Historical Perspective

Does Coronary Artery Bypass Grafting Alone Correct Moderate Ischemic Mitral Regurgitation?

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Background—The optimal management of moderate (3+) on a scale of 0 to 4+) ischemic mitral regurgitation (MR) remains controversial. Some advocate CABG alone, whereas others favor concomitant mitral annuloplasty. To clarify the optimal management of these patients, we evaluated the early impact of isolated CABG on moderate ischemic MR.

Methods and Results—Between January 1992 and August 1999, 136 patients (54% male, mean age 70.5 years, mean New York Heart Association class 2.7, mean ejection fraction 38.1%) with a preoperative diagnosis of moderate ischemic MR, without leaflet prolapse or pathology, underwent isolated CABG. Thirty-eight (28%) of 136 patients had intravenous transesophageal echocardiography (TEE) before CABG, and 68 (50%) had postoperative transesophageal echocardiography (TEE) within 6 weeks of surgery. The subgroups of patients undergoing intraoperative TEE and postoperative TTE had preoperative characteristics similar to the overall group. The 30-day operative mortality was 2.9% (4/136). Intraoperative TEE downgraded the severity of MR to mild or less (0 to 2+) in 89% (34/38). On postoperative TEE, 40% (27/68) continued to have at least moderate MR (3 to 4+), 51% (35/68) improved somewhat to mild (2+), and only 9% (6/68) had resolution of their MR (0 to 1+). The mean preoperative, intraoperative, and postoperative MR grade were 3.0±0.0, 1.4±1.0, and 2.3±0.8, respectively (P<0.001).

Conclusions—CABG alone for moderate ischemic MR leaves many patients with significant residual MR and may not be the optimal therapy for most patients. Intraoperative TEE may significantly underestimate the severity of ischemic MR. A preoperative diagnosis of moderate MR may warrant concomitant mitral annuloplasty. (Circulation. 2001;104 suppl 1):1-68-1-75.)

Key Words: coronary disease ■ echocardiography ■ mitral valve ■ regurgitation ■ surgery

Although most surgeons would agree that severe mitral regurgitation (MR) should be corrected at the time of CABG and that trace to mild MR can probably be left alone, the optimal management of moderate ischemic MR remains controversial. Those favoring a conservative approach make several arguments. First, revascularizing ischemic areas will improve regional wall motion and correct the MR.7,8 Second, several studies9-11 suggest that performing CABG alone, even if some residual MR persists, does not affect long-term survival or functional status. Third, mitral valve surgery adds significantly to the operative risk of CABG, with most series reporting operative mortality rates >10%.9,11 Next, patients with ischemic MR tend to have relatively small left atria, which makes mitral valve exposure and repair difficult for many surgeons. Finally, mitral valve replacement, if necessary, carries the added burden of long-term anticoagulation or risk of reoperation.

Many surgeons, however, have advocated more liberal use of mitral annuloplasty in patients with moderate ischemic MR at the time of CABG. They present several key arguments. (1) Chronic ischemic MR is a dynamic condition that is very dependent on preload and afterload. The preoperative echocardiogram merely represents a brief snapshot of the severity of MR at the time of the study. The fact that many patients with “moderate” or less MR present with significant symptoms of congestive heart failure or enlarged left atria suggests that they probably have frequent episodes of more severe MR. (2) CABG alone will not correct moderate ischemic MR in many patients, especially those with scarring from myocardial infarction and those with annular and ventricular dilatation.12 (3) According to several studies,13,14 significant residual MR can result in late symptoms and decreased long-term survival. (4) Mitral annuloplasty is nearly always technically feasible, and it alone will almost always correct moderate ischemic MR, which makes mitral valve replacement almost never necessary.15 (5) The high operative mortality rate for combined mitral valve surgery and CABG reported in the literature is outdated and reflects a significant number of patients undergoing mitral valve replacement. Mitral valve repair can now be performed at the time of CABG with an operative mortality rate as low as 3% to 4%,16,17 (6) When significant residual MR remains, it ex-
IMR Grading

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Predictors of Treatment Success

Ischemic Mitral Regurgitation in Patients Undergoing Elective Isolated Coronary Artery Bypass Graft Surgery

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Background—The persistence of moderate ischemic mitral regurgitation (IMR) after isolated coronary artery bypass graft surgery is an important independent predictor of long-term mortality. The aim of the present predictors of postoperative improvement in moderate IMR in patients with ischemic heart disease is to identify predictors of improved isolated coronary artery bypass graft surgery.

Methods and Results—The study population consisted of 135 patients with ischemic heart disease (57 men) and moderate IMR undergoing isolated coronary artery bypass graft surgery. Fourteen men were followed-up at 12 months follow-up echocardiography and were excluded. At the 12-month follow-up, 57 patients IMR (improvement group), whereas 64 patients failed to improve (failure group). Before coronary surgery, the improvement group had significantly more viable myocardium and less dysynchrony muscles than the failure group (P<0.001). All other preoperative parameters were similar in both groups. Viable myocardium (odds ratio, 1.45; 95% confidence interval, 1.22 to 1.89; P<0.001) and dysynchrony (odds ratio, 1.40; 95% confidence interval, 1.29 to 1.72; P<0.001) were associated with improvement in IMR. The majority (93%) of patients with viable myocardium showed an improvement in IMR. In contrast, only 34% and 18% of patients with no viable myocardium, respectively, showed an improvement in IMR, whereas 32% and 49%, respectively, showed worsening of IMR (P<0.001).

Conclusion—Rehabilitation improvement in moderate IMR by isolated coronary artery bypass graft surgery is associated with the presence of viable myocardium and absence of dysynchrony between papillary

Key Words: Cardiopulmonary bypass • Hibernation • Mitral valve • Regurgitation

Persistent moderate ischemic mitral regurgitation (IMR) after isolated coronary artery bypass graft (CABG) surgery is associated with poor prognosis. However, optimal interventional management is still under discussion. Randomized data on the benefit of restrictive aneurysmectomy at the time of CABG are lacking, and results of observational studies on the survival benefits are not consistent. Nevertheless, restrictive mitral valve aneurysmectomy at the time of CABG has become the recommended approach for the surgical management of patients presenting with severe preoperative IMR. Whether the same recommendation should be applied in patients with moderate perioperative IMR is controversial. The ambiguity relates to the higher perioperative mortality compared with isolated CABG. On the other hand, IMR may improve by CABG alone, and no reliable predictors of IMR improvement after isolated CABG are available.

Accordingly, the aim of the present preoperative predictors of unimpaired improvement in patients with severe IMR is to assess the benefits of CABG as the sole surgical approach.

Editorial see p 1

Clinical Perspective

Patients

Between February 2002 and June 2003, CABG was performed at two participating institutions. One was as follows: All patients underwent coronary artery surgery. In case of heart failure symptoms, the decision was to perform CABG.

Methods

A new approach for the surgical management of patients presenting with severe preoperative IMR is to assess the benefits of CABG as the sole surgical approach.

Continuing medical education (CME) credits are available for this article. Go to http://cmj.americanheart.org to take the quiz.

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Predictors of Treatment Failure

Outcome After Restrictive Mitral Valve Annuloplasty for Ischemic Mitral Regurgitation

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Background—Ischemic mitral regurgitation (MR) often persists after surgery and is associated with worse clinical outcomes. The goal of the present study was to determine whether clinical outcome could be predicted from preoperative analysis of mitral valve tethering/remodeling.

Methods and Results—In 71 consecutive patients undergoing restrictive mitral annuloplasty, the tethering/remodeling (PL angle, anterior leaflet angle, coaptation distance, and tenting distance) was assessed before and after surgery. The mean follow-up period was 7.3 ± 1.4 years. There were 52 women and 19 men, aged 56 ± 13 years. The mean New York Heart Association functional class was 3.2 ± 0.6. Intraoperative findings of tethering/remodeling were found in 54% of patients. Risk factors for tethering/remodeling included ischemic MR and the presence of a left atrial appendage thrombus. The presence of tethering/remodeling was associated with increased risk of mortality, reoperation, and hospitalization. Of the 27 patients who died during follow-up, 17 had tethering/remodeling (59%). Overall, in patients with tethering/remodeling, the risk of mortality, reoperation, and hospitalization was 20% higher than in patients without tethering/remodeling (p < 0.01). These findings support the hypothesis that tethering/remodeling is a major cause of treatment failure for ischemic MR.

Conclusions—Tethering/Remodeling

Tethering/Remodeling?
Potential Benefit of CABG + MV Repair

Table 3. Study End Points at 1 Year

<table>
<thead>
<tr>
<th>End Points</th>
<th>CABG (n=32)</th>
<th>CABG+MVR (n=27)</th>
<th>Δ</th>
<th>P Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary end point</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak VO₂, ml/kg/min</td>
<td>15.1±3.3</td>
<td>15.9±2.5</td>
<td>0.8±2.9</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Secondary end points</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LV ESVI, ml/m²†</td>
<td>71.8±16.1</td>
<td>67.4±20.4</td>
<td>-4.4±17.4</td>
<td>0.002</td>
</tr>
<tr>
<td>MR volume, ml/beat†</td>
<td>31.9±14.8</td>
<td>22.7±14.6</td>
<td>-9.2±19.1</td>
<td>0.001</td>
</tr>
<tr>
<td>BNP (pg/ml)</td>
<td>681.4±197.3</td>
<td>286.7±132.0</td>
<td>-394.7±213.6</td>
<td>0.003</td>
</tr>
</tbody>
</table>

Key Words: bypass surgery, coronary artery, coronary disease, mitral valve regurgitation, myocardial ischemia, surgery

1° Endpoint?
Consequences of IMR

Survivors of acute myocardial infarction risk for congestive heart failure (CHF) (1) affects subsequent outcome, particularly (2,3). Therefore, identification of patients presenting with no or minimal is essential in potentially altering post-MI minimizing CHF rate (4).

Ischemic mitral regurgitation (IMR) is potential due to coronary artery disease (CAD) of intrinsic valve lesions and is frequent. Previous data from our institution (5) were consistent in suggesting that IMR affects survival. However, with regard to complications such as occurrence of pulmonary data are available. The Survival And Ventricular Enlargement (SAVE) study provided seminal information that IMR may lead to higher CHF incidence (5). However, inclusion limited to the acute post-MI phase (<16 days), more advanced symptoms, and left ventricular (LV) alterations in patients with IMR and lack of endovascular confirmation left doubt on the intrinsic IMR influence on

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METHODS

Population. Patients were consecutively enrolled at the Mayo Clinic, Rochester, Minnesota, between 1990 and 1997 if they: 1) were in NYHA functional class I or II at diagnosis and had no history of CHF; 2) had a Q-wave MI on electrocardiogram and a history of MI older than 16 days; 3) had transesophageal echocardiography during the same evaluations in routine clinical practice, showing either IMR, which was prospectively quantitatively assessed, or no MR. Exclusion criteria were: NYHA functional class III/IV, recent MI (≤16 days), previous cardiac surgery, papillary muscle involvement, or high-grade aortic stenosis.
Other points of interest…..

• 8 cross-overs from the CABG alone to the CABG + MV Repair group based on intra-operative findings but after the sternotomy and randomization? (ITT vs. AT analyses?)

• The impact of concomitant maze procedures on the outcomes?

• The assumed baseline LVESVI was 80 ml/m2 but the observed baseline LVESVI was 54.8 ml/m2 and 59.6 ml/m2 in the two trial arms – what role did this play in the primary endpoint? Was the study under-powered to show the difference that you predicted?
This is not the end of the story, rather the beginning - we will learn much more from this evidence base in future analyses...