Predicting recurrent mitral regurgitation after mitral valve repair for severe ischemic mitral regurgitation

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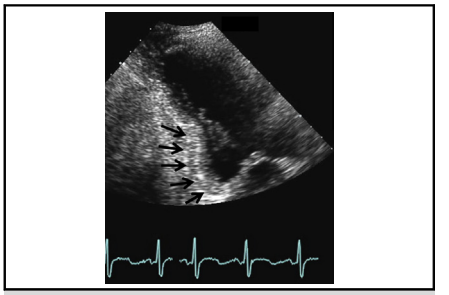
ABSTRACT

Objectives: The Cardiothoracic Surgical Trials Network recently reported no difference in the primary end point of left ventricular end-systolic volume index at 1 year postsurgery in patients randomized to repair (n = 126) or replacement (n = 125) for severe ischemic mitral regurgitation. However, patients undergoing repair experienced significantly more recurrent mitral regurgitation than patients undergoing replacement (32.6% vs 2.3%). We examined whether baseline echocardiographic and clinical characteristics could identify those who will develop moderate/severe recurrent mitral regurgitation or die.

Methods: Our analysis includes 116 patients who were randomized to and received mitral valve repair. Logistic regression was used to estimate a model-based probability of recurrence or death from baseline factors. Receiver operating characteristic curves were constructed from these estimated probabilities to determine classification cut-points maximizing accuracy of prediction based on sensitivity and specificity.

Results: Of the 116 patients, 6 received a replacement before leaving the operating room; all other patients had mild or less mitral regurgitation on intraoperative echocardiogram after repair. During the 2-year follow-up period, 76 patients developed moderate/severe mitral regurgitation or died (53 mitral regurgitation recurrences, 13 mitral regurgitation recurrences and death, and 10 deaths). The mechanism for recurrent mitral regurgitation was largely mitral valve leaflet tethering. Our model (including age, body mass index, sex, race, effective regurgitant orifice area, basal aneurysm/dyskinesis, New York Heart Association class, history of coronary artery bypass grafting, percutaneous coronary intervention, or ventricular arrhythmias) yielded an area under the receiver operating characteristic curve of 0.82.

Conclusions: The model demonstrated good discrimination in identifying patients who will survive 2 years without recurrent mitral regurgitation after mitral valve repair. Although our results require validation, they offer a clinically relevant risk score for selection of surgical candidates for this procedure. (J Thorac Cardiovasc Surg 2015;149:752-61)



Basal aneurysm/dyskinesis is an important predictor of recurrent MR after ischemic MR repair.

Central Message

Using data from the CTSN severe ischemic MR trial, we developed a model to predict MR recurrence in MV repair patients. This exploratory model, based on baseline clinical and echocardiographic characteristics, showed good discrimination (area under ROC = 0.82) in identifying those patients who survived 2 years without recurrent ischemic MR.

Author Perspective

The severe ischemic MR trial showed equivalent clinical outcomes for patients undergoing mitral-valve replacement and repair. One distinction between the groups was that a third of the repair patients developed moderate/severe MR within a few months of the surgery. Among survivors, those with most improved ventricular dimensions were repair patients, who did not experience recurrence. We analyzed factors that led to recurrence and developed a 10-factor exploratory model that predicted this outcome. Our results offer a better understanding of when repair will be successful and of mechanisms of failure that may lead to more innovative repair techniques.

Abbreviations and Acronyms

AUC = area under the curve
CABG = coronary artery bypass grafting
CTSN = Cardiothoracic Surgical Trials Network
EDV = end-diastolic volume
EROA = effective regurgitant orifice area
IMR = ischemic mitral regurgitation
LV = left ventricle
LVESVI = left ventricular end-systolic volume index
MR = mitral regurgitation
MV = mitral valve
NYHA = New York Heart Association
OR = operating room
PISA = proximal isovelocity surface area
ROC = receiver operating characteristic

Supplemental material is available online.

Ischemic mitral regurgitation (IMR) is a common complication of coronary artery disease, which carries an adverse prognosis, increasing the risk of late death by a factor of 2.[1] It occurs in approximately 25% of patients after myocardial infarction and is seen in up to 50% of patients with heart failure and cardiomyopathy.[2,3] Mitral regurgitation (MR) frequently occurs in patients with global left ventricle (LV) dysfunction and is a potent stimulus for adverse LV remodeling, which begets further MR. The mechanism of IMR relates to remodeling and distortion of the ischemic LV after infarction.[4-7] Ischemic LV distortion, such as occurs with development of an inferior aneurysm, leads to myocardial thinning and displacement, which supports the papillary muscles, which in turn anchors the mitral leaflets. Thus, displacement of the papillary muscles tethers the leaflets, affecting leaflet closure, and results in MR. Fundamentally, the mechanism of ischemic MR relates to a mismatch in the normal ventricular mitral valve (MV) spatial geometry.

The preferred method for surgical correction for severe IMR, specifically the choice between repair and replacement, has long been debated.[8-10] Previous studies have suggested that MV repair can be performed with lower perioperative mortality than replacement, but with high MR recurrence rates.[8,11-13] Specifically, repairing the MV with a restrictive annuloplasty ring may not eliminate the mechanistic problem in ischemic MR, which is leaflet tethering from a distorted ischemic LV wall. The Cardiothoracic Surgical Trials Network (CTSN) recently published results of a randomized trial (n = 251) comparing complete chordal-sparing MV replacement with MV repair with a complete downsized ring in patients with severe ischemic MR. In this trial, both surgical approaches reduced left ventricular end-systolic volume index (LVESVI) at 12 months, although there was no difference in 1-year LVESVI between the 2 treatment arms (the primary end point). Although 1-year mortality was similar in both groups, 32.6% of patients in the repair group developed moderate or severe MR at 1 year compared with only 2.3% in replacement group ($P < .001$). Of note, at 1 year, patients in the repair group without recurrent MR demonstrated greater improvement in LVESVI (ie, lower) than those with moderate or severe MR recurrence (47 ± 23 mL/m^2 vs 64 ± 24 mL/m^2, $P < .001$).[14]

Given these data, the question that emerges is whether one can identify a subgroup of patients who would most benefit from undergoing MV repair. Thus, the primary objective of this analysis is to determine whether we can discriminate between those patients who will experience moderate/severe MR recurrence after MV repair and those

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A complete list of the CTSN Investigators can be found in Appendix E1.

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