Dobutamine Stress testing
In Low Flow, Low EF, Low Gradient Aortic Stenosis
Case Studies

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Flow dependence of Velocity, Gradients, & Valve Motion/Orifice

\[ \Delta P \approx 4 \left(V_2^2 - V_1^2\right) \]
### Aortic Stenosis

**AHA & ACC Guidelines**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jet velocity</td>
<td>&lt; 3.0 m/s</td>
<td>3.0 – 4.0</td>
<td>&gt; 4.0 m/s</td>
</tr>
<tr>
<td>Mean gradient</td>
<td>&lt; 25 mmHg</td>
<td>25 – 40</td>
<td>&gt; 40 mmHg</td>
</tr>
<tr>
<td>Valve area</td>
<td>&gt; 1.5 cm²</td>
<td>1.0 – 1.5</td>
<td>&lt; 1.0 cm²</td>
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</table>

In Normal or High flow Conditions (SV > 35 mL/m²)

Nishimura R. et al. JACC 2014

#### Low Flow, Low EF, “Severe AS”

*Is It?*

![Echocardiogram Images](image1)

- **LVOT TVI 16 cm**
- **SV 45 ml**
- **Peak V 2.7 m/s**
- **Mean Gr 30 mmHg**
- **AVA 0.7 cm²**
Dobutamine Stress ECHO Protocol in Low Flow, Low EF, Severe AS

Starting dobutamine dose of 2.5 to 5 mcg/kg/min

\[ \downarrow \]

Increase dose 2.5 to 5 mcg/kg/min every 3-5 minutes

Maximum dobutamine dose of 20 mcg/kg/min

Infusion stopped when:

1) Maximum dobutamine dose reached (20 mcg/kg/min)
2) Positive result obtained
3) Heart rate rises 10-20 bpm over baseline or exceeds 100 bpm
4) Symptoms, blood pressure fall, or significant arrhythmias


Dobutamine Stress ECHO Protocol

3 types of responses

<table>
<thead>
<tr>
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<th>AVA</th>
<th>Implication</th>
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<tr>
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</tr>
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<td>↑</td>
<td>─</td>
<td>↑</td>
<td>AS not severe</td>
</tr>
<tr>
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<td>Severe CM / ?Severe AS</td>
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Case 1

Clinical Presentation

• 87 yo male with CAD s/p CABG, aortic stenosis, systolic HF EF 30-35%, HTN, DM, CKD III, TIA, paroxysmal AF presents with dyspnea and decompensated HF, NYHA III

• Exam: 124/59, HR 63, BMI 23 kg/m2
  – CV: RRR, +S3, II/VI SEM LSB

Echocardiogram

Vitals: BP 112/56 mmHg, HR 71 bpm
Dobutamine Stress ECHO

Parasternal

Apical 4 – Chamber

Baseline LVEF 30-34%
Peak LVEF 35-39%

Dobutamine Stress ECHO

2 – Chamber

Short Axis
Clinical Presentation
86 yo M with CAD s/p CABG, aortic stenosis, systolic HF EF 25% s/p CRT-D, COPD presents with dyspnea, NYHA IV

- Exam: 108/51, HR 79, 3L O2 93%, BMI 21 kg/m2
  - CV: RRR, II/VI systolic murmur RUSB, +JVD (12 cm), decreased breath sounds, 1+ edema
Echocardiogram

Parasternal

Short Axis – Aortic Valve

LVOT 2.2 cm

Vitals: BP 100/53 mmHg, HR 85 bpm

Dobutamine Stress ECHO

Parasternal

Apical 4 – Chamber
Baseline LVEF 25-29%
Peak LVEF 30-34%

Consistent with pseudo-severe aortic stenosis
Mild aortic stenosis
Case 3

Clinical Presentation
78 yo M with CAD, aortic stenosis, systolic HF EF 40%, COPD, CKD presents with dyspnea, NYHA III
• Exam: 127/51, HR 70, BMI 21 kg/m2
  – CV: RRR, II/VI systolic murmur RUSB, +wheezing, 2+ edema, +JVD

Echocardiogram

Parasternal

Short Axis – Aortic Valve

Vitals: BP 166/71 mmHg, HR 59 bpm
Dobutamine Stress ECHO

Parasternal

Apical 4 – Chamber

Dobutamine Stress ECHO

2 – Chamber

Short Axis

Baseline LVEF 40-44%
Peak LVEF 50-54%
Doppler

Baseline

Peak Dobutamine

Consistent with moderate aortic stenosis

75M with AS & NYHA Class III Heart Failure
Is DSE Needed?

SV = 40 ml
Mn Gr = 46 mmHg
AVA = 0.40 cm²
• 72 yr old man with NYHA class III heart failure
• Systolic ejection murmur
• The aortic valve was calcified
• LV dilated with an EF of 20%.

72M With Class III Heart Failure

Peak V = 2.2m/s  
Mean Grad = 11mmHg  
SV = 32 ml  
AVA = 32/47 = 0.69cm²
72M With Class III Heart Failure

Dobutamine infusion at 20mcg/kg/min

**Pulsed Doppler- LVO**

TVI = 10.8

**CW Aortic Valve**

Peak V = 2.8 m/s
Mean Grad = 14 mmHg
SV = 35 ml
AVA = 35/52 = 0.69 cm²

**Baseline**

Peak V = 2.2 m/s
Mean Grad = 11 mmHg
SV = 32 ml
AVA = 32/47 = 0.69 cm²

**Dobutamine**

Peak V = 2.8 m/s
Mean Grad = 14 mmHg
SV = 35 ml
AVA = 35/52 = 0.69 cm²
Dobutamine Echo in AS with Depressed LVEF & Low Gradient

3 types of responses

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Low Flow, Low EF, Low Gradient
Severe AS

Low Flow Low Gradient Severe AS
MG < 40 mmHg, AVA < 1 cm², LVEF < 50%, SV < 35 ml/m²

Low Dose Dobutamine Stress Echo

- MGr ≥ 40 mmHg
- MGr < 40 mmHg & AVA ≤ 1 cm²
- MGr < 40 mmHg & AVA > 1 cm²

Assess Δ in flow/Gr/AVA
Is SV still reduced?
How close to “cutoff” of Severe AS?
Contour of AS Jet
Ca Score of AV (1200 W, 2000 M)

True Severe AS
Pseudo Severe AS