Management of Moderate and Severe Ischemic Mitral Regurgitation

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Disclosures

- **Abbott Medical/St. Jude Medical**
  - Structural Heart Advisory board
  - Executive Committee: Portico trial

- **Boston Scientific**
  - Advisory Board, Executive Committee (Lotus Valve Trial)
  - National Co-PI, REPRISE IV trial

- **Claret Medical**
  - Advisory Board

- **Cryolife**
  - Advisor
  - Executive Committee, PROACT II trial

- **Edwards Lifesciences**
  - National Co-PI: PARTNER 2 (SAPIEN 3 Trial)
  - National Co-PI: ACTIVE Trial
  - Executive Committee: PARTNER 3 trial
  - Advisory Board

- **Gore Vascular**
  - Advisor

- **Jenavalve**
  - National Co-PI TAVR trial
Presentation

- 77 yo AA male
- Admitted for NSTEMI 2 days prior. Peak troponin 1.5.
- PMHx: HTN, IDDM, hyperlipidemia,
- PSHx: thyroidectomy, lap chole.
- PFHx: mother died of MI at age 92. Father no cardiac history. Brother with CABG at age 65 and doing well
- Meds: ASA, lipitor, januvia, insulin prn, metoprolol, enalapril
Cardiac Catheterization
Cardiac Catheterization
Cardiac Catheterization
Preoperative TTE
Preoperative TTE
Intraoperative TEE
CABG Only

• CABG x 3: on pump
  – RIMA TO LAD
  – LIMA TO MOM
  – SVG TO PDA
• LEFT MV ALONE
• DICHARGE POD #4
Postoperative TTE – 2 years later
Epidemiology of Ischemic MR

- 50% of MI’s are associated with some degree of ischemic MR
- 10% of MI’s are associated with moderate ischemic MR
- Ischemic MR is associated with reduced event-free survival
Secondary Mitral Regurgitation
Secondary Mitral Regurgitation
## Surgical Indications

**Current Guidelines**

<table>
<thead>
<tr>
<th>Existing society guidelines</th>
<th>AATS guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Moderate IMR</strong></td>
<td></td>
</tr>
<tr>
<td>A. MV repair can be considered at time of CABG (COR IIb, LOE B)</td>
<td>A. Patients with moderate IMR undergoing CABG should undergo concomitant MV repair with an undersized complete rigid annuloplasty ring to mitigate recurrence of MR in patients who have heart failure symptoms, those with significant mitral annular dilation and those in whom bypassable, hibernating, viable myocardium supporting the papillary muscle(s) is thought to be minimal (COR IIb, LOC A).</td>
</tr>
<tr>
<td>B. MV surgery can be considered at time of other cardiac surgery (eg, AVR) (COR IIb, LOE C)</td>
<td></td>
</tr>
<tr>
<td><strong>Severe IMR</strong></td>
<td></td>
</tr>
<tr>
<td>A. MV surgery is reasonable at time of CABG or other cardiac surgery (eg, AVR) (COR IIa, LOE C)</td>
<td>A. In the presence of basal aneurysm/dyskinesis, significant echocardiographic evidence of leaflet tethering, or moderate to severe LV remodeling (LVEDD &gt;65), patients should consider MV replacement (COR IIa, LOE A)</td>
</tr>
<tr>
<td>B. MV surgery can be considered as an isolated procedure for treatment of significant heart failure symptoms that persist despite guideline directed medical therapy (COR IIb, LOE C)</td>
<td>B. In the absence of basal aneurysm/dyskinesis, echocardiographic evidence of significant leaflet tethering, or moderate to severe LV remodeling (LVEDD &lt; 65), patients should consider MV repair with an undersized complete rigid ring (COR IIb, LOE B).</td>
</tr>
<tr>
<td><strong>MV replacement vs repair</strong></td>
<td></td>
</tr>
<tr>
<td>Not available</td>
<td></td>
</tr>
</tbody>
</table>

**MV replacement for IMR** is performed with complete preservation of both anterior and posterior leaflet chords (COR I, LOE B)

**MV repair for IMR** is performed with a small undersized complete rigid annuloplasty ring (COR IIa, LOE B)
# Chronic Severe Secondary Mitral Regurgitation: Intervention

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>COR</th>
<th>LOE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MV surgery is reasonable for patients with chronic severe secondary MR (stages C and D) who are undergoing CABG or AVR</td>
<td>IIa</td>
<td>C</td>
</tr>
<tr>
<td>MV surgery may be considered for severely symptomatic patients (NYHA class III-IV) with chronic severe secondary MR (stage D)</td>
<td>IIb</td>
<td>B</td>
</tr>
<tr>
<td>MV repair may be considered for patients with chronic moderate secondary MR (stage B) who are undergoing other cardiac surgery</td>
<td>IIb</td>
<td>C</td>
</tr>
</tbody>
</table>
CABG vs. CABG+ MVA
73 patients
Primary endpoint- MVO2 Consumption at 1 Year
Stopped early based on interim analysis

CONCLUSION
- Adding mitral annuloplasty to CABG in patients with moderate ischemic MR may improve functional capacity, left ventricular reverse remodeling, MR severity, and B-type natriuretic peptide levels, compared with CABG alone.

Circulation 2012
Moderate Secondary MR at Time of CABG

Influence of Mitral Regurgitation Repair on Survival in the Surgical Treatment for Ischemic Heart Failure Trial

Marek A. Deja, MD; Paul A. Grayburn, MD; Benjamin Sun, MD; Vivek Rao, MD; Lilin She, PhD; Michał Krejca, MD; Anil R. Jain, MS; Yeow Leng Chua, MBBS; Richard Daly, MD; Michele Senni, MD; Krzysztof Mokrzycki, MD; Lorenzo Menicanti, MD; Jae K. Oh, MD; Robert Michler, MD; Krzysztof Wróbel, MD; Andre Lamy, MD; Eric J. Velazquez, MD; Kerry L. Lee, PhD; Robert H. Jones, MD

**Conclusion**—Although these observational data suggest that adding mitral valve repair to CABG in patients with left ventricular dysfunction and moderate to severe MR may improve survival compared with CABG alone or medical therapy alone, a prospective randomized trial is necessary to confirm the validity of these observations.

**Clinical Trial Registration**—URL: http://www.clinicaltrials.gov. Unique identifier: NCT00023595.

*(Circulation. 2012;125:2639-2648.)*
Surgical Treatment of Moderate Ischemic Mitral Regurgitation


CONCLUSIONS

In patients with moderate ischemic mitral regurgitation, the addition of mitral-valve repair to CABG did not result in a higher degree of left ventricular reverse remodeling. Mitral-valve repair was associated with a reduced prevalence of moderate or severe mitral regurgitation but an increased number of untoward events. Thus, at 1 year, this trial did not show a clinically meaningful advantage of adding mitral-valve repair to CABG. Longer-term follow-up may determine whether the lower prevalence of mitral regurgitation translates into a net clinical benefit. (Funded by the National Institutes of Health and the Canadian Institutes of Health Research; ClinicalTrials.gov number, NCT00806988.)
Two-Year Outcomes of Surgical Treatment of Moderate Ischemic Mitral Regurgitation


CONCLUSIONS

In patients with moderate ischemic mitral regurgitation undergoing CABG, the addition of mitral-valve repair did not lead to significant differences in left ventricular reverse remodeling at 2 years. Mitral-valve repair provided a more durable correction of mitral regurgitation but did not significantly improve survival or reduce overall adverse events or readmissions and was associated with an early hazard of increased neurologic events and supraventricular arrhythmias. (Fundied by the National Institutes of Health and Canadian Institutes of Health Research; ClinicalTrials.gov

Considerations:
CABG alone: improves LV function and MR
CABG + MVer: persistent adverse consequences of MR
CTSN Moderate MR Trial Design

Patients Screened for Moderate Ischemic MR (n=6,676)

Randomized Patients (n=301)

CABG Alone (n=151)
CABG + Valve Repair *Undersized Ring* (n=150)

Outcomes Measured at 6, 12 and 24 months

Primary Endpoint Analysis (n=301)
## Integrative Method of MR Grading


<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>EROA (cm²)</td>
<td>&lt;0.2</td>
<td>0.2 - 0.39</td>
<td>≥0.4</td>
</tr>
<tr>
<td>VC width (mm)</td>
<td>&lt;3</td>
<td>3 - 6.9</td>
<td>≥7</td>
</tr>
<tr>
<td>Jet/LA area</td>
<td>&lt;20%</td>
<td>20-39%</td>
<td>≥40%</td>
</tr>
</tbody>
</table>

![Images of echocardiogram](image-url)
## Baseline Characteristics

<table>
<thead>
<tr>
<th></th>
<th>CABG Alone (N=151)</th>
<th>CABG + Repair (N=150)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Male –no. (%)</strong></td>
<td>99 (65.6)</td>
<td>106 (70.7)</td>
</tr>
<tr>
<td><strong>Age (yr)</strong></td>
<td>65.2 ± 11.3</td>
<td>64.3 ± 9.6</td>
</tr>
<tr>
<td><strong>White –no. (%)</strong></td>
<td>122 (80.8)</td>
<td>115 (76.7)</td>
</tr>
<tr>
<td><strong>Hispanic–no. (%)</strong></td>
<td>14 (9.3)</td>
<td>12 (8.0)</td>
</tr>
<tr>
<td><strong>Diabetes –no. (%)</strong></td>
<td>66 (43.7)</td>
<td>76 (50.7)</td>
</tr>
<tr>
<td><strong>Medical and Surgical History –no. (%)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Renal Insufficiency</td>
<td>28 (18.7)</td>
<td>24 (16.0)</td>
</tr>
<tr>
<td>Prior CABG</td>
<td>4 (2.8)</td>
<td>4 (2.8)</td>
</tr>
<tr>
<td>Prior PCI</td>
<td>24 (15.9)</td>
<td>26 (17.3)</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>76 (50.3)</td>
<td>82 (54.7)</td>
</tr>
<tr>
<td>Myocardial Infarction</td>
<td>97 (64.2)</td>
<td>103 (68.7)</td>
</tr>
<tr>
<td>Atrial Fibrillation</td>
<td>35 (23.3)</td>
<td>19 (12.8)</td>
</tr>
<tr>
<td>ICD</td>
<td>6 (4.0)</td>
<td>6 (4.0)</td>
</tr>
<tr>
<td>Stroke</td>
<td>9 (6.0)</td>
<td>15 (10.0)</td>
</tr>
</tbody>
</table>
## Operative Conduct and Length of Stay

<table>
<thead>
<tr>
<th></th>
<th>CABG Alone</th>
<th>CABG + MV Repair</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Grafts</td>
<td>3.3±0.9</td>
<td>3.2±0.9</td>
<td>NS</td>
</tr>
<tr>
<td>Aortic XClamp (min)</td>
<td>74.7±36.7</td>
<td>117.2±35.4</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>CPB time (min)</td>
<td>106.8±49.7</td>
<td>163.1±54.9</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>ICU stay</td>
<td>4.0±5.7</td>
<td>4.8±6.1</td>
<td>0.006</td>
</tr>
<tr>
<td>Postoperative LOS</td>
<td>9.4±5.9</td>
<td>11.3±8.2</td>
<td>0.002</td>
</tr>
</tbody>
</table>

*Data presented as mean ± std*
Distribution of Ring Size

Number of Patients

Ring Size (mm)

Sex  Male  Female

16  44  6
23  1  8
2  0
CTSN MMR Trial

30 Day Mortality:
2.7% (CABG) vs. 1.3% (CABG/MVr), p = 0.68

Hazard ratio, 0.90 (95% CI, 0.45–1.83)
P = 0.78
CTSN MMR Trial

**B Major Adverse Cardiac or Cerebrovascular Event**

Hazard ratio, 0.89 (95% CI, 0.60–1.34)
P = 0.58

<table>
<thead>
<tr>
<th>Month</th>
<th>CABG alone</th>
<th>CABG+MV repair</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>151</td>
<td>150</td>
</tr>
<tr>
<td>6</td>
<td>121</td>
<td>123</td>
</tr>
<tr>
<td>12</td>
<td>113</td>
<td>117</td>
</tr>
<tr>
<td>18</td>
<td>96</td>
<td>106</td>
</tr>
<tr>
<td>24</td>
<td>53</td>
<td>64</td>
</tr>
</tbody>
</table>
Rates of Serious Adverse Events and Re-hospitalization

Overall SAE Rate (100-pt years)
117.0 (CABG Alone) vs. 137.1 (CABG + Repair)
p=0.15

Heart Failure
CABG Alone: 20
CABG + MV Repair: 30
P=0.03

All Neurological Events
CABG Alone: 10
CABG + MV Repair: 10
P=NS

Stroke
CABG Alone: 5
CABG + MV Repair: 5
P=NS

Bleeding
CABG Alone: 2
CABG + MV Repair: 2
P=NS

Supraventricular Arrhythmia
CABG Alone: 15
CABG + MV Repair: 25
P=0.03

Re-hospitalizations
CABG Alone: 70
CABG + MV Repair: 70
P=NS
Mitral Regurgitation

- **Severe**
- **Moderate**
- **Mild**
- **Trace**
- **None**
## Moderate to Severe MR at 2 years

<table>
<thead>
<tr>
<th></th>
<th>CABG alone</th>
<th>CABG + MV Repair</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Moderate MR</strong></td>
<td>43.0%</td>
<td>24.8%</td>
<td>P=0.004</td>
</tr>
<tr>
<td><strong>Severe MR or MV operation</strong></td>
<td>11.4%</td>
<td>3.5%</td>
<td>P=0.02</td>
</tr>
</tbody>
</table>
Quality of Life at 1 year

Δ = Median improvement from baseline to 12 months

- Δ = 12% (CABG Alone)
- Δ = 14% (CABG + MV Repair)
- Δ = 45% (SF-12 Physical Function)
- Δ = 48% (MLHF)
Readmission Following Surgery

<table>
<thead>
<tr>
<th></th>
<th>From Baseline to 1 Yr</th>
<th>From 1 Yr to 2 Yr</th>
<th>From Baseline to 2 Yr</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CABG (N=151)</td>
<td>CABG plus Repair</td>
<td>CABG (N=128)</td>
</tr>
<tr>
<td></td>
<td>no. of patients (%)</td>
<td>P Value</td>
<td>CABG plus Repair (N=137)</td>
</tr>
<tr>
<td>Any Readmission</td>
<td>96 (75.2)</td>
<td>0.54</td>
<td>37 (35.4)</td>
</tr>
<tr>
<td>CV Readmission</td>
<td>51 (40.0)</td>
<td>0.56</td>
<td>20 (19.2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>133 (57.3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>129 (52.0)</td>
</tr>
</tbody>
</table>

Same between CABG alone and CABG + MV repair
Summary

• No difference at 2 year:
  – in the degree of reverse remodeling
  – in mortality
  – in MACCE, hospital readmission, or QOL

• CABG + MV repair associated with more:
  – neurologic events
  – increased cross clamp and cardiopulmonary bypass time
  – longer ICU and hospital LOS

• At 2 year, higher degree of moderate and severe MR in the CABG alone group
When To Correct Moderate Secondary MR

- Structural valve disease (not secondary)
- Tethered posterior leaflet
- Large left atrium (>4.0cm)
- Good surgical risk
- Significantly dilated LV
- Ejection <0.35-0.45
- Significantly dilated mitral annulus
- Severely tethered MV- especially anterior leaflet
- Atrial fibrillation
- MRI or PET proven infero-lateral scar
When NOT To Correct Moderate Secondary MR

- Viable, ischemic, revascularizable myocardium in papillary muscle distribution (Circ or RCA)
- Significant co-morbidities—better served with off-pump CABG
- Small left atrium
- Sinus rhythm
- Not on guideline directed medical therapy
Summary: Moderate IMR

- Diagnosis of moderate secondary MR is multi-modal to include multiple clinical and echo factors
- GDMT should be optimized prior to CABG
- There is no evidence from the CTSN trial that surgical correction of MR adds benefit to CABG alone up to 2 years.
- Specific anatomic and clinical factors should be taken into account during intra-operative decision-making
Severe IMR
Mitral Valve Repair vs Replacement for Severe Secondary MR

or

Is MV Repair Dead for Secondary (Functional) MR?
Surgical Options for MV Disease

REPLACEMENT

- Excellent MR reduction
- Faster (?)
- More reproducible
- Bioprostheses: limited longevity
- Mechanical: anticoagulation

REPAIR

- Maintains LV geometry
- Improved patient survival
- No anticoagulation
- Reduced risk of thromboembolism, endocarditis
Two-Year Outcomes of Surgical Treatment of Severe Ischemic Mitral Regurgitation

MV Repair vs Replace: Change in LVESVI

Mean change in LVESVI from baseline to 1 year

(ml/m²)

-6.6

-6.8

(p = NS)

MV Repair

MV Replacement
MV Repair vs Replacement for IMR

- Hazard ratio for death: 0.79 (95% CI: 0.46–1.35), P=0.39
- Hazard ratio for MACCE: 0.97 (95% CI: 0.66–1.42), P=0.88

<table>
<thead>
<tr>
<th>No. at Risk</th>
<th>Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>MV repair</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>100</td>
</tr>
<tr>
<td>MV replacement</td>
<td>0</td>
</tr>
</tbody>
</table>
In the repair group, the 12-month LVESVI was 64.1±23.9 ml per square meter in patients with recurrent mitral regurgitation versus 47.3±23.0 ml per square meter in those without recurrent mitral regurgitation (P<0.001).
Principles of MV Repair for FMR

- Restoring adequate leaflet coaptation
- Downsizing

↑ Leaflet coaptation  → ↓ subvalvular stress
Limitations of Ring Annuloplasty

Normal

Post Infarct

Ring

LV

LA

Ao

Papillary muscle

Tethering

MR

Persistent tethering

Ring

Courtesy Robert Levine
## Restrictive Annuloplasty in Ischemic MR

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Intraoperative</th>
<th>3 mo</th>
<th>1.5 y</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TTE (51 pts)</td>
<td>TEE (51 pts)</td>
<td>TTE (48 pts)</td>
<td>TTE (45 pts)</td>
<td></td>
</tr>
<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>

Coaptation Depth Correlates with Ischemic MR

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, f Pierre Voisine, MD, e Patrick T. O’Gara, MD, f Michael Argenziano, MD, g 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 Swayze, RN, BSN, t Vinod Thourani, MD, u Eric A. Rose, MD, v Louis P. Perrault, MD, w and Michael A. Acker, MD, x 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 at 1...
ABOUT STARBUCKS
TAKING ITS NAME FROM A CHARACTER IN HERMAN MELVILLE’S CLASSIC, MOBY DICK, STARBUCKS HAS GROWN FROM ITS HUMBLE BEGINNINGS (A SINGLE LOCATION IN SEATTLE) TO BE THE WORLD’S LARGEST COFFEEHOUSE

FAVOURITE BEVERAGE

SIZE OF THE CUP

Tall
12oz

Grande
24oz

Trento
31oz

An Illustrated History

1971
We start by selling coffee beans in Seattle's Pike Place Market.

1987
We add handcrafted espresso beverages to the menu.

1992
We become a publicly traded company.

2011
We mark 40 years and begin the next chapter in our history.
Post-Infarct Chord Cut

Improved coaptation

Intermediate chord cut

No MR

Messas et al Circulation 2001
Initial results of the chordal-cutting operation for ischemic mitral regurgitation

Michael A. Borger, MD, PhD, Patricia M. Murphy, MD, Asim Alam, MD, Shafie Fazel, MD, PhD, Manjula Maganti, MSc, Susan Armstrong, MSc, Vivek Rao, MD, PhD, and Tirone E. David, MD

Objective: Division of secondary chords (chordal cutting) has been proposed as a method for decreasing mitral valve leaflet tethering and mitral regurgitation in patients with ischemic mitral regurgitation. However, very little clinical data exist to date for this procedure.

Methods: We compared echocardiographic and clinical data in patients who underwent chordal-cutting mitral valve repair (n = 43) and those undergoing conventional mitral valve repair (control, n = 49) for ischemic mitral regurgitation.

Results: Patients who underwent chordal cutting had a higher prevalence of recent myocardial infarction, left main disease, diabetes, and peripheral vascular disease (all \( P < .05 \)). Left ventricular ejection fraction was lower in the chordal-cutting group (33 ± 2% vs 44 ± 2%) (mean ± SE) and preoperative tent height was greater (11.7 ± 0.5 vs 9.7 ± 0.6 mm; both \( P < .01 \)). In-hospital mortality was 10% in control patients and 9% in the chordal-cutting group (\( P = .9 \)). Other complication rates were similar for the two groups. The reduction in tent height before-to-after repair was similar in the two groups of patients, but those undergoing chordal cutting had a greater reduction in tent area (53 ± 3% vs 41 ± 3%; \( P = .01 \)). The chordal-cutting group also had greater mobility of the anterior leaflet, as measured by a reduction in the distance between the free edge of the anterior mitral valve leaflet and the posterior left ventricular wall (24 ± 3% vs 11 ± 4%; \( P = .01 \)). Control patients had more recurrent mitral regurgitation during 2 years of follow-up by univariate (37% vs 15%; \( P = .03 \)) and multivariate analysis (\( P = .03 \)). Chordal cutting did not adversely affect postoperative left ventricular ejection fraction (10% ± 5% relative increase in left ventricular ejection fraction vs 11% ± 6% in the control group; \( P = .9 \)).

Conclusion: Chordal cutting improves mitral valve leaflet mobility and reduces mitral regurgitation recurrence in patients with ischemic mitral regurgitation, without any obvious deleterious effects on left ventricular function.
MV Leaflet Tethering from Secondary Chordae Tendinae

“Seagull sign”

Large secondary chord to anterior leaflet

Courtesy of Michael Borger, MD, PhD
Results: Follow Up TTE

- Chordal Cutting
-Undersized Annuloplasty

$\text{Prevalence (\%)}$

$\text{Moderate or More MR}$

$p = 0.03$
Relocation of papillary muscles: 
Ring + String
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Survival

Freedom from MR$> II^\circ$

Langer et al, *Circulation* 2009;120(suppl I):S85-91
Treatment of Secondary MR in 2017

- Severe ischemic FMR → surgery (particularly if viable myocardium):
  - MV repair +/- subvalvular procedure in select pts
    - no basal aneurysm or severe tethering
    - LVIDd < 6.5 cm)
  - MV replacement in all others
    - Ruptured papillary muscle (acute IMR)
    - Patients in cardiogenic shock
    - Severe apical tenting (>11mm)
    - PLA > 45 degrees
    - During second CPB run
    - Complex MR leaks?
    - Surgeons who do not do many repairs?
Treatment of Secondary MR in 2017

- Severe MR due to DCM → surgery if symptomatic with relatively preserved LV function and size (MR secondary to long-standing AF?)
  - MV repair is optimal in these patients
Treatment of Secondary MR in 2017

- Severe FMR in nonsurgical candidates:
  - MitraClip vs medical management (COAPT and other trials)
  - CRT or LVAD / HTx (select patients)
  - Transcatheter MV repair or replacement (very select patients)
2016 AATS Guidelines

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).

Thank You

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