MITRAL VALVE REPAIR FOR HEART FAILURE AND IDENTIFICATION OF SUITABLE PATIENTS

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Shipra Srivastava
Manisha Mishra
Magnitude of the problem

- In US alone ~5 million people (2.2% of total population) suffering with heart failure.
- 550,000 new cases diagnosed each year.
- Of these ~53,000 will die annually, since less than 3000 will be transplanted.
• Less than 3000 offered transplantation.
• Transplantation limited by donor availability and its inapplicability in older patients and those with co-morbid conditions.
• Secondary mitral regurgitation, as a complication of end-stage CMP may affect up-to 60% of all heart failure patients.
• Mitral valve surgery has a large role to play in these patients with heart failure.
Efficacy of Mitral valve surgery in heart failure compared to HTx

1. 40 patients with poor LVEF (28±/-5%)
2. Underwent MV repair (n=26) or replacement (n=14) at University hospital Munster, Germany.
3. Matched to age and time period with 148 patients undergoing HTx.
4. Mean follow up of 50+/-3.4 months.
**Pathophysiology:**
What happens to the failing heart with MR?

1. Disease induces apical and lateral displacement of one or both papillary muscles.
2. Resultant pull on chordae and leaflets prevents their proper closure and causes mitral regurgitation.
3. This increases LV preload, volume and wall tension.
4. To compensate this, LV undergoes eccentric hypertrophy and dilatation. The LV becomes globular and its base more circular. *(Remodeling)*
5. Which further separates the papillary muscles and pulls the leaflets away from each other increasing the regurgitation and further remodeling *(continued remodeling)*.
6. This vicious cycle at one point leads to failure by LV to maintain forward flow, when LV mass to volume ratio is disturbed.
How does annuloplasty help in heart failure?

1. In comparison to a replacement, annuloplasty remodels the base of LV in normal elliptical shape, whereas an artificial valve makes it more spherical.
2. **Induces reverse remodeling** by cutting the regurgitation induced increase in pre-load, wall tension and LV volumes, thereby attaining normal mass to volume ratio.
How does annuloplasty help in heart failure?

- Mitral valve repair must achieve LV reverse remodeling to be effective.
- In ischemic cases, remodeling by infarct expansion must be prevented by complete revascularisation or other adjunctive techniques.
- If reverse remodeling doesn’t happen and LV continues to dilate with resultant papillary muscle separation and leaflet tethering, recurrent MR will result.
**Key Questions**

- Can it be done in pts with advanced heart failure with severe LV dysfn. with an acceptable operative mortality?
- Does it reverse LV remodeling and improve symptoms?
- Does elimination of MR in pts. with heart failure improve survival?
- Repair or replacement?
- Which repair technique for good long term results?
- Which subset of patients may not have good long term results with repair?
- Which pts should *not* be operated? (C/I)
Can it be done in pts with advanced heart failure with severe LV dysfunction with an acceptable operative mortality?
Intermediate-Term Outcome Of Mitral Reconstruction In Cardiomyopathy

Steven F. Bolling, MD, Francis D. Pagani, MD, PhD, G. Michael Deeb, MD, David S. Bach, MD

The Journal of Thoracic and Cardiovascular Surgery
Volume 115, Issue 2, Pages 381-388 (February 1998)
DOI: 10.1016/S0022-5223(98)70282-X
Intermediate-Term Outcome Of Mitral Reconstruction In Cardiomyopathy

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The Journal of Thoracic and Cardiovascular Surgery 1998 115, 381-388

• Between June 1993-1997
• 48 consecutive patients with mean age 63yrs
• End stage DCMP, Refractory MR, NYHA class III-IV,
• LVEF 8-25% (Mean 16+/3)
• All had previous CABG, one with recurrent VT

• All underwent undersized annuloplasty
Intermediate-Term Outcome Of Mitral Reconstruction In Cardiomyopathy

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RESULTS

Actuarial survival after mitral valve reconstruction in cardiomyopathy, as determined by the Kaplan-Meier method.

Operative mortality ~2%
1 yr survival 82%
2 yr survival 72%
Intermediate-Term Outcome Of Mitral Reconstruction In Cardiomyopathy

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RESULTS

• Operative Mortality ~ 2%
• 1 yr survival 82%
• 2 yr survival 72%
• Mean EF 26%
• NYHA class 3.9+/-0.3 to 2.0 +/-0.6

“Undersized annuloplasty provides an annular solution to myocardial problem.”
Prospective, Randomized, multi-centric study involving 29 centers
• 193 pts in MV surgery group, 102, MV surgery alone, 91 MV surgery + CorCap
• Inclusion criteria: NYHA II-IV HF, LVEF<35%, LVEDD>60, 6MWT<450.

Patients were followed for a median duration of 22.9 months.
Acorn Trial

Kaplan-Meier survival curve for the entire group of 193 patients in the MV surgery stratum.

30 day  1.6% (mortality)
12 months  86.5%
24 months  85.2%

Acker et al  J Thorac Cardiovasc Surg 2006;132:568-77
Acorn Trial

Reduction in LVEDV for the entire group of 193 patients in the MV surgery stratum. There was a progressive and significant reduction in LVEDV at 3, 6, 12, and 18 months, consistent with reverse re-modeling.

Similar to the changes in LVEDV, there was a progressive and significant decrease in LVESV at 3, 6, 12, and 18 months.
## Major series of mitral repair in functional MR and their results

<table>
<thead>
<tr>
<th>Author (Ref. #)</th>
<th>Year</th>
<th>n</th>
<th>IDC (%)</th>
<th>CABG (%)</th>
<th>NYHA Functional Class III/IV (%)</th>
<th>LVEF (%)</th>
<th>LVEDD (cm)</th>
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<tbody>
<tr>
<td>Geidel et al. (45)</td>
<td>2007</td>
<td>121</td>
<td>16</td>
<td>70</td>
<td>N/A</td>
<td>30 ± 9</td>
<td>63 ± 8</td>
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<tr>
<td>Calafiore et al. (42)</td>
<td>2007</td>
<td>49</td>
<td>25</td>
<td>67</td>
<td>49/51</td>
<td>27 ± 7</td>
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<td>Acker et al. (38)</td>
<td>2006</td>
<td>193</td>
<td>94</td>
<td>0</td>
<td>72/5</td>
<td>24 ± 9</td>
<td>70 ± 9</td>
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<td>De Bonis et al. (44)</td>
<td>2005</td>
<td>77</td>
<td>34</td>
<td>51</td>
<td>75/25</td>
<td>28 ± 4</td>
<td>68</td>
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<td>Wu et al. (9)</td>
<td>2005</td>
<td>126</td>
<td>29</td>
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<td>N/A</td>
<td>23 ± 7</td>
<td>65 ± 8</td>
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<td>Shah et al. (48)</td>
<td>2005</td>
<td>101</td>
<td>84</td>
<td>0</td>
<td>N/A</td>
<td>34 ± 9</td>
<td>61 ± 9</td>
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<td>Calafiore et al. (41)</td>
<td>2004</td>
<td>102</td>
<td>0</td>
<td>91</td>
<td>68/30</td>
<td>37 ± 12</td>
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<td>Gummert et al. (46)</td>
<td>2003</td>
<td>66</td>
<td>80</td>
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<td>N/A</td>
<td>23 ± 6</td>
<td>69 ± 10</td>
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<tr>
<td>Rothenburger et al. (47)</td>
<td>2002</td>
<td>31</td>
<td>66</td>
<td>33</td>
<td>21/10</td>
<td>23 ± 7</td>
<td>66 ± 8</td>
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<td>Bitrán et al. (39)</td>
<td>2001</td>
<td>21</td>
<td>0</td>
<td>100</td>
<td>90/10</td>
<td>&lt;25</td>
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<td>Bishay et al. (40)</td>
<td>2000</td>
<td>44</td>
<td>30</td>
<td>0</td>
<td>34/27</td>
<td>28 ± 6</td>
<td>65 ± 8</td>
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<td>Chen et al. (43)</td>
<td>1998</td>
<td>81</td>
<td>23</td>
<td>77</td>
<td>N/A</td>
<td>&lt;30</td>
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</table>

<table>
<thead>
<tr>
<th>Author (Ref. #)</th>
<th>Year</th>
<th>Operation</th>
<th>30-Day Mortality (%)</th>
<th>Survival (Years)</th>
<th>NYHA Baseline to Follow-Up</th>
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<tbody>
<tr>
<td>Geidel et al. (45)</td>
<td>2007</td>
<td>MVA in all</td>
<td>3.3</td>
<td>91% at 30 months</td>
<td>3.4 to 1.5</td>
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<tr>
<td>Calafiore et al. (42)</td>
<td>2007</td>
<td>MVA in 29; MVR in 20</td>
<td>4.2</td>
<td>78% at 5 yrs</td>
<td>3.5 to 2.2</td>
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<td>Acker et al. (38)</td>
<td>2006</td>
<td>MVA 85; MVR 15</td>
<td>1.6</td>
<td>85% at 2 yrs</td>
<td>2.82 to 2.25</td>
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<td>De Bonis et al. (44)</td>
<td>2005</td>
<td>MVA in 23; ETE + MVA in 54</td>
<td>3.8</td>
<td>91% at 2.7 yrs</td>
<td>3.4 to 1.4</td>
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<td>Wu et al. (9)</td>
<td>2005</td>
<td>MVA in all</td>
<td>4.8</td>
<td>60% at 5 yrs</td>
<td>N/A</td>
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<td>Shah et al. (48)</td>
<td>2005</td>
<td>MVA in all</td>
<td>2.9</td>
<td>70% at 5 yrs</td>
<td>N/A</td>
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<td>Calafiore et al. (41)</td>
<td>2004</td>
<td>MVA in 82; MVR in 20</td>
<td>3.9</td>
<td>74% at 5 yrs</td>
<td>3.2 to 2.1</td>
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<tr>
<td>Gummert et al. (46)</td>
<td>2003</td>
<td>MVA in all</td>
<td>6.1</td>
<td>66% at 5 yrs</td>
<td>3.0 to 2.0</td>
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<tr>
<td>Rothenburger et al. (47)</td>
<td>2002</td>
<td>MVA in 16; MVR in 15</td>
<td>6.5</td>
<td>77% at 5 yrs</td>
<td>3.3 to 2.1</td>
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<tr>
<td>Bitrán et al. (39)</td>
<td>2001</td>
<td>CABG + MVA</td>
<td>0.0</td>
<td>86% at 2 yrs</td>
<td>67% I-II, 17% III</td>
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<tr>
<td>Bishay et al. (40)</td>
<td>2000</td>
<td>MVA in 35; MVR in 9</td>
<td>2.3</td>
<td>67% at 5 yrs</td>
<td>2.8 to 1.2</td>
</tr>
<tr>
<td>Chen et al. (43)</td>
<td>1998</td>
<td>MVA in most</td>
<td>11.0</td>
<td>38% at 5 yrs</td>
<td>3.3 to 1.6</td>
</tr>
</tbody>
</table>
Which repair technique for good long term results?
Which repair technique for good long term results?

Flexible Versus Nonflexible Mitral Valve Rings for Congestive Heart Failure
Differential Durability of Repair

Martinus T. Spoor, MD; Amy Geltz, RN; Steven F. Bolling, MD

Background—Surgical intervention is playing an increasingly important therapeutic role in congestive heart failure (CHF) patients with ischemia and dilated cardiomyopathy. Their mitral regurgitation (MR) is a result of left ventricular (LV) geometrical distortion. The optimal type of ring for CHF patients with geometric ventricular-based MR is unknown. This study reviewed the results of flexible versus nonflexible complete mitral valve rings in CHF patients with geometric mitral regurgitation.

Methods and Results—Using a prospectively maintained database, patients undergoing mitral valve reconstruction (MVR) with either a flexible or nonflexible complete ring were identified on the basis of preoperative ejection fraction (EF) ≤30% and no primary mitral pathology. These 2 groups of CHF patients with severe geometric MR were then compared in terms of recurrent MR requiring reoperation. Between 1992 and 2004, 289 patients with EF ≤30%, received an undersized complete mitral annuloplasty ring as their MVR procedure. Of these, 170 patients had a flexible complete ring. In follow-up, 16 “flexible” patients (9.4%) required a repeat procedure for significant recurrent geometric MR and CHF (10 replacements, 3 re-repairs, 3 transplants). The average time to reoperation was 2.4 years. In contrast, 119 patients with an EF ≤30% received a MVR using an undersized nonflexible complete ring. Only 3 “non-flexible” patients required a repeat operation, MVR (1), and 2 patients required a transplant. The time to reoperation was 4.0 years. A significant difference in reoperation rates, for recurrent MR, between the 2 groups (P=0.012). There were no differences between groups, in terms of age, ring size used, preoperative EF, LV size, MR grade, or New York Heart Association class.

Conclusions—Patients with CHF having a flexible ring have a higher likelihood of developing recurrent MR requiring reoperation. The use of a nonflexible ring appears to significantly reduce the need for repeat surgical procedures. Further refinement and development of nonflexible ring systems, aimed at LV restoration, deserve ongoing investigation. (Circulation. 2006;114[suppl I]:I-67–I-71.)

- 289 patients, EF<30%
- 170 Flexible, 119 Rigid
- Both groups matched in terms of age, pre-op EF, MR grade, LV size

Spoor M.T., Bolling S.F. Circulation. 2006;114[suppl I]:I-67–I-71
Which repair technique for good long term results?

### TABLE 5. Repeat Procedures and Echocardiography Findings for Recurrent MR by Ring Flexibility

<table>
<thead>
<tr>
<th></th>
<th>Flexible Ring</th>
<th>Nonflexible Ring</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patients</td>
<td>170</td>
<td>119</td>
<td></td>
</tr>
<tr>
<td>MV replacements</td>
<td>10</td>
<td>0</td>
<td>P&lt;0.01</td>
</tr>
<tr>
<td>MV Re-repair</td>
<td>3</td>
<td>1</td>
<td>P=NS</td>
</tr>
<tr>
<td>Transplant</td>
<td>3</td>
<td>2</td>
<td>P=NS</td>
</tr>
<tr>
<td>Total repeat procedures</td>
<td><strong>16 (9.5%)</strong></td>
<td>3 (2.5%)</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>Time to reoperation</td>
<td>2.4 years</td>
<td>4 years</td>
<td>P&lt;0.01</td>
</tr>
<tr>
<td>LVIDd at primary operation (mm)</td>
<td>60.4±7</td>
<td>60.3±3</td>
<td>NS</td>
</tr>
<tr>
<td>LVIDs at primary operation (mm)</td>
<td>54.5±13</td>
<td>47±3</td>
<td>NS</td>
</tr>
<tr>
<td>Decrease in LVIDd preoperatively at time of second operation (mm)</td>
<td>6.5±12</td>
<td>0.5±2.1</td>
<td>NS</td>
</tr>
<tr>
<td>Decrease in LVIDs preoperatively at time of second operation (mm)</td>
<td>6.5±13</td>
<td>6±4.2</td>
<td>NS</td>
</tr>
<tr>
<td>Mean gradient at time of second operation (mm Hg)</td>
<td>10±6</td>
<td>6±1</td>
<td>NS</td>
</tr>
</tbody>
</table>

*Spoor M.T., Bolling S.F.  Circulation. 2006;114[suppl I]:I-67–I-71*
Conclusion:  
Differently from what was thought, in ischemic or idiopathic dilated cardiomyopathy, dilation of mitral ring is proportional and does not exclusively affect the posterior portion. The degree of left ventricular dilation does not determine the degree of dilation of the mitral ring because they are independent processes.
Which repair technique for good long term results?

Ischemic Mitral Regurgitation: Recent Advances
Anelechi C. Anyanwu, MD, FRCS
David H. Adams, MD

Opinion statement
This article reviews recent developments in the pathophysiology and management of ischemic mitral regurgitation. Recent imaging studies using three-dimensional echocardiography have added clarity to the mechanism responsible for this condition. This article also discusses recent studies on outcomes of surgical repair, including current results and potential risks of restrictive annuloplasty. Because of the limitations imposed by restrictive annuloplasty, adjunctive surgical methods focusing on the left ventricle or papillary muscles are being investigated to address this disease. In the interim, a downsized complete rigid or semirigid annuloplasty repair appears to offer good midterm outcomes.

Current Treatment Options in Cardiovascular Medicine 2008, 10:529–537
Failure of a flexible posterior annuloplasty band for the repair of ischemic mitral regurgitation.

Current Treatment Options in Cardiovascular Medicine 2008, 10:529–537
### Which repair technique for good long term results?

<table>
<thead>
<tr>
<th>Study</th>
<th>Main result</th>
<th>Conclusion</th>
<th>Limitations and flaws</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crabtree et al., 2008</td>
<td>52% survival at 5 y; 28% of patients with moderate or severe MR at latest echo</td>
<td>Questions the benefit of adding annuloplasty to CABG</td>
<td>Use of inadequate technique: 44% of patients received an incomplete (posterior) annuloplasty with a flexible band. Such bands have limited efficacy as they do not address tethering and dilatation of the anterior annulus. Echo follow-up available in only 57% of patients</td>
</tr>
<tr>
<td>Gelsomino et al., 2008</td>
<td>Reverse remodeling seen in only 41% of patients</td>
<td>Annuloplasty + CABG is ineffective in a large percentage of patients</td>
<td>Suboptimal early results: 7% repair failure or residual MR rate</td>
</tr>
<tr>
<td>Mihaljevic et al., 2007</td>
<td>CABG + annuloplasty did not improve long-term functional status or survival compared with CABG alone</td>
<td>Annuloplasty is insufficient to improve long-term clinical outcomes</td>
<td>Limited revascularization approach: average of 2 bypasses per patient suggests incomplete revascularization</td>
</tr>
</tbody>
</table>

CABG—coronary artery bypass surgery; echo—echocardiogram; MR—mitral regurgitation.

*Studies purporting to residual and/or recurrence of mitral regurgitation post-repair*

What these studies add?

1. Anterior annulus also dilates in CMP.
2. Flexible rings and bands will fail.
3. No patient should leave the operating room with residual MR.
4. Complete revascularisation is a must.
Which repair technique for good long term results?

Restrictive Annuloplasty and Coronary Revascularization in Ischemic Mitral Regurgitation Results in Reverse Left Ventricular Remodeling

Jeroen J. Bax, MD; Jerry Braun, MD; Soeresh T. Somer, MD; Robert Klautz, MD; Eduard R. Holman, MD; Michel I.M. Versteegh, MD; Eric Boersma, MSc; Martin J. Schalij, MD; Ernst E. van der Wall, MD; Robert A. Dion MD

Background—Data on combined coronary artery bypass grafting (CABG) and restrictive annuloplasty in patients with ischemic cardiomyopathy are scarce, and the effect on reverse left ventricular (LV) remodeling is unknown.

Methods and Results—51 patients with ischemic LV dysfunction (LV ejection fraction 31±8%) and severe mitral regurgitation (grade 3 to 4+) underwent CABG and restrictive annuloplasty with stringent downsizing of the mitral annulus (by 2 sizes, Physio-ring, mean size 28±2). Serial transthoracic echocardiographic studies were performed (before surgery and within 3 months and 1.5 years after surgery) to assess mitral regurgitation, transmural gradient, leaflet coaptation, and left atrial and LV reverse remodeling. Clinical follow-up (New York Heart Association [NYHA] class, survival, events) was assessed at 2-year follow-up. Early operative mortality was 5.6%; at 2-year follow-up, all patients were free of endocarditis and thromboembolism, and 1 needed re-operation for recurrent mitral regurgitation; 2-year survival was 84%. NYHA class improved from 3.4±0.8 to 1.3±0.4 (P<0.01), with all patients in class I/II. Intraoperative transesophageal echo showed minimal (grade 1+) mitral regurgitation in 8 patients and none in 43, without stenosis. Leaflet coaptation was 0.8±0.2 cm. These values remained unchanged: all patients had no or minimal (grade 1+) mitral regurgitation at 2-year follow-up. LV end-systolic and end-diastolic dimensions decreased from 51±10 to 43±12 mm (P<0.001) and from 64±8 to 58±11 mm (P<0.001). Left atrial dimension decreased from 53±8 to 47±7 mm (P<0.001).

Conclusion—Excellent results of combined restrictive annuloplasty and CABG were obtained. Residual mitral regurgitation was absent/minimal at 2-year follow-up, associated with a significant reduction in left atrial dimension and LV reverse remodeling. (Circulation. 2004;110[suppl II]:II-103–II-108.)

• 51 pts., Severe LV dysfn. LVEF 31 +/- 8, Severe MR (gr 3-4).
• Rigid ring, downsized by 2 sizes to achieve a co-aptation height of 8 mm, Avr. 28+/-2
• Average no. of grafts- 3.3+/- 0.8.
• IMA used in 84% of patients.
Which repair technique for good long term results?

- Total follow-up 2 yrs
- 84% 2yr survival
- All pts no or mild MR (except for 1 patient who got re-op in 9 months)
- Significant LV reverse remodeling

Reverse LV remodeling
Which repair technique for good long term results?

• Complete rigid ring.
• Strictly downsized 2 sizes.
• At least 8 mm of coaptation.
• Complete revascularisation – *Avr. No. of grafts* - 3+, *Use of IMA*
• Adjunctive techniques in borderline cases- *Papillary muscle approximation*, *Secondary chordal cutting*, *Kron’s stitch*
Which repair technique for good long term results?

Adjunctive Techniques:

Papillary Muscle Re-approximation (Re shapes the ventricle)
Which repair technique for good long term results?

Adjunctive Techniques:

- Secondary Chordal Resection
- Kron’s Stitch
Repair or replacement?
Repair or replacement?

Mitral Replacement or Repair for Functional Mitral Regurgitation in Dilated and Ischemic Cardiomyopathy: Is it Really the Same?

Michele De Bonis, MD, David Ferrara, MD, Maurizio Taramasso, MD, Maria Chiara Calabrese, MD, Alessandro Verzini, MD, Nicola Buzzatti, MD, and Ottavio Alfieri, MD
Department of Cardiac Surgery, San Raffaele University Hospital, Milan, Italy

Background. This was a study to compare the results of mitral valve (MV) repair and MV replacement for the treatment of functional mitral regurgitation (MR) in advanced dilated and ischemic cardiomyopathy (DCM).

Methods. One-hundred and thirty-two patients with severe functional MR and systolic dysfunction (mean ejection fraction 0.32 ± 0.078) underwent mitral surgery in the same time frame. The decision to replace rather than repair the MV was taken when 1 or more echocardiographic predictors of repair failure were identified at the preoperative echocardiogram. Eighty-five patients (64.4%) received MV repair and 47 patients (35.6%) received MV replacement. Preoperative characteristics were comparable between the 2 groups. Only ejection fraction was significantly lower in the MV repair group (0.308 ± 0.077 vs 0.336 ± 0.076, p = 0.04).

Results. Hospital mortality was 2.3% for MV repair and 12.5% for MV replacement (p = 0.03). Actuarial survival at 2.5 years was 92 ± 3.2% for MV repair and 73 ± 7.9% for MV replacement (p = 0.02). At a mean follow-up of 2.3 years (median, 1.6 years), in the MV repair group LVEF significantly increased (from 0.308 ± 0.077 to 0.382 ± 0.095, p < 0.0001) and LV dimensions significantly decreased (p = 0.0001). On the other hand, in the MV replacement group LVEF did not significantly change (from 0.356 ± 0.076 to 0.31 ± 0.11, p = 0.56) and the reduction of LV dimensions was not significant. Mitral valve replacement was identified as the only predictor of hospital (odds ratio, 6; 95% confidence interval, 1.1 to 31; p = 0.03) and overall mortality (hazard ratio, 3.1; 95% confidence interval, 1.1 to 8.9; p = 0.02).

Conclusions. In patients with advanced dilated and ischemic cardiomyopathy and severe functional MR, MV replacement is associated with higher in-hospital and late mortality compared with MV repair. Therefore, mitral repair should be preferred whenever possible in this clinical setting.

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Repair or replacement?

132 pts with severe functional MR
• Mean EF – 0.32 +/- 0.078
• 85 (64.4%) repaired (rigid downsized 2 sizes), 47 (35.6%) replaced (complete chordal preservation)
• Pre-op characteristics comparable between the 2 groups.
• EF significantly lower in repair group- (0.308 +/- 0.077 vs 0.336 +/- 0.076, p=0.04).

• Hospital mortality was 2.3% for MV repair and 12.5% for MV replacement, (p=0.03).
• At a mean follow-up of 2.3 years (median, 1.6 years), in the MV repair group LVEF significantly increased (from 0.308 +/- 0.077 to 0.382 +/- 0.095, p < 0.0001)
• LV dimensions significantly decreased (p= 0.0001).
• MR 3+ was noted in 7.7% of patients, all of whom did not undergo reverse remodeling.
Repair or replacement?

Comparison of mitral valve repair versus replacement with respect to overall survival.

Mitral valve replacement was identified as the only predictor of hospital (odds ratio, 6; 95% confidence interval, 1.1 to 31; p 0.03) and overall mortality (hazard ratio,3.1; 95% confidence interval, 1.1 to 8.9; p = 0.02).
Repair or replacement?

Is repair preferable to replacement for ischemic mitral regurgitation?

A. Marc Gillinov, MD
Por Nils Wiorup, MD
Eugene H. Blackstone, MD
Ehab S. Bishay, MD
Delos M. Cosgrove, MD
Jennifer White, MS
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482 pts, 397 repaired, 85 replaced.
Followed up up to 7 yrs, Mean 3.3 yrs.
Repair or replacement?

Is repair preferable to replacement for ischemic mitral regurgitation?

Survival at 30 days, 1 yr and 5 yrs

- **Repair** 94% 82% 58%
- **Replace** 81% 56% 36%

**High risk patients**
- Older age
- Higher functional class
- Greater wall motion
- Poorer renal fn.

**Better risk patients**

Gillinov et al. *J Thorac Cardiovasc Surg* 2001;122:1125-41
Repair or replacement?

Is repair preferable to replacement for ischemic mitral regurgitation?

Freedom from repair failure at 5 yrs - 91%.

Freedom from mitral valve replacement after repair

Repair or replacement?

Is repair preferable to replacement for ischemic mitral regurgitation?

Conclusions:

• Most patients derive a survival advantage from mitral valve repair rather than replacement.
• Among the most severely ill patients, the survival benefit of mitral valve repair is diminished.
• When mitral valve repair is performed, a formal annuloplasty should be used.
• Left anterior descending disease should be treated by ITA grafting.
What these 2 papers add?

1. Replacement carries a higher immediate and long term mortality.
2. Recurrent MR occurs if LV doesn’t reverse remodel.
3. Benefit of repair is lost in high risk group because their ventricle has gone beyond the point of recovery (lost the potential of reverse remodeling).
Repair suitability: Remodeling reversal is the key

- Should have ischemia viability.
- Should have reverse remodeling viability.
  - Absence of severe LV dilatation (LVEDD > 80mm).
  - Lower sphericity index.
  - Preserved LV torsion (cardiac MRI).
  - Degree of myocardial fibrosis (Gadolinium enhanced MRI).
  - Presence of contractile reserve.
- Echocardiographic predictors of remodeling failure.
- Favourable surgical considerations-
  - CABG - bypassable targets.
  - Ventricular reconstruction - infarct excision.
- Favourable medical considerations-
  - Absence of refractory heart failure
  - Reversible PHT
**Echocardiographic predictors of repair failure**

Mitral valve deformation
- Coaptation distance $\geq 1$ cm
- Tenting area $>2.5 - 3$ cm$^2$
- Complex jets
- Posterolateral angle $>45^\circ$

Local LV remodelling
- Interpapillary muscle distance $>20$ mm
- Posterior papillary-fibrosa distance $>40$ mm
- Lateral wall motion abnormality

Global LV remodelling
- EDD $>65$ mm, ESD $>51$ mm (ESV $>140$ mL)
- Systolic sphericity index $>0.7$
Echocardiographic predictors of repair failure

Mechanisms of Recurrent Functional Mitral Regurgitation After Mitral Valve Repair in Nonischemic Dilated Cardiomyopathy
Importance of Distal Anterior Leaflet Tethering

Alex Pui-Wai Lee, MB, ChB; Michael Acker, MD; Spencer H. Kubo, MD; Steven F. Bolling, MD; Seung W. Park, MD; Charles J. Bruce, MD; Jae K. Oh, MD

Anterior leaflet angle >25 degrees

(Circulation. 2009;119:2606-2614.)
Which patients are poor risk for surgery?

- Heart failure duration > 5 yrs.
- Resting heart rate > 100/min
- Systolic BP < 90 with low pulse pressure
- Serum sodium < 135 mmol/dL
- BUN > 100mg/dL
- Serum creatinine > 2.5mg/dL
- High bilirubin
- LVEDD > 80mm
- Peak VO2 < 14 mg/Kg/min
- 6MWT < 350 m.
- Refractory right heart failure, severe PHT
- Cardiac cachexia

Those who are dependent on inotropes for end organ perfusion and those who are poor risk for CPB in general.

Such patients should be offered transplant straightaway.
Conclusions:

• With transplantation being a limited treatment resource, alternative therapies like mitral valve repair have a bigger role to play.
• Mitral valve surgery must induce reverse remodeling of LV for repair durability, functional improvement and good long term results.
• Reverse remodeling identifiers must be searched in all patients.
• Poor risk patients may receive replacement, instead of repair.
• Repair must include at least 8 mm of coaptation, complete revascularisation (3 or more grafts including IMA), and rigid ring downsized 2 sizes.
• In borderline cases additional procedures must be carried out.
Thank You
Is presence of MR associated with worse survival?

Relation of frequency and severity of mitral regurgitation to survival among patients with left ventricular systolic dysfunction and heart failure

Benjamin H Trichon, MD, G Michael Felker, MD, Linda K Shaw, MS, Christopher H Cabell, MD, Christopher M O’Connor, MD

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were significantly lower in patients with moderate to severe MR versus those with mild or no MR (p <0.001). MR was found to be an independent predictor of mortality after multivariable analysis (hazards ratio 1.23, 95% confidence interval 1.13 to 1.34, p = 0.0001). This relation of MR and survival was present in those with ischemic and nonischemic cardiomyopathies. MR is common in patients with LV systolic dysfunction and heart failure. After adjusting for other clinical variables, the presence of MR independently predicted worsened survival.
Is presence of MR associated with worse survival?

Prognostic significance of mitral regurgitation and tricuspid regurgitation in patients with left ventricular systolic dysfunction

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Background Mitral regurgitation (MR) and tricuspid regurgitation (TR) frequently develop in patients with left ventricular systolic dysfunction (LVSD). Ventricular volume overload that occurs in patients with MR and TR may lead to progression of myocardial dysfunction. We hypothesized that MR and TR would provide markers of risk in patients with LVSD. Methods We reviewed clinical, electrocardiographic, and echocardiographic data on 1421 consecutive patients with LVSD (left ventricular ejection fraction ≤35%). Predictors of survival (freedom from death or United Network for Organ Sharing [UNOS]-1 transplantation) were identified in a multivariable analysis with a Cox proportional hazards analysis. The impact of MR and TR (none to mild, moderate, or severe) then was assessed separately with Kaplan-Meier survival analysis. Results During the follow-up period (mean ± SD, 365 ± 364 days), death occurred in 435 study subjects (31%) and UNOS-1 transplantation in 28 subjects (2%). Multivariable predictors of poor outcome included increasing MR and TR grade, cancer, coronary artery disease, and absence of an implantable cardiac defibrillator. Relative risk was 1.84 (95% CI 1.43-2.38) for severe MR and 1.55 (95% CI 1.14-2.11) for severe TR. Survival with Kaplan-Meier analysis related inversely to MR grade (none to mild 1004 ±31 days, moderate 795 ±34 days, severe 628 ±47 days, P < .0001) and TR grade (none to mild 977 ±28 days, moderate 737 ±40 days, severe 658 ±55 days, P = .0001). Conclusion Patients with severe MR or TR represent high-risk subsets of patients with LVSD. Future study is warranted to determine whether pharmaceutical or surgical strategies to relieve MR and TR have a favorable impact on survival. (Am Heart J 2002;144:524-9.)