Chest Pain in Women
What is Your Diagnostic Plan?

No Need for Noninvasive Test

Jang-Ho Bae, MD., PhD., FACC.
Konyang University Hospital
Daejeon, Korea
Chest pain in Women

• ACS

• Atypical

• Stable angina
F/29

• **C/C**: typical chest pain for 2 hrs

• **Past history**: none
• **Risk factors**: none
• **Family history**: none
• **V/S**: 100/60mmHg, 93bpm

• **BW**: 45kg, **Height**: 165cm, **BMI**: 16.5

• **Tn-I**: 0.11ng/mL, **CK-MB**: 6.3ng/mL

• **LDL-C**: 108mg/dL
<table>
<thead>
<tr>
<th>Measurement</th>
<th>Value</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vent. Rate</td>
<td>91 bpm</td>
<td>Normal sinus rhythm</td>
</tr>
<tr>
<td>PR interval</td>
<td>140 ms</td>
<td>Marked ST abnormality, possible inferior subendocardial injury</td>
</tr>
<tr>
<td>QRS duration</td>
<td>86 ms</td>
<td>Marked ST abnormality, possible anterolateral subendocardial injury</td>
</tr>
<tr>
<td>QT/QTc</td>
<td>372/457 ms</td>
<td>Abnormal ECG</td>
</tr>
<tr>
<td>P-R-T axes</td>
<td>83/84/77°</td>
<td>Abnormal ECG</td>
</tr>
<tr>
<td>P duration</td>
<td>58 ms</td>
<td>Abnormal ECG</td>
</tr>
</tbody>
</table>

GE MAC55 V009C (1)
25mm/s 10mm/mV 16 - 150Hz 60Hz

Attending MD:
Hospital course

• ASA+Clopidogrel+Heparin+GP IIb/IIIa inhibitors

• VF 10 min after POBA; #2 DC cardioversion

• Hematemesis (fresh, 300 cc) 2 hrs after POBA
1 day after POBA

Dieulafoy's lesion with bleeding
4 days after POBA
Medication

- ASA + Clopidogrel + Statin restarted after EGD
FU CAG, 7 days after POBA
Hospital course

- Discharged after FU CAG

- She can run 4.5km for 1 hr without any symptom
Case, 54/F

- **C.C** (Onset: 1 years ago)
  - intermittent palpitation
  - chest discomfort, atypical
  - (resting onset, substernal area)
- Risk factor; none
- 24h holter
  - Sinus rhythm
  - PVC’s
Pretest likelihood of CAD in women

ACC/AHA practice guidelines on Exercise testing

<table>
<thead>
<tr>
<th>Age</th>
<th>Typical/Definite AP</th>
<th>Atypical/Probable AP</th>
<th>Nonanginal chest pain</th>
<th>Asymptomatic</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-39</td>
<td>Intermediate</td>
<td>Very low</td>
<td>Very low</td>
<td>Very low</td>
</tr>
<tr>
<td>40-49</td>
<td>Intermediate</td>
<td>Low</td>
<td>Very low</td>
<td>Very low</td>
</tr>
<tr>
<td>50-59</td>
<td>Intermediate</td>
<td>Intermediate</td>
<td>Low</td>
<td>Very low</td>
</tr>
<tr>
<td>60-69</td>
<td>High</td>
<td>Intermediate</td>
<td>Intermediate</td>
<td>Low</td>
</tr>
<tr>
<td>≥70</td>
<td>High</td>
<td>Intermediate</td>
<td>Intermediate</td>
<td>Low</td>
</tr>
</tbody>
</table>

Circulation 2005;111:682
Treadmill test (baseline)
Treadmill test (stage 5)
Treadmill test (recovery 4:50)
Symptomatic Women

• In a low-risk patient, a positive stress test result may be more likely to represent a false-positive result, leading to additional invasive testing, unnecessary

• Exercise testing is not recommended in this group

• The exercise ECG is the recommended first test of choice
  – symptomatic
  – intermediate-risk women
  – able to exercise
  – normal baseline ECG
ACC/AHA 2002 Guideline update for Exercise Testing

**Class IIa**

1. Evaluation of asymptomatic persons with diabetes mellitus who plan to start vigorous exercise. *(Level of Evidence: C)*

**Class IIb**

1. Evaluation of persons with multiple risk factors as a guide to risk-reduction therapy.*

2. Evaluation of asymptomatic men older than 45 years and women older than 55 years:
   - Who plan to start vigorous exercise (especially if sedentary) or
   - Who are involved in occupations in which impairment might impact public safety or
   - Who are at high risk for CAD due to other diseases (eg, peripheral vascular disease and chronic renal failure)

**Class III**

1. Routine screening of asymptomatic men or women.
Prognostic value of functional capacity

What makes a differences in the accuracy of ST-segment depression in women?

1. More baseline ST-T changes, making interpretation of ECG changes with exercise difficult

2. Estrogen may cause a digoxin-like effect on ST segments with exercise
   – In premenopausal women, menstrual cycle
   – In postmenopausal women, oral estrogen therapy

3. older when they present for stress testing and may have a decreased exercise tolerance
Limitations of exercise ECG in women

- Exertional symptoms of low predictive value
- Shorter exercise durations
- Lower ECG voltages, more nonspecific ST-T
- Lower CAD prevalence
- High rate of false positives

Emerging evidence on the role of heart rate recovery, functional capacity, and integrative test scores specifically applied in large cohorts of women have not been fully incorporated into the most recent ACC/AHA guidelines for exercise testing.
Pretest likelihood of CAD in women

ACC/AHA practice guidelines on Exercise testing

<table>
<thead>
<tr>
<th>Age</th>
<th>Typical /Definite AP</th>
<th>Atpical /Probable AP</th>
<th>Nonanginal chest pain</th>
<th>Asymptomatic</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-39</td>
<td>Intermediate</td>
<td>Very low</td>
<td>Very low</td>
<td>Very low</td>
</tr>
<tr>
<td>40-49</td>
<td>Intermediate</td>
<td>Low</td>
<td>Very low</td>
<td>Very low</td>
</tr>
<tr>
<td>50-59</td>
<td>Intermediate</td>
<td>Intermediate</td>
<td>Low</td>
<td>Very low</td>
</tr>
<tr>
<td>60-69</td>
<td>High</td>
<td>Intermediate</td>
<td>Intermediate</td>
<td>Low</td>
</tr>
<tr>
<td>≥70</td>
<td>High</td>
<td>Intermediate</td>
<td>Intermediate</td>
<td>Low</td>
</tr>
</tbody>
</table>

Current guidelines support imaging for symptomatic intermediate to high probability women
Algorithm for evaluation of symptomatic women using exercise ECG or cardiac imaging

Intermediate - High Likelihood Women with Atypical or Typical Chest Pain Symptoms *

Normal Rest ECG and Able to Exercise

- Exercise Treadmill Testing
  - Low post-ETT likelihood
  - Int Risk TM
    - Risk factor modification +/- Anti-Ischemic Rx
    - Normal or mildly abnormal with normal LV function

Diabetes, Abnormal Rest ECG, or Questionable Exercise Capacity

- Stress Cardiac Imaging
  - Able to exercise or h/o symptoms with low-level exercise
    - Exercise Stress
    - Moderately or severely Abnormal or reduced EF
      - Cardiac catheterization
  - Unable to exercise (orthopedic reasons, CVA, LBBB, etc.)
    - Pharmacologic Stress
      - Cardiac catheterization

Symptomatic women; clinical issues

- More anginal (atypical) symptoms
- Lower rates of CAD at angiography
- Without epicardial CAD, continue to have symptoms

Presentation & Prevalence of CAD by Gender

Braunwald’s Heart Disease, 7th Ed. p1955
CV Mortality Trends

Deaths (thousands)

Years

1979 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00

Males
Females

Braunwald’s Heart Disease, 7th Ed. p1952
Gender bias in the diagnosis of IHD

• Refer rate in pts with positive nuclear exercise tests; 6.3 times higher in men than in women
• Older
• More risk (HBP, DM, UA, CHF, but less smoker)
• More atypical symptoms
• Delayed medical attention
Clinical reasons for symptoms

• Non-obstructive atherosclerosis
• Vascular dysfunction
• Microvascular disease
• Subendocardial ischemia
Gender difference

Atheroma burden

Maximal CFR after IC adenosine

Han SH, Bae JH, Lerman A. Eur Heart J 2008;29:1359-1369
Mestrual cycle & non-invasive test

• Progesterone level is independent factor influencing the presence of ST depression

• Not related with myocardial contractility during exercise echocardiography

Exercise/Drug echocardiography in women

- Improves diagnostic accuracy
- Dominate over nuclear techniques

- **Majority of studies; in men**
- Onset of CAD is delayed in women, so women may be older and less likely to reach an adequate heart rate with exercise
- Recommended for the symptomatic women with an intermediate to high pretest probability of CAD

Braunwald’s Heart Disease, 7th Ed. P1956
Radionuclide scan in women

- Thallium scan; moderate increase in sensitivity and specificity
- SPECT; may not improve accuracy
- Limitation of SPECT; Higher false positive due to breast attenuation and small heart

Braunwald’s Heart Disease, 7th Ed. P1956
Challenges in women with non-invasive tests

- Most studies; predominantly in cohorts of men
- High false positive
- Lower ECG voltage
- More nonspecific ST-T changes
- Smaller hearts
- Anterior perfusion defects – breast attenuation
- Lung dz/obese – reduced LV opacification

Carotid IMT

- CHS; older women in the highest quartile of IMT were > 3-fold more MACE
- Risk stratification
- No definition for abnormal
Coronary CT

• Calcium signify the presence of atherosclerosis
• Not specific for luminal obstruction
• Calcium testing was not recommended in 2000 ACC/AHA expert consensus to diagnose obstructive CAD due to low specificity
• CAC testing for CAD risk detection should be limited to clinically selected women in intermediate risk
Conclusions 1; chest pain in women

• ACS; early invasive strategy

• SA; noninvasive test in at least intermediate to high risk women

• Asymptomatic; not indicated for noninvasive test
Conclusion 2

- Can be accurately diagnosed via cardiac imaging
- Women at risk for CAD are less often referred
- Further studies are needed to fully appreciate the multi-factorial role of reproductive hormones on the vascular system and diagnostic testing
Thank you
Very much