

## Stress Echocardiography in Aortic Valve Disease

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## AS - the magnitude

- One out of four over 65 have AV sclerosis
- 4% over 75 have A.S.
- One out of 6 with AV sclerosis develops AS
- 2.5% of patients with AV sclerosis will develop severe AS at 8 years
- 1/2 of patients with mild to moderate AS develop severe AS



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## Stress testing In Severe AS

- Symptomatic Severe AS
- Asymptomatic Severe AS
- Low flow, low EF, Severe AS
- Low flow, normal EF, Severe AS



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### Aortic Stenosis a Progressive Disease

#### Severity of Disease

	Mild AS	Moderate AS	Severe AS
peak Velocity *	2.5 - 3.0 m/s	3.0 - 4.0 m/s	> 4.0 m/s
mean Gradient *	< 25 mmHg	> 40	> 50 mmHg
Valve Area	> 1.5 cm <sup>2</sup>		< 1.0 cm <sup>2</sup>

ACC/AHA    ESC

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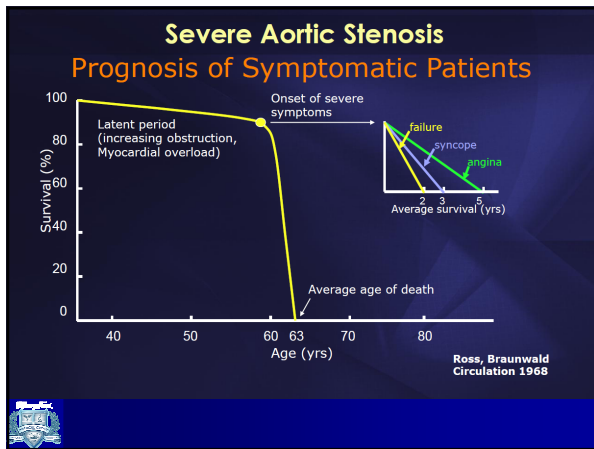
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**PRACTICE GUIDELINE**

### 2008 Focused Update Incorporated Into the ACC/AHA 2006 Guidelines for the Management of Patients With Valvular Heart Disease

**CLASS I**

1. AVR is indicated for symptomatic patients with severe AS.\* (Level of Evidence: B)
2. AVR is indicated for patients with severe AS\* undergoing coronary artery bypass graft surgery (CABG). (Level of Evidence: C)
3. AVR is indicated for patients with severe AS\* undergoing surgery on the aorta or other heart valves. (Level of Evidence: C)
4. AVR is recommended for patients with severe AS\* and LV systolic dysfunction (ejection fraction less than 0.50). (Level of Evidence: C)

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**PRACTICE GUIDELINE**

**2008 Focused Update Incorporated Into the ACC/AHA 2006 Guidelines for the Management of Patients With Valvular Heart Disease**

**CLASS III**  
 1. Exercise testing should not be performed in symptomatic patients with AS. (Level of Evidence: B)

• CLASS III: Conditions for which there is evidence and/or general agreement that the procedure/treatment is not useful/effective and in some cases may be harmful




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**Severe Asymptomatic AS- the magnitude**

- ▣ One out of four over 65 have A. sclerosis
- ▣ 4% over 75 have A. S.
- ▣ One out of 6 with A. sclerosis develops AS
- ▣ 1/2 of patients with mild to moderate AS develop severe AS
- **Every third to every second patient is asymptomatic**




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**Severe Asymptomatic AS- Its complicated**

- ▣ One out of four over 65 have A. sclerosis
- ▣ 4% over 75 have A. S.
- ▣ One out of 6 with A. sclerosis develops AS
- ▣ 1/2 of patients with mild to moderate AS develop severe AS
- **Every third to every second patient is asymptomatic**
- **Risk for SCD**
- **Risk for irreversible myocardial damage**
- **"Its hard to make an asymptomatic patient feel better"**




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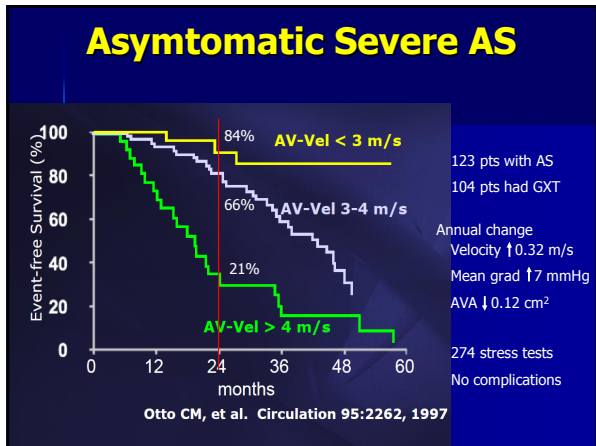
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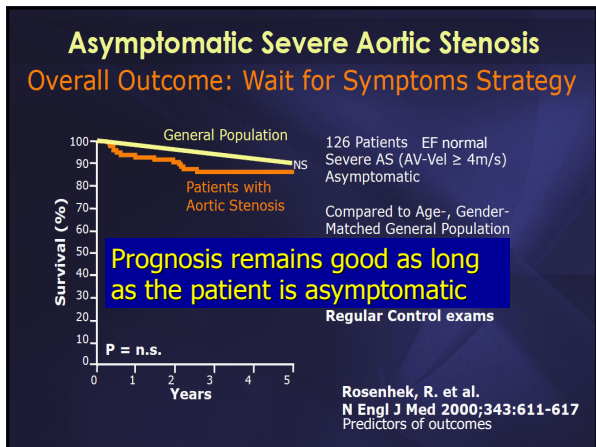
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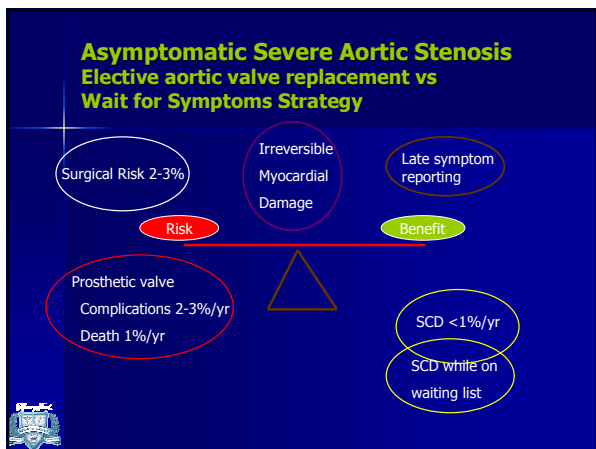
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## Severe: Presymptomatic

- 3-4% Mortality soon after onset of Sx
- 7% Mortality while on surgical waiting list
- 12% Mortality before surgery can be performed
- 1-2% OP mortality for AVR
- Push to identify the high risk presymptomatic patient



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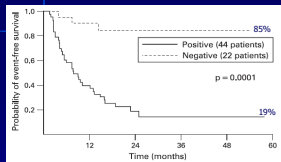
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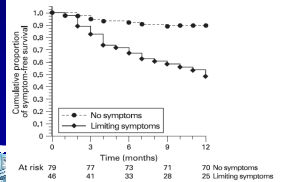
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## Exercise-Testing in Asymptomatic Severe AS



Amato et al Heart 2001 Brazil  
66 patients with AVA < 1.0 cm<sup>2</sup>  
Asymptomatic, No arrhythmia  
Symptoms (CP, Presyncope)  
BP increase <20 mmHg  
ST depression > 2 mm  
Only 50% of the 66 patients were event free (Sx, SCD) at 16 months



Das et al , Eur Heart J 2005 - London  
125 patients with EOA <1.4cm<sup>2</sup>  
Modified Bruce Protocol  
55% positive predictive accuracy  
83% with dizziness  
79% if age <70

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## Stress-Testing

- Morbidity 0.0005%
- Mortality 0.00004%
- Modified Bruce, Ellestadt
- Symptom limited
- Stop if BP drops >10 - 20 mmHg
- Stop if ST depression >5 mm
- More than 3 consecutive PVCs



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**PRACTICE GUIDELINE**

**2008 Focused Update Incorporated Into the ACC/AHA 2006 Guidelines for the Management of Patients With Valvular Heart Disease**

**CLASS IIb**  
 1. Exercise testing in asymptomatic patients with AS may be considered to elicit exercise-induced symptoms and abnormal blood pressure responses. (*Level of Evidence: B*)

**CLASS IIb:** Usefulness/efficacy is less well established by evidence/opinion.

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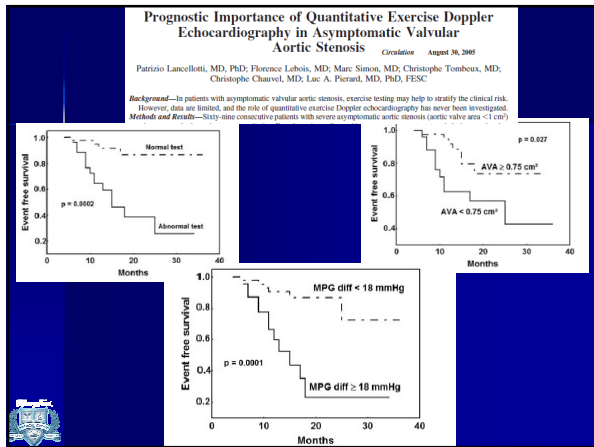
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**Severe LV dysfunction with AS**

- LV dysfunction = Reduced cardiac output = Reduced velocity
  - Decreased velocity
  - EF <40%
  - Pressure gradient < 30 – 40 mmHg
- Two diagnostic possibilities:
  - True anatomically severe AS
  - Pseudosevere AS with heavy Ca<sup>++</sup> and cardiomyopathy
- Can be difficult to differentiate

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## AS with EF <35%

- Usually symptomatic – therefore exercise test is contraindicated
- EF <50% Class I indication in severe AS
- Operative mortality is higher (11 – 33%), but without surgery the mortality is even higher
- Even octogenarians with low EF have improved survival after AVR



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## AS with low gradient, low EF and low cardiac output

- Cannot use velocity to assess severity
  - Severe AS AVA  $\leq 0.75\text{cm}^2$ ,
  - Dimensionless index = LVOT/AoV TVI or V  $\leq 0.25$
- Consider use of low dose Dobutamine
- Severe AS will manifest an increase in gradient, change in valve area  $< 0.2\text{ cm}^2$  and dimensionless index  $< 0.25$ .
- Mild to moderate AS will manifest an increase in valve area and an increase in dimensionless index.
- Dobutamine provides evidence for contractile reserve if SV increases  $> 20\%$ .



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### PRACTICE GUIDELINE

#### 2008 Focused Update Incorporated Into the ACC/AHA 2006 Guidelines for the Management of Patients With Valvular Heart Disease

#### CLASS IIa

1. Dobutamine stress echocardiography is reasonable to evaluate patients with low-flow/low-gradient AS and LV dysfunction. (Level of Evidence: B)
2. Cardiac catheterization for hemodynamic measurements with infusion of dobutamine can be useful for evaluation of patients with low-flow/low-gradient AS and LV dysfunction. (Level of Evidence: C)



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## DSE in Low Flow Low Gradient AS and Normal Ejection Fraction

1. Increasingly recognized and challenging entity
2. EF  $\geq$  50% , low mean gradients  $<$  30 mm hg, AVA  $<$  1 sq cm
3. Low indexed stroke volume ,  $<$  35ml/sqm, small concentric remodelled ventricles
4. Important to rule out technical errors prior to making the diagnosis. Consider EOA projected, Zva, Energy Loss index
5. Role of Dobutamine challenge to increase CO to differentiate



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## Not ready for Prime Time

- Stenosis Severity
  - Stroke Work Loss =
  - Energy loss index (ELI)
  - Valve Resistance
- Effects of outflow obstruction on the LV
  - LV load
  - Mid wall meridional wall stress
- Ventricular vascular coupling
  - Valvulo-arterial impedance ( $Z_{va}$ )
- Systemic Vascular Resistance
- S' (LV systolic longitudinal velocity)
- AV Compliance
- Arterial compliance
- BNP



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Thank you



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