Aortic Valvular Stenosis, Symptomatic, Severe, Low Flow/Low Gradient, Age 60 Years
From Medical Therapy, to Surgical AVR, To Transcatheter AVR/Valvuloplasty

The Interventionalist’s View

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Zena and Michael a Weiner Professor of Medicine
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Low Flow/Low Gradient Severe AS Defined by a Stroke Volume Index (SVI) <35 mL/m$^2$ / AVG <40mmHg with Low EF (<50%) or Normal EF

SVI: cardiac output/heart rate X body surface area
Algorithm for the Assessment of Stenosis Severity and the Management of Classical (low LVEF) LF-LG AS

CLASSICAL LOW-FLOW LOW-GRADIENT AS
AVA<1.0 cm², AVAi<0.6 cm²/m², MG<40 mmHg, LVEF<50%

Dobutamine-Stress Echo

↑ SV ≥ 20%

Flow Reserve

 ΔP≥40, AVA≤1.0
True-Severe AS
Surgical/Transcatheter AVR

ΔP<40, AVA>1.0
Pseudo-Severe AS
HF Therapy

Flow Reserve

↑ SV < 20%

AS Severity: Indeterminate
MDCT: AoV Ca Score
♀ >1200, ♂ >2000

Yes
True-Severe AS
Surgical/Transcatheter AVR

No

Surgical/Transcatheter AVR
Algorithm for the Assessment of Stenosis Severity and the Management of Paradoxical (normal LVEF) LF-LG AS

PARADOXICAL LOW-FLOW LOW-GRADIENT AS
AVAI<1.0 cm²  AVAI<0.6 cm²/m²  MG<40 mmHg
LVEF>50%  SVI<35 ml/m²

STEP #1
Measurement Error?
- No
- Corroborate measurement of SV, AVA, MG by other methods

STEP #2
Symptoms?
- Yes
- Close Follow-up + Exercise Testing
- No or equivocal

Anti-hypertensive Therapy
- Yes

STEP #3
Hypertension?
- Yes
- Pseudo-Severe
- No

Rule out pseudo-severe AS:
- AoV Calcium by MDCT
- Dobutamine Stress Echo

STEP #4
Stenosis Severity?
- True-Severe

Consider Surgical or Transcatheter AVR
Mortality to 2 Yrs of Pts with Severe Symptomatic AS and LF in the PARTNER Trials Stratified by Treatment Received
Impact of Low Flow on the Outcome of High-Risk Patients Undergoing Transcatheter Aortic Valve Replacement

Florent Le Ven, MD,* Mélanie Freeman, MD,† John Webb, MD,† Marie-Annick Clavel, DVM, PhD,* Miriam Wheeler, MD,† Éric Dumont, MD,* Chris Thompson, MD,† Robert De Larochellière, MD,* Robert Moss, MD,† Daniel Doyle, MD,* Henrique B. Ribeiro, MD,* Marina Urena, MD,* Luis Nombela-Franco, MD,* Josep Rodés-Cabau, MD,* Philippe Pibarot, DVM, PhD*
CLINICAL RESEARCH

Impact of Low Flow on the Outcome of High-Risk Patients Undergoing Transcatheter Aortic Valve Replacement

30-day Mortality (%)

Overall $p = 0.15$

$NF$ vs $LF$ $p = 0.01$

<table>
<thead>
<tr>
<th>Group</th>
<th>0-30 Days Mortality</th>
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<tbody>
<tr>
<td>NF-HG</td>
<td>6%</td>
</tr>
<tr>
<td>NF-LG</td>
<td>5%</td>
</tr>
<tr>
<td>LF-HG</td>
<td>12%</td>
</tr>
<tr>
<td>LF-LG-NEF</td>
<td>9%</td>
</tr>
<tr>
<td>LF-LG-LEF</td>
<td>12%</td>
</tr>
</tbody>
</table>

Patients at risk:
- NF-HG: 195
- NF-LG: 110
- LF-HG: 158
- LF-LG-NEF: 86
- LF-LG-LEF: 90

All-cause mortality (%)

$p = 0.002$

Patients at risk:
- NF-HG: 195
- NF-LG: 110
- LF-HG: 158
- LF-LG-NEF: 86
- LF-LG-LEF: 90
Outcome and Impact of Aortic Valve Replacement in Patients With Preserved LVEF and Low-Gradient Aortic Stenosis

Victor Dayan, MD, PhD,* Gustavo Vignolo, MD,* Julien Magne, PhD,† Marie-Annick Clavel, DVM, PhD,‡ Dania Mohty, MD,† Philippe Pibarot, DVM, PhD‡
Outcome and Impact of Aortic Valve Replacement in the Different Subtypes of Flow/Gradient Aortic Stenosis

Mortality According to Subtypes of Aortic Stenosis

<table>
<thead>
<tr>
<th>Subtype Comparison</th>
<th>Odds Ratio</th>
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<tbody>
<tr>
<td>LF-LG vs HG AS</td>
<td></td>
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<tr>
<td>NF-LG vs HG AS</td>
<td></td>
</tr>
<tr>
<td>LF-LG vs NF-LG AS</td>
<td></td>
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<tr>
<td>LF-LG vs MAS</td>
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Mortality According to Type of Treatment

<table>
<thead>
<tr>
<th>Type of Treatment</th>
<th>Odds Ratio</th>
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<tbody>
<tr>
<td>LF-LG AS</td>
<td></td>
</tr>
<tr>
<td>NF-LG AS</td>
<td></td>
</tr>
<tr>
<td>LG AS</td>
<td></td>
</tr>
<tr>
<td>HG AS</td>
<td></td>
</tr>
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</table>

Dayan et al., J Am Coll Cardiol 2015;66:2594
Outcome and Impact of Aortic Valve Replacement in Patients With Preserved LVEF and Low-Gradient Aortic Stenosis

CONCLUSIONS Patients with paradoxical LF-LG AS and NF-LG AS have increased risk of mortality compared with other subtypes of AS with preserved left ventricular ejection fraction, and improved outcome with AVR. (J Am Coll Cardiol 2015;66:2594-603) © 2015 by the American College of Cardiology Foundation.
# Guidelines Recommendations for AVR in Low-Flow, Low-Gradient AS

<table>
<thead>
<tr>
<th>Recommendation for AVR</th>
<th>Class</th>
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<tbody>
<tr>
<td><strong>CLASSICAL LF-LG (D2 Stage)</strong> AVR is reasonable in symptomatic patients with low LVEF, low-flow/low-gradient severe AS with a DSE that shows a mean gradient $\geq$ 40 mm Hg with an AVA $\leq$ 1.0 cm$^2$ at any dobutamine dose</td>
<td>IIa</td>
</tr>
<tr>
<td><strong>PARADOXICAL LF-LG (D3 Stage)</strong> AVR is reasonable in symptomatic patients who have low-flow, low-gradient severe AS who are normotensive and have an LVEF $\geq$ 50% if clinical, hemodynamic, and anatomic data support valve obstruction as the most likely cause of symptoms</td>
<td>IIa</td>
</tr>
</tbody>
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*Nishimura et al., J Am Coll Cardiol 2014;63:2438*