Minimally Invasive Mitral Valve Repair: The New Gold Standard?

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Mitral Valve Repair
“The Gold Standard”

Nishimura, RA et al.
2014 AHA/ACC Valvular Heart Disease Guideline

Class I

Mitral valve repair is recommended in preference to mitral valve replacement (MVR) when surgical treatment is indicated for patients with chronic severe primary MR limited to the posterior leaflet (155, 183-198). (Level of Evidence: B)

Mitral valve repair is recommended in preference to MVR when surgical treatment is indicated for patients with chronic severe primary MR involving the anterior leaflet or both leaflets when a successful and durable repair can be accomplished (195-197, 199-203). (Level of Evidence: B)

Class IIa

Mitral valve repair is reasonable in asymptomatic patients with chronic severe primary MR (stage C1) with preserved LV function (LVEF >60% and LVESD <40 mm) in whom the likelihood of a successful and durable repair without residual MR is greater than 95% with an expected mortality rate of less than 1% when performed at a Heart Valve Center of Excellence.
Mitral Valve Procedures - Trends

Number of Mitral Valve Procedures
Cumulative over last 10 years

Adult Cardiac Surgery Database. Executive Summary 10 years. STS Period ending 3/31/2017. 3/30/2017
Executive Summary contents
Early Mitral Valve Repair
Clear Benefit

Suri RM et al, Association Between Early Surgical Intervention vs Watchful Waiting and Outcomes for Mitral Regurgitation Due to Flail Mitral Valve Leaflets. JAMA 2013; 310(6):609
Isolated MV repair (n=28,140) operative mortality was 1.2%.

For asymptomatic patients, operative mortality was 0.6%.

Trends in MIVS
Society of Thoracic Surgeons Database

Minimally Invasive Valve Surgery
Benefits to the Patient

✧ Less pain
✧ Shorter hospital stay
✧ Lower blood loss
✧ Faster recovery and return to normal activity
✧ Greater satisfaction
Minimally Invasive Valve Surgery
Benefits to the Surgeon

- Excellent visualization of structures
- Clear sterile field perception
- More direct access to the mitral valve
The Law of Conservation of Pain
(As applied to Minimally Invasive Surgery)

Pain is neither created nor destroyed, it is transferred from the Patient to the Surgeon

Michael Argenziano, M.D.
Initial Concerns
Less-Invasive Mitral Valve Operations: Trends and Outcomes from the STS Adult Cardiac Surgery Database

✧ Equivalent mortality
✧ Longer CPB and cross-clamp times
✧ Higher repair rates in MIS group
✧ Lower blood transfusions
✧ **Significantly higher stroke rate**

✧ Similar mortality between MIVS and conventional

✧ MIVS has higher incidence of:
  ✧ Aortic Dissection, CVA & Phrenic paralysis

✧ MIVS is superior in:
  ✧ POP AF
  ✧ Mediastinal drainage
  ✧ Patient’s satisfaction and pain
Mitral Valve Surgery Right Lateral Minithoracotomy or Sternotomy?

Sünderman et al. 2014

- 30-day mortality equivalent for MIS and CS
- Lower blood loss
- Longer CPB and clamp times
- Higher incidence of vascular complications

<table>
<thead>
<tr>
<th>Study</th>
<th>Events Total</th>
<th>Conv. Events Total</th>
<th>Risk Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chitwood (1997)</td>
<td>0</td>
<td>31</td>
<td>0.33 [0.01; 8.13]</td>
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<tr>
<td>Felger (2001)</td>
<td>1</td>
<td>55</td>
<td>2.00 [0.01; 21.71]</td>
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<tr>
<td>Felger (2001 Rob)</td>
<td>0</td>
<td>72</td>
<td>0.33 [0.01; 8.13]</td>
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<tr>
<td>Gammie (2010)</td>
<td>81</td>
<td>4222</td>
<td>2.00 [0.01; 21.71]</td>
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<tr>
<td>Goldstone (2013)</td>
<td>0</td>
<td>201</td>
<td>0.33 [0.01; 8.13]</td>
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<tr>
<td>Grossi (2001 b)</td>
<td>2</td>
<td>100</td>
<td>0.33 [0.01; 8.13]</td>
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<td>Holzhey (2011)</td>
<td>4</td>
<td>143</td>
<td>0.33 [0.01; 8.13]</td>
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<td>Iribarne (2010)</td>
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<td>Iribarne (2011)</td>
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<td>21</td>
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<td>McKnight (2012)</td>
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<tr>
<td>Mihaljevic (2011 Rob)</td>
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<td>100</td>
<td>0.33 [0.01; 8.13]</td>
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<tr>
<td>Neto (2012)</td>
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<td>Raanani (2010)</td>
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<td>61</td>
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<td>Suri (2009)</td>
<td>10</td>
<td>350</td>
<td>0.33 [0.01; 8.13]</td>
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<tr>
<td>Speziale (2011)</td>
<td>1</td>
<td>70</td>
<td>0.33 [0.01; 8.13]</td>
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<td>Stevens (2012)</td>
<td>6</td>
<td>481</td>
<td>0.33 [0.01; 8.13]</td>
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<tr>
<td>Stevens (2012 Rob)</td>
<td>3</td>
<td>447</td>
<td>0.33 [0.01; 8.13]</td>
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</tbody>
</table>

No Difference

Neurologic Events

**What Is the Role of Minimally Invasive Mitral Valve Surgery in High-Risk Patients?**

A Meta-Analysis of Observational Studies

Moscarelli et al.

- Comparable early mortality
- Lower transfusion requirement
- Less atrial fibrillation
- Lower stroke

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### Fig 2. Forest plots of minimally invasive mitral valve surgery (MIMVS) versus standard sternotomy (ST): (A) overall early mortality and (B) high-quality studies. (CI = confidence interval)

Right Minithoracotomy Versus Full Sternotomy for Mitral Valve Repair: A Propensity Matched Comparison

Lange et al.

Survival after isolated Mitral Valve Repair
matched versus unmatched patients

A matched patients

<table>
<thead>
<tr>
<th></th>
<th>Mini-Thoracotomy</th>
<th>Sternotomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>at 5 yrs</td>
<td>87.4±3.6</td>
<td>73.8±6.9</td>
</tr>
<tr>
<td>at 10 yrs</td>
<td>93.5±3.7</td>
<td>59.9±18.1</td>
</tr>
</tbody>
</table>

p=0.56

B unmatched patients

<table>
<thead>
<tr>
<th></th>
<th>Mini-Thoracotomy</th>
<th>Sternotomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>at 5 yrs</td>
<td>82.6±2.6</td>
<td>63.6±4.6</td>
</tr>
<tr>
<td>at 10 yrs</td>
<td>90.9±1.1</td>
<td>88.4±4.8</td>
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</tbody>
</table>

p<0.001

Lange, Voss, Kehl, DrReNat, MazzitelliTassani-Prell, and Gunther, Right Minithoracotomy Versus Full Sternotomy for Mitral Valve Repair: A Propensity Matched Comparison Ann Thorac Surg 2017;103:573–9
Minimally Invasive vs Conventional Mitral Valve Repair

2010 Gammie
*Significantly Higher Stroke Rate*

2011 Cheng
Ao. Diss and Stroke Risk

2013 Cao
No difference

2014 Sünderman
No difference in neurologic events
More vascular complications

2017 Lange
Similar functional outcome and QOL variables
The Challenge...

✧ AVOID TRANSFERRING THE LEARNING CURVE TO THE PATIENT

✧ Minimize neurologic complications

✧ Avoid vascular complications
Minimally Invasive Mitral Valve Repair

Learning Curves

75-125 Surgeries to overcome Learning Curve

>50 Surgeries/Year to maintain competence

STS/EACTS Latin America Cardiovascular Surgery Conference 2017

Minimally Invasive Mitral Valve Surgery is a TEAM SPORT
The Question

♦ Are these results reproducible in smaller centers?

♦ What about LatAm?

♦ How to do it?
Patients & Methods

- Historical cohort of patients undergoing mitral valve repair between January 2004 and June 2017
  - Prospective harvest from July 2008

- Inclusion criteria:
  - First-time isolated mitral valve repairs
    - Conventional or minimally invasive
  - Dedicated Team

- Exclusion criteria
  - History of preoperative arrhythmias
Mitral Valve Procedures

[Bar chart showing the percentage of replacement and repair procedures from 2004 to 2016, with a peak in repair procedures around 2010-2015.]
Sampling Algorithm

Mitral Procedures  
$n = 1602$

- Replacement  
$N = 980$
- Repair  
$N = 622$
- Dedicated Team  
$N = 346$

CONVENTIONAL  
$N = 282$

Exclusion Criteria  
Previous surgery and arrhythmias

VA – MIVR  
$N = 64$

CONVENTIONAL  
$N = 65$

VA – MIVR  
$N = 51$
### Results – Preoperative Variables

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>CONVENTIONAL</th>
<th>VA-MIVR</th>
<th>P VALUE Differences between groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body mass index Median (IQR)</td>
<td>26.3 (23-29)</td>
<td>24.3 (22.8-26)</td>
<td>0.005</td>
</tr>
<tr>
<td>Diabetes mellitus n (%)</td>
<td>1 (1.5)</td>
<td>0</td>
<td>0.374</td>
</tr>
<tr>
<td>Hypertension n (%)</td>
<td>29 (44.6)</td>
<td>6 (11.7)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Previous myocardial infarction n (%)</td>
<td>1 (1.5)</td>
<td>0</td>
<td>0.374</td>
</tr>
<tr>
<td>Previous stroke n (%)</td>
<td>2 (3.1)</td>
<td>0</td>
<td>0.206</td>
</tr>
<tr>
<td>COPD n (%)</td>
<td>6 (9.2)</td>
<td>0</td>
<td>0.084</td>
</tr>
<tr>
<td>Preoperative Blocker n (%)</td>
<td>26 (40)</td>
<td>44 (86.3)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Preoperative creatinine Median (IQR)</td>
<td>0.9 (0.8-1)</td>
<td>1 (0.9-1.1)</td>
<td>0.005</td>
</tr>
<tr>
<td>Ejection fraction Median (IQR)</td>
<td>58.5 (46-64)</td>
<td>60 (55-62)</td>
<td>0.227</td>
</tr>
</tbody>
</table>
Preoperative Euroscore II

CONVENTIONAL

3.5 (IQR 2.9-5.8)

VA-MIVR

0.9 (IQR 0.6-2.3)
## Variables Affecting Euroscore II

<table>
<thead>
<tr>
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<th>VA-MIVR</th>
<th>P VALUE Differences between groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renal Impairment; n (%)</td>
<td>29 (44.6)</td>
<td>20 (39.2)</td>
<td>0.559</td>
</tr>
<tr>
<td>NYHA &gt; II; n (%)</td>
<td>53 (86.9)</td>
<td>43 (83)</td>
<td>0.892</td>
</tr>
<tr>
<td>Pulmonary hypertension; n (%)</td>
<td>35 (72.9)</td>
<td>14 (33.3)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Elective; n (%)</td>
<td>48 (74.8)</td>
<td>40 (78.4)</td>
<td>0.557</td>
</tr>
</tbody>
</table>
Intraoperative Results

CONVENTIONAL

VA-MIVR

Minutes Median (IQR)

105 (90-106) 132 (110-151)

83 (69-100) 99 (88-117)

CPB

X-CLAMP
### Primary Outcomes

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>CONVENTIONAL</th>
<th>VA-MIVR</th>
<th>P VALUE (Differences between groups)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bleeding requiring reoperation; n (%)</td>
<td>1 (1.5)</td>
<td>1 (1.9)</td>
<td>0.862</td>
</tr>
<tr>
<td>Deep wound infection; n (%)</td>
<td>1 (1.5)</td>
<td>0</td>
<td>0.379</td>
</tr>
<tr>
<td>Stroke; n (%)</td>
<td>1 (1.5)</td>
<td>1</td>
<td>0.862</td>
</tr>
<tr>
<td>Mortality (%)</td>
<td>0</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>Postoperative AF; n (%)</td>
<td>5 (7.6)</td>
<td>3 (5.1)</td>
<td>0.672</td>
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</tbody>
</table>
### Secondary Outcomes

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>CONVENTIONAL</th>
<th>VA-MIVR</th>
<th>P VALUE Differences between groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICU stay (hours); Median (IQR)</td>
<td>24 (24-72)</td>
<td>24 (21-24)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Transfusion; n (%)</td>
<td>35 (38.5)</td>
<td>1 (1.9)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Hospital stay (days); Median (IQR)</td>
<td>6.5 (5-12)</td>
<td>5 (4-8)</td>
<td>0.005</td>
</tr>
</tbody>
</table>
Freedom from Reoperation

Kaplan-Meier Freedom from Reoperation

Log Rank 0.327

Number at risk
CONVENTIONAL VA - MIVR
78 50 39 28 14 6 1 0
59 18 6 4 1 1 1 1

Months
Probability
0.00 0.25 0.50 0.75 1.00

CONVENTIONAL VA-MIVR
Conclusion

✧ MIVS should be performed by surgeons who have already mastered conventional repair techniques
✧ Outcomes are progressively improving – Already better than conventional surgery?
✧ Heart Team Approach Flattens Learning Curve
✧ Establish Heart Valve Centers of Excellence to Increase Case Volume
Thank You

STS/EACTS Latin America Cardiovascular Surgery Conference
September 21-22, 2017 | Cartagena, Colombia

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