. In-hospital mortality was 1%. During a median follow-up of 4.3 years, 3 more patients died of noncardiac causes, resulting in a cumulative survival at 8 years of 89% (95% confidence interval: 65%-97%). Fifteen patients required a reintervention after valve-sparing reoperation, mostly owing to prolapse or retraction of autograft cusps. Freedom from reintervention was 76% (95% confidence interval: 57%-87%) at 8 years. The reintervention hazard was increased in patients who had isolated and/or severe aortic regurgitation at valve-sparing reoperation. In patients without reintervention after valve-sparing autograft reoperation (n = 63), severe aortic regurgitation was present in 3% at last follow-up.

Conclusions: Valve-sparing autograft reoperations after the Ross procedure carry a low operative risk, with acceptable reintervention rates in the first postoperative decade. Patients with isolated and/or severe autograft regurgitation have an increased hazard of reintervention after valve-sparing reoperation; for these patients, careful preoperative weighing of surgical options is required. (J Thorac Cardiovasc Surg 2015;150:1132-7)



Estimated freedom from reintervention after valve-sparing reoperation.

Central Message

Valve-sparing autograft reoperations carry low operative risk, with acceptable reintervention rates in the first postoperative decade.

Perspective

This study provides surgeons with important information on the characteristics and outcome after valve-sparing reoperations after the Ross procedure. Durable valve-sparing reoperation is shown to be possible in most patients. However, in patients with isolated autograft regurgitation, careful reconsideration of the surgical approach may be necessary.

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Aortic valve replacement through the Ross procedure offers patients a living valve substitute that provides good hemodynamics and freedom from long-term use of anticoagulation methods. The main concern after the Ross procedure in adult patients is reoperation on the autograft, as a result of progressive root dilation and/or autograft insufficiency.[1]

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Historically, reoperations after the Ross procedure consisted of excision of autograft material followed by a Bentall procedure.[2] Currently, surgeons prefer to preserve the autograft valve if possible, by performing a reoperation, to maintain the advantages associated with a functioning valve.[3,4] However, concern remains about the long-term fate of the autograft cusps after reoperation.

Evidence on outcome after valve-sparing reoperations after the Ross procedure is scarce; only a few centers have published their short-term results.[4,5] The current retrospective study aims to determine the durability of valve-sparing reoperations after the Ross procedure in the first postoperative decade, in a European multicenter cohort.

METHODS

Institutional review board permission for this study was obtained in each center. Informed written consent was obtained from all patients. The study was performed in accordance with the Declaration of Helsinki.

Patient Inclusion and Data Collection

All patients who underwent a valve-sparing reoperation after the Ross procedure in 1 of the 6 participating centers were included in the study. Our cohort includes patients reported on previously by Luciani and colleagues[4] (N = 17), de Kerchove and colleagues[5] (N = 26), and Charitos and colleagues[6] (N = 24).

Preoperative patient characteristics, including information on the initial Ross procedure, perioperative surgical data on the valve-sparing reoperation after the Ross procedure, and postoperative follow-up data were retrospectively collected in each of the participating centers. In all, 86 patients who underwent operation between 1997 and 2013 were included in the study.

Statistical Analysis

Statistical analyses were performed using IBM SPSS, version 21.0 (IBM, Armonk, NY). Normal distribution of continuous data was assessed using the Shapiro-Wilk test. Continuous variables are displayed as mean ± SD, or median ± interquartile range; discrete variables are displayed as counts and percentages.

Overall survival and freedom from reintervention after valve-sparing reoperation were analyzed using the Kaplan-Meier method. Curves were truncated when the number of patients at risk dropped below 9 (<10% of the original population at risk). Ninety-five percent confidence intervals were calculated using log transformation of the cumulative hazard function.

With Cox regression, a univariable analysis of potential risk factors for reintervention after valve-sparing reoperation was performed. Variables included the following: gender; bicuspid aortic valve (yes/no); indication for initial Ross procedure (aortic regurgitation; aortic stenosis; combination); Ross technique (full root; inclusion cylinder; subcoronary); interval from the Ross procedure at time of valve-sparing reoperation; age at time of valve-sparing reoperation; isolated aortic regurgitation as indication for valve-sparing reoperation (yes/no); prolapse (yes/no); severe aortic regurgitation at the time of valve-sparing reoperation (grade ≥3; yes/no); valve-sparing autograft root replacement (yes/no); reimplantation versus remodelling technique; annulus repair (yes/no); and isolated autograft valve repair (yes/no). Pearson's correlation coefficient was used to assess correlations between variables included in the univariable analyses. A 1-way ANOVA with Tukey honestly significant difference post hoc test was performed to assess possible differences in reintervention rates after valve-sparing reoperation among the 3 types of valve-sparing autograft root replacement techniques.

RESULTS

In the participating centers, 1783 Ross procedures were performed from 1997 to 2013. During this period, 87 patients (44.2%) received a valve-sparing reoperation after the Ross procedure, of a total of 197 patients who required ≥1 reoperation on the autograft. One patient was excluded from our study population, owing to intraoperative conversion to autograft valve replacement. An overview of patient and procedural characteristics at the time of the initial Ross procedure (Table 1) and of the perioperative details of the valve-sparing reoperation after the Ross procedure (Table 2), as well as details of autograft valve repair (Table 3), are provided. At the time of the valve-sparing reoperation after the Ross procedure, the median age of patients was 38.4 years (interquartile range: 27.1-51.6 years).

Early Outcome

After the valve-sparing reoperation after the Ross procedure, 1 patient died on day 9 postoperatively after cardiac arrest. With this 1 death, 30-day mortality was 1.2% (binomial 95% confidence interval: 0.03%-6.24%).

One patient, who had isolated autograft valve repair, underwent reintervention after valve-sparing reoperation on day 5 postoperatively, owing to grade III autograft regurgitation. The autograft valve was replaced by a homograft valve. Bleeding complications occurred in 3 patients, requiring resternotomy in 2. One patient suffered a transient ischemic attack. The median hospital stay was 7 days (interquartile range: 6-9 days; range: 4-17 days).

Late Mortality

Follow-up after the valve-sparing reoperation after the Ross procedure was 95% complete, with a median duration of 4.3 years (interquartile range: 2.4-6.3 years; range: 54 days to 16.2 years; 343 patient years). Three cancer-related deaths occurred at 5.8 years, 7.5 years, and 10.0 years, respectively. Estimated freedom from all-cause mortality at 8 years' follow-up was 89% (95% confidence interval: 65%-97%).

Reintervention After Valve-Sparing Reoperation

Surgical reintervention after valve-sparing reoperation was performed in 15 patients (Table 3). Estimated freedom from reintervention was 76% at 8 years' follow-up (95% confidence interval: 57%-87%) (Figure 1). Although most autograft cusps appeared thin and pliable at explantation, 2 patients had autograft cusp calcifications.

Univariable analysis revealed several variables that were potentially associated with the hazard of reintervention after valve-sparing reoperation (Table 4). Isolated autograft