Mitral regurgitation surgery in patients with ischemic cardiomyopathy and ischemic mitral regurgitation: Factors that influence survival

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Objective: The treatment of patients with ischemic cardiomyopathy and concomitant mitral regurgitation can be challenging and is associated with reduced long-term survival. It is unclear how mitral valve repair versus replacement affects subsequent outcome. Therefore, we conducted this study to understand the predictors of mortality and to delineate the role of mitral valve repair versus replacement in this high-risk population.

Methods: From 1993 to 2007, 431 patients (mean age, 70 ± 9 years) with ischemic cardiomyopathy (left ventricular ejection fraction ≤ 45%) and significant ischemic mitral regurgitation (>2) were identified. Patients (44) with concomitant mitral stenosis were excluded from the analysis. A homogeneous group of 387 patients underwent combined coronary artery bypass grafting and mitral valve surgery, mitral valve repair in 302 (78%) and mitral valve replacement in 85 (22%). Uni- and multivariate analyses were performed on the entire cohort, and the predictors of mortality were identified in 2 distinct risk phases. Furthermore, we specifically examined the impact of mitral valve repair versus replacement by comparing 2 propensity-matched subgroups.

Results: Follow-up was 100% complete (median, 3.6 years; range, 0–15 years). Overall 1-, 5-, and 10-year survivals were 82.7%, 55.2%, and 24.3%, respectively, for the entire group. The risk factors for an increased mortality within the first year of surgery included previous coronary artery bypass grafting (hazard ratio = 3.39; $P < .001$), emergency/urgent status (hazard ratio = 2.08; $P = .007$), age (hazard ratio = 1.5; $P = .03$), and low left ventricular ejection fraction (hazard ratio = 1.31; $P = .026$). Thereafter, only age (hazard ratio = 1.58; $P < .001$), diabetes (hazard ratio = 2.5; $P = .001$), and preoperative renal insufficiency (hazard ratio = 1.72; $P = .025$) were predictive. The status of mitral valve repair versus replacement did not influence survival, and this was confirmed by comparable survival in propensity-matched analyses.

Conclusions: Survival after combined coronary artery bypass grafting and mitral valve surgery in patients with ischemic cardiomyopathy (left ventricular ejection fraction ≤ 45%) and mitral regurgitation is compromised and mostly influenced by factors related to the patient's condition at the time of surgery. The specifics of mitral valve repair versus replacement did not seem to affect survival. (J Thorac Cardiovasc Surg 2011;142:995-1001)

Patients with ischemic heart disease and mitral regurgitation (MR) comprise one of the more perplexing and challenging groups to treat in cardiac surgery. Some of these patients have 2 independent disease processes of coronary ischemia and myxomatous MR, and they tend to have a favorable survival outcome after surgical correction.[1-3] However, the outcome seems to be more guarded in those who have coronary ischemia and functional MR, that is, ischemic MR (IMR).[4] In this population, IMR can be due to various pathophysiologic processes ranging from acute papillary muscle ischemia/rupture to chronic left ventricular (LV) remodeling after myocardial infarction, resulting in tethered and incompetent mitral leaflets unable to coapt. Accordingly, their clinical presentation varies, ranging from acute pulmonary edema to recurrent bouts of congestive heart failure. This has been shown to influence the surgeon's decision to perform mitral valve repair (MVP) or mitral valve replacement (MVR).[5,6] All these factors contribute to the difficulty in understanding the comparative efficacy of MVP versus MVR, and it is not surprising to have

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Abbreviations and Acronyms

CABG = coronary artery bypass grafting
HR = hazard ratio
ICM = ischemic cardiomyopathy
IMR = ischemic mitral regurgitation
LAD = left anterior descending
LITA = left internal thoracic artery
LV = left ventricular, left ventricle
LVEF = left ventricular ejection fraction
MR = mitral regurgitation
MV = mitral valve
MVP = mitral valve repair
MVR = mitral valve replacement

conflicting literature reports supporting MVP or MVR.[7] Furthermore, many of the reported experiences have shortcomings of small sample size, experiences accumulated over many decades of evolving practices, and a heterogeneous patient population.[8] Nonetheless, the current general consensus seems to favor MVP over MVR in patients with IMR even though a significant rate of MR recurrence is a well-recognized fact.[9,10] The rate of MR recurrence after MVP seems to be particularly high in patients with poor left ventricular ejection fraction (LVEF), and this may adversely affect survival. We conducted this study specifically to examine these perplexing issues in a currently relevant cohort of patients with significant ischemic cardiomyopathy (ICM) and IMR. The primary objective was to understand the risk factors associated poor survival after combined coronary artery bypass grafting (CABG) and MVP/MVR in patients with an LVEF 45% or less. The secondary objective was to understand the impact of MVP versus MVR on survival.

PATIENTS AND METHODS

Study Design

This is a retrospective analysis of prospectively gathered data over more than a 10-year period (median, 3.6 years; range, 0–15 years). The cardiac surgery database (1993–2007) at Mayo Clinic (Rochester, Minn) was used to create a homogeneous study cohort of patients who underwent cardiac surgery for ischemic heart disease with significant IMR. We identified patients who underwent a combined CABG and MVP or MVR first. Then, we excluded those who have had any one of the following conditions: LVEF greater than 45%, infective endocarditis, congenital valvular heart disease, rheumatic valvular disease, or any degree of mitral stenosis. All patients with mixed pathologies were thoroughly assessed, as echocardiographic data and operative findings were reviewed to confirm the ischemic cause of the MR. The Mayo Foundation Institutional Review Board approved this study, and individual consent was obtained for all patients included in this study.

We explored the mortality hazards for the entire cohort in 2 different risk phases (early up to 1 year after surgery and late thereafter). Statistically significant risk factors for mortality were identified for each of these 2 risk phases. Furthermore, we examined the specific impact related to the type of mitral valve (MV) procedure by comparing 2 subgroups based on MVP and MVR, propensity matched on 14 baseline characteristic variables (age, gender, hypertension, diabetes, history of smoking, body surface area, preoperative New York Heart Association class, chronic renal failure, preoperative dialysis, previous CABG surgery, previous valve procedure, history of congestive heart failure, LVEF, and emergency/urgent status of the procedure).

Definitions

The cause of MR was presumed to be ischemic. All patients had a significant degree of mitral annular dilation and LV dysfunction due to prior myocardial infarction. In patients who required more complex repair for mixed valvular pathology, operative and echocardiography reports were reviewed to confirm that myocardial ischemia was the primary mechanism for MR. The operative and echocardiographic findings were reviewed in detail in these patients, and they were deemed to have IMR on the basis of leaflet tethering, prior myocardial infarction, and leaflet tethering. All patients included in this study had an undersized ring/band implanted when applicable. In patients with repairs, the ring was chosen according to the undersized intercommissural distance when applicable. In patients with a 63- to 65-mm posterior band, the band was cut and undersized to the appropriate length. The exact nature of chordal preservation in each patient undergoing MVR was not established. However, our institutional policy has been to preserve the posterior leaflet whenever possible with an increasing recent tendency toward preserving as much of the anterior leaflet and by transposing it to the posterior annulus.

Follow-up

Patients were followed systematically by using mailed questionnaires, telephone interview, or examination at the Mayo Clinic. Clinical follow-up for both patients with MVR and MVP was 100% complete. Mean follow-up among survivors was 4.2 years (range, 0–15.7 years).

Statistical Analysis

Descriptive statistics for categoric variables are reported as frequency and percentage, and continuous variables are reported as mean (standard deviation) or median (range) as appropriate. Categoric variables were compared between MVP and MVR groups using the chi-square test, and continuous variables were compared using 2-sample t test or Wilcoxon rank-sum test when appropriate. The Kaplan–Meier method was used to draw survival curves and calculate 1-, 5-, and 10-year survival statistics. Cox regression models were used to find the univariate and multivariate predictors of early (1-year) and long-term (late or constant) survivals. The multivariable model considered univariate significant variables ($P < .05$) with model selection using the stepwise method (backward and forward methods resulted in the same model). All statistical tests were 2-sided with the alpha level set at .05 for statistical significance.

RESULTS

Patient Characteristics

From 1993 to 2007, 431 patients were identified and required a combined CABG and MVP/MVR procedure. Of these, 44 patients were excluded because they had mitral stenosis, yielding 387 patients for this study. The mean age at the time of surgery was 70.1 $\pm$ 9.1 years (range 43–91 years), and 261 patients were male (67%). CABG surgery was performed in all patients. MVP was performed in 302 patients (78%), and MVR was performed in 85 patients (22%). All patients had LV dysfunction (LVEF $\leq$ 45%), and the mean LVEF by preoperative transthoracic echocardiography was 33.6% $\pm$ 8.4% (range, 9–45).