Principles of Balloon Aortic Valvuloplasty

BAV Basics

Ted Feldman, M.D., FSCAI FACC FESC
Evanston Hospital

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Ted Feldman MD, FACC, FESC, FSCAI

Disclosure Information

The following relationships exist:

Grant support: Abbott, BSC, Edwards, WL Gore

Off label use of products and investigational devices will be discussed in this presentation
Balloon Aortic Valvuloplasty

Medicare Volumes

Series 1

Current Indications for BAV

- **Bridge to AVR**
  - stabilize shock
  - treat severe CHF
- **Bridge to TAVI**
  - symptom relief
  - stabilization while evaluation is undertaken
- **Diagnostic test- see how patient responds**
  - low gradient/low output patient
  - mixed lung and valve disease
- **Therapy for “no-option” patient**
  - Anyone can undergo AVR
  - Apical-descending aorta conduit is an option for some
- **Pre-op for non-cardiac surgery**
- **Pre-TAVI**
  - Predilatation
  - sizing
Table 1. Baseline Characteristics of the Patients and Echocardiographic Findings.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>TAVI (N = 179)</th>
<th>Standard Therapy (N = 179)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age — yr</td>
<td>83.1±8.6</td>
<td>83.2±8.3</td>
<td>0.95</td>
</tr>
<tr>
<td>Male sex — no. (%)</td>
<td>82 (45.8)</td>
<td>84 (46.9)</td>
<td>0.92</td>
</tr>
<tr>
<td>STS score?</td>
<td>11.2±5.8</td>
<td>12.1±6.1</td>
<td>0.14</td>
</tr>
<tr>
<td>Logistic EuroSCORE†</td>
<td>26.4±17.2</td>
<td>30.4±19.1</td>
<td>0.04</td>
</tr>
<tr>
<td>NYHA class — no. (%)</td>
<td></td>
<td></td>
<td>0.68</td>
</tr>
<tr>
<td>II</td>
<td>14 (7.8)</td>
<td>11 (6.1)</td>
<td></td>
</tr>
<tr>
<td>III or IV</td>
<td>165 (92.2)</td>
<td>168 (93.9)</td>
<td></td>
</tr>
<tr>
<td>Coronary artery disease — no. (%)</td>
<td>121 (67.6)</td>
<td>133 (74.3)</td>
<td>0.20</td>
</tr>
<tr>
<td>Previous myocardial infarction — no./total no. (%)</td>
<td>33/177 (18.6)</td>
<td>47/178 (26.4)</td>
<td>0.10</td>
</tr>
<tr>
<td>Previous intervention — no./total no. (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CABG</td>
<td>58/155 (37.4)</td>
<td>73/160 (45.6)</td>
<td>0.17</td>
</tr>
<tr>
<td>PCI</td>
<td>47/154 (30.5)</td>
<td>39/157 (24.8)</td>
<td>0.31</td>
</tr>
<tr>
<td>Balloon aortic valvuloplasty</td>
<td>25/154 (16.2)</td>
<td>39/160 (24.4)</td>
<td>0.09</td>
</tr>
<tr>
<td>Cerebral vascular disease — no./total no. (%)</td>
<td>48/175 (27.4)</td>
<td>46/167 (27.5)</td>
<td>1.00</td>
</tr>
<tr>
<td>Peripheral vascular disease — no./total no. (%)</td>
<td>54/178 (30.3)</td>
<td>45/179 (25.1)</td>
<td>0.29</td>
</tr>
<tr>
<td>COPD — no. (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any</td>
<td>74 (41.1)</td>
<td>94 (52.2)</td>
<td>0.04</td>
</tr>
<tr>
<td>Oxygen-dependent</td>
<td>38 (21.2)</td>
<td>46 (25.7)</td>
<td>0.38</td>
</tr>
<tr>
<td>Creatinine &gt;2 mg/dl (177 μmol/liter) — no./total no. (%)</td>
<td>10/178 (5.6)</td>
<td>17/178 (9.6)</td>
<td>0.23</td>
</tr>
<tr>
<td>Atrial fibrillation — no./total no. (%)</td>
<td>28/85 (32.9)</td>
<td>39/80 (48.8)</td>
<td>0.04</td>
</tr>
<tr>
<td>Permanent pacemaker — no./total no. (%)</td>
<td>35/153 (22.9)</td>
<td>31/159 (19.3)</td>
<td>0.49</td>
</tr>
<tr>
<td>Pulmonary hypertension — no./total no. (%)</td>
<td>50/118 (42.4)</td>
<td>53/121 (43.3)</td>
<td>0.90</td>
</tr>
<tr>
<td>Frailty — no./total no. (%)</td>
<td>21/116 (18.1)</td>
<td>33/118 (28.0)</td>
<td>0.09</td>
</tr>
<tr>
<td>Extensively calcified aorta — no. (%)</td>
<td>34 (19.0)</td>
<td>20 (11.2)</td>
<td>0.05</td>
</tr>
<tr>
<td>Deleterious effects of chest-wall irradiation — no. (%)</td>
<td>15 (8.9)</td>
<td>15 (8.4)</td>
<td>1.00</td>
</tr>
<tr>
<td>Chest-wall deformity — no. (%)</td>
<td>15 (8.9)</td>
<td>9 (5.0)</td>
<td>0.29</td>
</tr>
<tr>
<td>Liver disease — no./total no. (%)</td>
<td>6/177 (3.4)</td>
<td>6/178 (3.4)</td>
<td>1.00</td>
</tr>
<tr>
<td>Echocardiographic findings</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aortic-valve area — cm²</td>
<td>0.6±0.2</td>
<td>0.6±0.2</td>
<td>0.97</td>
</tr>
<tr>
<td>Mean aortic-valve gradient — mm Hg</td>
<td>44.5±15.7</td>
<td>43.0±15.3</td>
<td>0.39</td>
</tr>
<tr>
<td>Mean LVEF — %</td>
<td>53.9±13.1</td>
<td>51.1±14.3</td>
<td>0.06</td>
</tr>
<tr>
<td>Moderate or severe mitral regurgitation — no./total no. (%)</td>
<td>38/171 (22.2)</td>
<td>38/165 (23.0)</td>
<td>0.90</td>
</tr>
</tbody>
</table>

Leon MB et al.  
N Engl J Med 2010;363:1597-1607
## Patient Assessment

- **STS score**
- **TTE**
  - Etiology of AS - ?bicuspid
  - *Annulus diameter*, sino-tubular junction
  - LV function
  - AI
  - MR
- **TEE**
  - More accurate annulus measurement
  - *Aortic atheroma*
- **Coronary angiography**
  - Ilio-femoral angiogram at time of diagnostic study
  - Separate session for diagnostic cath during early experience
- **PFTs (pulmonary function testing)**
  - Help define surgical options
- **CTA abdomen & pelvis ?**
BAV Equipment

- **Sheaths**
  - 9-14F

- **Conventional Balloons**
  - Cordis Maxi- 18, 20, 22, 25mm x4cm
  - Z-Med II- 18, 20, 22, 23, 25mm x4cm
  - Tyshak- 18, 20, 22, 23, 25mm x4cm
    - 8F compatible but thin walled, prone to rupture
  - Longer balloon 5-6cm if rapid pacing is not used

- **New Balloon Systems**
  - InterValve V8- contoured shape
  - Loma Vista- kevlar material
  - CardioSculpt- cutting wires
  - Pi-R-Squared- mechanical shock

- **Wires**
  - 0.035” extra stiff is the workhorse
  - Safari- preshaped

- **Small stuff: extension tubing, high pressure stopcocks**
  - High pressure ≈ 1050psi or 380psi with PCI inflation device vs 20psi for conventional
## BAV Procedure Technique

- Arterial access & pre-closure
- AS severity assessment
- Balloon size selection
- LV access
- Rapid pacing
- Balloon inflation, deflation and withdrawal
- Post procedure assessment
- Femoral closure
Multiple fluoro shots before puncture
RFA 4F micro-puncture sheath angiogram shows high bifurcation so cannula removed & pressure applied

Access on L favorable for 10F sheath placement
Peripheral vs Central Aortic Pressure

- Double lumen pigtail
- Reverse transducers to confirm match
- Better to know about AI from echo before this point
Annulus measurement

- TEE gives larger measure than TTE
- 1st inflation balloon:annulus ≤1:1
- Frequency of AI increases as balloon:annulus exceeds 1:1
Crossing the Valve & LV Access
If there is RBBB, place temp pacer before entering LV
Curve for 0.035” Extra-Stiff Wire
Placement of wire into LV:
"Boosted" Inflation

Feldman T, Chiu YC, Carroll JD: Single balloon aortic valvuloplasty: increased valve areas with improved technique
J Invasive Cardiol 1:295-300, 1989
Volume Driven Inflation
SEQUENCE

- Pacer on
- Inflate when BP drops
- Post when balloon locks
- Pacer off at peak inflation
- Withdraw balloon as soon as max inflation reached
- This may be before pacer is stopped
Pacing for AI
**Outcome & Complications**

**Balloon Aortic Valvuloplasty**

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptom improvement</td>
<td>12-18 months</td>
</tr>
<tr>
<td>Hospital mortality</td>
<td>2-6%</td>
</tr>
<tr>
<td>Cath lab mortality</td>
<td>≈1%</td>
</tr>
<tr>
<td><strong>Transfusion</strong></td>
<td>&lt;3%</td>
</tr>
<tr>
<td>Stroke</td>
<td>&lt;1%</td>
</tr>
<tr>
<td><strong>Tamponade</strong></td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Permanent Pacemaker</td>
<td>1-3%</td>
</tr>
<tr>
<td>Vascular complication req intervention</td>
<td>3-7%</td>
</tr>
<tr>
<td>Length of stay</td>
<td>2.2 days</td>
</tr>
</tbody>
</table>

*References:
J Invasive Cardiol 13:592-596, 2001
CCI 64:314-321, 2005
CCI 74:957-964, 2009
JACC. Intv. 2010;3;1150-1156*