Hemodynamic Results of an Algorithmic Three-Pronged Approach to Bicuspid Aortic Valve Repair

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Decision making in BAV repair: the Algorithm

• Nuanced and complex
  • The decision regarding which procedure to perform is influenced by many variables.

• Show the results of our center’s decision making approach to BAV repair for aortic insufficiency and why we choose the following options:
  1. Valve Sparing Root Reimplantation (VSRR)
  2. External Subannular Aortic Ring (ESAR)
  3. Subcommissural Annuloplasty (SCA)
  4. Abort to AVR or Bentall procedure
Bicuspid Aortic Valve with Insufficiency

- Calcification
- Extreme fenestration
- Decreased leaflet surface area
- Geometric height < 18 mm

- Yes
  - AVR ± proximal aortic repair
    (Bio-Bentall, Mechanical Composite, Wheat Procedure)

- No
  - Root Aneurysm or Dilation
    - Yes
      - Annulus ≤ 27mm
      - Yes: VSRR
      - No: BAV repair + SCAR
    - No: BAV repair + ESAR
Methods

• A retrospective review was performed of 144 patients with BAV undergoing primary valve repair from January 1, 2003 to March 31, 2018.
  • VSRR (n=71) was performed in patients with aneurysmal aortic roots with or without aortic insufficiency (AI)
  • ESAR (n=22) was performed in patients with AI and aortic annulus >27mm without aortic root dilatation.
  • SCA (n=51) was performed in patients with AI and aortic annulus ≤27mm without aortic root dilatation.
• Primary endpoints of freedom from AI >2+ and freedom from aortic valve reoperation were analyzed using Kaplan-Meier analysis.
# Demographics

<table>
<thead>
<tr>
<th></th>
<th>VSRR (n=71)</th>
<th>ESAR (n=22)</th>
<th>SCA (n=51)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>44.7 ± 12.6</td>
<td>41.3 ± 10.7</td>
<td>43.3 ± 13.5</td>
<td>0.52</td>
</tr>
<tr>
<td><strong>Male</strong></td>
<td>61 (85.9)</td>
<td>17 (77.3)</td>
<td>45 (88.2)</td>
<td>0.47</td>
</tr>
<tr>
<td><strong>Diabetes</strong></td>
<td>7 (9.9)</td>
<td>0 (0.0)</td>
<td>3 (5.9)</td>
<td>0.30</td>
</tr>
<tr>
<td><strong>HTN</strong></td>
<td>36 (50.7)</td>
<td>2 (9.1)</td>
<td>27 (52.9)</td>
<td>0.003</td>
</tr>
<tr>
<td><strong>CAD</strong></td>
<td>9 (12.7)</td>
<td>1 (4.6)</td>
<td>3 (5.9)</td>
<td>0.52</td>
</tr>
<tr>
<td><strong>LVEF &lt; 50%</strong></td>
<td>12 (16.9)</td>
<td>1 (4.6)</td>
<td>6 (11.8)</td>
<td>0.001</td>
</tr>
<tr>
<td><strong>Preoperative AI &gt; 2+</strong></td>
<td>26 (36.6)</td>
<td>16 (72.7)</td>
<td>30 (58.8)</td>
<td>0.01</td>
</tr>
<tr>
<td><strong>Pre-op LVEDD (cm)</strong></td>
<td>5.6 ± 1.0</td>
<td>5.5 ± 0.9</td>
<td>5.4 ± 0.8</td>
<td>0.60</td>
</tr>
<tr>
<td><strong>Annular Diameter (mm)</strong></td>
<td>30.2 ± 3.8</td>
<td>29.6 ± 3.7</td>
<td>28.1 ± 3.0</td>
<td>0.03</td>
</tr>
<tr>
<td><strong>SOV diameter (cm)</strong></td>
<td>4.7 ± 3.3</td>
<td>3.6 ± 4.4</td>
<td>3.7 ± 4.4</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td><strong>STJ diameter (cm)</strong></td>
<td>3.9 ± 7.1</td>
<td>3.3 ± 6.1</td>
<td>3.3 ± 4.9</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>
## Perioperative outcomes

<table>
<thead>
<tr>
<th></th>
<th>VSRR (n=71)</th>
<th>ESAR (n=22)</th>
<th>SCA (n=51)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cardiopulmonary bypass (min)</strong></td>
<td>274.6 ± 56.8</td>
<td>185.4 ± 46.0</td>
<td>143.1 ± 39.6</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Crossclamp (min)</strong></td>
<td>223.8 ± 47.5</td>
<td>136.7 ± 37.5</td>
<td>94.4 ± 30.3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>30-day mortality</strong></td>
<td>1 (1.4)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0.75</td>
</tr>
<tr>
<td><strong>Stroke</strong></td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>1.00</td>
</tr>
<tr>
<td><strong>Annular reduction (%)</strong></td>
<td>15.4 ± 8.0</td>
<td>19.1 ± 7.3</td>
<td>12.7 ± 6.6</td>
<td>0.01</td>
</tr>
<tr>
<td><strong>Concomitant ascending replacement</strong></td>
<td>N/A</td>
<td>7 (31.8)</td>
<td>24 (46.2)</td>
<td>0.20</td>
</tr>
<tr>
<td><strong>Concomitant hemiarch or arch procedure</strong></td>
<td>41 (57.8)</td>
<td>7 (31.8)</td>
<td>23 (44.2)</td>
<td>0.12</td>
</tr>
<tr>
<td><strong>MG (mmHg, post-op TTE)</strong></td>
<td>6.5 ± 3.6</td>
<td>10.4 ± 5.1</td>
<td>12.7 ± 4.9</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>PG (mmHg, post-op TTE)</strong></td>
<td>12.1 ± 6.4</td>
<td>18.0 ± 8.0</td>
<td>23.7 ± 9.2</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
Long-term Outcomes

Freedom from AI > 2+

Freedom from Re-operation

Product-Limit Survival Estimates
With Number of Subjects at Risk

Survival Probability

Logrank p=0.7641

Product-Limit Survival Estimates
With Number of Subjects at Risk

Survival Probability

Logrank p=0.0966

Reappraisal
1: Valve Sparring Root Reimplantation
2: External Subannular Aortic Ring
3: Subcommissural Aneurysmoplasty

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Conclusions

• We have an algorithm and an approach to BAV repair in patients with/without root aneurysm
  • Root diameter > 40-45mm
  • Annular diameter > 27 mm
  • Decision towards AVR/Bentall in calcification and extreme fenestration

• Decision making based on this algorithm results in:
  • 93.7% freedom from AI > 2+ in VSRR group (10 years)
  • 92.9% freedom from AI > 2+ in ESAR group (5 years)
  • 100% freedom from AI > 2+ in SCA group (5 years) after algorithm change in 2013

• Reoperation in all groups is quite low

• Limitations:
  • We changed our algorithm significantly in 2013 based on review of our own SCA data (Vallabhajosyula P et al., Ann Thorac Surg 2014)

• We believe this to be a reasonable approach to BAV repair
THANK YOU