Ischemic Mitral Regurgitation: Repair or Replacement

Vinod H. Thourani, MD

Professor of Surgery
Chair, Department of Cardiac Surgery
Medstar Heart and Vascular Washington Hospital Center
Georgetown University
Washington, DC, USA

STS Cartagena Meeting
September, 2017
Disclosures

• Abbott Medical/St. Jude Medical
  – Structural Heart Advisory board
  – Executive Committee: Portico trial
• Boston Scientific
  – Advisory Board, Executive Committee (Lotus Valve Trial)
• Cryolife
  – Advisor
• Edwards Lifesciences
  – National Co-PI: PARTNER 2 (SAPIEN 3 Trial)
  – Executive Committee: PARTNER 3 trial
  – Advisor
• Gore
  – Advisor
• Jenavalve
  – National Co-PI
Ischemic Mitral Regurgitation

- Ischemic mitral regurgitation (IMR) develops 2º to a MI.
- It imposes a volume overload on the LV, increases wall stress, and causes adverse LV remodeling and heart failure

Grigioni, JACC, 2005
Ischemic Mitral Regurgitation

Ischemic Cardiomyopathy

Post-MI Ventricular Remodeling

PM Displacement
Annular Dilatation

Mitral Regurgitation
Coaptation Depth Correlates with Ischemic MR

Inter-papillary muscle: Dynamics and IMR

Karla Thourani, JACC 2015
Mitral Annuloplasty for IMR
Current Standard of Care

- Annular approach to restoring valve competence
- Sub-valvular tethering or leaflet tenting persist even after annuloplasty
- 40% patients develop recurrent IMR within 3 years of surgery
R = 0.73

Incidence of ≥2+ MR after MVA (%)

Time after MVA (log scale)

Magne J, et al. Cardiology 2009;112:244-259
# Restrictive Annuloplasty in Ischemic MR

<table>
<thead>
<tr>
<th></th>
<th>Baseline TTE (51 pts)</th>
<th>Intraoperative TEE (51 pts)</th>
<th>3 mo TTE (48 pts)</th>
<th>1.5 y TTE (45 pts)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>MR, grade</td>
<td>3.4±0.6</td>
<td>0.2±0.4</td>
<td>0.4±0.3</td>
<td>0.8±0.8</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>LA, mm</td>
<td>53±8</td>
<td>—</td>
<td>51±8</td>
<td>47±7</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>LVEDD, mm</td>
<td>64±8</td>
<td>—</td>
<td>61±9</td>
<td>58±11</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>LVESD, mm</td>
<td>51±10</td>
<td>—</td>
<td>48±10</td>
<td>43±12</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Coaptation, cm</td>
<td>—</td>
<td>0.8±0.2</td>
<td>0.8±0.1</td>
<td>0.8±0.2</td>
<td>NS</td>
</tr>
<tr>
<td>Transmitral grade (mm Hg)</td>
<td>—</td>
<td>2.7±0.6</td>
<td>2.5±0.4</td>
<td>2.4±0.6</td>
<td>NS</td>
</tr>
<tr>
<td>MVA (cm²)</td>
<td>—</td>
<td>2.6±0.8</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

Secondary Chordal Cutting for IMR

- Addresses sub-valvular tethering
- Transect strut chordae to restore leaflet coaptation and valve closure
- Does chordal cutting relieve tethering over entire leaflet or is it anatomy dependent?
- How do the chordal forces redistribute after chordal cutting?
Patch Augmentation to Improve Leaflet Kinematics

Tethered Leaflet

Central Incision to Allow Leaflet to Attain “Stress Free” State

Patch Augmentation to the Shape of the Opening
Papillary muscle sling to treat IMR

A papillary muscle sling that reduces inter-papillary muscle distance could restore leaflet motion and coaptation, and eliminate mitral regurgitation.
Posterior papillary stitch

Mitral-Valve Repair versus Replacement for Severe Ischemic Mitral Regurgitation

A Deaht

Hazard ratio, 0.79 (95% CI, 0.42–1.47)
P=0.45

No. at Risk
MV repair 126 116 114 109 106
MV replacement 125 109 104 103 101

Months

Death (%)
Two-Year Outcomes of Surgical Treatment of Severe Ischemic Mitral Regurgitation

Two-Year Outcomes of Surgical Treatment of Severe Ischemic Mitral Regurgitation


<table>
<thead>
<tr>
<th>Variable</th>
<th>Repair (N=126)</th>
<th>Replacement (N=125)</th>
<th>P Value‡</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Clinical end point</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Death</td>
<td>24/126 (19.0)</td>
<td>29/125 (23.2)</td>
<td>0.42</td>
</tr>
<tr>
<td>Stroke</td>
<td>10/126 (7.9)</td>
<td>7/125 (5.6)</td>
<td>0.46</td>
</tr>
<tr>
<td>Worsening New York Heart Association class†</td>
<td>5/85 (5.9)</td>
<td>5/84 (6.0)</td>
<td>1.0</td>
</tr>
<tr>
<td>Rehospitalization for heart failure</td>
<td>27/126 (21.4)</td>
<td>22/125 (17.6)</td>
<td>0.44</td>
</tr>
<tr>
<td>Failed index mitral-valve procedure</td>
<td>6/126 (4.8)</td>
<td>0</td>
<td>0.03</td>
</tr>
<tr>
<td>Mitral-valve reoperation</td>
<td>4/126 (3.2)</td>
<td>1/125 (0.8)</td>
<td>0.37</td>
</tr>
<tr>
<td>Moderate or severe recurrent mitral regurgitation</td>
<td>57/97 (58.8)</td>
<td>3/79 (3.8)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>MACCE‡</td>
<td>53/128 (42.1)</td>
<td>53/125 (42.4)</td>
<td>0.96</td>
</tr>
<tr>
<td>Canadian Cardiovascular Society class III or IV</td>
<td>4/82 (4.9)</td>
<td>0/80</td>
<td>0.19</td>
</tr>
</tbody>
</table>

no. of events (rate/100 patient-yr)
Moderate/severe MR by TTE assessment in surviving pts at 30 days, 6, 12 and 24 months
Cumulative incidence of MR recurrence and/or death over 2 years (n=116)
Conclusions

- About 30% of patients had moderate/severe at 1 month post-op
- By 24 months 46% of surviving patients experience moderate or severe MR
- Little progression of mod MR to severe
- Progression to mod MR and even severe is dynamic and in about 10% pts is reversible at different time points
- Basal aneurysm/dyskinesis is strongly associated with MR recurrence
- Model needs validation but appears promising for predicting pts at high risk
- These pts better treated with replacement or more complex repair techniques
Predicting recurrent mitral regurgitation after mitral valve repair for severe ischemic mitral regurgitation

Irving L. Kron, MD, a Judy Hung, MD, b Jessica R. Overbey, MS, c Denis Bouchard, MD, d Annette C. Gelijns, PhD, e Alan J. Moskowitz, MD, e Pierre Voisine, MD, f Patrick T. O’Gara, MD, g Michael Argenziano, MD, h Robert E. Michler, MD, h Marc Gillinov, MD, i John D. Puskas, MD, j James S. Gammie, MD, k Michael J. Mack, MD, l Peter K. Smith, MD, m Chittoor Sai-Sudhakar, MD, n Timothy J. Gardner, MD, o Gorav Ailawadi, MD, p Xin Zeng, MD, q Karen O’Sullivan, MPH, r Michael K. Parides, PhD, s Roger Swayne, RN, BSN, t Vinod Thourani, MD, u Eric A. Rosenhek, u Louis P. Perrault, MD, v and Michael A. Acker, MD, w for the CTSN Investigators

ABSTRACT

Objectives: The Cardiothoracic Surgical Trials Network recently reported no difference in the primary end point of left ventricular end-systolic volume index in 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, Base aneurysm/dyskinesis is an important predictor of recurrent MR after ischemic MR repair.

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.
Restrictive Mitral Annuloplasty Cures Ischemic Mitral Regurgitation and Heart Failure

Jerry Braun, MD, Nico R. van de Veire, MD, Robert J. M. Klautz, MD, PhD, Michel I. M. Versteegh, MD, Eduard R. Holman, MD, PhD, Jos J. M. Westenberg, PhD, Eric Boersma, PhD, Ernst E. van der Wall, MD, PhD, Jeroen J. Bax, MD, PhD, and Robert A. E. Dion, MD, PhD

Ischemic MR: Repair or Replace?

- Complete MV ring for repair in IMR
- Caution: basilar aneurysm
- Caution: large ventricular dimension
- Caution: severe leaflet tethering
2016 update to The American Association for Thoracic Surgery (AATS) consensus guidelines: Ischemic mitral valve regurgitation

AATS Ischemic Mitral Regurgitation

Irving L. Kron, MD, a Damien J. LaPar, MD, MSc, a
Michael A. Acker, MD, b David H. Adams, MD, c
Gorav Ailawadi, MD, a Steven F. Bolling, MD, d
Judy W. Hung, MD, e D. Scott Lim, MD, f
Michael J. Mack, MD, g Patrick T. O’Gara, MD, h
Michael K. Parides, PhD, i and John D. Puskas, MD e

Illustrated mechanism of ischemic mitral regurgitation. Apically displaced leaflet coaptation with restricted leaflet closure results in mitral regurgitation.

Central Message

This contribution provides an update to the 2015 AATS evidence-based guidelines for the management of ischemic mitral regurgitation.

See Editorial Commentary page 1080.
Severe Ischemic MR
A. **MV replacement** is reasonable in patients with severe IMR who remain symptomatic despite guideline directed medical and cardiac device therapy, and who *have* a basal aneurysm/dyskinesis, significant leaflet tethering, and/or severe LV dilation (LVEDD >6.5 cm) (COR IIa, LOE B).
B. MV repair with an undersized complete rigid annuloplasty ring may be considered in patients with severe IMR who remain symptomatic despite guideline directed medical and cardiac device therapy and who *do not have* a basal aneurysm/dyskinesis, significant leaflet tethering, or severe LV enlargement (COR IIb, LOE B).

Mitral Valve Replacement (MVR) vs Repair
A. MVR for IMR is performed with complete preservation of both anterior and posterior leaflet chords (COR I, LOE B).
B. **MV repair** for IMR is performed with small undersized complete rigid annuloplasty ring (COR IIa, LOE B).
Conclusions

- IMR is a complex medical/surgical phenomenon which is incompletely understood.
- There remains a multitude of available treatment strategies including:
  - medical/heart failure therapy
  - Surgical ring or replacement
  - Subannular therapy with papillary approximation therapies
- It is probable that MV Replacement provides a more durable correction of severe IMR compared to MV repair.
- The most optimal therapy will be a multi-disciplinary heart team approach.
Thank You

Vinod H. Thourani, MD

vinod.h.thourani@medstar.net