

Predictors of long-term survival after surgical mitral valve repair in patients with heart failure

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Introduction Heart failure often coexists with mitral regurgitation (MR), which could be diagnosed in up to 60% of patients with left ventricular ejection fraction (LVEF) lower than 40%. Significant (moderate or severe) MR occurs in 1 in 6 patients in this population.¹ Moreover, it was shown that MR impairs long-term prognosis in patients with heart failure (HF).¹ As MR is the result of geometric and functional abnormalities of the left ventricle rather than their cause in both ischemic and dilated cardiomyopathy, it is still controversial whether the long-term effect of mitral valve repair recompenses the high operative risk in this group of patients. The aim of this study was to assess the early and long-term outcomes in patients with decreased LVEF who underwent mitral valve repair and to determine the predictors of long-term survival.

Methods We retrospectively analyzed the medical records of 39 patients (mean [SD] age, 63 [12] years) who underwent mitral valve repair due to significant MR and who were preoperatively diagnosed with impaired left ventricular function defined as LVEF \leq 40% (mean [SD] LVEF, 32.3% [5.7%]; range, 15%–40%). The patients scheduled for concomitant aortic valve surgery, surgical ventricular restoration, or surgery due to infective endocarditis were excluded from the study. The majority of patients (31 [79.5%]) had significant symptoms, with New York Heart Association class 3 or 4 assigned, although only 1 patient required inotropic support and an intra-aortic balloon pump before surgery. The etiology of mitral valve insufficiency was ischemic (26 [66.7%]), functional in the course

of dilated cardiomyopathy (9 [23.1%]), or mixed (functional and degenerative; 4 [10.3%]). Pulmonary hypertension was present in 17 patients (43.6%), chronic atrial fibrillation in 12 (30.8%), and chronic obstructive pulmonary disease (COPD) in 7 (17.9%).

In all patients, mitral valve repair involved restrictive mitral ring annuloplasty and was performed via median sternotomy. In 6 cases, an additional mitral valve repair procedure, selected based on the mechanism of MR, was performed. Twenty seven patients (69.2%) underwent a concomitant intervention: coronary artery bypass grafting (19 [48.7%]), tricuspid annuloplasty (11 [28.2%]), and radiofrequency ablation for atrial arrhythmia (3 [7.7%]); 3 of them underwent 2 additional procedures.

Follow-up Having obtained local ethics committee approval, we accessed data on survival and dates of death of all patients from the Polish Ministry of the Interior and Administration. Thirty four demographic, clinical, and echocardiographic parameters were analyzed to identify the independent risk factors for late mortality.

Statistical analysis All statistical analyses were performed using the Statistica 6.0 software (StatSoft, Poland). Continuous variables were compared with the *t* test or the Mann–Whitney test, and categorical variables with the χ^2 test. First, we used univariate Cox analysis to identify variables predicting mortality, and then the significant variables were included in multivariable Cox regression to determine the independent risk factors for mortality. Late survival

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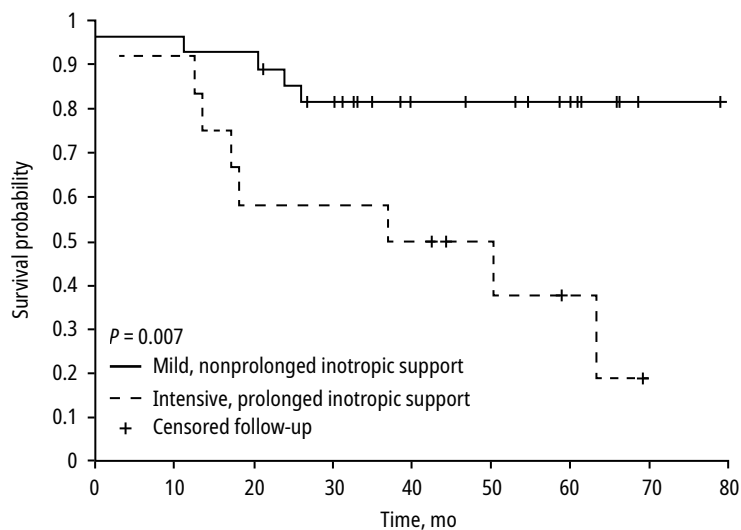
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Patients at risk, n	0	10	20	30	40	50	60	70	80
All	39	38	37	32	27	19	16	11	1
Receiving intensive support	12	12	11	7	7	6	4	2	0
Receiving mild support	27	26	26	25	20	13	12	9	1

FIGURE 1 Long-term cumulative survival depending on postoperative inotropic support

was analyzed with the Kaplan–Meier method. The probability of survival in 2 study groups was compared with the log-rank test. A *P* value less than 0.05 was considered significant.

Results and discussion Regarding preoperative clinical parameters, only COPD was proven to be a risk factor for all-cause mortality in our study (HR, 7.95; 95% CI, 6.66–9.25; *P* = 0.002). This disease is similar to HF in many respects—it is a progressive disease, usually with poor prognosis. Therefore, it is not surprising that the coexistence of COPD and HF affects patients’ survival.² Pulmonary hypertension could potentially link COPD with increased mortality in patients with HF. However, in our study, the presence of echocardiographic signs of pulmonary hypertension did not influence patients’ prognosis.

The second predictor of worse survival was the need to receive extensive postoperative inotropic support (HR, 7.76; 95% CI, 6.52–9; *P* = 0.001). Inotropes are an obvious choice to prevent and treat postoperative complications related to hemodynamic instability in patients with preoperative HF. In our center, anesthesiologists routinely start administering inotropes at the time of weaning the patient from cardiopulmonary bypass and continue the treatment for a few hours after surgery, adjusting the dose and type of catecholamines to the patient’s condition. In the present study, the majority of patients (34 [87.2%]) required inotropic support

on the first postoperative day, but almost one third of the study population (12 [30.8%]) was inotrope-dependent for over 2 days. We also used an intra-aortic balloon pump (in 6 patients [15.4%]) relatively often compared with the results presented by other authors (2.4%³ and 8.2%⁴). However, it did not correlate with increased mortality (as discussed below) or an increased rate of renal failure, which is a sensitive indicator of hemodynamic compromise. Compared with other studies, the number of patients requiring temporary renal replacement therapy (1 [2.6%]) was similar⁴ or even lower.³ It may suggest that the aggressive treatment of hemodynamic instability gives an opportunity to stabilize the patient and avoid organ failure. Although the need for intense postoperative inotropic support (at least 2 inotropes for at least 48 hours) did not increase early mortality, it was a strong predictor of worse long-term prognosis. However, survival probability started to differ significantly between patients who required intense inotropic support and those who did not after 1-year follow-up (FIGURE 1). In our opinion, exacerbated postoperative HF is just a marker of a more advanced disease and limited compensatory reserve.

In our study, only 1 patient died in the early postoperative period. Thirty-day mortality was 2.6%, which is lower than 3.25% predicted by the EuroSCORE II risk model. As previously shown, early mortality depends on procedure complexity, starting from 0.5% in isolated mitral valve repair⁵ and raising up to 6.1%⁶ when a concomitant surgery is performed.

In our study, the median (interquartile range) follow-up of hospital survivors was 41 (26–61) months. Twelve deaths occurred after a median (interquartile range) time of 19 (13–32) months, which accounts for the overall cumulative survival of 57% in the study group. The 2- and 5-year cumulative survival rates were 77% and 66%, respectively.

As for the last 15 years we have observed a revolution in the transcatheter treatment of MR, there needs to be a place for discussion about the surgical outcomes in the context of percutaneous intervention. The introduction of the MitraClip system has provided new perspectives for patients at high surgical risk. However, the 2-year mortality rate of about 30% is expectable in patients with HF undergoing transcatheter mitral valve repair, which was confirmed by Rosa et al⁷ in their meta-analysis of 23 studies on the MitraClip implantation. Against this background, the 2-year mortality of 23% observed in our study group can be treated as an acceptable and explicable risk, especially if almost 70% of the patients underwent a complex cardiac surgery. Data on a longer follow-up in the population with HF after transcatheter mitral valve repair are currently insufficient. On the contrary,

the long-term effects of surgical mitral valve repair were described in numerous reports yet in small populations.^{6,8-10} The estimated 5-year survival rate ranged from about 55% to 80%,^{6,8-10} with a mean value close to our outcome (66%). As highlighted by many authors, poor prognosis in patients with HF and MR, independently of an intervention performed, is in fact the consequence of cardiomyopathy, which is the major contributor to disease progression. A similar conclusion was presented by Jin et al¹¹ in a study on the impact of MR on the outcomes of cardiac resynchronization therapy (CRT)—another procedure which can reduce MR: although a decrease of at least 1 MR level was observed in about 70% of patients with significant MR 6 months after receiving CRT, significant MR before implantation remained a predictor of worse clinical outcomes, mainly of an increased rate of HF-related hospitalizations. Whether a patient with an indication for CRT should be referred for mitral valve repair is an important issue, however beyond the scope of the current report. Shortly, we believe that the decision should be made on a case-by-case basis and by a multidisciplinary team including a electrophysiologist.

To conclude, in high-volume centers with experienced teams of cardiac surgeons and anesthesiologists, surgical mitral valve repair may be an efficient and safe strategy for selected patients with coexistent MR and left ventricular dysfunction, even in the era of transcatheter interventions. The possibility to deliver comprehensive treatment, eg, simultaneous coronary revascularization or tricuspid valve repair, is an advantage of an open-heart surgery. Nevertheless, long-term outcomes are still unsatisfactory, being severely diminished by the progressive nature of HF and comorbidities like COPD.

ARTICLE INFORMATION

CONFLICT OF INTEREST None declared.

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