Minimally Invasive Mitral Valve Repair: Indications and Approach

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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.
Early Mitral Valve Repair
Clear Benefit

Survival Benefit

Risk of CHF

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
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
Trends in Mitral Valve Surgery in the United States: Results From The Society of Thoracic Surgeons Adult Cardiac Database

James S. Gammie, MD, Shubin Sheng, PhD, Bartley P. Griffith, MD, Eric D. Peterson, MD, J. Scott Rankin, MD, Sean M. O’Brien, PhD, and James M. Brown, MD

Division of Cardiac Surgery, University of Maryland Medical Center, Baltimore, Maryland; Duke Clinical Research Institute, Durham, North Carolina; and Centennial Medical Center, Vanderbilt University, Nashville, Tennessee

Isolated MV repair (n=28,140) operative mortality was 1.2%.

For asymptomatic patients, operative mortality was 0.6%.

World Trends in MIVS

Aortic CAGR: 16%*
Mitral CAGR: 17%

*Without Transapical aortic valves
Source: Internal market research
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
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

Cheng DC. Innovations • 2011
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

What Is the Role of Minimally Invasive Mitral Valve Surgery in High-Risk Patients?
A Meta-Analysis of Observational Studies

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

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

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
Minimally Invasive Mitral Valve Surgery is a TEAM SPORT
The Question

✧ Are these results reproducible in smaller centers?

✧ What about LatAm?

✧ What are the indications/contraindications

✧ 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 repair
    - Conventional or minimally invasive
  - Dedicated Team

- Exclusion criteria
  - History of preoperative arrhythmias
  - Previous surgery
Sampling Algorithm

Mitral Procedures
n= 1602

Replacement
N=980

Repair
N= 622

Dedicated Team
N=346

CONVENTIONAL
N= 282

VA – MIVR
N= 64

Exclusion Criteria
Previous surgery and arrhythmias

CONVENTIONAL
N= 142

VA – MIVR
N= 58

N=346

2010

N=1602

n=1602

N=346

N= 64

N=282

VA – MIVR

CONVENTIONAL

N=142

N= 58

N=282

N= 622

N=980

Replacement

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CONVENTIONAL

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N= 622

N=346

VA – MIVR

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N=58

Exclusion Criteria
Previous surgery and arrhythmias
## Results - Preoperative Variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Conventional n =142</th>
<th>Minimally invasive n =58</th>
<th>p value</th>
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<tbody>
<tr>
<td>Body mass index Median (IQR)</td>
<td>25.9 (23.6-19.4)</td>
<td>24.5 (2.8-26.19)</td>
<td>0.01</td>
</tr>
<tr>
<td>Ejection fraction Median (IQR)</td>
<td>55 (46-60)</td>
<td>60 (55-61)</td>
<td>0.0127</td>
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<td>Renal Impairment n (%)</td>
<td>75 (45.3)</td>
<td>435 (60.3)</td>
<td>0.061</td>
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<td>NYHA &gt; II n (%)</td>
<td>104 (78.8)</td>
<td>52 (91.2)</td>
<td>0.039</td>
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<td>Pulmonary hypertension n (%)</td>
<td>60 (42.5)</td>
<td>14 (26.4)</td>
<td>0.047</td>
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<td>Elective; n (%)</td>
<td>86 (60.5)</td>
<td>45 (77.6)</td>
<td>0.044</td>
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Preoperative Euroscore II

CONVENTIONAL

3.5 (IQR 2.9-5.8)

VA-MIVR

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

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Mitral Valve Procedures - Trends

![Graph showing trends in Mitral Valve Procedures]

- **Replacement**
- **Repair**

Values:
Mitral Valve Repair
Trends in Degenerative MR
Intraoperative Results

<table>
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<th>VA-MIVR</th>
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<tr>
<td>Minutes Median</td>
<td>105 (90-106)</td>
<td>132 (110-151)</td>
</tr>
<tr>
<td>IQR</td>
<td>83 (69-100)</td>
<td>99 (88-117)</td>
</tr>
</tbody>
</table>

CPB | X-CLAMP
Learning Curve

CBP Time

VA-MIVR

CONVENTIONAL

Linear (VA-MIVR)
Learning Curve
Aortic Cross-Clamp Time

- VA-MIVR
- CONVENTIONAL
- Linear (VA-MIVR)
### Primary Outcomes

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<td>Bleeding requiring reoperation n (%)</td>
<td>9 (6.3)</td>
<td>1 (1.7)</td>
<td>0.287</td>
</tr>
<tr>
<td>Deep wound infection n (%)</td>
<td>3 (2.1)</td>
<td>0</td>
<td>0.558</td>
</tr>
<tr>
<td>Stroke n (%)</td>
<td>2 (1.4)</td>
<td>2 (3.4)</td>
<td>0.581</td>
</tr>
<tr>
<td>Mortality (%)</td>
<td>0</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>Postoperative AF n (%)</td>
<td>45 (31.7)</td>
<td>2 (3.4)</td>
<td>&lt;0.001</td>
</tr>
</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>
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Freedom from Cardiac Death
Freedom from Reoperation
Conclusions

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