Transthoracic Echocardiographic Measurement of the Ascending Aorta in Bicuspid Aortic Valve Patients: A Simple Standardized Method

Alfred Albano

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### Table 1. Clinical and Echocardiographic Characteristics of Patients With Bicuspid and Tricuspid Aortic Valves

<table>
<thead>
<tr>
<th></th>
<th>BAV (n=45)</th>
<th>Control (n=45)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y</td>
<td>47.5 ± 12.6</td>
<td>47.8 ± 12.6</td>
<td></td>
</tr>
<tr>
<td>Male, %</td>
<td>60</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Height, cm</td>
<td>172 ± 11</td>
<td>173 ± 12</td>
<td></td>
</tr>
<tr>
<td>Weight, kg</td>
<td>83 ± 23</td>
<td>88 ± 20</td>
<td></td>
</tr>
<tr>
<td>Body surface area, m²</td>
<td>1.98 ± 0.27</td>
<td>2.01 ± 0.28</td>
<td></td>
</tr>
<tr>
<td>Heart Rate, bpm</td>
<td>70 ± 10</td>
<td>77 ± 12</td>
<td></td>
</tr>
<tr>
<td>SBP, mm Hg</td>
<td>121 ± 14</td>
<td>110 ± 8</td>
<td></td>
</tr>
<tr>
<td>DBP, mm Hg</td>
<td>75 ± 10</td>
<td>76 ± 10</td>
<td></td>
</tr>
<tr>
<td>Ejection Fraction, %</td>
<td>63 ± 6</td>
<td>63 ± 4</td>
<td></td>
</tr>
<tr>
<td>Mild AS</td>
<td>19 (42%)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Moderate AS</td>
<td>2 (4%)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Severe AS</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Mild AR</td>
<td>16 (36%)</td>
<td>5 (11%)</td>
<td></td>
</tr>
<tr>
<td>Moderate AR</td>
<td>12 (27%)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Severe AR</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

### Table 2. Aortic Dimensions at Various Locations and in Different Phases of the Cardiac Cycle in Patients with Bicuspid and Tricuspid Aortic Valves

<table>
<thead>
<tr>
<th></th>
<th>BAV (n=45)</th>
<th>Control (n=45)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>End-diastole 1cm</td>
<td>3.50 ± 0.49</td>
<td>2.92 ± 0.35</td>
<td></td>
</tr>
<tr>
<td>End-diastole 2cm</td>
<td>3.75 ± 0.54</td>
<td>3.01 ± 0.37</td>
<td></td>
</tr>
<tr>
<td>End-diastole 3cm</td>
<td>3.84 ± 0.55</td>
<td>3.05 ± 0.38</td>
<td></td>
</tr>
<tr>
<td>End-systole 1cm</td>
<td>3.59 ± 0.48</td>
<td>3.00 ± 0.35</td>
<td></td>
</tr>
<tr>
<td>End-systole 2cm</td>
<td>3.64 ± 0.54</td>
<td>3.10 ± 0.35</td>
<td></td>
</tr>
<tr>
<td>End-systole 3cm</td>
<td>3.95 ± 0.58</td>
<td>3.15 ± 0.36</td>
<td></td>
</tr>
<tr>
<td>Mid-systole 1cm</td>
<td>3.59 ± 0.48</td>
<td>3.05 ± 0.35</td>
<td></td>
</tr>
<tr>
<td>Mid-systole 2cm</td>
<td>3.96 ± 0.54</td>
<td>3.15 ± 0.36</td>
<td></td>
</tr>
<tr>
<td>Mid-systole 3cm</td>
<td>4.06 ± 0.58</td>
<td>3.22 ± 0.36</td>
<td></td>
</tr>
</tbody>
</table>

### Table 3. Percentage of Dilated Aortas Detected in Patients With Bicuspid Valves Using Control Criteria Applied Under Various Measurement Methodologies

<table>
<thead>
<tr>
<th></th>
<th>Control + 2SD (n=45)</th>
<th>Dilated BAV (n=45)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>End-diastole 1cm</td>
<td>3.87</td>
<td>16 (35%)</td>
<td></td>
</tr>
<tr>
<td>End-diastole 2cm</td>
<td>3.75</td>
<td>24 (53%)</td>
<td></td>
</tr>
<tr>
<td>End-diastole 3cm</td>
<td>3.01</td>
<td>25 (55%)</td>
<td></td>
</tr>
<tr>
<td>End-systole 1cm</td>
<td>3.70</td>
<td>18 (42%)</td>
<td></td>
</tr>
<tr>
<td>End-systole 2cm</td>
<td>3.81</td>
<td>24 (53%)</td>
<td></td>
</tr>
<tr>
<td>End-systole 3cm</td>
<td>3.99</td>
<td>25 (55%)</td>
<td></td>
</tr>
<tr>
<td>Mid-systole 1cm</td>
<td>3.74</td>
<td>21 (47%)</td>
<td></td>
</tr>
<tr>
<td>Mid-systole 2cm</td>
<td>3.87</td>
<td>28 (52%)</td>
<td></td>
</tr>
<tr>
<td>Mid-systole 3cm</td>
<td>3.94</td>
<td>28 (52%)</td>
<td></td>
</tr>
</tbody>
</table>

### Table 4. Mean Differences in Aortic Diameter Between Different Phases of the Cardiac Cycle in BAV Patients and Controls

<table>
<thead>
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<th>BAV (n=45)</th>
<th>Control (n=45)</th>
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<tr>
<td>End-diastole 1cm</td>
<td>0.10 ± 0.11</td>
<td>0.06 ± 0.09</td>
<td></td>
</tr>
<tr>
<td>End-diastole 2cm</td>
<td>0.09 ± 0.10</td>
<td>0.06 ± 0.06</td>
<td></td>
</tr>
<tr>
<td>End-diastole 3cm</td>
<td>0.19 ± 0.13</td>
<td>0.13 ± 0.09</td>
<td></td>
</tr>
<tr>
<td>End-systole 1cm</td>
<td>0.09 ± 0.15</td>
<td>0.10 ± 0.09</td>
<td></td>
</tr>
<tr>
<td>End-systole 2cm</td>
<td>0.12 ± 0.09</td>
<td>0.06 ± 0.04</td>
<td></td>
</tr>
<tr>
<td>End-systole 3cm</td>
<td>0.21 ± 0.13</td>
<td>0.18 ± 0.09</td>
<td></td>
</tr>
<tr>
<td>Mid-systole 1cm</td>
<td>0.11 ± 0.13</td>
<td>0.10 ± 0.09</td>
<td></td>
</tr>
<tr>
<td>Mid-systole 2cm</td>
<td>0.10 ± 0.09</td>
<td>0.06 ± 0.05</td>
<td></td>
</tr>
<tr>
<td>Mid-systole 3cm</td>
<td>0.20 ± 0.11</td>
<td>0.17 ± 0.09</td>
<td></td>
</tr>
</tbody>
</table>

### Table 5. Percentage of Dilated Aortas Detected in Patients With Bicuspid Valves Using Control Criteria Applied Under Various Measurement Methodologies

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<tr>
<td>Mid-systole 2cm</td>
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<td>3.94</td>
<td>28 (52%)</td>
<td></td>
</tr>
</tbody>
</table>
Figure 1. Measurement of aortic diameter in a BAV patient at 1cm, 2cm, 3cm, and 4cm from the STJ in end-systole using EchoPac software.

Figure 2. (A) Intraobserver variability at 2 times and (B) interobserver variability between two investigators (AA, LP) for aortic measurements 1cm, 2cm, and 3cm from the STJ in end-diastole (black squares) and end-systole (black triangles).
Figure 3. Aortic diameter in 28 BAV patients measured in 1cm intervals from the STJ up to 4cm.

Figure 4. Ascending aorta diameter measured in end-systole for 45 BAV patients.

Figure 5. Ascending aorta diameter measured in end-systole for 45 control subjects with a tricuspid aortic valve.