Why and When to Repair the Aortic Valve?

Ismail El-Hamamsy, MD PhD

Associate Professor
Division of Cardiac Surgery
Co-Director, Aortic and Connective Tissue Clinic
Montreal Heart Institute
Université de Montreal
THE AORTIC ROOT IS A LIVING STRUCTURE
AORTIC ROOT DYNAMICS

Dagum et al. Circulation 1999
AORTIC VALVE STRUCTURE

Endothelial Cells

Aortic Side

Collagen

GAGs

Elastin

Ventricular Side

Interstitial Cells
- Smooth muscle cells
- Fibroblasts
- Myofibroblasts

Smooth muscle actin

Water & Fibroblasts
Fibrosa ~45%
Spongiosa ~35%
Ventricularis ~20%

Total thickness ~200-700μm

VALVE ENDOTHELIAL CELL HETEROGENEITY

Simmons et al. Circ Res 2005
AORTIC VALVE CELLULAR STRUCTURE

Neurofilament

Endothelium-Dependent Regulation of the Mechanical Properties of Aortic Valve Cusps

Ismail El-Hamamsy, MD,* Kartik Balachandran, MS,† Magdi H. Yacoub, FRS,* Louis M. Stevens, MD, SM,‡ Padmini Sarathchandra, PhD,* Patricia M. Taylor, PhD,* Ajit P. Yoganathan, PhD,† Adrian H. Chester, PhD*
THE AORTIC ROOT

LIVING STRUCTURE = COMPLEX FUNCTIONS

Laminar flow

Excellent hemodynamics

Resistance to infections

Low thrombogenicity
OUTCOMES FOLLOWING AV SURGERY

- Flow (laminar)
- Hemodynamics (gradients)
- Resistance to infections
- Thrombogenicity
- Survival
- Valve-related complications
- Quality of life
Rationale

A LIVING AORTIC VALVE

IMPROVED CLINICALLY-RELEVANT OUTCOMES
• High level of physical activity

• Quality of life

• Prolonged anticipated life expectancy
  = Exposure to valve-related complications
    – Degeneration + Reoperation (tissue valves)
    – Bleeding + Thromboembolisms (mechanical valves)
-2-
CONVENTIONAL AVR IN THE YOUNG
=
EXCESS MORTALITY
CONVENTIONAL AVR

SEVERAL ADVANTAGES

– Standardized

– Easily reproducible

– Short operative times

– Long-term data
Figure 2. The annual observed (solid diamonds) and expected (open diamonds) death risk after primary AVR in patients who survived the first postoperative month (n = 2,227). The numbers (N) of patients at risk and the first year death risk are given.
The younger the patients are, 
The higher excess mortality is.

Table 4. Basic Data Concerning Observed and Expected Deaths Based on Data From Follow-Up Years 1 through 15*  

<table>
<thead>
<tr>
<th>Age (yrs)</th>
<th>Patient-Years at Risk</th>
<th>Observed Number of Deaths</th>
<th>Expected Number of Deaths</th>
<th>O/E Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤50</td>
<td>2,182</td>
<td>31</td>
<td>6.8</td>
<td>4.5</td>
</tr>
<tr>
<td>51–60</td>
<td>2,954.5</td>
<td>98</td>
<td>36.9</td>
<td>2.7</td>
</tr>
<tr>
<td>61–70</td>
<td>5,578.5</td>
<td>274</td>
<td>152.1</td>
<td>1.8</td>
</tr>
<tr>
<td>≥71</td>
<td>3,579</td>
<td>212</td>
<td>208.2</td>
<td>1.0</td>
</tr>
</tbody>
</table>
MECHANICAL AVR IN THE YOUNG

Long-term outcomes after elective isolated mechanical aortic valve replacement in young adults

Ismail Bouhout, MSc, Louis-Mathieu Stevens, MD, PhD, Amine Mazine, MSc, Nancy Poirier, MD, Raymond Cartier, MD, Philippe Demers, MD, and Ismail El-Hamamsy, MD, PhD

1997-2006: 469 isolated mechanical AVR <65 years

Mean follow-up: 9.1 ± 3.5 years

Follow-up 95% complete (4099 patient-years)

Mean age: 53.2 ± 9.2

Bouhout et al. JTCVS 2014
A 10 years, 1 in 5 patients is dead or reoperated.
Valve-Related Complications

PROACT RESULTS
Prospective Randomized On-X Valve Anticoagulation Clinical Trial

- 65% Fewer Bleeds
- No Increase in TE
- INR: 1.5–2.0
- 63,000 INR Data Points
- 33 US Centers

Learn More
» Read the article at JTCVS
» Watch the slide presentation
» Request more information
PROACT Trial (n=375 pts)

<table>
<thead>
<tr>
<th>Primary Event</th>
<th>Test group (pt-yr = 766.2)</th>
<th>Control group (pt-yr = 878.6)</th>
<th>Rate Ratio (test/ctrl)</th>
<th>95% CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Patients (n)</td>
<td>Rate (%/pt-yr)</td>
<td>Patients (n)</td>
<td>Rate (%/pt-yr)</td>
<td></td>
</tr>
<tr>
<td>Bleeding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major</td>
<td>12</td>
<td>1.57</td>
<td>34</td>
<td>3.87</td>
<td>0.40</td>
</tr>
<tr>
<td>Hemorrhagic stroke</td>
<td>1</td>
<td>0.13</td>
<td>4</td>
<td>0.46</td>
<td>0.29</td>
</tr>
<tr>
<td>Minor</td>
<td>9</td>
<td>1.17</td>
<td>35</td>
<td>3.98</td>
<td>0.29</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>21</strong></td>
<td><strong>2.74</strong></td>
<td><strong>69</strong></td>
<td><strong>7.85</strong></td>
<td><strong>0.35</strong></td>
</tr>
<tr>
<td>Ischemic stroke</td>
<td>6</td>
<td>0.78</td>
<td>7</td>
<td>0.80</td>
<td>0.98</td>
</tr>
<tr>
<td>TIA</td>
<td>11</td>
<td>1.44</td>
<td>7</td>
<td>0.80</td>
<td>1.80</td>
</tr>
<tr>
<td>Neurologic event</td>
<td>17</td>
<td>2.22</td>
<td>14</td>
<td>1.59</td>
<td>1.39</td>
</tr>
<tr>
<td>Peripheral TE</td>
<td>4</td>
<td>0.52</td>
<td>1</td>
<td>0.11</td>
<td>4.59</td>
</tr>
<tr>
<td>All TE</td>
<td>21</td>
<td>2.74</td>
<td>15</td>
<td>1.71</td>
<td>1.61</td>
</tr>
<tr>
<td>Thrombosis</td>
<td>2</td>
<td>0.26</td>
<td>2</td>
<td>0.23</td>
<td>1.15</td>
</tr>
<tr>
<td>Major event (major bleeding, all TE, thrombosis)</td>
<td>35</td>
<td>4.57</td>
<td>51</td>
<td>5.80</td>
<td>0.79</td>
</tr>
<tr>
<td>Primary endpoint</td>
<td>44</td>
<td>5.74</td>
<td>86</td>
<td>9.79</td>
<td>0.59</td>
</tr>
</tbody>
</table>

Puskas et al. JTCVS 2014
younger patients had worse than expected survival that was further diminished with insertion of a small prosthesis.
Very Long-Term Outcomes of the Carpentier-Edwards Perimount Valve in Aortic Position

Thierry Bourguignon, MD, Anne-Lorraine Bouquisaux-Stablo, MD, Pascal Candolfi, PhD, Alain Mirza, MD, Claudia Loardi, MD, Marc-Antoine May, MD, Rym El-Khoury, MD, Michel Marchand, MD, and Michel Aupart, MD

2,659 Perimount patients; 1984-2008

Excess Mortality in Young Adults

Very long-term outcomes of the Carpentier-Edwards Perimount aortic valve in patients aged 50–65 years

Thierry Bourguignon, Pierre Lhommet, Rym El Khoury, Pascal Candolfi, Claudia Loardi, Alain Mirza, Julie Boulanger-Lothion, Anne-Lorraine Bouquiaux-Stablo-Duncan, Michel Marchand and Michel Aupart

The Perimount Valve in the Aortic Position: Twenty-Year Experience With Patients Under 60 Years Old

Jessica Forcillo, MD, MS, Ismail El Hamamsy, MD, PhD, Louis-Mathieu Stevens, MD, PhD, David Badrudin, Michel Pellerin, MD, Louis P. Perrault, MD, PhD, Raymond Cartier, MD, Denis Bouchard, MD, MS, Michel Carrier, MD, MBA, and Philippe Demers, MD, MS

Department of Cardiac Surgery, Montreal Heart Institute and Université de Montréal, Montreal, Quebec, Canada
TISSUE AVR IN THE YOUNG

1981-2011: 144 isolated bioprosthetic AVRs

Exclusion: Concomitant procedures, reoperations, urgent operations

Mean age: 51 ± 9 years

Mean follow-up: 10 years

Forcillo et al. ATS 2014
TISSUE AVR IN THE YOUNG

Forcillo et al. ATS 2014
CONVENTIONAL AVR IN THE YOUNG

CURATIVE

PALLIATIVE
EXCESS MORTALITY IS OBSERVED UP TO 60 YEARS OF AGE AT THE TIME OF SURGERY
A LIVING AORTIC VALVE = IMPROVED OUTCOMES?
AORTIC VALVE REPAIR

IS IT WORTHWHILE? 
Why?

IS IT DURABLE? 
When?
AORTIC VALVE REPAIR

• No randomized trials

• Single-center (single-surgeon) series
SURVIVAL
1995-2010: 475 elective AV repair (AI or aneurysm)

Mean age: 53 ± 16 years

Mean follow-up: 4.6 years
Risk of Valve-Related Events After Aortic Valve Repair

Joel Price, MD, MPH, Laurent De Kerchove, MD, David Glineur, MD, PhD, Jean-Louis Vanoverschelde, MD, PhD, Philippe Noirhomme, MD, and Gebrine El Khoury, MD

![Graph showing survival rates:]

- Valve-Related Survival: 90%
- Cardiac Survival: 81%
- Overall Survival: 73%
Valve repair improves the outcome of surgery for chronic severe aortic regurgitation: A propensity score analysis

Christophe de Meester, MS, Agnès Pasquet, MD, PhD, Bernhard L. Gerber, MD, PhD, David Vancraeynest, MD, PhD, Philippe Noirhomme, MD, Gébrine El Khoury, MD, and Jean-Louis J. Vanoverschelde, MD, PhD.
A quarter of a century of experience with aortic valve-sparing operations

1988-2010: 371 consecutive valve-sparing procedures (~15/year)

Mean age: 47 ± 15 years

Median follow-up: 8.9 years
A quarter of a century of experience with aortic valve-sparing operations

Tirone E. David, MD, Christopher M. Feindel, MD, Carolyn M. David, BN, and Cedric Manlhiot, BSc

12% Acute type A dissection
35% Marfan syndrome

N=296 Reimplantation
N=75 Remodeling

Survival lower than matched general population
Aortic valve repair leads to a low incidence of valve-related complications

Diana Aicher\textsuperscript{a}, Roland Fries\textsuperscript{b}, Svetlana Rodionycheva\textsuperscript{a}, Kathrin Schmidt\textsuperscript{a},
Frank Langer\textsuperscript{a}, Hans-Joachim Schäfers\textsuperscript{a,*}

1995-2007: 640 consecutive valve-sparing procedures

81\% of all patients with AI

Mean age: 56 ± 17 years

Mean follow-up: 4.8 years

Aicher et al. EJCTS 2010
Aortic valve repair leads to a low incidence of valve-related complications

Diana Aicher\textsuperscript{a}, Roland Fries\textsuperscript{b}, Svetlana Rodionycheva\textsuperscript{a}, Kathrin Schmidt\textsuperscript{a}, Frank Langer\textsuperscript{a}, Hans-Joachim Schäfers\textsuperscript{a,*}

\textbf{10\% acute dissection}

Survival for the whole patient cohort was 92\% at 5 years and \textbf{80\% at 10 years} with significantly better survival in patients with a bicuspid rather than a tricuspid AV ($p = 0.0004$). Survival at 10 years was worse in patients with concomitant coronary artery bypass grafting (75\% vs 85\%; $p = 0.42$).
• No studies into the second decade
  – Mean follow-up <10 years

• ~80% survival at 10 years despite:
  – Inclusion of acute type A dissections
  – Connective tissue disorders
VALVE-RELATED COMPLICATIONS
VALVE-RELATED COMPLICATIONS

FREEDOM FROM ALL VALVE-RELATED COMPLICATIONS
(Reoperation, endocarditis, thromboembolism and hemorrhage)

88% at 10 years

Aicher et al. EJCTS 2010
# VALVE-RELATED COMPLICATIONS

## A quarter of a century of experience with aortic valve-sparing operations

Tirone E. David, MD, Christopher M. Feindel, MD, Carolyn M. David, BN, and Cedric Manlhiot, BSc

<table>
<thead>
<tr>
<th>Freedom from</th>
<th>1</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>18</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality</td>
<td>97.3 ± 0.8</td>
<td>94.6 ± 1.2</td>
<td>89.0 ± 2.0</td>
<td>79.7 ± 3.4</td>
<td>76.8 ± 4.3</td>
</tr>
<tr>
<td>Reoperation*</td>
<td>99.7 ± 0.3</td>
<td>99.7 ± 0.3</td>
<td>97.0 ± 1.3</td>
<td>94.8 ± 2.0</td>
<td>94.8 ± 2.0</td>
</tr>
<tr>
<td>Aortic insufficiency†</td>
<td>99.7 ± 0.3</td>
<td>99.6 ± 0.4</td>
<td>93.2 ± 2.0</td>
<td>90.7 ± 2.6</td>
<td>78.0 ± 4.8</td>
</tr>
<tr>
<td>Mitral insufficiency‡</td>
<td>100</td>
<td>99.2 ± 0.6</td>
<td>92.8 ± 2.1</td>
<td>88.8 ± 3.5</td>
<td>88.8 ± 3.5</td>
</tr>
<tr>
<td>Thromboembolism§</td>
<td>99.5 ± 0.4</td>
<td>96.6 ± 1.0</td>
<td>94.1 ± 1.5</td>
<td>92.2 ± 2.4</td>
<td>90.1 ± 3.2</td>
</tr>
<tr>
<td>Valve-related event</td>
<td></td>
<td></td>
<td>98.1 ± 0.6</td>
<td>95.5 ± 1.1</td>
<td>91.2 ± 2.4</td>
</tr>
</tbody>
</table>

David et al. JTCVS 2014
**VALVE-RELATED COMPLICATIONS**

Reported Outcome After Valve-Sparing Aortic Root Replacement for Aortic Root Aneurysm: A Systematic Review and Meta-Analysis

Bardia Arabkhani, MD, Aart Mookhoek, MD, Isabelle Di Centa, MD, Emmanuel Lansac, MD, PhD, Jos A. Bekkers, MD, PhD, Rob De Lind Van Wijngaarden, MD, PhD, Ad J. J. C. Bogers, MD, PhD, and Johanna J. M. Takkenberg, MD, PhD

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pooled Data</th>
<th>Range</th>
<th>Included Studies (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total patient number</td>
<td>4.777</td>
<td>32–430</td>
<td>31</td>
</tr>
<tr>
<td>Surgical period</td>
<td>1988–2012</td>
<td></td>
<td>31</td>
</tr>
<tr>
<td>Mean age (years)</td>
<td>51.0</td>
<td>29–63</td>
<td>30</td>
</tr>
<tr>
<td>Gender, male (%)</td>
<td>71.0</td>
<td>57%–85</td>
<td>30</td>
</tr>
<tr>
<td>Comorbidity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connective tissue disease (%)</td>
<td>23.9</td>
<td>0–100</td>
<td>35</td>
</tr>
<tr>
<td>Severe aortic regurgitation (%)</td>
<td>46.1</td>
<td>6.4–100</td>
<td>25</td>
</tr>
<tr>
<td>Bicuspid aortic valve (%)</td>
<td>14.1</td>
<td>0–33</td>
<td>28</td>
</tr>
<tr>
<td>Prior cardiac operation (%)</td>
<td>4.49</td>
<td>2–12</td>
<td>14</td>
</tr>
<tr>
<td>Other indications</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute type A dissection (%)</td>
<td>10.5</td>
<td>0–33</td>
<td>28</td>
</tr>
</tbody>
</table>

Arabkhani et al. ATS 2015
**VALVE-RELATED COMPLICATIONS**

Reported Outcome After Valve-Sparing Aortic Root Replacement for Aortic Root Aneurysm: A Systematic Review and Meta-Analysis

Bardia Arabkhani, MD, Aart Mookhoek, MD, Isabelle Di Centa, MD, Emmanuel Lansac, MD, PhD, Jos A. Bekkers, MD, PhD, Rob De Lind Van Wijngaarden, MD, PhD, Ad J. J. C. Bogers, MD, PhD, and Johanna J. M. Takkenberg, MD, PhD

---

**Table 2. Linearized Occurrence Rates of Late Outcome Events**

<table>
<thead>
<tr>
<th>Pooled Late Outcome Events</th>
<th>LOR + 95% CI</th>
<th>Heterogeneity (I²)</th>
<th>Included Studies (n)</th>
<th>Events (n)</th>
<th>Patient Years (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Late mortality</td>
<td>1.53 (1.19–1.96)</td>
<td>82.6</td>
<td>31</td>
<td>262</td>
<td>21,274</td>
</tr>
<tr>
<td>Reoperation on aortic valve</td>
<td>1.32 (1.0–1.74)</td>
<td>72.3</td>
<td>31</td>
<td>228</td>
<td>21,274</td>
</tr>
<tr>
<td>Hemorrhage</td>
<td>0.23 (0.13–0.42)</td>
<td>78.7</td>
<td>26</td>
<td>15</td>
<td>19,158</td>
</tr>
<tr>
<td>Thromboembolism</td>
<td>0.41 (0.22–0.77)</td>
<td>27.6</td>
<td>26</td>
<td>42</td>
<td>19,158</td>
</tr>
<tr>
<td>Endocarditis</td>
<td>0.23 (0.11–0.51)</td>
<td>0.00</td>
<td>30</td>
<td>29</td>
<td>20,930</td>
</tr>
<tr>
<td>MAVRE</td>
<td>1.66 (1.24–2.23)</td>
<td>100</td>
<td>20</td>
<td>300</td>
<td>19,158</td>
</tr>
</tbody>
</table>
QUALITY OF LIFE
Quality of life after aortic valve surgery: Replacement versus reconstruction

Diana Aicher, MD, Annika Holz, Susanne Feldner, MD, Volker Köllner, MD, and Hans-Joachim Schäfers, MD

**TABLE 1. Patient characteristics**

<table>
<thead>
<tr>
<th>Group</th>
<th>No.</th>
<th>Sex (male/female)</th>
<th>Age at operation (y, mean ± SD)</th>
<th>Age at survey (y, mean ± SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>87</td>
<td>63:24</td>
<td>38 ± 6</td>
<td>40 ± 6</td>
</tr>
<tr>
<td>II</td>
<td>40</td>
<td>35:5</td>
<td>40 ± 7</td>
<td>46 ± 7</td>
</tr>
<tr>
<td>III</td>
<td>39</td>
<td>27:12</td>
<td>40 ± 7</td>
<td>46 ± 7</td>
</tr>
</tbody>
</table>
## QUALITY OF LIFE

<table>
<thead>
<tr>
<th>Valve-specific questions</th>
<th>Group I</th>
<th>Group II</th>
<th>Group III</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. If I had to do it over again, would I make the same decision to have surgery?</td>
<td>Yes: 94.0%</td>
<td>Yes: 89.7%</td>
<td>Yes: 100.0%</td>
<td>.821</td>
</tr>
<tr>
<td></td>
<td>I don’t know: 3.6%</td>
<td>I don’t know: 7.7%</td>
<td>I don’t know: 0.0%</td>
<td>P value: &lt;.001</td>
</tr>
<tr>
<td></td>
<td>No: 2.4%</td>
<td>No: 2.6%</td>
<td>No: 0.0%</td>
<td>P value: &lt;.001</td>
</tr>
<tr>
<td>2. Is there a valve sound that bothers me?</td>
<td>Never/rarely: 91.5%</td>
<td>Never/rarely: 41.0%</td>
<td>Never/rarely: 92.4%</td>
<td>P value: &lt;.001</td>
</tr>
<tr>
<td></td>
<td>Occasionally: 6.1%</td>
<td>Occasionally: 33.3%</td>
<td>Occasionally: 5.1%</td>
<td>P value: &lt;.001</td>
</tr>
<tr>
<td></td>
<td>Frequently/always: 2.4%</td>
<td>Frequently/always: 25.7%</td>
<td>Frequently/always: 2.5%</td>
<td>P value: &lt;.001</td>
</tr>
<tr>
<td>3. Following my valve surgery, the frequency of doctor visits and blood tests bothers me.</td>
<td>Never/rarely: 75.9%</td>
<td>Never/rarely: 61.6%</td>
<td>Never/rarely: 84.2%</td>
<td>P value: .011</td>
</tr>
<tr>
<td></td>
<td>Occasionally: 20.5%</td>
<td>Occasionally: 17.9%</td>
<td>Occasionally: 13.2%</td>
<td>P value: .011</td>
</tr>
<tr>
<td></td>
<td>Frequently/always: 3.6%</td>
<td>Frequently/always: 20.5%</td>
<td>Frequently/always: 2.6%</td>
<td>P value: .011</td>
</tr>
<tr>
<td>4. The possibility of complications due to my implanted valve concerns me.</td>
<td>Never/rarely: 48.2%</td>
<td>Never/rarely: 48.7%</td>
<td>Never/rarely: 61.5%</td>
<td>P value: .309</td>
</tr>
<tr>
<td></td>
<td>Occasionally: 43.4%</td>
<td>Occasionally: 30.8%</td>
<td>Occasionally: 33.3%</td>
<td>P value: .309</td>
</tr>
<tr>
<td></td>
<td>Frequently/always: 8.4%</td>
<td>Frequently/always: 20.5%</td>
<td>Frequently/always: 5.2%</td>
<td>P value: .309</td>
</tr>
<tr>
<td>5. I am concerned about possible bleeding caused by my anticoagulant medication.</td>
<td>Never/rarely: 80.5%</td>
<td>Never/rarely: 43.6%</td>
<td>Never/rarely: 79.5%</td>
<td>P value: &lt;.001</td>
</tr>
<tr>
<td></td>
<td>Occasionally: 12.2%</td>
<td>Occasionally: 15.4%</td>
<td>Occasionally: 7.7%</td>
<td>P value: &lt;.001</td>
</tr>
<tr>
<td></td>
<td>Frequently/always: 7.3%</td>
<td>Frequently/always: 41.0%</td>
<td>Frequently/always: 12.8%</td>
<td>P value: &lt;.001</td>
</tr>
<tr>
<td>6. I am afraid that my valve may fail.</td>
<td>Never/rarely: 53.7%</td>
<td>Never/rarely: 51.3%</td>
<td>Never/rarely: 76.9%</td>
<td>P value: .036</td>
</tr>
<tr>
<td></td>
<td>Occasionally: 34.1%</td>
<td>Occasionally: 28.2%</td>
<td>Occasionally: 17.9%</td>
<td>P value: .036</td>
</tr>
<tr>
<td></td>
<td>Frequently/always: 12.2%</td>
<td>Frequently/always: 20.5%</td>
<td>Frequently/always: 5.2%</td>
<td>P value: .036</td>
</tr>
<tr>
<td>7. I am afraid that I may need another valve operation.</td>
<td>Never/rarely: 38.0%</td>
<td>Never/rarely: 48.7%</td>
<td>Never/rarely: 53.8%</td>
<td>P value: .382</td>
</tr>
<tr>
<td></td>
<td>Occasionally: 43.0%</td>
<td>Occasionally: 25.6%</td>
<td>Occasionally: 25.6%</td>
<td>P value: .382</td>
</tr>
<tr>
<td></td>
<td>Frequently/always: 17.0%</td>
<td>Frequently/always: 25.7%</td>
<td>Frequently/always: 20.6%</td>
<td>P value: .382</td>
</tr>
</tbody>
</table>
Quality of life after aortic valve repair is similar to Ross patients and superior to mechanical valve replacement: a cross-sectional study

Pavel Zacek, T. Holubec, M. Vobornik, J. Dominik, J. Takkenberg, J. Harrer and J. Vojacek

Conclusions: Postoperative quality of life is influenced by the type of aortic valve procedure and is negatively linked with mechanical prosthesis implantation and long-term anticoagulation. Aortic valve-sparing strategy should be considered in cases with suitable valve morphology due to favorable clinical results and beneficial impact on the long-term quality of life.
HEMODYNAMICS
Comparison of Hemodynamics After Aortic Root Replacement Using Valve-Sparing or Bioprosthetic Valved Conduit

Jeremy D. Collins, MD, Edouard Semaan, MD, Alex Barker, PhD, Patrick M. McCarthy, MD, James C. Carr, MD, Michael Markl, PhD, and S. Chris Malaisrie, MD
Comparison of Hemodynamics After Aortic Root Replacement Using Valve-Sparing or Bioprosthetic Valved Conduit

Background. The purpose of this study is to compare aortic hemodynamics and blood flow patterns using invivo four-dimensional (4D) flow magnetic resonance imaging. Flow asymmetry in BIO-ARR was increased compared with VSARR, evidenced by more AAo outflow (0.6 vs 1.6 BIO-ARR, 0.4 vs 1.1 in VSARR).

Conclusions. The VSARR results in improved hemodynamic outcomes when compared with BIO-ARR, as indicated by reduced peak velocities in the aortic root and less helix flow in the AAo by 4D flow MRI. Longitudinal research assessing the clinical impact of these differences in hemodynamic outcomes is warranted.


Collins et al. ATS 2015
AORTIC VALVE REPAIR

WHEN?
To Preserve or Not to Preserve?

The **DECISION** depends on

- **FEASIBILITY**
- **EXPECTED DURABILITY**

The **EVALUATION** rests on

- **PREOP IMAGING**
- **INTRAOP ASSESSMENT**
## MECHANISMS OF AI

<table>
<thead>
<tr>
<th>AI Class</th>
<th>Type I</th>
<th>Type II</th>
<th>Type III</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal cusp motion with Functional Aortic Annulus dilatation</td>
<td>Cusp Prolapse</td>
<td>Cusp Restriction</td>
</tr>
<tr>
<td></td>
<td>Ia</td>
<td>Ib</td>
<td>Ic</td>
</tr>
</tbody>
</table>

### THE MOST COMMON MECHANISM IN BAV
Improved Understanding of AI in BAV

MECHANISMS OF AI

Prolapse of the fused cusp
Improved Understanding of AI in BAV

COMMISSURAL ORIENTATION

125°
Improved Understanding of AI in BAV

ANNULAR DILATATION

32mm
IMPROVEMENTS IN SURGICAL TECHNIQUE
RELEVANCE OF CUSP PROLAPSE


AI at 1 year

mean AI (grade)

** p < 0.001

height of resuspension (grade)
RELEVANCE OF CUSP PROLAPSE

EFFECTIVE HEIGHT

≥9 mm

~50%

RELEVANCE OF CUSP PROLAPSE

EFFECTIVE HEIGHT

Aicher et al. Circulation 2011
CUSP RETRACTION

GEOMETRIC HEIGHT

≥20-21mm

Schafers et al. JTCVS 2013
COMMISSURAL ORIENTATION

Aicher et al. Circulation 2011
CUSP REPAIR TECHNIQUES

AVOIDANCE OF PATCH REPAIR

Boodhwani et al. JTCVS 2010
AV Repair Durability

Aortic valve repair leads to a low incidence of valve-related complications.

Diana Aicher\textsuperscript{a}, Roland Fries\textsuperscript{b}, Svetlana Rodionycheva\textsuperscript{a}, Kathrin Schmidt\textsuperscript{a}, Frank Langer\textsuperscript{a}, Hans-Joachim Schäfers\textsuperscript{a,*}

Improving Results with Experience and Understanding

Aicher et al. EJCTS 2010
Favorable ECHO Characteristics (BAV)

• **CUSPS**
  – Pliable
  – Little to no calcium
  – Sufficient length of coaptation

• **AORTIC ANNULUS**
  – <28mm

• **COMMISSURES**
  – Circumferential orientation 160-180°
Favorable INTRAOP Characteristics (BAV)

• **CUSPS**
  – Pliable
  – Geometric height ≥21mm
  – Little to no calcium/fenestrations

• **COMMISSURES**
  – Circumferential orientation 160-180°
25 yo male with BAV (R-L fusion)
Severe eccentric AI with LV dilatation
Annulus = 30mm
Sinus = 39mm
STJ = 38mm
25 yo male with BAV (R-L fusion)
Severe eccentric AI with LV dilatation

Subcoronary Annuloplasty ring
Restoration of effective height
STJ Tailoring
61 yo male with BAV (R-L fusion)
Severe AI with LV dilatation
Annulus = 28mm
Sinus = N
STJ = N
61 yo male with BAV (R-L fusion)
Severe AI with LV dilatation
Annulus = 28mm
Sinus = N
STJ = N
61 yo male with BAV (R-L fusion)
Severe AI with LV dilatation

Subcoronary Annuloplasty Ring
Extensive cusp effective plication to restore effective height
61 yo male with BAV (R-L fusion)  
Severe AI with LV dilatation

1 Year postop  Bioprosthetic AVR
SUMMARY

AORTIC VALVE REPAIR

• **WHY?**
  – Survival
  – Valve-related complications
  – Quality of life

• **WHEN?**
  – Echo and intraop determination
  – Feasibility doesn’t always mean durability – JUDGEMENT
i.elhamamsy@icm-mhi.org