Chest Pain in Women
;What is Your Diagnostic Plan?

No Need for Noninvasive Test

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Chest pain in Women

- ACS
- Atypical
- Stable angina

F/29

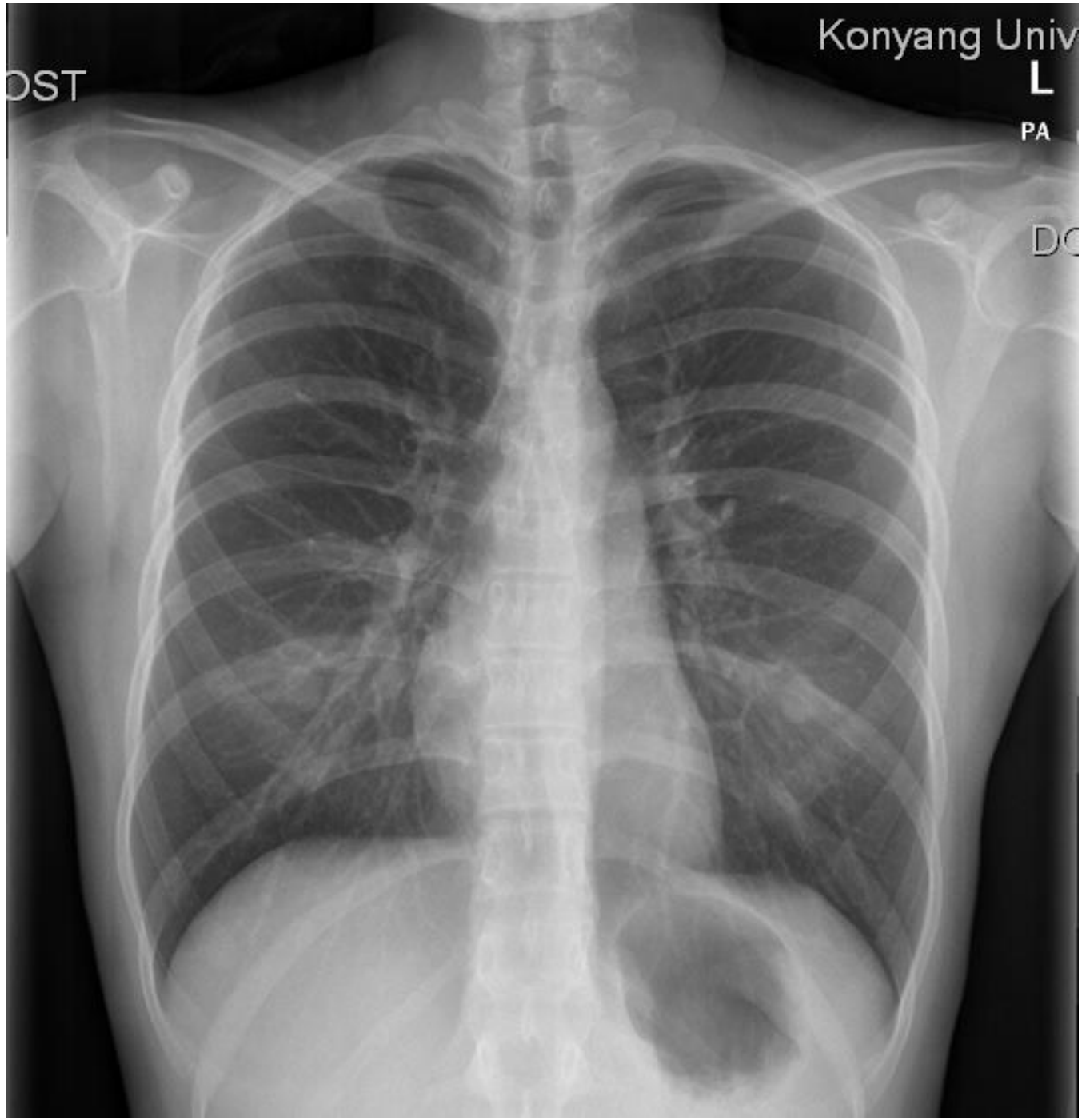
- **C/C**; typical chest pain for 2 hrs

- **Past history**; none
- **Risk factors**; none
- **Family history**; none

- **V/S**; 100/60mmHg, 93bpm

- BW; 45kg, Height; 165cm, BMI; 16.5

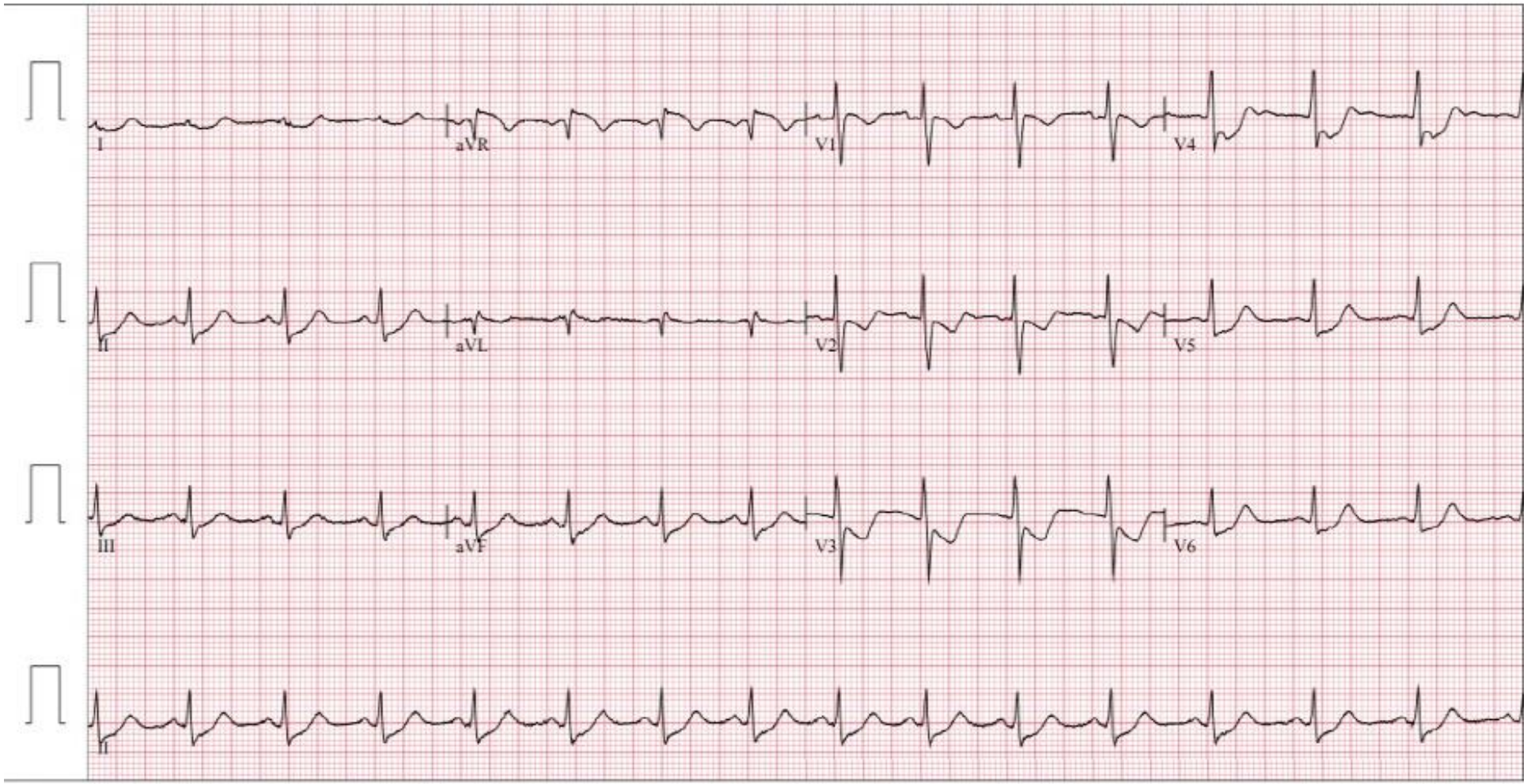
- Tn-I; 0.11ng/mL, CK-MB; 6.3ng/mL
- LDL-C; 108mg/dL


OST
Konyang Univ
L
PA
DC

Vent. Rate	91 bpm
PR interval	140 ms
QRS duration	86 ms
QT/QTC	372/457 ms
P-R-T axes	83/84/77 °
P duration	58 ms

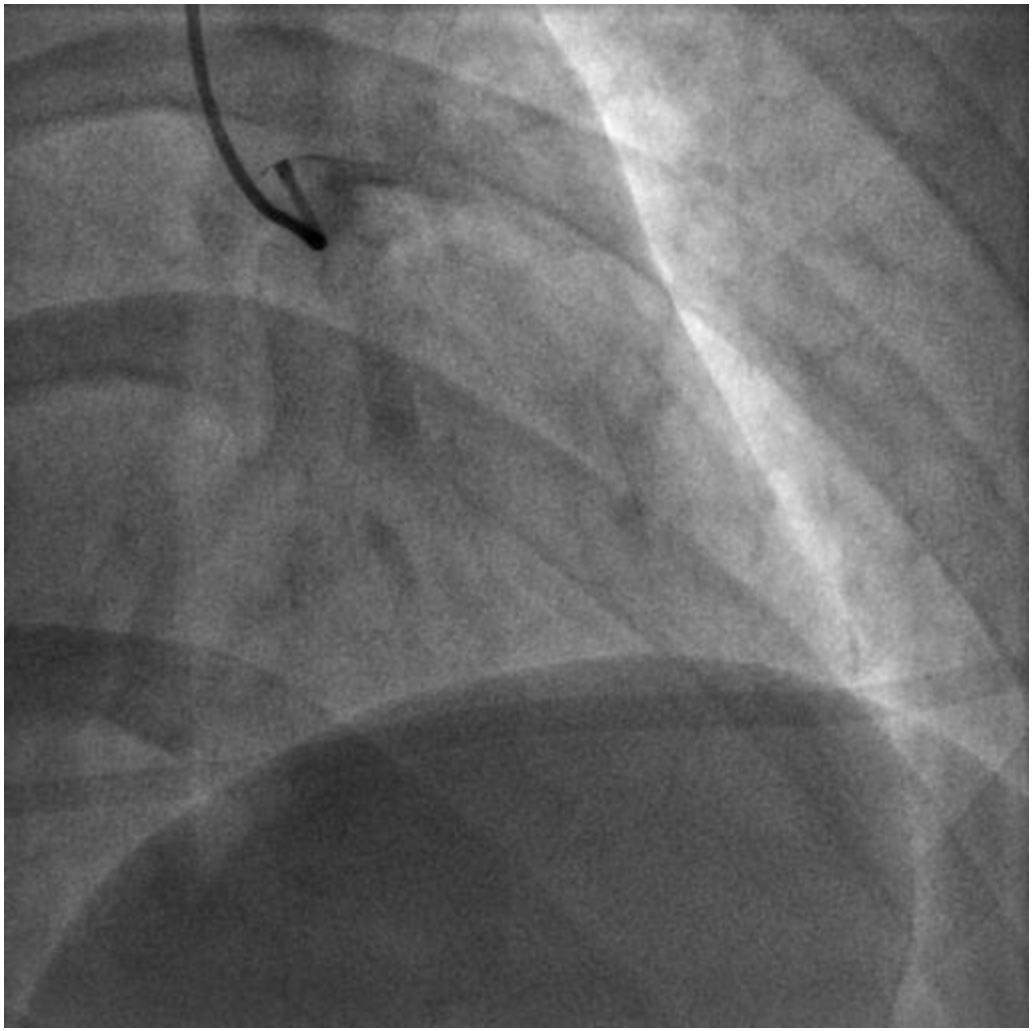
Interpretation

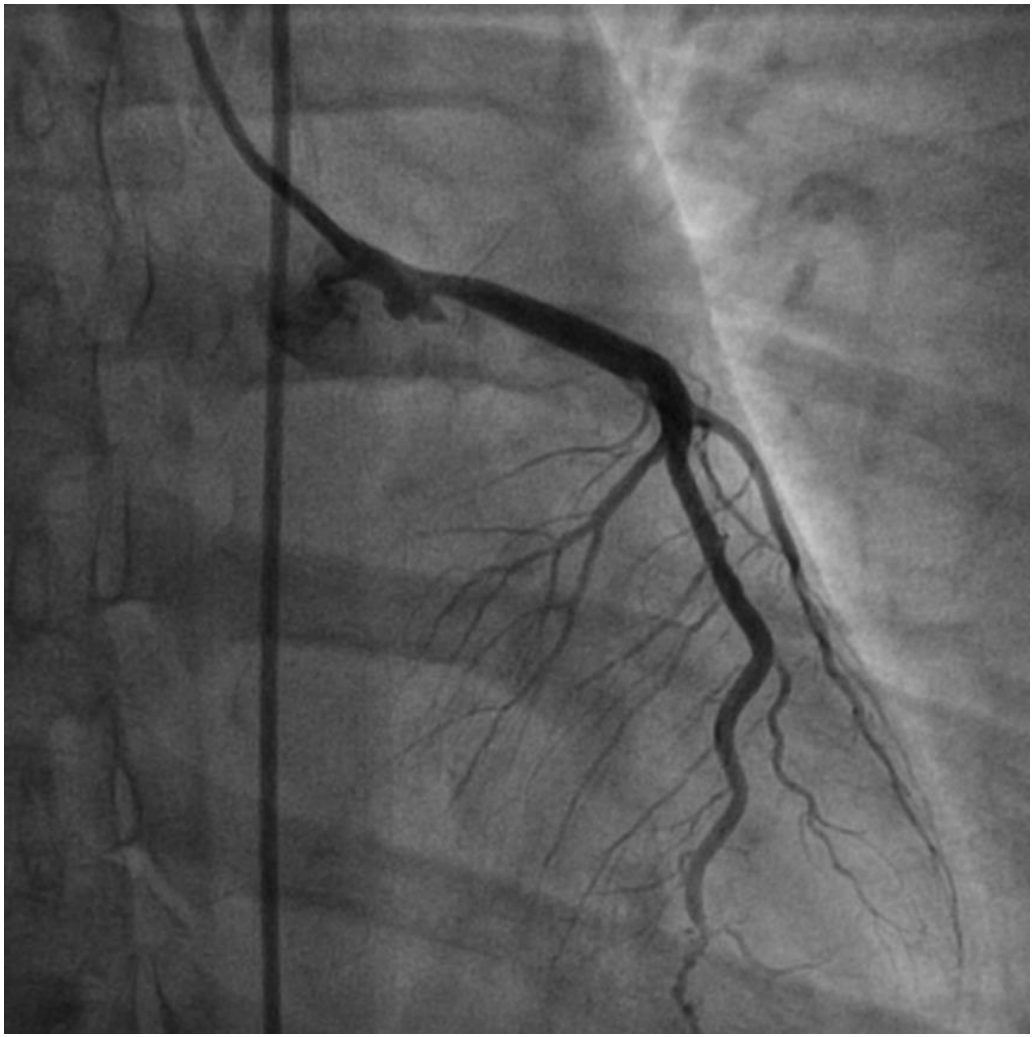
Normal sinus rhythm
Marked ST abnormality, possible inferior subendocardial injury
Marked ST abnormality, possible anterolateral subendocardial injury
Abnormal ECG

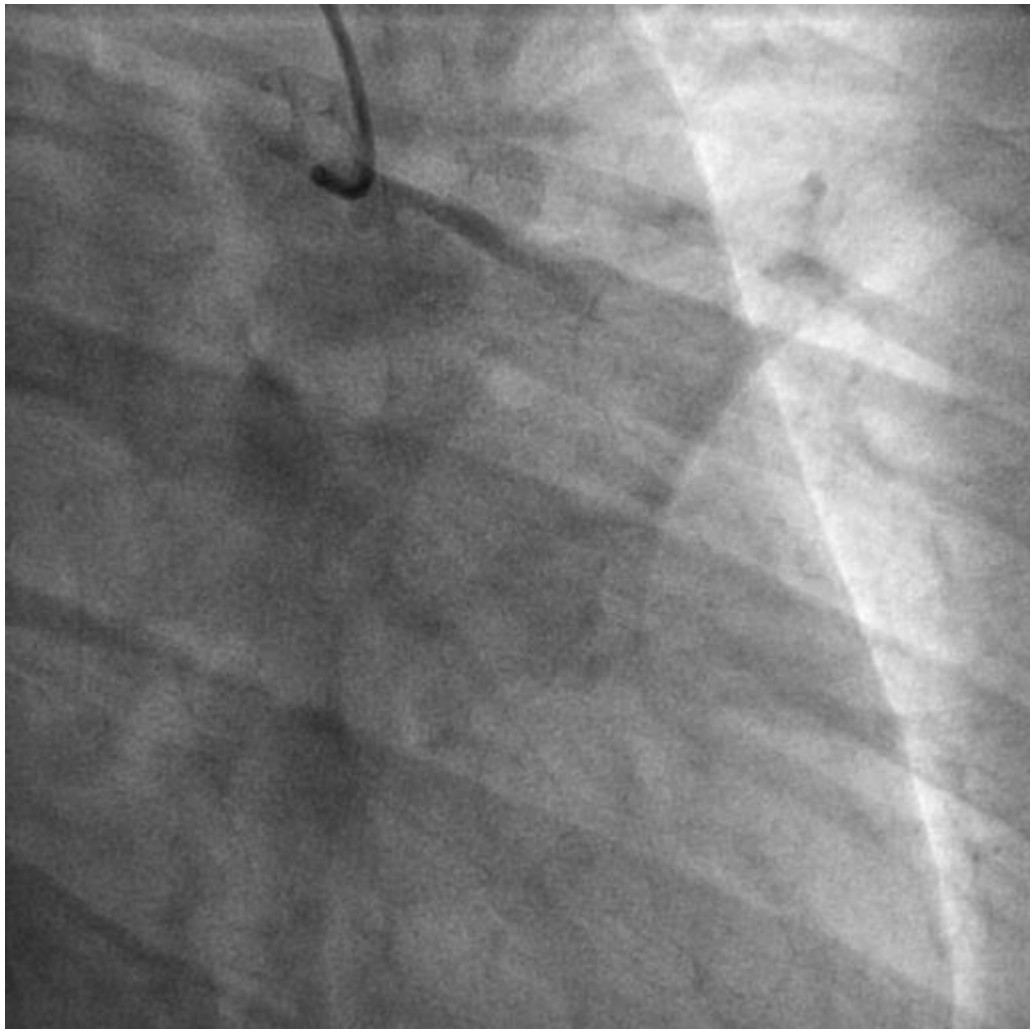


GE MAC55 V009C (1)
25mm/s 10mm/mV 16 - 150Hz 60Hz

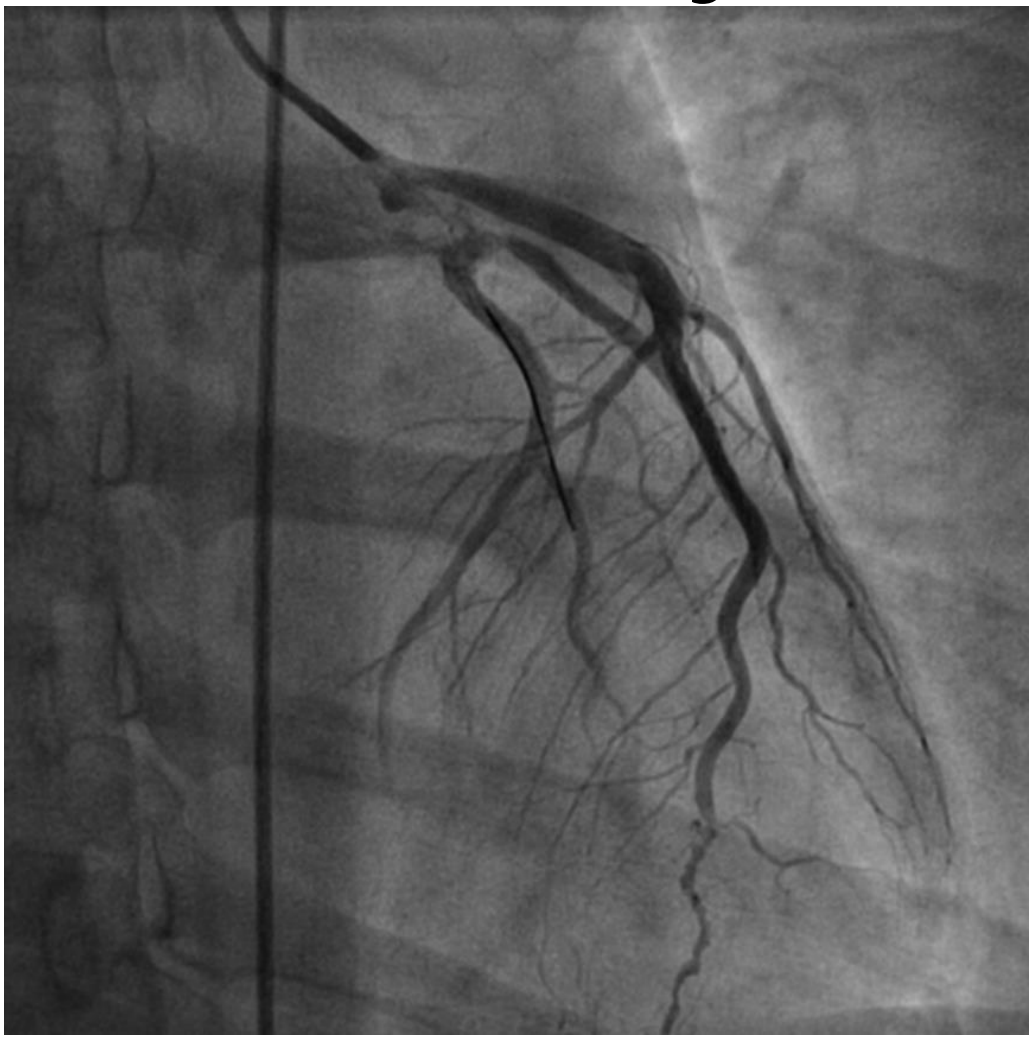
Attending MD:



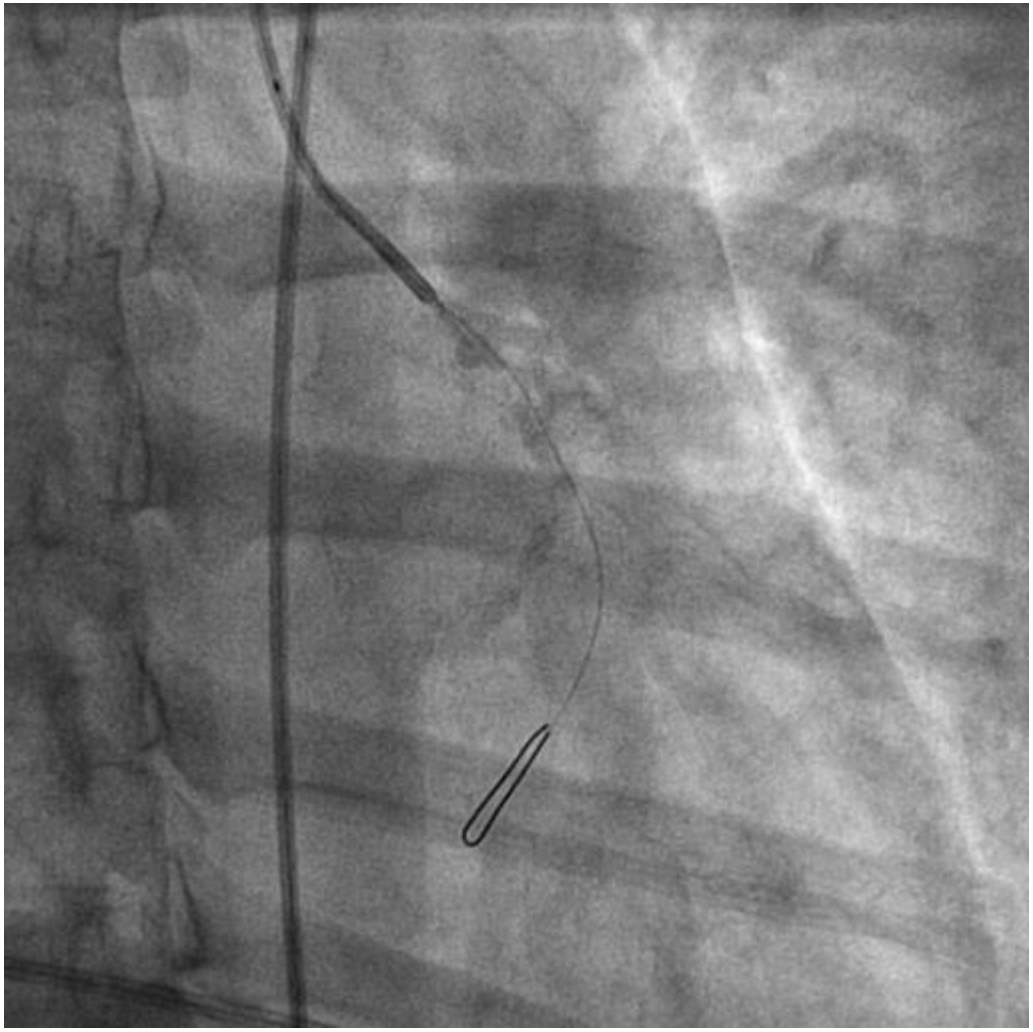




After wiring



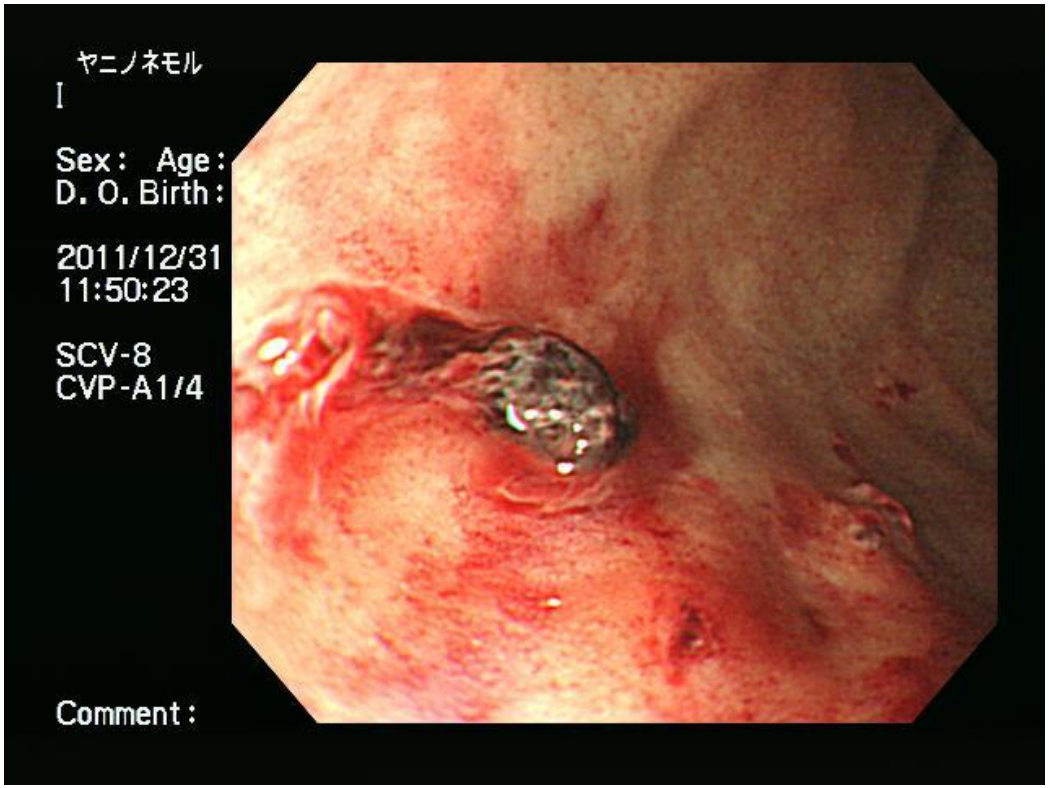
After POBA

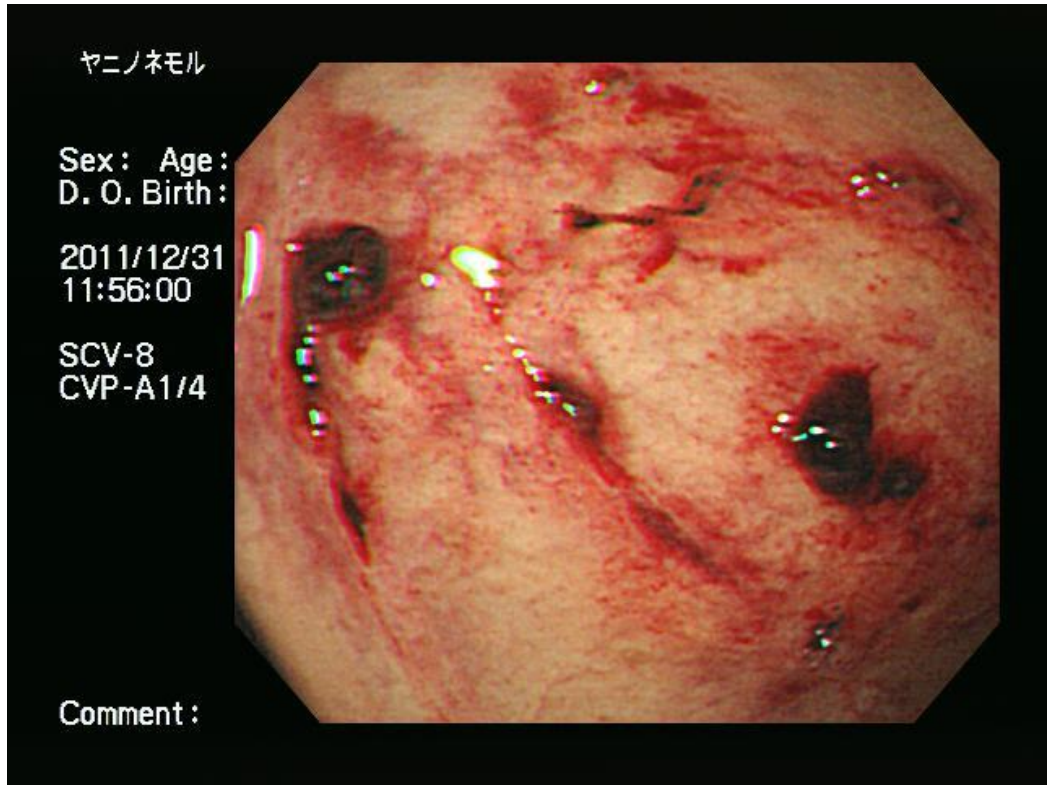


Hospital course

- ASA+Clopidogrel+Heparin+GP IIb/IIIa inhibitors
- VF 10 min after POBA; #2 DC cardioversion
- Hematemesis (fresh, 300 cc) 2 hrs after POBA

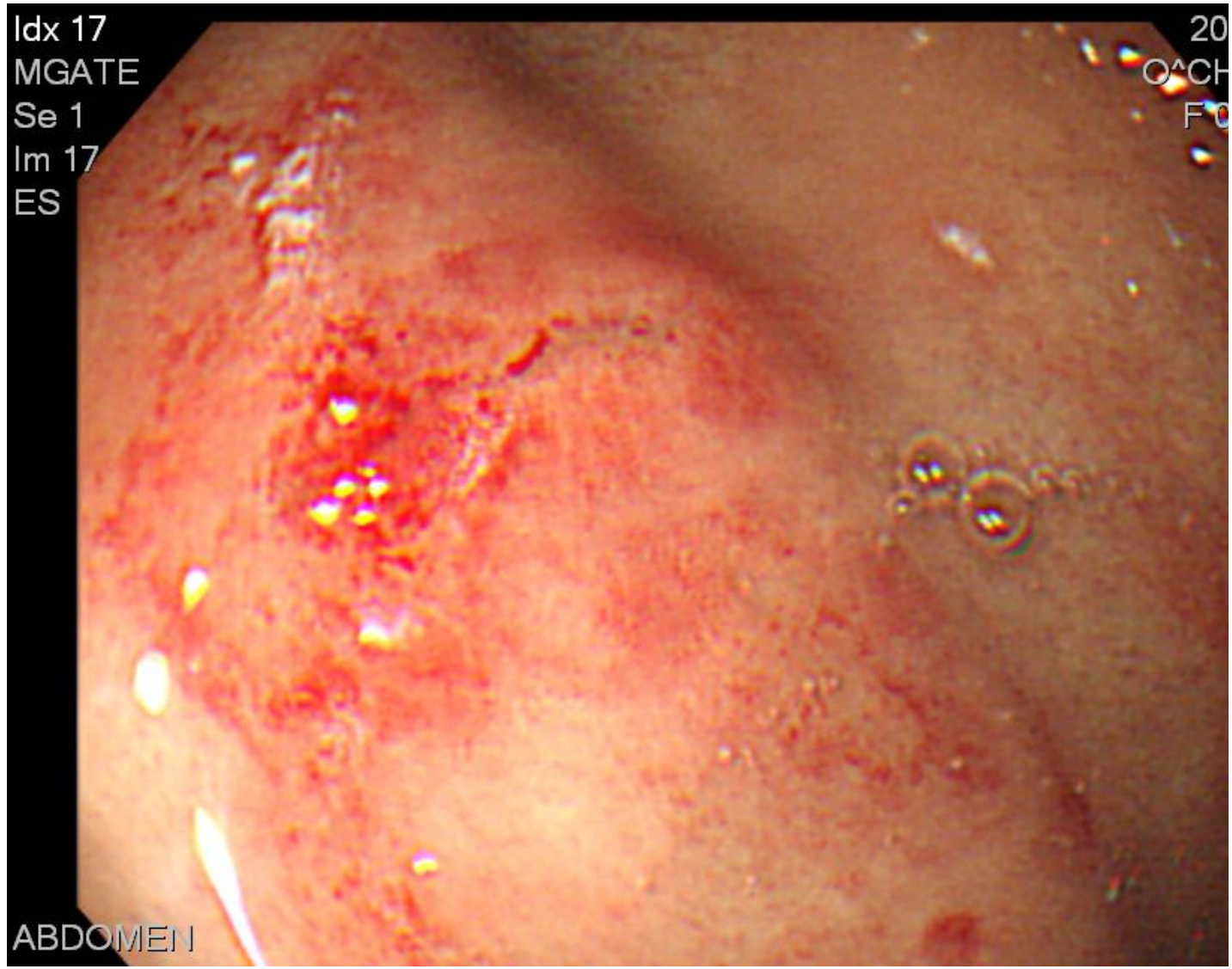
1 day after POBA





Dieulafoy's lesion with bleeding

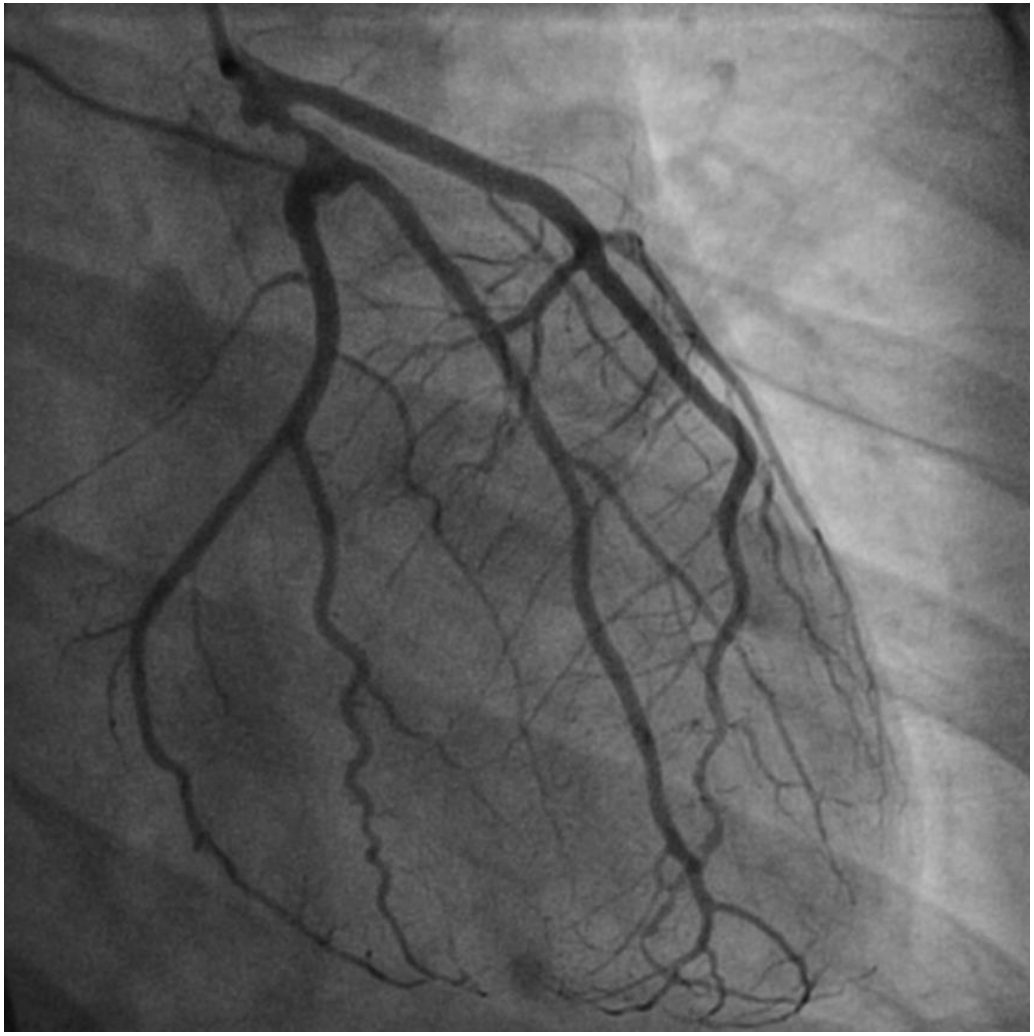
4 days after POBA

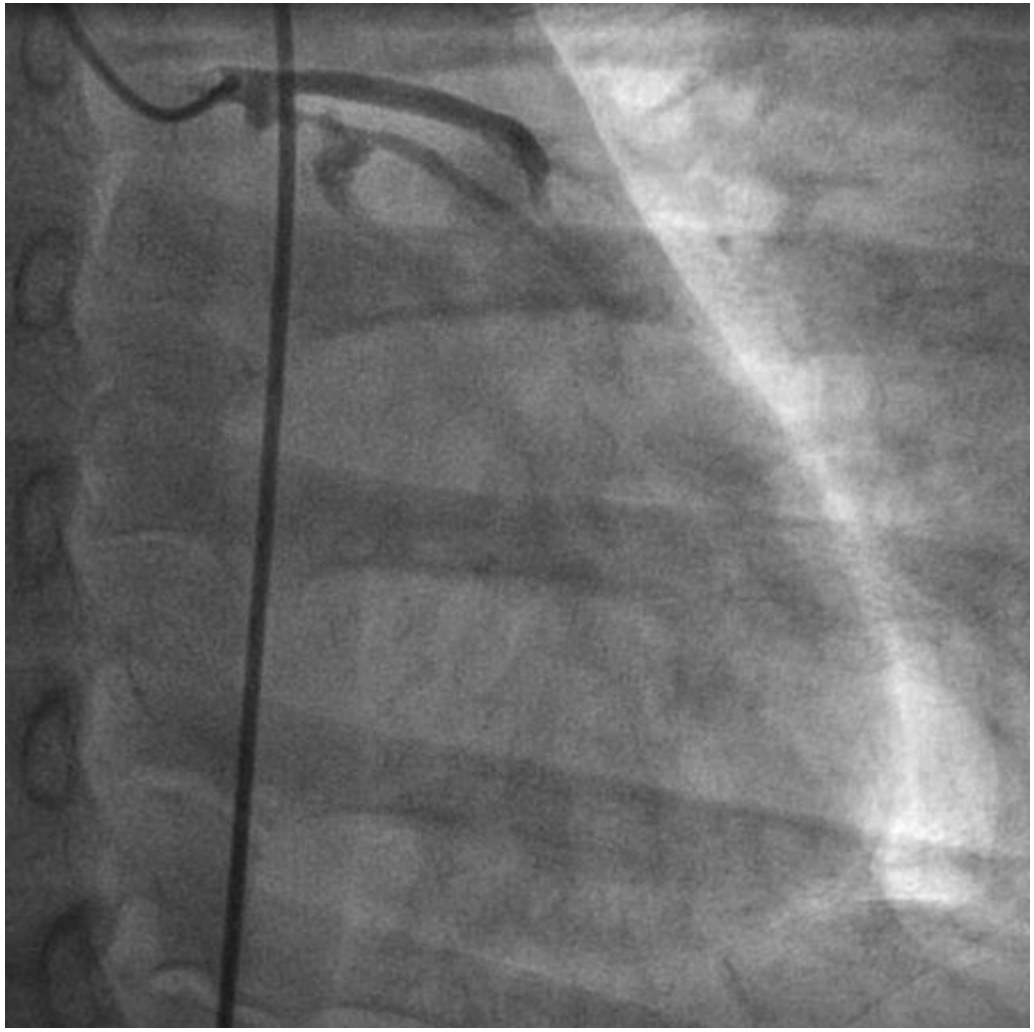


Medication

- **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

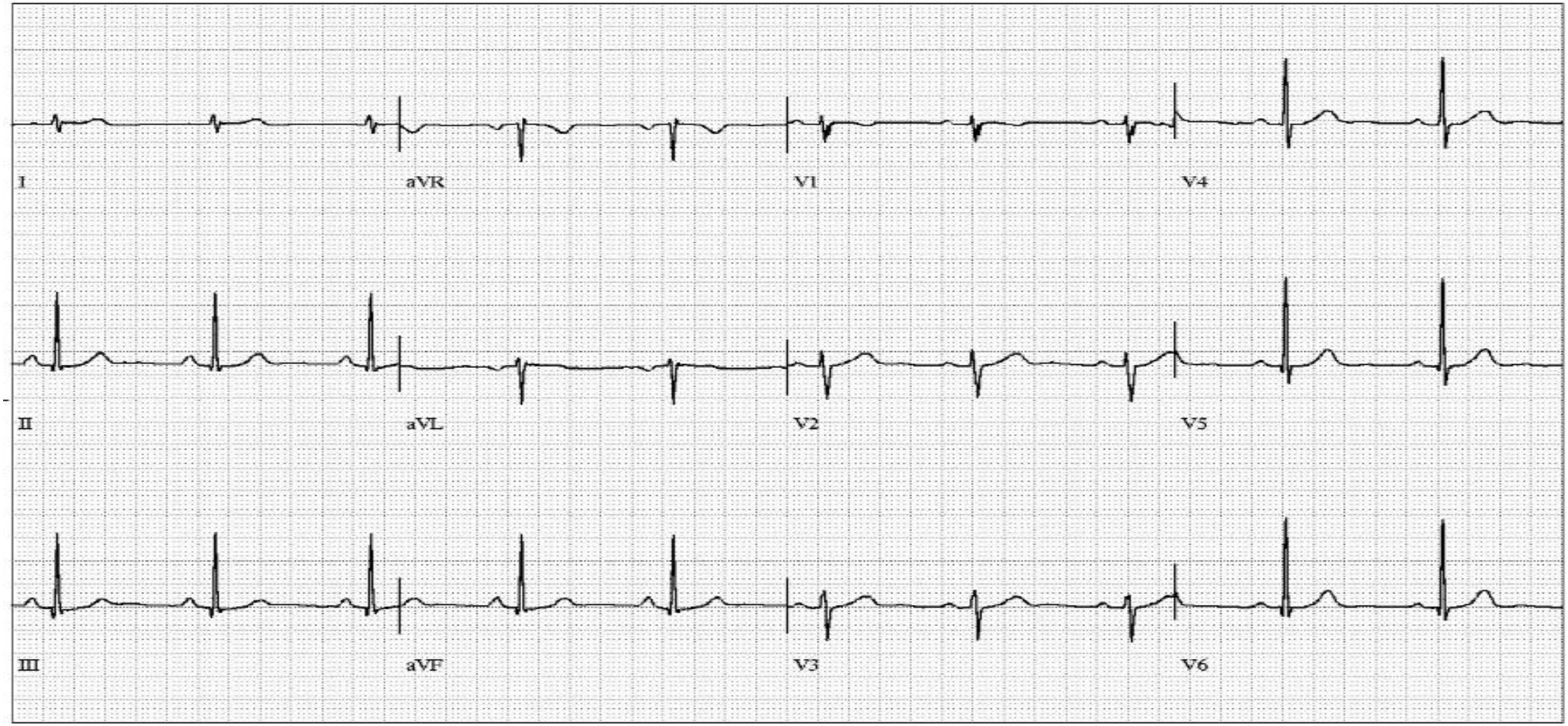
Pretest likelihood of CAD in women

ACC/AHA practice guidelines on Exercise testing

Age	Typical /Definite AP	Atpical /Probable AP	Nonanginal chest pain	Asympt omatic
30-39	Intermediate	Very low	Very low	Very low
40-49	Intermediate	Low	Very low	Very low
50-59	Intermediate	Intermediate	Low	Very low
60-69	High	Intermediate	Intermediate	Low
≥70	High	Intermediate	Intermediate	Low

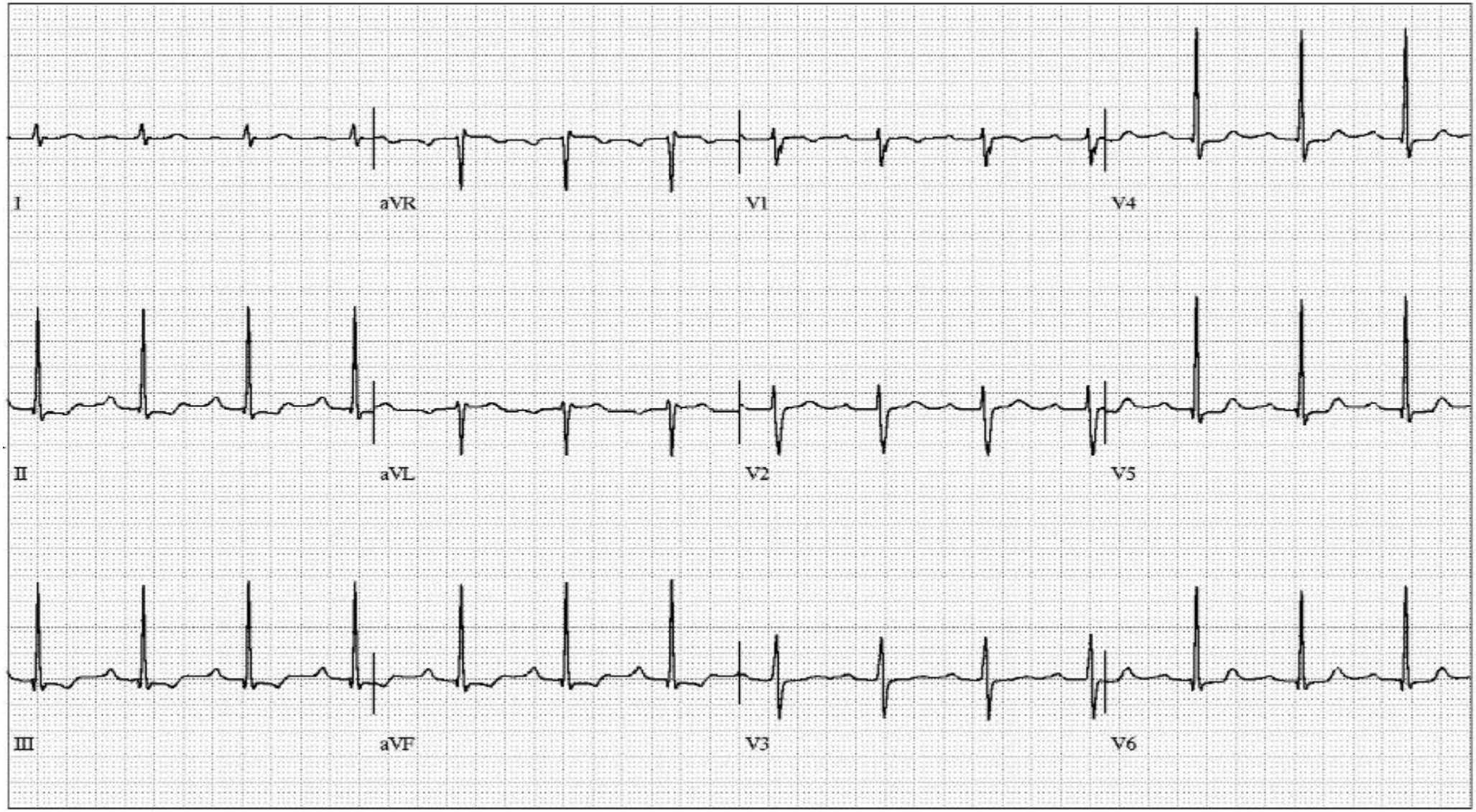
Circulation 2005;111:682

Treadmill test (baseline)

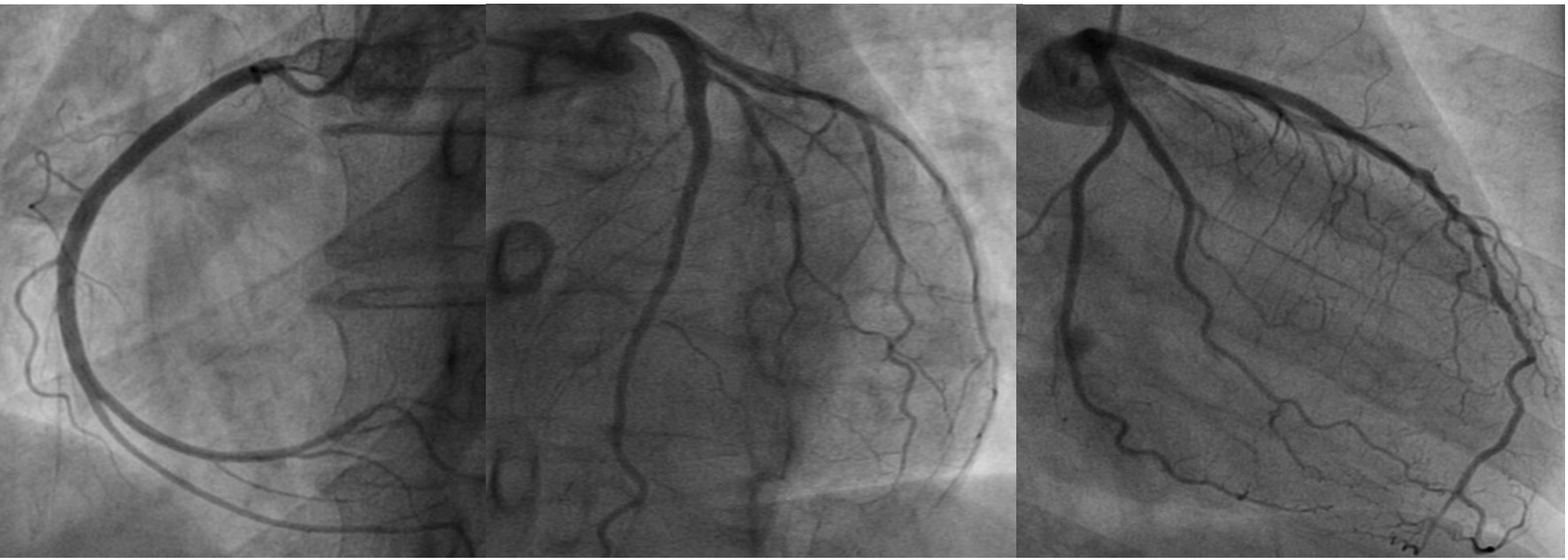


Treadmill test (stage 5)

Treadmill test (recovery 4:50)



CAG



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

Circulation 2010;122:2507

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.*

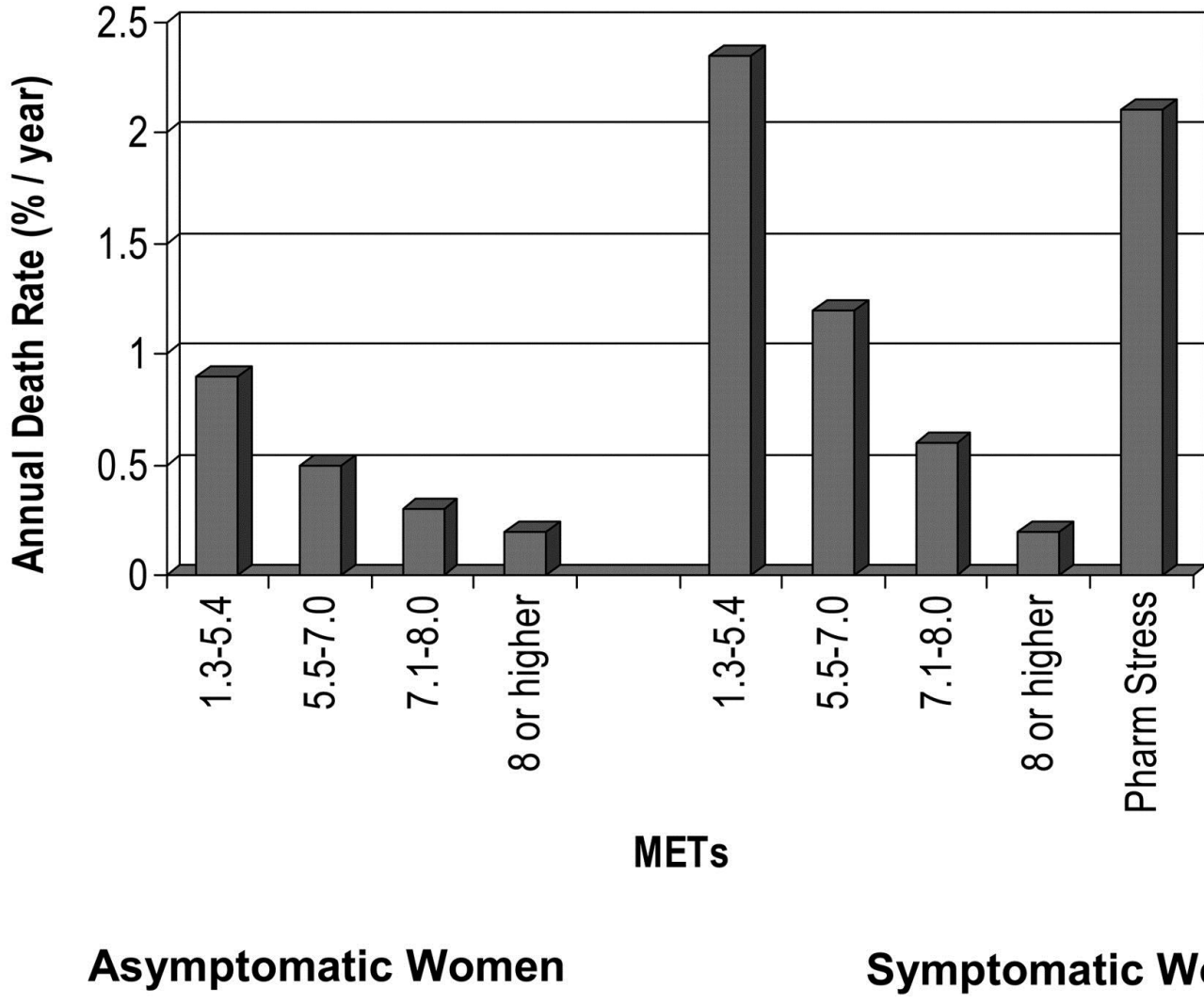
2. Evaluation of asymptomatic men older than 45 years and women older than 55 years:
   - Who plan to start vigorous exercise (especially if sedentary) or
   - Who are involved in occupations in which impairment might impact public safety or
   - Who are at high risk for CAD due to other diseases (eg,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

Class III

1. Routine screening of asymptomatic men or women.

Circulation 2002;106:1883

Prognostic value of functional capacity



Mieres J H et al. Circulation 2005;111:682-696

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

Circulation 2010;122:2507

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.

Mieres J H et al. Circulation 2005;111:682-696

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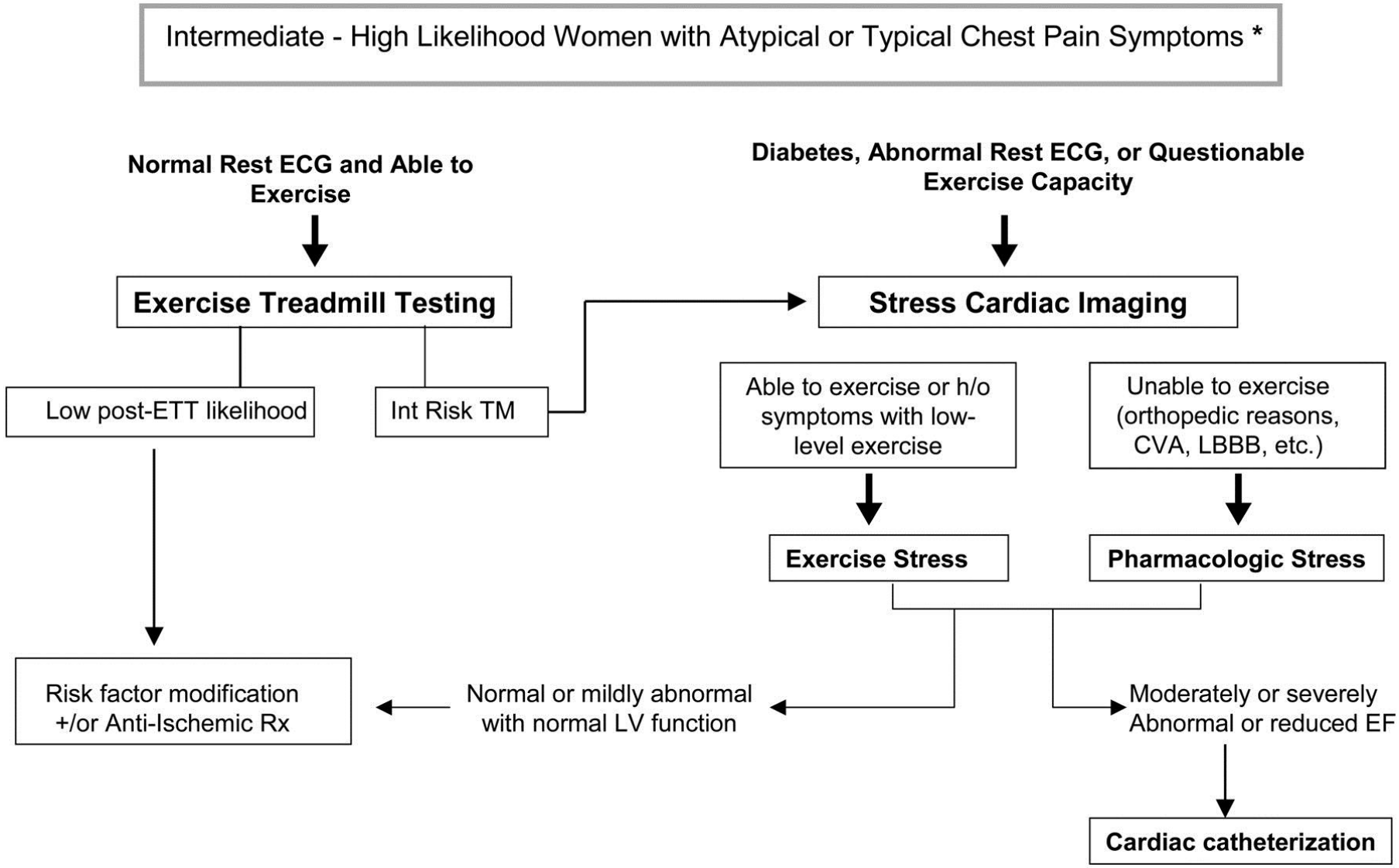
Current guidelines support imaging for symptomatic intermediate to high probability women

Circulation 2005;111:682

Algorithm for evaluation of symptomatic women using exercise ECG or cardiac imaging



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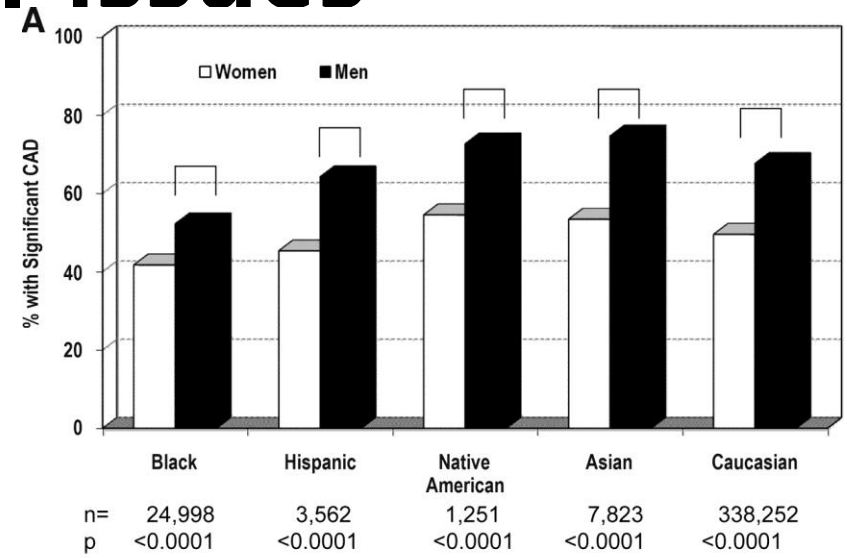
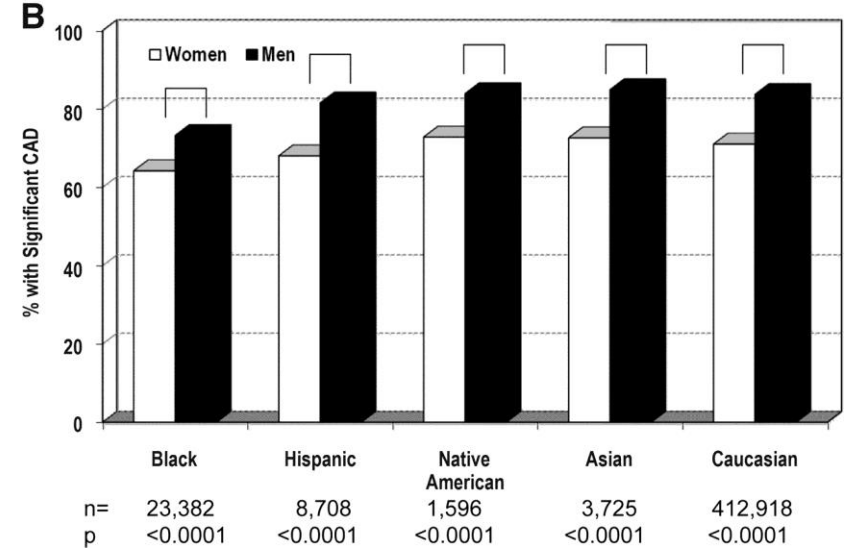
Symptomatic women ; clinical issues

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



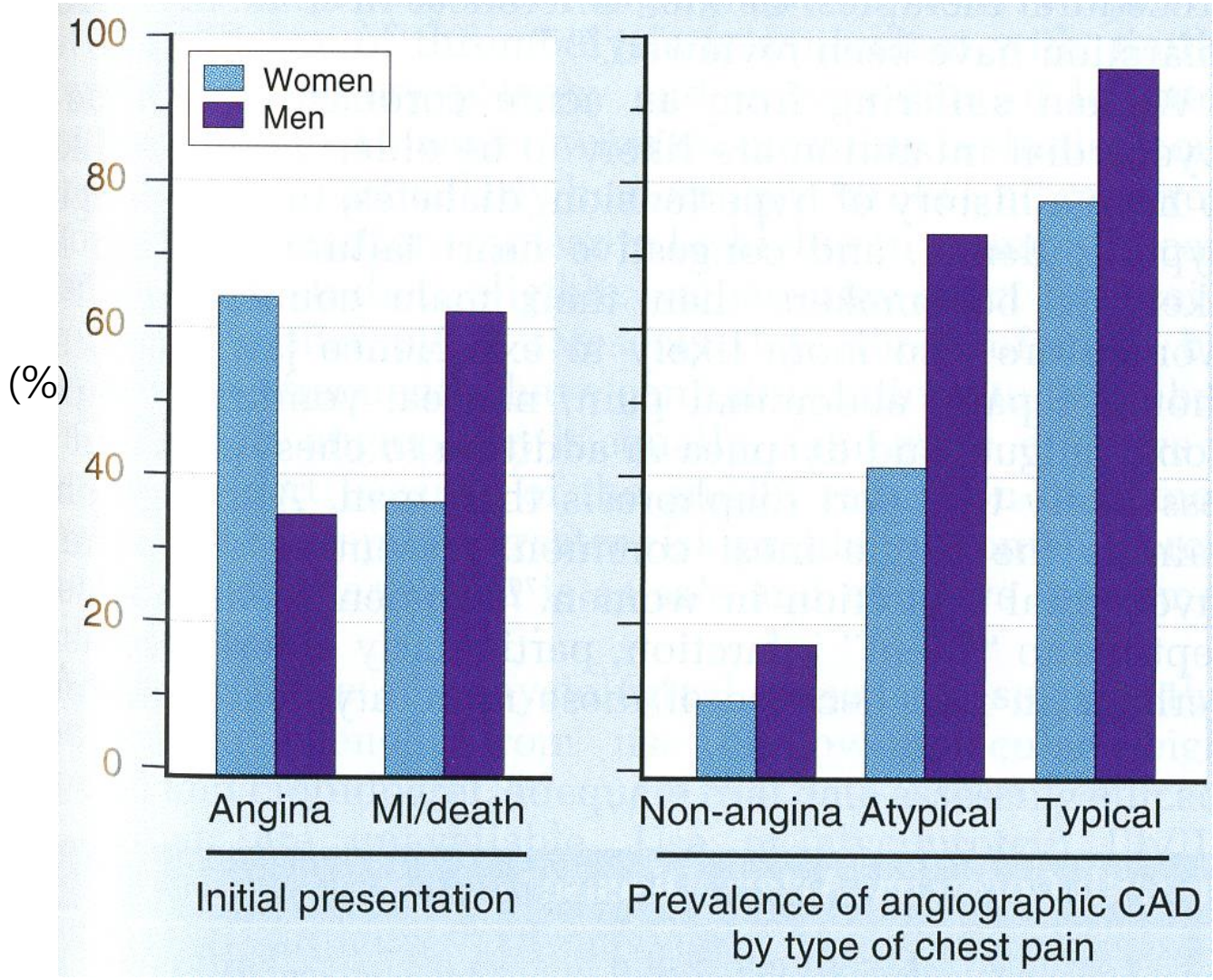
SA



ACS

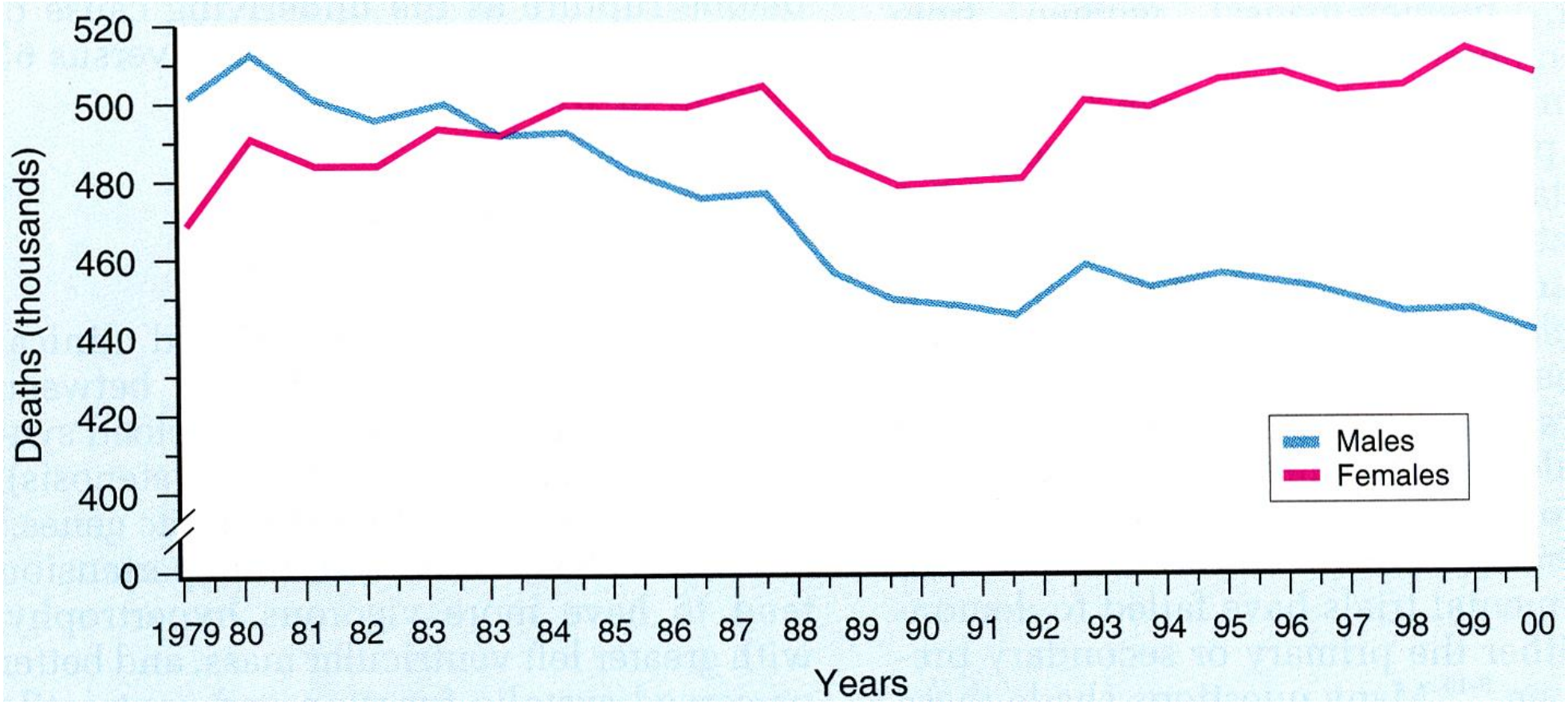
Shaw L J et al. Circulation 2008;117:1787-1801

Presentation & Prevalence of CAD by Gender



Braunwald`s Heart Disease, 7th Ed. p1955

CV Mortality Trends



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

Braunwald`s Heart Disease, 7th Ed. p1956

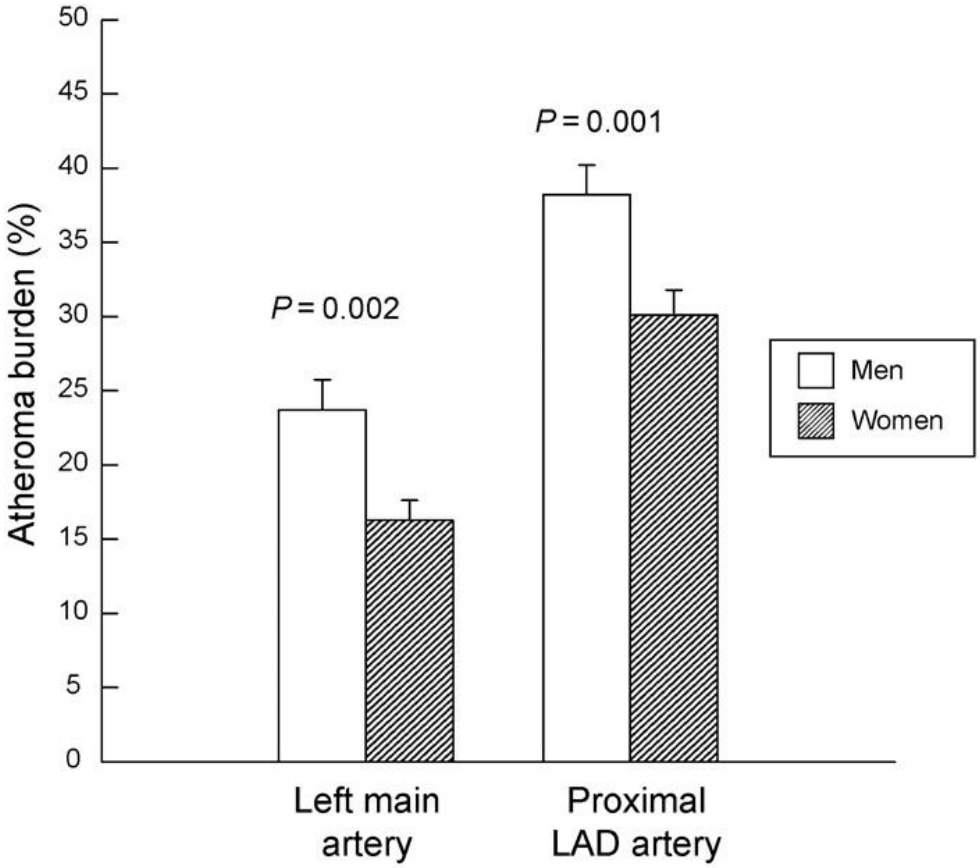
Clinical reasons for symptoms

- Non-obstructive atherosclerosis
- Vascular dysfunction
- Microvascular disease
- Subendocardial ischemia

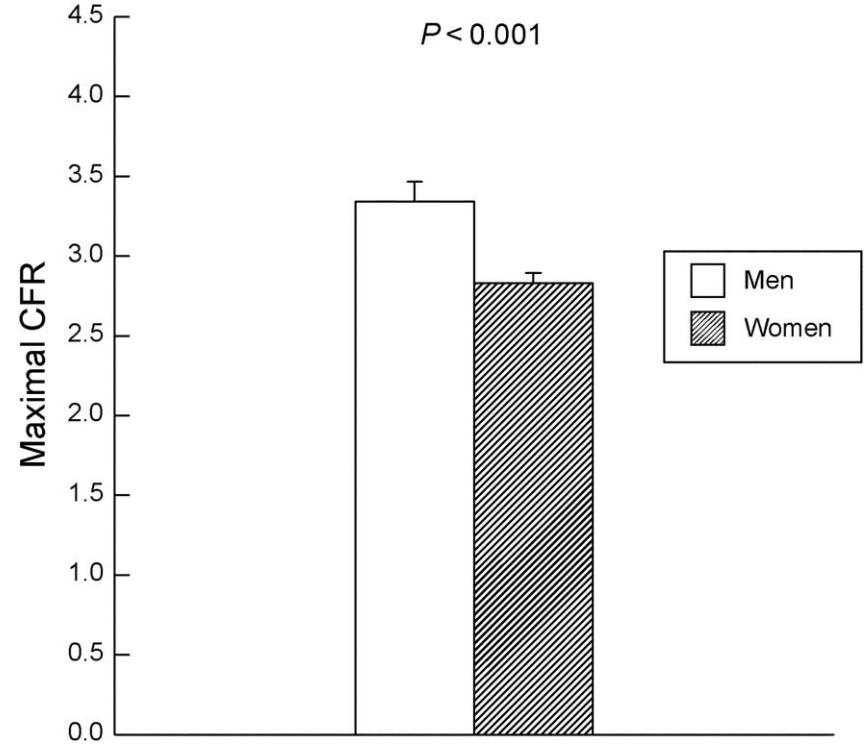
Cleve Clin J Med 2007;74:585

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

Grzybowski A, et al. Am Heart J 2008;156:964

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
Mieres J H et al. Circulation 2005;111:682-696

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
Mieres J H et al. Circulation 2005;111:682-696

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

Mieres J H et al. Circulation 2005;111:682-696

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