

Is a good perioperative echocardiographic result predictive of durability in ischemic mitral valve repair?

K. Serri, MD, D. Bouchard, MD, P. Demers, MD, M. Coutu, MD, M. Pellerin, MD, M. Carrier, MD, L. P. Perrault, MD, PhD, R. Cartier, MD, P. Pagé, MD, M. Cossette, MSc, and A. J. Basmadjian, MD, MSc



Dr. Basmadjian

Supplemental material is available online.

Background: Chronic ischemic mitral regurgitation is associated with poor long-term survival. Despite the increasing popularity of valve repair, its durability and long-term outcome for ischemic mitral regurgitation have recently been questioned.

Methods: Seventy-eight patients underwent repair for ischemic mitral regurgitation between 1996 and 2002 at our institution. Of these patients, 73 had complete clinical and echocardiographic follow-up. Preoperative, intraoperative, and postoperative clinical data were obtained, and the results of echocardiograms were reviewed to assess the rate of recurrence of regurgitation after repair and to identify predictive factors.

Results: The mean preoperative mitral regurgitation grade, New York Heart Association class, and left ventricular ejection fraction were 2.72, 2.65, and 39.4%, respectively. Mortality was 12.3% at 30 days and 30.1% at a mean follow-up of 39 ± 25 months. Immediate postoperative echocardiography showed absent or mild mitral regurgitation in 89.4% of patients and showed moderate mitral regurgitation in 10.6%. Freedom from reoperation was 93.2%. Recurrent moderate mitral regurgitation (2+) was present in 36.7% of patients, and severe mitral regurgitation (3+ to 4+) was present in 20.0% at mean follow-up of 28.1 ± 22.5 months. Only age ($P = .0130$) and less marked preoperative posterior tethering ($P = .0362$) were predictive of recurrent mitral regurgitation. Patients with a preoperative New York Heart Association class greater than II and recurrent mitral regurgitation greater than 2+ had decreased survival ($P = .0152$ and $P = .0450$, respectively).

Conclusions: Significant recurrent mitral regurgitation occurs following repair for ischemic mitral regurgitation, despite good early results. This finding raises questions about the need for improved repair techniques, better patient selection, or eventual mitral valve replacement in selected patients.

Chronic ischemic mitral regurgitation (IMR) is generally defined as mitral regurgitation (MR) secondary to myocardial infarction.¹ IMR has been shown to be an independent predictor of mortality,²⁻⁴ with reported survival of 40% to 60% at 5 years.^{1,5-8} Operative mortality is increased for patients undergoing mitral valve operation and revascularization in the presence of IMR when compared with nonischemic MR^{4,6,7} or revascularization alone.

Surgical correction, either by replacement or repair, is generally recommended for 3+ and 4+ IMR.⁹⁻¹¹ In comparative analyses, repair seems to benefit most patients with IMR, with the possible exception of high-risk groups (higher New York Heart Association [NYHA] functional class or emergency operation).^{1,12} In patients who undergo repair, residual MR greater than 1+ is associated with increased late mortality.¹³

Mitral valve repair, which most often involves the use of an undersized annuloplasty ring, has been shown to be effective, with 98% short-term success.¹ Data

From the Montreal Heart Institute, University of Montreal, Montreal, Quebec, Canada.

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Address for reprints: A. J. Basmadjian, MD, MSc, Montreal Heart Institute, Research Center, 5000 Belanger, Montreal, Quebec, Canada, HIT 1C8 (E-mail: arsene.basmadjian@icm-mhi.org).

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Abbreviations and Acronyms

AVR	= aortic valve replacement
IMR	= ischemic mitral regurgitation
LV	= left ventricle
LVEF	= left ventricular ejection fraction
MR	= mitral regurgitation
NYHA	= New York Heart Association

concerning MR recurrence after repair in patients with degenerative mitral valve disease have recently been published and show a significant incidence of late MR.¹⁴ Long-term results of repair for IMR are not defined, in part because of underreporting of failure rates and because death is an important competing end point in the evaluation of repair failure. Although good results have been reported,¹⁵ high recurrence rates of MR at follow-up have recently been published, and this raises questions about the long-term results of mitral valve repair.^{5,16} Moreover, very few studies have evaluated predictors of recurrence.

Therefore, our objective was to analyze the incidence of MR recurrence after mitral valve repair for IMR and attempt to define possible predictors of recurrence by looking at preoperative, perioperative, and postoperative clinical and echocardiographic data.

Patients and Methods

All patients who had mitral valve repair performed at the Montreal Heart Institute between 1996 and 2002 were considered. Seventy-eight patients with MR resulting from myocardial infarction¹ with normal mitral valve leaflets and chordae were identified. Of these patients, 73 (94%) had long-term postoperative clinical and echocardiographic follow-up and were included in the study.

Patient Characteristics

The following patient data were analyzed: age; comorbidities (including hypertension, diabetes, and preoperative atrial fibrillation); extent of coronary artery disease on preoperative coronary angiogram (significant lesions were defined as >50% narrowing of a major coronary artery); previous myocardial infarction, either recent (within 30 days before surgery) or old; left ventricular ejection fraction (LVEF) and NYHA functional class before surgery and at last follow-up; repeat operation; associated valvular lesions; urgent operation (defined as within 48 hours of admission); and preoperative intra-aortic balloon pump use. Recent myocardial infarctions were defined as a chest pain syndrome associated with either ST segment elevation on the electrocardiogram or cardiac enzymes above the upper limit of normal. A prior myocardial infarction was assumed if an akinetic segment was observed on the echocardiogram, with or without associated Q waves on the electrocardiogram.

Surgical Techniques

For intraoperative data, we analyzed bypass time, aortic cross-clamp time, type of repair, annular size, associated procedures,

number of grafts, adequacy of revascularization, postoperative myocardial infarction (defined as creatine kinase MB >100 U/L), and early postoperative death (within 30 days or during the index hospitalization). Revascularization was deemed complete only if all coronary arteries with significant lesions (>50% stenosis) were grafted, independent of artery caliber or segmental wall motion at baseline.

Echocardiographic Results

The results of immediate postoperative transesophageal or transthoracic echocardiograms within the first postoperative week were assessed for the presence and severity of early residual MR. After a mitral valve repair procedure at our institution, an echocardiographic examination is performed before discharge, at 6 months, and then every 1 to 2 years. The severity of MR is graded on a scale of 1 to 4 according to color jet area, pulsed wave-Doppler of the pulmonary veins, and proximal isovelocity surface area according to American Society of Electrocardiography guidelines.¹⁷ The results of preoperative and postoperative echocardiograms were obtained for the severity of MR (graded according to color jet area and pulsed wave-Doppler of the pulmonary veins), LVEF, regional left ventricular (LV) function, LV end-diastolic and end-systolic dimensions, left atrial diameter, systolic pulmonary artery pressure, and associated valvular lesions.

A subgroup of patients had both preoperative and postoperative echocardiograms available for detailed analysis. Echocardiograms were reviewed by 1 observer for the severity of MR,¹⁷ as well as for the direction of the regurgitant jet (central vs eccentric), LVEF, regional LV wall motion, LV end-diastolic and end-systolic dimensions, left atrial dimensions, left atrial volume,¹⁸ the presence of associated valvular lesions, and systolic pulmonary artery pressure, as determined from the tricuspid regurgitant jet. The LV sphericity index was measured by calculating the ratio between the LV major axis and minor axis dimensions in the apical 4-chamber view.¹⁹⁻²¹ As this ratio decreases and approaches unity, the LV becomes more spherical. The mitral annular diameter was measured in the apical 4- and 2-chamber views, and the mean annular diameter was calculated. The degree of anterior and posterior tethering was estimated by measuring the distance between the anterior mitral annulus and the anterior or posterior papillary muscle tip, respectively (Figure E1). Tenting height and area were also measured.²²

Clinical Follow-up

Follow-up was performed at a specialized valvular heart disease outpatient clinic. Most patients were seen for follow-up, whereas a few patients were followed up through mail correspondence.

Statistical Analysis

Patient characteristics and echocardiographic results are expressed as means \pm SD or simple frequencies and percentages. Late mortality was studied by using survival analysis. Survival curves were computed by using the Kaplan-Meier formulas and were compared between groups by using the log-rank test. Univariate and multivariate linear regression were used to identify predictors of MR recurrence. To detect any differences between the echocardiographic subgroup and the rest of the study population, independent sample *t* tests were performed on normally

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