Low Flow-Low Gradient Severe Aortic Stenosis: Fact or Fiction
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Nothing to disclose

2014 AHA/ACC Guideline for the Management of Patients With Valvular Heart Disease

Stages of Valvular AS

Nishimura RA, et al. JACC 2014

Low Gradient - Severe AS

• With low EF and low output - challenges:
  1. Differentiating severe AS from mild AS with systolic HF caused by another etiology
  2. Deciding whether AVR is an appropriate therapy

• With normal EF - challenges
  1. Is it real or artifactual?
  2. How should patients be treated?
58M with dyspnea, AS murmur and EF 33%

Apical

Right Parasternal

Windows for Recording AS Velocity

72M With Class III Heart Failure

Peak V = 2.2m/s
Mean Grad = 11mmHg

AVA = 3.14 x (10.3/47) = 32/47 = 0.69cm²

Surgery: YES NO

75M with AS and NYHA Class III heart failure
Low Flow- Low Gradient  AS

Class IIa

Low-dose dobutamine stress testing using echocardiographic or invasive hemodynamic measurements is reasonable in patients with symptomatic low-flow/low-gradient severe AS with reduced LVEF and with all of the following (Level of Evidence: B):

- a. Calcified aortic valve with reduced systolic opening;
- b. LVEF less than 50%;
- c. Calculated valve area 1.0 cm2 or less; and
- d. Aortic velocity less than 4.0 m per second or mean pressure gradient less than 40 mm Hg.

Positive response: 20% increase in SV and mean gradient

Nishimura RA, et al. JACC 2014
Rest Dobutamine 20mcg/kg/min

Peak velocity = 3m/s
Mean gradient = 23mmHg
Stroke volume = 39ml
AVA = 0.70cm²

Peak velocity = 4.5m/s
Mean gradient = 49mmHg
Stroke volume = 84ml
AVA = 0.90cm²

Low-gradient AS: operative risk stratification and predictors for long-term outcome: a multicenter study using dobutamine stress hemodynamics

<table>
<thead>
<tr>
<th>Group I (n=92)</th>
<th>Group II (n=44)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SV response</td>
<td>33% (26-46)*</td>
</tr>
<tr>
<td>EF response</td>
<td>12% (7-15)*</td>
</tr>
<tr>
<td>Mean PG response</td>
<td>47% (21-56)*</td>
</tr>
<tr>
<td>AVA response</td>
<td>0.1 (0.1-0.2)*</td>
</tr>
</tbody>
</table>

* Significant change


Class IIa
3. AVR is reasonable in symptomatic patients with low-flow/low-gradient severe AS with reduced LVEF (stage D2) with a (43, 141, 142), (Level of Evidence: B):
   a. Calcified aortic valve with reduced systolic opening;
   b. Resting valve area 1.0 cm² or less;
   c. Aortic velocity less than 4 m per second or mean pressure gradient less than 40 mm Hg;
   d. LVEF less than 50%; and
   e. A low-dose dobutamine stress study that shows an aortic velocity 4 m per second or greater or mean pressure gradient 40 mm Hg or higher with a valve area 1.0 cm² or less at any dobutamine dose.

What do we do with patients who do not show contracts reserve?

Nishimura RA, et al. JACC 2014

67M with AS murmur and NYHA Class III heart failure

Patient Survival (%)

Follow-up (months)

Survival in Severe AS Patients with Low Flow/Low gradient and Poor Contractile Reserve (EF <40, mean 28%)

Comparison of Outcome of Higher Versus Lower Transvalvular Gradients in Patients With Severe Aortic Stenosis and Low (<40%) LVEF

Ben-Dor I, et al. Am J Cardiol 2012

Total Group: n = 81
Matched Group: n = 42

18

Comparison of Outcome of Higher Versus Lower Transvalvular Gradients in Patients With Severe Aortic Stenosis and Low (<40%) LVEF

Ben-Dor I, et al. Am J Cardiol 2012

N = 270

TAVR is not approved for patients with low gradients
Low Gradient - Severe AS

• With low EF and low output - challenges:
  1. Differentiating severe AS from mild AS with systolic HF caused by another etiology
  2. Deciding whether AVR is an appropriate therapy

• With normal EF - challenges
  1. Is it real or artifactual?
  2. How should patients be treated?

Low Gradient- Severe Aortic Stenosis With Preserved EF

MeanGr < 40 mmHg (or Pk Vel < 4 m/s), and AVA < 1 cm²

• Problems with current definition of Severe AS (valve area < 1 cm²).
• Errors of calculation
  – Falsely low SV: error in LVOTd measurement or PW sampling
  – Falsely low gradient: non-parallel CW alignment
• Low Stroke Volume (Small LV with Normal EF)
  – How serious is it?

Contrast Echocardiography

75M with a murmur of Aortic Stenosis
### Aortic Stenosis

**AHA & ACC Guidelines**

<table>
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<tr>
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<th>Moderate</th>
<th>Severe</th>
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<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 cm$^2$</td>
<td>1.0 – 1.5</td>
<td>&lt; 1.0 cm$^2$</td>
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Bonow R. et al. JACC, 2006

**Proposed Aortic Stenosis Criteria**

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<td>&gt; 1.5 cm$^2$</td>
<td>0.9 – 1.5</td>
<td>≤ 0.8 cm$^2$</td>
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Currently used in The PARTNER and CORE Valve trials

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**Low Gradient- Severe Aortic Stenosis With Preserved EF**

- Problems with current definition of Severe AS (valve area < 1 cm$^2$).
- Errors of calculation
  - Falsely low SV: error in LVOTd measurement or PW sampling
  - Falsely low gradient: non-parallel CW alignment
- Low Stroke Volume (Small LV with Normal EF)
  - How serious is it?
Low flow, Low Gradient
Severe AS with Normal LVEF

• Retrospective Study
• Several Co-morbidities
• HTN in 74%
• Conc LVH
• 30-50% of pts had mean gradient < 30mmHg

Prognosis of Asymptomatic AS
With Normal LVEF

Jander et al. Circ 2011

Otto et al. Circ 1997

Zoghbi Circulation 123: 838, 2011

Outcome of Patients With Aortic Stenosis,
Small Valve Area, and Low-Flow, Low-Gradient
Despite Preserved LVEF

Clavel MA, et al. JACC 2012

187pts LFAS matched to 187 pts with HGAS and 187 with Mod AS

Outcome of Patients With AS, Small Valve Area,
and Low-Flow, Low-Gradient Despite Preserved LVEF

C

D

187pts LFAS matched to 187 pts with HGAS and 187 with Mod AS
Class IIa
AVR is reasonable in symptomatic patients with low-flow/low-gradient severe AS (stage D3) with an LVEF 50% or greater, a calcified aortic valve with significantly reduced leaflet motion, and a valve area 1.0 cm² or less only if clinical, hemodynamic, and anatomic data support valve obstruction as the most likely cause of symptoms and data recorded when the patient is normotensive (systolic BP <140 mm Hg) indicate (Level of Evidence: C):

a. An aortic velocity less than 4 m per second or mean pressure gradient less than 40 mmHg; and
b. A stroke volume index less than 35 mL/m²; and

c. An indexed valve area 0.6 cm²/m² or less.

Nishimura RA, et al. JACC 2014