Identifying patients who benefit from restrictive annuloplasty in ischemic mitral regurgitation: An elusive yet essential quest! Toward a patient-tailored approach

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Supported by the National Heart, Lung, and Blood Institute, Bethesda, Md (grant 5UM1HL088963); the Canadian Institutes of Health Research, Ottawa, Ontario, Canada; and the National Institute of Neurological Disorders and Stroke, Bethesda, Md (grant 7U01 HL088942).

Disclosures: Authors have nothing to disclose with regard to commercial support.

Received for publication Sept 4, 2015; accepted for publication Sept 5, 2015.

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J Thorac Cardiovasc Surg 2016;151:906-8

0022-5223/\$36.00

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<http://dx.doi.org/10.1016/j.jtcvs.2015.09.034>

Left ventricular remodeling is an independent risk for death and heart failure in patients with ischemic mitral regurgitation (IMR). Left ventricular “reverse” remodeling is desirable and is most consistently achieved in IMR when mitral regurgitation is enduringly corrected. Many experts believe that a restrictive annuloplasty (RA) is the most effective operation to correct IMR, but how to identify those patients who will benefit from RA remains elusive.

SEVERE IMR

Recently published results from the National Heart, Lung, and Blood Institute–sponsored Cardiothoracic Surgery Network (CTSN)¹ evaluated patients with severe IMR randomly allocated to RA with an undersized complete ring or chordal-sparing mitral valve replacement. The CTSN trial demonstrated no difference at 1 year in the primary end point of left ventricular reverse remodeling (end-systolic volume index [ESVI]), nor were there differences in 30-day and 1-year mortalities, in major adverse cardiac events, or in quality of life. The prevalence of moderate or severe IMR increased from 32.6% to 46% between years 1 and 2^{2,3}; however, in the overwhelming majority of these patients with persistent IMR, the grade of IMR was improved and only moderate in degree. Importantly, patients undergoing RA in whom IMR was eliminated had the greatest degree of reverse remodeling at 2 years. Understanding the baseline characteristics of these patients will be critical for future patient selection. Whether this improvement in left ventricular geometry will be associated with greater

freedom from heart failure or death will become known in time.

MODERATE IMR

What can be said of patients with moderate IMR? The literature on patients in whom the IMR grade was strictly and uniformly defined as “moderate” is limited to 4 randomized trials,⁴⁻⁷ the largest of which was recently published by the CTSN.⁴ These trials demonstrated that the greatest improvement in IMR grade was achieved with the addition of RA to bypass surgery versus bypass alone, and persistent IMR uncommonly progressed to severe at 1 year. Two of these trials showed a significant improvement in New York Heart Association functional class and left ventricular reverse remodeling with the addition of RA. These clinically significant differences have supported the addition of RA in patients with moderate IMR. Why these differences were not seen in the CTSN trial is unknown. Baseline differences in left ventricular size, regional wall motion and left ventricular dysenergy, and tethering parameters in these trials may have influenced

Recurrent mitral regurgitation 2 years after restrictive annuloplasty for severe IMR.

Central Message

Optimizing restrictive annuloplasty in ischemic mitral regurgitation.

See Articles page 940, 1044, and 1051.

See Editorial Commentaries page 957, 1049, and 1060.

the effect of adding RA. These factors are currently under investigation for the CTSN patient population.

CURRENT STATE OF KNOWLEDGE

To date, randomized trials and virtually all observational studies of moderate and severe IMR have enrolled “all comers” (any patient with IMR with an indication for coronary artery bypass grafting), rather than a predefined group of patients with chronic moderate or severe IMR for whom enrollment criteria considered regional ventricular function or myocardial viability. While important, such selective clinical trial enrollment criteria would face significant enrollment challenges. Nevertheless, for better selection of patients for RA, further analysis of left ventricular dimension, regional and global dysfunction or scar, location of bypass grafts, and tethering parameters are needed and may provide insight into the mechanism of IMR and its persistence or recurrence. Perhaps subgroup analyses from recent trials might help our understanding.

For the present, selecting patients for RA should first exclude those patients known not to benefit and second, as best as possible with current information, identify common baseline factors in those patients who have had enduring resolution of IMR after RA. IMR is most likely to persist after RA in patients with severe IMR who have basal dyskinesis or aneurysm and in those patients with extremely large ventricles at baseline (>70 mm mL/m²). Guidelines proposed by the American Association for Thoracic Surgery (see this issue of the *Journal*¹) for severe IMR may help steer patients who are unlikely to have a satisfactory results with repair to a safe, effective, and predictable result with mitral valve replacement. As yet, we do not know whether these same criteria are applicable to patients with moderate IMR. To the contrary, there is evidence from the randomized trials that patients with the largest ventricles at baseline (>70 mm mL/m²) had the greatest improvement in left ventricular ESVI and the most durable improvement in IMR. These points remain largely unresolved, and the quest is ongoing to select and adapt the right operation to the right patient at the right time.

FUTURE AREAS OF RESEARCH

Because of the nonnegligible prevalence of persistent IMR in patients with severe IMR undergoing RA,⁸ some groups have proposed adjunctive surgical techniques,⁹ including papillary muscle relocating, strut chordae cutting, leaflet augmentation, and papillary muscle banding, in addition to RA.¹⁰ Fattouch and colleagues¹¹ and others have demonstrated improvement in left ventricular ESVI and a lower prevalence of persistent IMR with papillary muscle banding plus RA versus RA alone. Patients at risk for IMR persistence after RA could perhaps benefit

from these adjunctive procedures. The challenge lies in identifying these patients before surgery. Interestingly, in the experimental report by the Emory group in this issue of the *Journal*, papillary muscle banding was superior to RA in reducing IMR, and the combination of both was associated with increased mitral valve gradients. The results of adjunctive mitral repair techniques require validation and emphasize the importance of surgical therapies that address the underlying ventricular pathology in patients with IMR.

The importance of therapeutic validation is particularly true for percutaneous approaches to valve repair and valve replacement,¹² which may offer options to treat IMR and must measure success not only as procedural or echocardiographic improvement of IMR but also by long-term improvement in IMR and left ventricular ESVI as well as survival and heart failure.¹³

Ultimately, the goal of surgery in patients with IMR is to tailor the operation to the specific individual patient, offering the most durable result with the maximum clinical benefit at an acceptable operative risk. For this, we must refine our clinical investigative skills and pursue relevant randomized controlled trials, despite their cost and inherent challenges, to advance knowledge on how to treat this puzzling and all too common condition.

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