How Old is Too Old?

“No one is so old as to think he cannot live one more year.”

MARCUS TULLIUS CICERO
Roman statesman and scholar

Calcific Aortic Stenosis

- Most important valvular lesion in elderly
- 40% of people in US are expected to reach 80 years
- High operative success rate

Elderly defined as:

Age 70 years and above

Management of Calcific Aortic Stenosis in the Elderly

Pravin M. Shah, MD, MACC

How old does one have to be to be called elderly?
Aortic Stenosis in Elderly

Special challenges

- Symptom Evaluation
- Diagnosis
- Comorbidities
- Expectations

Symptoms

- Fatigue – AS vs Aging
- Dyspnea – AS vs Diastolic Dysfunction
- Syncope – AS vs Bradyarrhythmias
- Angina – AS vs CAD

Physical Signs

- Arterial Pulse – Anacrotic pulse is rare
- A2 absent (single S2)
- S4, if audible is unrelated to severity
- Murmur – variable intensity
- Carotid murmur difficult to interpret

Echocardiography

- Accoustic Window
- LV Dysfunction - Diastolic - Systolic
- Upper Septal Hypertrophy

Aortic Stenosis Definition of Severity

<table>
<thead>
<tr>
<th>Jet Velocity (m/s)</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 3.0</td>
<td>3.0 - 4.0</td>
<td>&gt; 4.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mean Gradient (mm Hg)</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 25</td>
<td>25 – 40</td>
<td>&gt; 40</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Valve Area (cm²)</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&gt; 1.5</td>
<td>1.0 – 1.5</td>
<td>&lt; 1.0</td>
</tr>
</tbody>
</table>
Aortic Stenosis

**Aortic Valve Area**

Continuity Principle

\[
\text{LVOT } \pi r^2 \times V_1 \text{VTI} = \text{AVA} \times V_2 \text{VTI}
\]

\[
\text{AVA} = \frac{\pi r^2 \cdot V_1 \text{VTI}}{V_2 \text{VTI}}
\]
Aortic Stenosis - Quantitation

- Dimensionless Index

\[
V_1\frac{TVI}{TVI} \propto \text{Stroke Volume}
\]
\[
V_2\frac{TVI}{TVI} \propto \text{Mean gradient}
\]

< 0.25 = severe AS
< 0.2 = critical AS

Aortic Stenosis in Elderly

Diagnosis

Cardiac Catheterization

ACC / AHA Guidelines

Cardiac Catheterization – Indications

Class I
1. Coronary angiography is recommended before AVR in patients with AS at risk for CAD

2. Cardiac catheterization for hemodynamic measurements is recommended for assessment of severity of AS in symptomatic patients when noninvasive tests are inconclusive or discrepant with clinical findings.
Cardiac Catheterization – Contraindications

Class III
1. Cardiac catheterization for hemodynamic measurements is not recommended for the assessment of severity of AS before AVR when noninvasive tests are adequate and concordant with clinical findings

Exercise Testing Guidelines

- Exercise testing in asymptomatic patients with AS may be considered to elicit exercise-induced symptoms and abnormal blood pressure responses

- Exercise testing should not be performed in symptomatic patients with AS

Aortic Stenosis in Elderly

Diagnosis

Low Flow – Low Gradient AS

Low Flow - Low Gradient Severe AS

- e.g. Mean PG < 35 mmHg, LVEF < 35%

Dobutamine Response:

- Mean Gradient
- Dimensionless Index
- AV Resistance

Low Cardiac Output / Low Gradient AS: Two Patient Types

Severe AS with Elevated Afterload

Mild/Moderate AS with Low Contractile Function

Low Gradient (<30mm Hg)

Decreased Ejection Fraction

Low Stroke Volume

Low Calculated EOA

Likely To Benefit From Surgery

Unlikely To Benefit From Surgery

Dobutamine Response

AS Severity | Contractility | Flow | Gradient | AV Area
--- | --- | --- | --- | ---
Severe AS | Increase | Increase | Increase | Unchanged
Mid or Mod. AS | Increase | Increase | Might Increase | Increase
End Stage CMV | Unchanged | Unchanged | Unchanged | Unchanged
**Aortic Stenosis in Elderly**

**Comorbidities**
- CAD
- Hypertension
- COPD
- Diabetes
- Nephropathy
- PVD / Carotid Disease
- Aortic Atheroma
- Aortic Aneurysm
- Malignancy

**Surgical Management**
- Operative Mortality
- Complications
- Bioprosthetic vs Mechanical AVR
- “Long-term” Results

**Aortic Stenosis in Elderly**

**Surgical Outcome**
- Comparison between patients < 70 years with those ≥ 70 years

**University of Toronto**
**Reported Experience - 1989**

- 469 PTS > 70 YEARS
- OP MORTALITY – 10%

Conclusion: Elderly patients in good risk categories should be offered surgical intervention for correction of valvular lesions.

**AVR in the Elderly**
**Operative Mortality**

<table>
<thead>
<tr>
<th>Study</th>
<th>Age</th>
<th>Number</th>
<th>w/CABG</th>
<th>Hosp Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milano</td>
<td>≥ 70</td>
<td>355</td>
<td>23</td>
<td>7.6%</td>
</tr>
<tr>
<td>et al. (1998)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salazar</td>
<td>≥ 70</td>
<td>117</td>
<td>20%</td>
<td>14.5%</td>
</tr>
<tr>
<td>et al. (2004)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sutcliffe</td>
<td>≥ 75</td>
<td>616</td>
<td>51%</td>
<td>9.6%</td>
</tr>
<tr>
<td>et al. (2006)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Mayo Clinic Reported Experience - 1996

- 322 patients ≥ 80 years
- Hospital mortality 13.7%

CONCLUSION: Higher mortality, but outlook excellent with normal expected survival.

AVR due to AS

<table>
<thead>
<tr>
<th>Procedures</th>
<th>Group A (≥70)</th>
<th>Group B (&lt;70)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total AVR</td>
<td>124</td>
<td>221</td>
</tr>
<tr>
<td>Isolated AVR</td>
<td>61 (49.2%)</td>
<td>55 (24.8%)</td>
</tr>
<tr>
<td>Assoc CABG</td>
<td>45 (36%)</td>
<td>151 (68.3%)</td>
</tr>
<tr>
<td>Assoc Maze Proc</td>
<td>8 (6.4%)</td>
<td>15 (6.8%)</td>
</tr>
<tr>
<td>Assoc MV Proc</td>
<td>11 (8.8%)</td>
<td>16 (7.2%)</td>
</tr>
</tbody>
</table>

Influence of Age

<table>
<thead>
<tr>
<th>Procedures</th>
<th>Group A (≥70)</th>
<th>Group B (&lt;70)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operative Deaths</td>
<td>3.2%</td>
<td>2.4%</td>
</tr>
<tr>
<td>Isolated AVR</td>
<td>55 (24.9%)</td>
<td>61 (49.2%)</td>
</tr>
<tr>
<td>Operative Deaths</td>
<td>0.9%</td>
<td>0%</td>
</tr>
<tr>
<td>AVR + Other Procedures</td>
<td>182</td>
<td>64</td>
</tr>
</tbody>
</table>

Influence of Gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>Group A (≥70)</th>
<th>Group B (&lt;70)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>141</td>
<td>80</td>
</tr>
<tr>
<td>Operative Deaths</td>
<td>2.8%</td>
<td>3.8%</td>
</tr>
<tr>
<td>Females</td>
<td>85</td>
<td>39</td>
</tr>
<tr>
<td>Operative Deaths</td>
<td>2.4%</td>
<td>2.6%</td>
</tr>
</tbody>
</table>

Complication Rates

<table>
<thead>
<tr>
<th>Complications</th>
<th>Group A (≥70) n=221</th>
<th>Group B (&lt;70) n=124</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renal Failure</td>
<td>5.4%</td>
<td>3.2%</td>
</tr>
<tr>
<td>Transient Stroke</td>
<td>4.1%</td>
<td>0.8%</td>
</tr>
<tr>
<td>Permanent Stroke</td>
<td>0.5%</td>
<td>1.6%</td>
</tr>
<tr>
<td>Atrial Fibrillation</td>
<td>22.6%</td>
<td>10.5%</td>
</tr>
<tr>
<td>Heart Block</td>
<td>2.7%</td>
<td>0.8%</td>
</tr>
<tr>
<td>Pulmonary Ventilation &gt;24 hrs</td>
<td>19%</td>
<td>12.1%</td>
</tr>
</tbody>
</table>

AVR in Patients ages 80-89
Early Reported Series - 1986

- 76 patients
- Aged 80-89 (mean 82)
- All functional class III or IV
- 38 had CABG – mortality 5.2%
- 15 Valve surgery – mortality 6.6%
- 23 Valve/CABG – mortality 30%
Surgery in Nonagenarians
Reported 1996
- 14 patients aged 90 or >
- 8 isolated CABG and 6 isolated AVR
- Hospital mortality – 7% (One AVR)
- Hospital morbidity – 71%

Conclusion: Cardiac surgery in carefully selected nonagenarians is justified and can be performed with acceptable results.

Samuels et al., J Card Surg 1996;11:121-127

AVR due to AS
Mortality Age 70 - 97 yrs old

<table>
<thead>
<tr>
<th></th>
<th>70 – 79 yrs old</th>
<th>80 – 89 yrs old</th>
<th>90 – 97 yrs old</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total AVR</td>
<td>129</td>
<td>88</td>
<td>4</td>
</tr>
<tr>
<td>Hospital Deaths</td>
<td>3 (2.3%)</td>
<td>4 (4.5%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

Aortic Stenosis in Elderly
Contraindications to Surgery
- CHF – FC IV
- Calcified Aorta
- Renal Failure
- Emphysema / COPD
- Active Malignancy
- Recent Stroke / CVA

How Old is Too Old?
“You know you are getting old when the candles cost more than the cake.”
Bob Hope, USA comedian and actor

How Old is Too Old?
“You know you’re getting old when all the names in your black book have M.D. after them.”
ARNOLD PALMER, USA professional golfer

CONCLUSIONS
- Heart valve surgery in the elderly can restore an excellent quality of life and a normal life expectancy.
CONCLUSIONS

• A patient should not be denied surgical intervention for valvular heart disease based solely on age.

Aortic Valve Disease
Case # 1

• 79 year old female
• Concentric LVH
• Valve gradient 120 mm
• Valve area 0.5
• Symptomatic – FC III
“No one is so old as to think he cannot live one more year.”

MARCUS TULLIUS CICERO
Roman statesman and scholar