

Criteria for Evaluating the Results and Long-Term Prognosis of Surgical Interventions in Ischemic Mitral Insufficiency

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Abstract It should be noted that as experience accumulates in the use of surgical methods for the treatment of MC diseases, there is a need for an objective assessment of the long-term prognosis and results of this intervention. Thus, patients whose share of total scarring after MI was less than 25%, with complete revascularization with MC intervention, survival rates increase. However, patients with IMR and a more severe increase in myocardial scarring have the highest risk of mortality despite surgical treatment.

Keywords Revascularization, Mitral regurgitation, Aortocoronary bypass grafting, Transthoracic echocardiography, Tricuspid insufficiency, Infective endocarditis, Mitral valve

This study analyzed mortality, early, and long-term outcomes after surgical intervention in patients diagnosed with ischemic mitral regurgitation (IMR). The research was based on both retrospective and prospective data.

1. Introduction

Another unexplored issue, which is emphasized by clinicians, is the risk factors affecting mortality, immediate and long-term results after surgical intervention on the IC in patients with IMR. Due to the fact that despite significant advances in medical and surgical therapies, the risk of mortality associated with IMR after MI remains high [1], [2], [3], [4]. Also, current evidence Interesting in this direction are the studies of R. Lorusso et al. Lorusso et al. (2008) in a multicenter retrospective registry evaluated postoperative outcomes of emergency surgical interventions for severe acute MI in 279 patients. In doing so, the authors found that early mortality among patients with ischemic etiology was higher than in other etiologies of acute MI, such as degenerative or infective endocarditis (26.9% vs. 14.8% and 22.7%, respectively). In addition, postoperative complications were more frequent in patients with acute MI, requiring longer ICU stays and a greater need for inotropes and

mechanical support. It is worth noting that in this registry in multivariate analysis the main predictors of early death were acute endocarditis, LV dysfunction and CHD [5]. e suggests that surgical intervention of MI is associated with significant mortality.

The indications for surgery for IMR are limited due to the lack of survival benefit. Therefore, surgical treatment of IMR is recommended only for patients who remain symptomatic despite optimal medical therapy [4], [6], [7].

Of particular note is the study by N. Sharma et al (2021) involving 1000 consecutive patients admitted with MI in 2016/17 treated with percutaneous coronary intervention with transthoracic echocardiography before discharge. Compared to patients without MR, patients with MR were older (70 ± 12 vs. 63 ± 13 years; $p < 0.001$), with worse left ventricular ejection fraction (LVEF) ($52 \pm 15\%$ vs. $55 \pm 11\%$; $p < 0.001$) and creatinine clearance (69 ± 33 mL/min vs. 90 ± 39 mL/min; $p < 0.001$). They also had higher rates of hypertension (64% vs. 55%; $p = 0.012$), heart failure (3.4% vs. 1.1%; $p = 0.014$), previous MI (28% vs. 20%; $p = 0.005$), and severe flow limitation in the circumflex (50% vs. 33%; $p < 0.001$) or right coronary artery (51% vs. 42%; $p = 0.014$). The prevalence and severity of MR were not affected by IM subtype. Revascularization later than 72 hours after symptom onset was associated with an increased likelihood of MR (33% vs. 25%; $p = 0.036$) in patients with non-ST-elevation myocardial infarction (NSTEMI). At a median of 3.2 years, 56 of 288

(19%) patients with untreated MR died. Age and LVEF independently predicted all-cause mortality.

A number of authors have identified the following significant risk factors for complications and mortality in surgical treatment of moderate ischemic MI: severe heart failure (NYHA class IV), marked reduction in LVEF (less than 30%), large effective regurgitation orifice area (more than 70 mm²), excessively high natriuretic peptide level (more than 10 000 pg/mL), severe right ventricular failure (tricuspid annular plane systolic excursion less than 15 mm), high pulmonary hypertension or tricuspid annular plane systolic excursion, and severe concomitant comorbid pathology. tricuspid annular plane systolic excursion) less than 15 mm), high pulmonary hypertension or tricuspid insufficiency and severe associated comorbid pathology (e.g., severe renal failure) [8], [9], [10].

Preserved annulus geometry and myocardial viability studies can help predict the likelihood of improvement in IMR after revascularization. It may also help identify patients who are more likely to benefit from revascularization combined with MC intervention [11], [12].

K. Kusunose et al (2017) conducted an observational cohort study to identify predictors of mortality in patients with percutaneous MC intervention (15 underwent MC replacement and 102 underwent MC repair).

2. Methods

Clinical, instrumental, and laboratory data from patients diagnosed with ischemic heart disease and mitral regurgitation were analyzed. Data from the multicenter retrospective registry conducted by Lorusso et al. (2008) and the prospective observation study involving 1,000 myocardial infarction (MI) patients conducted by N. Sharma et al. during 2016–2017 were included. Additionally, the observational cohort study by Kusunose et al. (2017), aimed at identifying

mortality predictors in patients undergoing percutaneous mitral valve (MC) intervention, was used.

Demographic characteristics, cardiac function parameters (left ventricular ejection fraction — LVEF), laboratory results (creatinine clearance, natriuretic peptide levels), and history of previous conditions (hypertension, diabetes, heart failure, prior MI) were evaluated.

- The severity of ischemic mitral regurgitation was assessed by transthoracic echocardiography.
- Myocardial viability and scarring were evaluated using cardiac magnetic resonance imaging (MRI).
- Surgical interventions included percutaneous mitral valve procedures (repair or replacement) and emergency revascularization surgeries.
- All patient information was kept confidential, recorded into individual registration forms, and transferred into electronic format for statistical analysis.

During the study, magnetic resonance imaging (MRI) was used to assess LV remodeling and myocardial scarring. The effective regurgitant orifice area was calculated from the surface area of the proximal isovelocity using echocardiography. There were 43 deaths (37%) during follow-up (median, 62 months). In multivariate analysis, age ≥ 70 years ($P=0.013$), diabetes mellitus ($P=0.001$), dyslipidemia ($P=0.012$), papillary scar ($P=0.010$), incomplete revascularization ($P=0.001$), and total scar (%), effective regurgitant orifice area ≥ 0.20 cm² ($P=0.005$) were independently associated with all-cause mortality. Although patients with effective regurgitant orifice area < 0.2 cm² at baseline demonstrated an increased hazard ratio of 3.3 for every 10% increase in scar, the hazard ratio increased to 9 for every 10% increase in scar in those with baseline effective regurgitant orifice area ≥ 0.20 cm². Mortality was also significantly higher in patients with incomplete revascularization compared with patients with vascularized viable myocardium (61% versus 28%; $P<0.001$).

Table 1. Multivariate analysis of prognostic factors associated with mortality in patients with ischemic mitral regurgitation

Nº	Factor	Condition / Indicator	P-value	Comment
1	Age	≥ 70 years	0.013	Older age is associated with increased mortality
2	Diabetes mellitus	Present	0.001	Independent risk factor
3	Dyslipidemia	Present	0.012	Independent risk factor
4	Papillary muscle scar	Present	0.010	Associated with all-cause mortality
5	Incomplete revascularization	Present	0.001	Mortality 61% vs. 28% (compared to patients with viable myocardium)
6	Total scar (% of myocardium)	Every 10% increase	—	Increased scar burden raises risk
7	Effective regurgitant orifice area (EROA)	≥ 0.20 cm ²	0.005	Independent risk factor
8	Patients with EROA < 0.20 cm ²	3.3x increased risk per 10% scar increase	—	Even with small EROA, scar increases risk
9	Patients with EROA ≥ 0.20 cm ²	9x increased risk per 10% scar increase	—	High EROA significantly magnifies risk
10	Mortality	43 cases (37%)	—	Median follow-up: 62 months

The current study demonstrates the powerful prognostic ability of myocardial scar quantification using delayed contrast imaging in CMP to predict outcomes; patients undergoing percutaneous PCI with smaller areas of IM experienced more favorable outcomes after the procedure compared with those with larger areas of IM. In addition, patients with smaller areas of IM with less significant IMR demonstrated >75% survival, whereas patients with larger areas of IM had <50% survival at a median follow-up of 5.2 years. As shown, viability assessment with MRI provides prognostic value in patients with ischemic cardiomyopathy and IMR who underwent subsequent percutaneous MC intervention [13].

The use of transcatheter IC therapy is considered appropriate in high-risk patients with severe IMR, especially in patients with hemodynamic instability. It provides a less invasive approach that may be better tolerated in high-risk heart failure patients with IMR and LV dysfunction.

The choice of optimal surgical treatment for secondary MR remains controversial. MC reconstruction performed using a smaller rigid complete ring to restore valve leaflet coaptation is the reference standard [14] and can be performed with acceptable perioperative risk in carefully selected patients with secondary MR and poor LV function [15]. More pronounced restriction of valve flap mobility predicts poor surgical outcome with restoration of valve function as well as recurrence of MR.

Restrictive mitral annuloplasty is burdened with a high recurrence rate of MR ranging from 30% to 40% at 6 to 12 months of age and approximately 60% at 5 years [16]. MR is more common with the use of partial annuloplasty bands or flexible complete rings [17] as well as with the placement of rigid complete rings [17], [16].

3. Conclusions

Ischemic mitral regurgitation (IMR) following myocardial infarction remains a serious clinical problem associated with high mortality and morbidity despite advancements in medical and surgical treatments. Studies show that surgical interventions for IMR are linked with significant early and late mortality, particularly in patients with severe left ventricular dysfunction, extensive myocardial scarring, or incomplete revascularization. Identifying risk factors such as age, left ventricular ejection fraction, myocardial viability, degree of mitral regurgitation, and comorbidities like diabetes and renal failure is crucial for improving patient selection and outcomes.

Recent evidence supports a more selective approach to intervention, favoring surgery or transcatheter therapies only for symptomatic patients unresponsive to optimal medical management. Imaging modalities like cardiac MRI provide valuable prognostic information and can guide therapy planning. However, recurrence of mitral regurgitation after surgical repair remains a major challenge, especially with restrictive annuloplasty techniques. Further research is needed to refine

surgical strategies and to better personalize treatment to maximize survival and quality of life in this high-risk patient group.

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