Stress Echocardiography and Valvular Heart Disease

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DISCLOSURE

Relevant Financial Relationship(s)
None

Off Label Usage
None
Objectives

- General indications
- Stress modalities
- Use in native valve disease
- Use in prosthetic heart disease

General Indications

1. Asymptomatic severe valve disease
2. Symptoms with non-severe valve disease
3. Valve disease with LV dysfunction
### Stress Modalities

<table>
<thead>
<tr>
<th>Stress Level</th>
<th>Exercise Only</th>
<th>Exercise or Dobutamine</th>
<th>Dobutamine Only</th>
</tr>
</thead>
</table>
| **Symptomatic** | • Nonsevere MR  
• Mild MR (CABG)  
• Nonsevere AI | **Symptomatic**  
• Pulmonary edema  
• Nonsevere MS  
• Nonsevere AS  
• Paradoxical low-flow AS  
• Equivocal PPM | |  
| **Asymptomatic** | • Severe MR  
• Severe MS  
• Severe AS  
• Severe AI | **Asymptomatic**  
• Moderate MS | |  
| Low EF | | | Low EF  
• LFLG AS  
• Low flow AV prosthesis |

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### ETT vs Bicycle

- **Treadmill only pre and post images**
- **Supine bike: continuous imaging; protocol: 0, 25, 50, 100 Watts**
- **Predicted max workload (healthy subjects): 2.5 W/kg (women); 3W/kg (men)- 10% for every decade above 30**
Asymptomatic Severe Disease

Meta-Analysis of Prognostic Value of Stress Testing in Patients

Meta-Analysis of Prognostic Value of Stress Testing in Asymptomatic AS

AJC 2009;104:972

- N= 491 (50-79 years old)
- Safe
- Negative test: No SCD; 21 % adverse cardiac events (11-36 months)
- Positive test: 5% SCD; 66% adverse cardiac events
Important echo findings

• New regional WMA’s
• Decrease in LVEF
• Poor prognosis: gradient increases > 18-20 mmHg
• PAP >60 mmHg

Case

• 64 year old male: known heart murmur for 20 years
• Hypertension and hyperlipidemia
• NYHA Class I: walks 30-40 minutes daily with no symptoms
• Needs a TURP
Septum 15 mm Posterior wall 13 mm
EF 72%

Peak velocity: 4.2 m/s
Mean gradient: 43 mmHg
AVA: 1 cm²
Indexed AVA: 0.51 cm²/m²
Stress Echo

- Bruce protocol: 6.29 min:sec
- 83% FAC. No symptoms
- BP 128/84 mmHg (rest); 160/70 mmHg (peak)
- 85% maximal predicted HR
- 7.5 METS; double product: 26240
- Stress ECG: 1 mm downsloping inferior ST segment depression
Mean gradient: 54 mmHg

What to advise?

1. AVR before TURP
2. TURP then AVR
3. Proceed cautiously with TURP
4. Proceed cautiously with TURP; then watchful waiting
ACC Guidelines: Ila

Moderate-risk elective noncardiac surgery with appropriate intraoperative and postoperative hemodynamic monitoring is reasonable to perform in patients with asymptomatic severe AS

Case

- 33 year old G₀P₀
- Wants to get pregnant
- No cardiac symptoms
- Echo: EF 65%
- MV mean gradient 7 mmHg (HR 65 BPM). MVA 1.4 cm²
- Valvuloplasty score: 3
- PAP: 35 mmHg
Does she need a stress echo?

1. Yes
2. No
3. Consult Dr. Freeman

ACC/AHA Guidelines
MS and pregnancy

Asymptomatic severe MS and pregnancy

Class I: Percutaneous valvuloplasty is recommended before pregnancy in asymptomatic women with severe MS (MVA $\leq 1.5 \text{ cm}^2$) with favorable morphology

JACC 2014;63(22):2438
Case

- 58 year old male: known heart murmur
- NYHA class I
- History of hypertension and hyperlipidemia

ESD: 37 mm; EDD: 60mm: EF 68%
RV 62 cc   ERO: 0.4 cm²
What to do next?

1. Cardiac cath
2. Bicycle echo
3. TEE
4. Follow up 6 months

Bicycle echo

- Exercise time: 10 min
- 87% maximal predicted heart rate
- 100 Watts
- 6.8 METS
- BP (rest): 144/80 mmHg
- BP (stress): 190/70 mmHg
- Dyspnea at peak
What to advise next?

1. TEE
2. MV repair
3. Watchful waiting
4. TEE/MV repair
### ACC/AHA Guidelines for VHD 2014

#### Indications for Mitral Operation

#### Chronic Severe Primary MR

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>LV size (LVESD &gt; 40mm)</td>
<td>I</td>
</tr>
<tr>
<td>LV dysfunction EF &gt;30%-60%</td>
<td>I</td>
</tr>
<tr>
<td>&gt;95% chance of repair</td>
<td>IIa</td>
</tr>
</tbody>
</table>

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**JACC 2014;63(22):2438**
Valve Disease with LV dysfunction

Case

- 87 year old woman
- NHYA class II
- Weight loss and anorexia
- New fall in EF
SV: 28 cc
SV indexed: 19 cc
Peak velocity: 3.1 m/s
Mean gradient: 24 mmHg
AVA 0.44 cm²

Cardiac cath

- 90% proximal LAD (long)
- 70% ostial OM
- Totally occluded RCA
- Stent LAD and OM
- Persistent LV dysfunction
- Dobutamine echo ordered
Aortic Stenosis

Low cardiac output
Low pressure gradient

Baseline Doppler hemodynamics → Dobutamine stress

- Gradient ↑ AVA → Severe AS
- Gradient ↓ AVA → Not severe AS

EF < 50%
Mean gradient < 40 mmHg
mmHg
REST
SV: 28 cc
Peak velocity 3 m/s
Mean gradient 22 mmHg
AVA 0.46 cm²

PEAK
SV: 44 cc
Peak velocity 4.2 m/s
Mean gradient 50 mmHg
AVA 0.48 cm²
What to advise?

1. AVR
2. Watchful waiting
3. TAVR
4. Hospice

Follow up
Surgeon declined for OR
Symptoms
Preserved EF
?Lesion severity?

Case

• 60 year old woman: progressive DOE
• Currently NYHA Class III
• S/P percutaneous mitral valvuloplasty 2004
Mean gradient 8 mmHg (HR 75 BPM)
MVA 1.4 cm²
PAP: 28 mmHg

Stress data

Bruce protocol: 9:26 min/sec
91% maximal predicted HR
86% FAC
Test stopped for dyspnea
BP (rest): 116/88 mmHg
BP (stress): 194/80 mmHg
What to do next?

1. EVO\textsubscript{2}
2. Percutaneous valvuloplasty
3. MVR
4. Watchful waiting
ACC/AHA Guidelines: Symptomatic severe MS

Class I: MV OR recommended for severely symptomatic (Class III/IV) with severe MS who are not high risk for OR and who are not candidates for or failed previous PBMC

Exercise Response in Severe MS

- Mean gradient > 15 mmHg (stress)
- Mean gradient > 18 mmHg (Dob)
- +/- SPAP > 60 mmHg
Prosthetic Valves

• **Aortic**: mean gradient increase at least >20 mmHg and failure for valve area to increase

• **Mitral**: mean gradient increase at least > 12 mmHg often associated with PHT (≥ 60 mmHg)

A Diagnostic Dilemma
68 year old female: SOBOE. S/P AVR 3 years prior. 20 year history migraine medicine

Mean gradient: 4 mmHg (HR 44 BPM) 
$T_{1/2}$: 158 ms 
MVA ($t_{1/2}$): 1.39 cm$^2$ 
MVA (cont. eq) 1.25 cm$^2$ 
PAP: 35 mmHg
How severe is the MS?

1. Mild
2. Mild-moderate
3. Moderate
4. Severe
5. Difficult to tell

Stress Echocardiogram

- Supine bike: 6 minutes; 75 watts
- 76% max predicted HR
- BP (rest): 146/56 mmHg
- BP (stress): 198/108 mmHg
- Stopped for leg fatigue/dyspnea
MVA (planimetry): 1.4 cm$^2$

Rest
- Mean gradient: 4 mmHg
- PAP: 30 mmHg

Stress
- Mean gradient: 20 mmHg
- PAP: 61 mmHg
What to advise?

1. Watchful waiting
2. Pulmonary work up
3. MVR
4. Percutaneous valvuloplasty