Aortic Valve Stenosis

Postoperative Evaluation and Outcome Following Aortic Valve Replacement

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High Transprosthetic Gradient
Case presentation

- Female, 78 yrs
- Aortic valve replacement (19mm Carbomedics bileaflet valve)
- COPD, Hypertension
- Routine visit 14 years after surgery
- NYHA functional class II, no angina
- Physical exam: 149cm, 56 kg, BSA 1.5 cm²/m²
  BP 150/70 mmHg
  Systolic murmur, normal clicks
- Laboratory: Hct 32%, Hb 11.2 mg/dl
High Transprosthetic Gradient
Case presentation: Echocardiography
High Transprosthetic Gradient

Case presentation: Echocardiography

CW-Doppler: aortic valve

Doppler: aortic regurgitation
High Transprosthetic Gradient

Case presentation: Echocardiography

- Normal LV size and function, LVH, diast. dysf.
- Prosthetic aortic valve:
  - peak gradient 77 mmHg
  - mean gradient 45 mmHg
  - moderate aortic regurgitation (paravalvular)
    (color, PHT 380m, desc. ao retrogr. flow +/-)
- Mild mitral regurgitation
- Syst. PAP 38 mmHg
High Transprosthetic Gradient

Interpretation of echo data?

1. High echo gradient in a normally functioning mechanical valve
2. Prosthetic valve stenosis
High Transprosthetic Gradient

High transprosth gradient: Systematic workup

- Look at baseline echo data:
  Was there a progression of the gradient?
  (information not available)

- Search for normal values in the literature:
  Find out about normal Doppler values according to valve type and size

- Fluoroscopy:
  Exclude thrombotic obstruction

- TEE:
  Suspicion for thrombus or pannus
# Normal Doppler Values

## Carbomedics Bileaflet Aortic Valves

<table>
<thead>
<tr>
<th>Size</th>
<th>N</th>
<th>Peak Velocity (m/s)</th>
<th>Peak Gradient (mmHg)</th>
<th>Mean Gradient (mmHg)</th>
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<tbody>
<tr>
<td>19 mm</td>
<td>63</td>
<td>3.1 ± 0.4</td>
<td>33 ± 11</td>
<td>17 ± 5</td>
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<tr>
<td>21 mm</td>
<td>111</td>
<td>2.6 ± 0.5</td>
<td>26 ± 10</td>
<td>13 ± 5</td>
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<tr>
<td>23 mm</td>
<td>120</td>
<td>2.4 ± 0.4</td>
<td>25 ± 7</td>
<td>11 ± 4</td>
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<tr>
<td>25 mm</td>
<td>103</td>
<td>2.3 ± 0.3</td>
<td>20 ± 9</td>
<td>9 ± 5</td>
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<tr>
<td>27 mm</td>
<td>57</td>
<td>2.2 ± 0.6</td>
<td>19 ± 7</td>
<td>8 ± 3</td>
</tr>
</tbody>
</table>

19 mm ± 2 SD: 1.6 to 3.9, 11 to 55, 7 to 27

**Normal Values for Doppler Echocardiographic Assessment of Heart Valve Prosthesis.**

High Transprosthetic Gradient
Differential Diagnosis

- Prosthetic valve stenosis
  - valve thrombosis
  - pannus
- High flow rate
  - aortic regurgitation
  - high cardiac output
  - anemia
- Localized gradients / Pressure recovery
- Patient Prosthesis Mismatch
High Transprosthetic Gradient
Fluoroscopy
High Transprosthetic Gradient

Catheterization (not at our request - previously performed)

mean Gradient:
Catheter: 26 mmHg
Doppler: 45 mmHg
High Transprosthetic Gradient
Localized Gradient and Pressure Recovery
“Patient Prosthesis Mismatch is defined as an effective orifice area of the implanted prosthesis that is smaller than that of a normal human valve.”

Rahimtoola, Circulation. 1978;58:20-24
Patient Prosthesis Mismatch

When is a prosthesis too small?

- **Patient Prosthesis Mismatch**
  - $\text{iEOA} < 0.80$ to $0.85$ cm$^2$/m$^2$

- **Severe Mismatch**
  - $\text{iEOA} < 0.6$ cm$^2$/m$^2$

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*Pibarot et al., J Am Coll Cardiol. 2000;36: 1131-1141*
Elevated gradient due to a combination of:

1. High flow rate
   - moderate aortic regurgitation
   - anemia

2. Small valve size: Patient Prosthesis Mismatch

3. Localized gradients

4. Pressure recovery
High Transprosthetic Gradient

Management

The patient was managed conservatively

- 78 years old patient with good quality of life
- Stable NYHA II (presence of COPD)
- Only mild hemolytic anemia
- High operative risk
- Possibility of implantation of a larger valve improbable
Prosthetic Aortic Valve Evaluation
Valve Regurgitation
Prosthetic Aortic Valve Evaluation
Sutureless Valve Dislocation
Prosthetic Aortic Valve Evaluation

Sutureless Valve - Leaflet Flutter
AVR Postoperative Evaluation

Summary

- Assessment of Ventricular Function
- Assess Valve Function
- Record Baseline Hemodynamic Parameters
- Assess Valve Regurgitation Valvular/Paravalvular
- Diagnosis of Endocarditis and Associated Complications
- Differential Diagnosis of High Transprosthetic Gradients
  - Valve Obstruction / Degeneration
  - Patient-Prosthesis Mismatch
  - High Flow State
  - Pressure Recovery
- Complementarity of TTE and TEE
Aortic Valve Replacement

Survival

Hammermeister K et al. J Am Coll Cardiol 2000;36:1152-1158
Aortic Valve Replacement

Complications - Reoperations

Complications*

- bleeding, endocarditis, systemic embolism, nonthrombotic valve obstruction, valvular regurgitation or valve thrombosis

Reoperations

* bleeding, endocarditis, systemic embolism, nonthrombotic valve obstruction, valvular regurgitation or valve thrombosis

Hammermeister K et al. J Am Coll Cardiol 2000;36:1152-1158
Aortic Valve Replacement
Survival in Elderly Patients

Likosky D S et al. Circulation 2009;120:S127-S133
Partner Trial: High-Risk Patients

Mortality: TAVI vs Aortic Valve Surgery

Hazard ratio, 0.93 (95% CI, 0.71–1.22)
P = 0.62

SOURCE Registry (TAVI)
Cause of Late Deaths (30 days to 1 year) n=179/1038
## Life Expectancy in Years

### Europe and US

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<th>Age</th>
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<td></td>
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<td>2.3</td>
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</tbody>
</table>

**Eurostat.** European Commission. Life Expectancy by Sex and Age. Queries for Survival performed for the year 2007 for the European Union (27 countries)


**Rosenhek, R. et al., Eur Heart J 2011**

ESC Working Group on Valvular Heart Disease Position Paper. Assessing the Risk of Interventions in Patients with Valvular Heart Disease
Risk Assessment
The High-Risk Patient

- Patient Preferences
- Natural Disease History
- Risk of Intervention
  - Long-term postprocedural outcome
  - Risk Scores?
- Individualized Risk Assessment
- Life Expectancy
- Team Approach

Timing and Choice of Procedure

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