Severe ischemic mitral regurgitation: Repair or replace?

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Both European and US guidelines for the management of patients with valvular heart disease stipulate that mitral valve surgery can be considered for patients with severe functional (secondary) mitral regurgitation (MR) who remain significantly symptomatic despite optimal medical therapy, including cardiac resynchronization when indicated.^{1,2} This relatively weak, class IIb recommendation is predicated on the uncertainty as to the degree to which the benefit of surgical intervention outweighs the risks inherent in surgery for these patients with challenging pathology, and does not specify the type of surgical intervention to be performed. The choice between mitral valve (MV) repair and replacement for severe, functional MR must weigh the lower short- and intermediate-term morbidity and mortality associated with repair against the more predictable eradication of MR with replacement.³⁻⁶ Until recently, this choice was informed mostly by retrospective and single-center observational studies that included relatively few patients undergoing chordal-sparing MV replacement, a technique now known to be important for the preservation of left ventricle (LV) geometry and function.³

The evidence base to support surgical decision making for chordal-sparing MV replacement versus repair for the operative treatment of severe ischemic MR includes a large, retrospective, propensity-matched study of 1006 patients (244 matched pairs) with LV dysfunction (ejection fraction < 0.40) cared for at 13 Italian institutions over a 15-year time frame (1996-2011).⁷ The median qualitative MR grade as assessed by echocardiography for the matched pairs was 2.8 ± 0.5 on a scale of 0 to 4. There was no difference in short- or long-term mortality rates between matched pairs treated with MV replacement or repair. Furthermore, no between-group differences in long-term LV function, cardiac- or valve-related mortality, or exercise capacity were identified. MV repair was the strongest

Patients undergoing repair without recurrent mitral regurgitation have lower left ventricular end-systolic volume index than those patients with recurrent mitral regurgitation ($P < .001$).

Central Message

Optimal choice between MV repair or replacement for severe functional MR should depend on tethering and remodeling characteristics.

Perspective

A recent randomized trial did not find any clinical differences between MV repair or MV replacement for severe functional MR at 1 year. The authors drew on a variety of sources of evidence about leaflet tethering and adverse LV remodeling to provide insight into the optimal choice between surgical options for individual patients.

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multivariable predictor of the need for valve-related reoperation (hazard ratio, 2.9; 95% confidence interval, 2.5-3.2; $P < .001$).

A recently reported National Institutes of Health and Canadian Institute of Health Research-sponsored Cardiothoracic Surgical Trials Network (CTSN) randomized trial⁸ in 251 patients with severe ischemic MR (defined using an integrative echocardiographic method) demonstrated no difference at 1 year in the primary end point of reverse LV remodeling (change from baseline in LV end-systolic volume index) between patients undergoing MV replacement and repair. In addition, no difference was found between groups with respect to 30-day or 1-year mortality, major adverse cardiac and cerebrovascular events, or quality of life. In this randomized trial, the rates of recurrent moderate or severe MR in surviving patients at 1 and 2 years after repair was 32.6% and 46%, respectively.⁹ Moderate

Abbreviations and Acronyms

MR	= mitral regurgitation
MV	= mitral valve
LV	= left ventricle
CTSN	= Cardiothoracic Surgical Trials Network

recurrent MR, which constituted the vast majority of this combined end point, did not generally progress to severe MR over 2 years of follow-up. In a nonprespecified subgroup analysis, patients undergoing MV repair who did not develop recurrent MR showed significantly greater reductions in LV end-systolic volume index (ie, reverse remodeling) than patients with recurrent MR.

Several observational studies have identified predictors of recurrent ischemic MR after MV repair. These factors fall into 2 categories: echocardiographic parameters of the extent of MV leaflet tethering and indices of adverse LV remodeling/dilation. The former include anterior and posterior leaflet angles, leaflet tethering length, and leaflet tenting area. Investigators have also identified the angle between the tip of the anterior leaflet and the annular plane as a strong predictor of MR recurrence. An anterior leaflet angle $>25^{\circ}$ to 39.5° ¹⁰⁻¹⁴ has been independently associated with recurrent MR and may be of relatively greater importance than other echocardiographic measures of leaflet tethering (eg, posterior leaflet angle, coaptation depth, and tenting area) or indices of LV size or sphericity. LV size and function and the qualitative degree of MR have also been identified as key independent determinants of recurrent MR.¹⁵⁻²³ In the CTSN trial, the strongest (and only independent) predictor of recurrent MR in the repair group was the presence of basal aneurysm/dyskinesis.⁹ This was 1 of 10 preoperative factors that served as the basis for a predictive model for patients at highest risk of recurrent MR (area under the receiver operating characteristics curve, 0.82). Surprisingly, preoperative echocardiographic measures of MV tethering were not independently predictive of MR recurrence.

Based on these observations, we believe that the presence of basal aneurysm/dyskinesis, echocardiographic evidence of significant leaflet tethering, and/or moderate to severe LV dilation favor the use of chordal-sparing mitral valve replacement over mitral valve repair for treatment of medically refractory severe ischemic MR. In the absence of basal aneurysm/dyskinesis, the echocardiographic evidence of significant leaflet tethering, or moderate to severe LV dilation, MV repair using an undersized, complete, rigid ring may be reasonable. More complex mitral repair operations that specifically address leaflet tethering have shown promising results,²⁴⁻²⁷ but remain investigational and incompletely validated.

Long-term follow-up of the surviving patients in this CTSN trial will be important to better understand the clinical consequences of moderate/severe recurrent MR in the repair group, the incidence of prosthesis-related complications, heart failure hospitalizations, quality of life, and survival.

Conflict of Interest Statement

Dr Goldstein is on the medical advisory board and is a surgical proctor for Heartware, Inc; acts as a consultant for Medtronic, Inc; and also holds the Data and Safety Monitoring Board chair for the C-Pulse System: A Heart Assist Device Clinical Study (COUNTER HF) trial, Sunshine Heart, Inc. All other authors have nothing to disclose with regard to commercial support.

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