Myocardial Ischemia:
Matching the Patient to the Modality

David Hurrell, M.D.
Chairman of Cardiology

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Where you DON'T want to be…

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Where you DO want to be…

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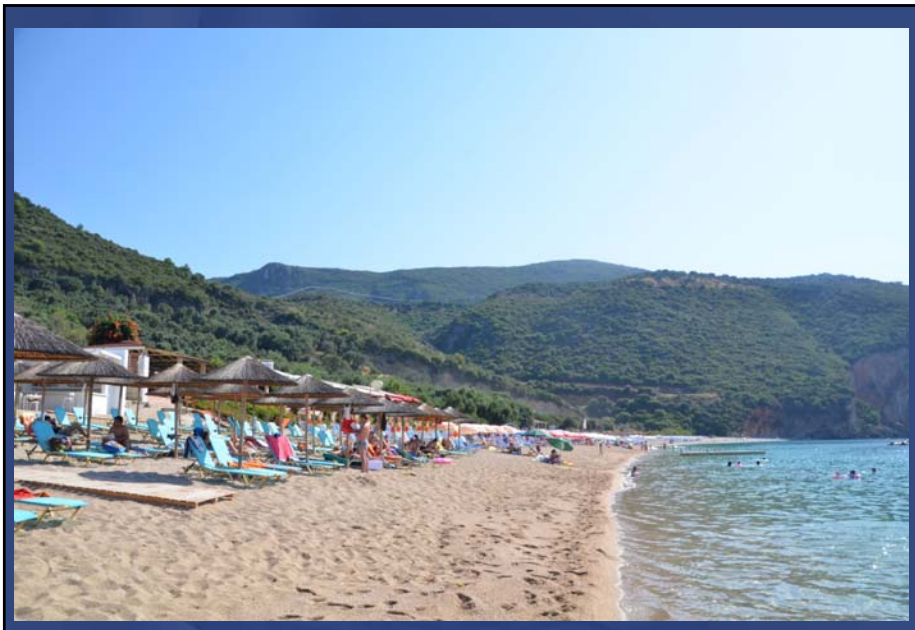

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What Test Would You Choose?

- 75-year-old woman has severe COPD and arthritis. Chest pain has both typical and atypical components, C.A.C. ?IV
- Risk: smoking, HTN
- EKG at rest: RBBB, NSR, biatrial enlargement

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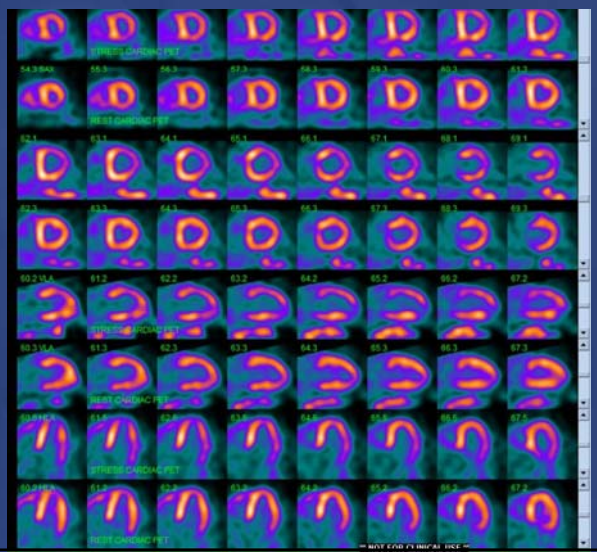
75-year-old woman has severe COPD and arthritis



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75 yo woman with COPD

- Regadenoson PET nuclear perfusion performed.
- Large size moderately reversible defect in mid anterior, anterolateral walls and entire apex.
- EF = 65%

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What Test Would You Choose?

- 52-year-old man has atypical chest pain and an anxiety disorder.
- Risk: family history
- EKG at rest: Normal

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52 yo man with atypical CP

- Exercises 13 min on a Bruce protocol to a HR of 160, no chest pain and a negative EKG

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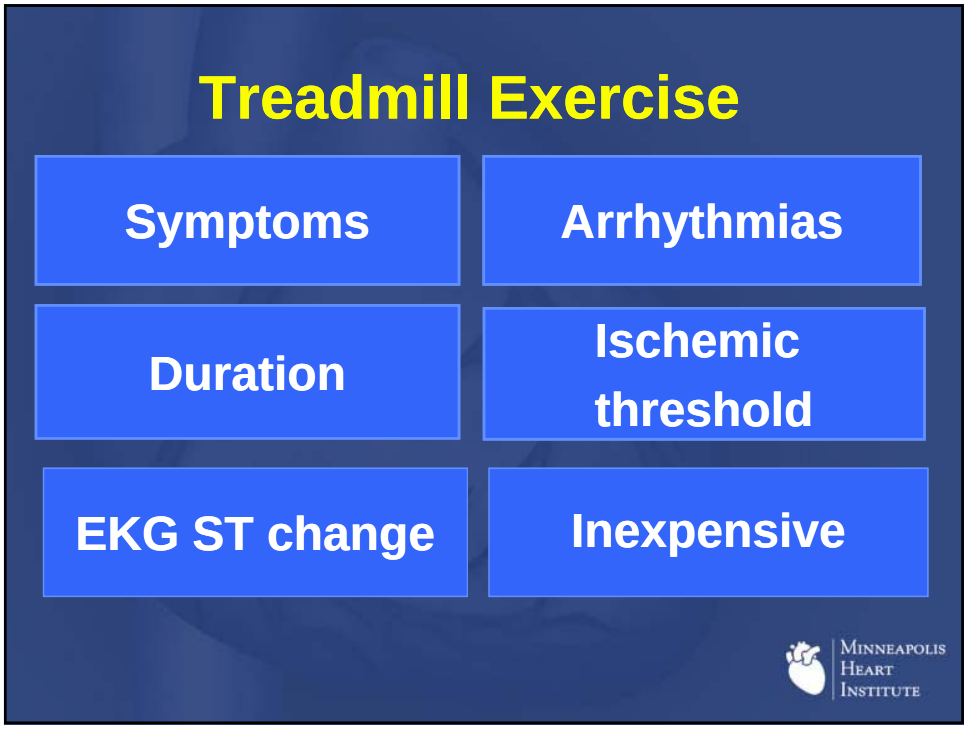
Treadmill Exercise
Symptoms
Arrhythmias
Duration
Ischemic threshold
EKG ST change
Inexpensive
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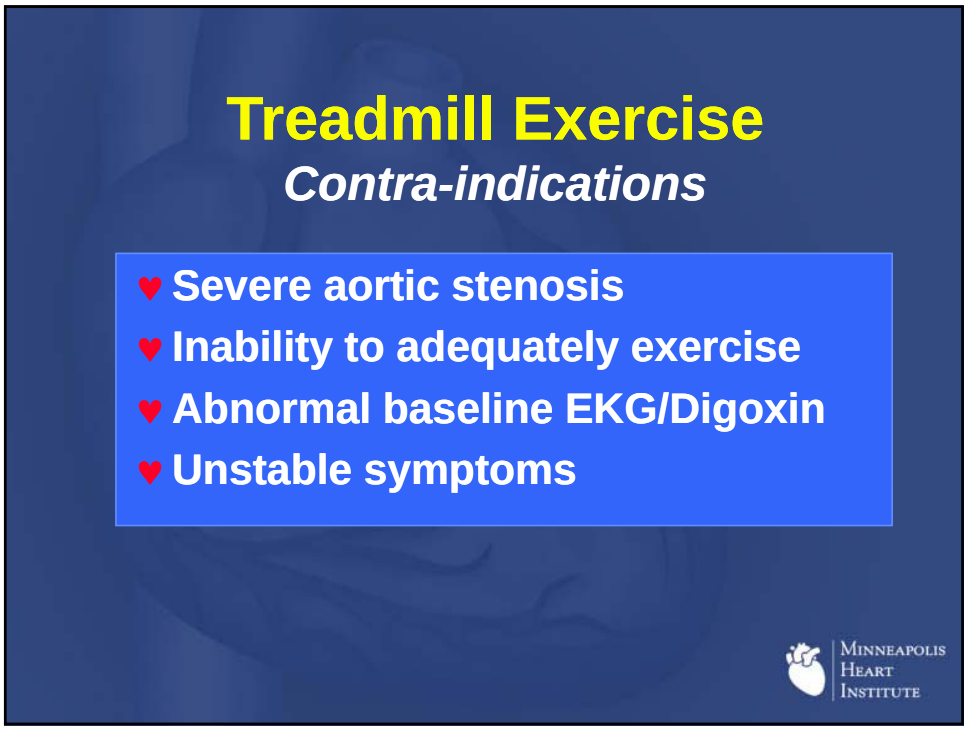
Treadmill Exercise
Contra-indications
Severe aortic stenosis
Inability to adequately exercise
Abnormal baseline EKG/Digoxin
Unstable symptoms
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Treadmill Exercise

Protocols

- Bruce
- Modified Bruce
- Naughton
- Bicycle

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Treadmill Exercise

Endpoints for cessation of test

- Significant chest pain c/w angina
- Symptom tolerated maximum
- Significant arrhythmias
- Significant ST depression? (>3mm)

Not target HR achieved!

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Treadmill Exercise

Non-diagnostic EKG's

- LBBB (?RBBB)
- Baseline ST-T wave changes
- LVH, particularly with strain
- Digoxin therapy
- WPW

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Beyond the Treadmill

EKG unreliable

Pt can't exercise

More info needed

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What Test Would You Choose?

- 40-year-old man has atypical angina, Canadian anginal class (C.A.C.) II?
- Risk: smoking, hypercholesterolemia, HTN
- EKG at rest: NSR, LVH

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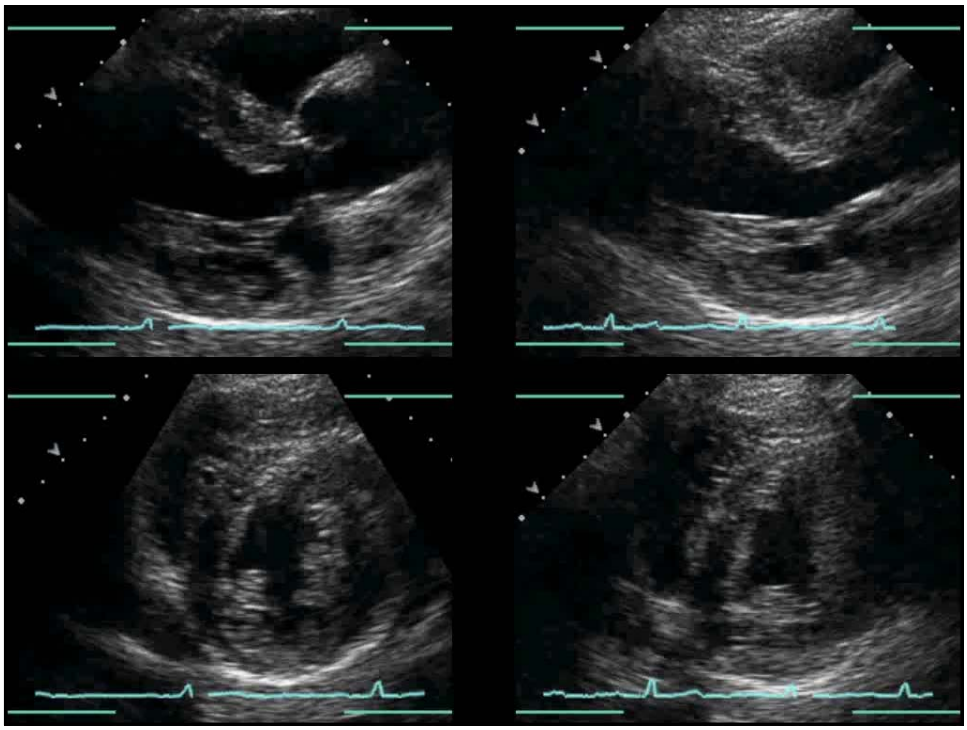

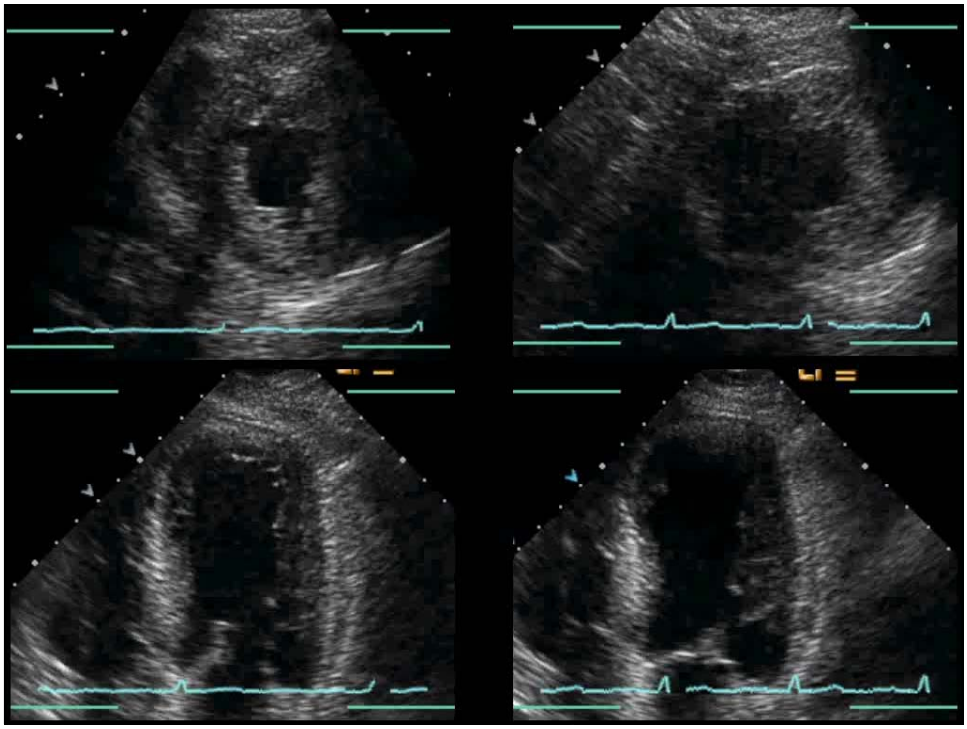

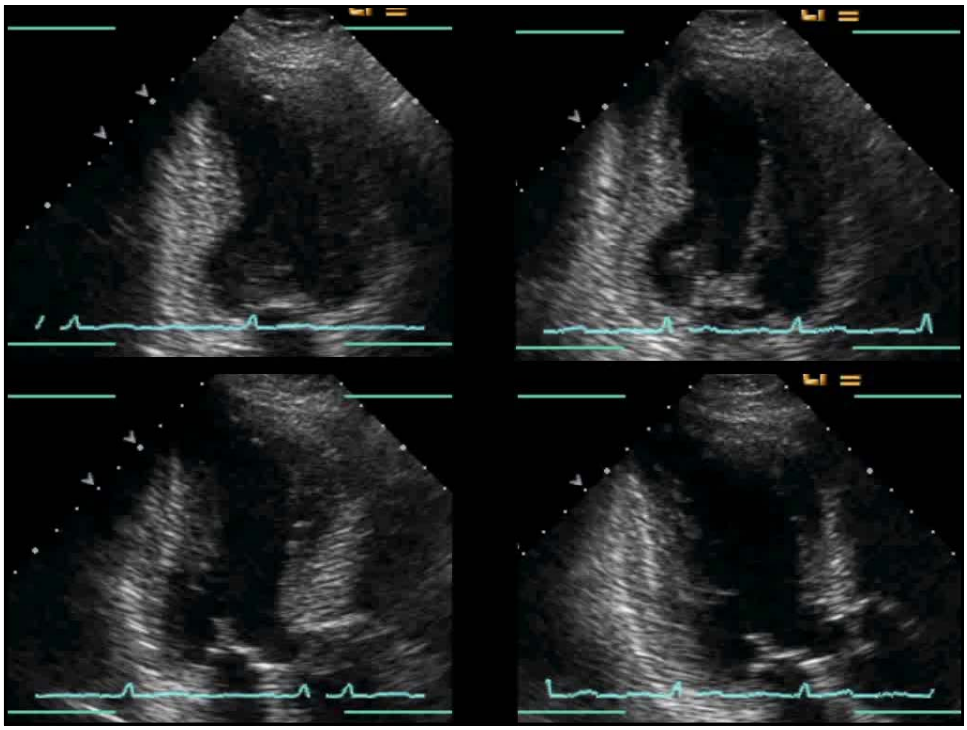

40 yo man with atypical angina

- Exercises 10 min on a Bruce protocol with 1.5 mm of slowing upsloping ST depression
- Stress echo images are normal

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It is difficult to make predictions, especially about the future.

Dan Quayle

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The Value of a Normal Study
No Known CAD

- In patients with no known h/o CAD, a normal perfusion study carried an event rate of <1%/year.
- The same can be said for patients with a high likelihood of CAD.
- It applies to both Thallium and Cardiolite
- Stress echo also predicts a <1% event rate.

Bateman et al. J Am coll Cardiol 1993;21:67A

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The Value of a Normal Study
Known CAD

- A normal nuclear scan predicted a *2.2%* event rate.
- A normal stress echo predicted a *14.1%* event rate!

Bateman TM et al. J Am Coll Cardiol 1993;21:67A

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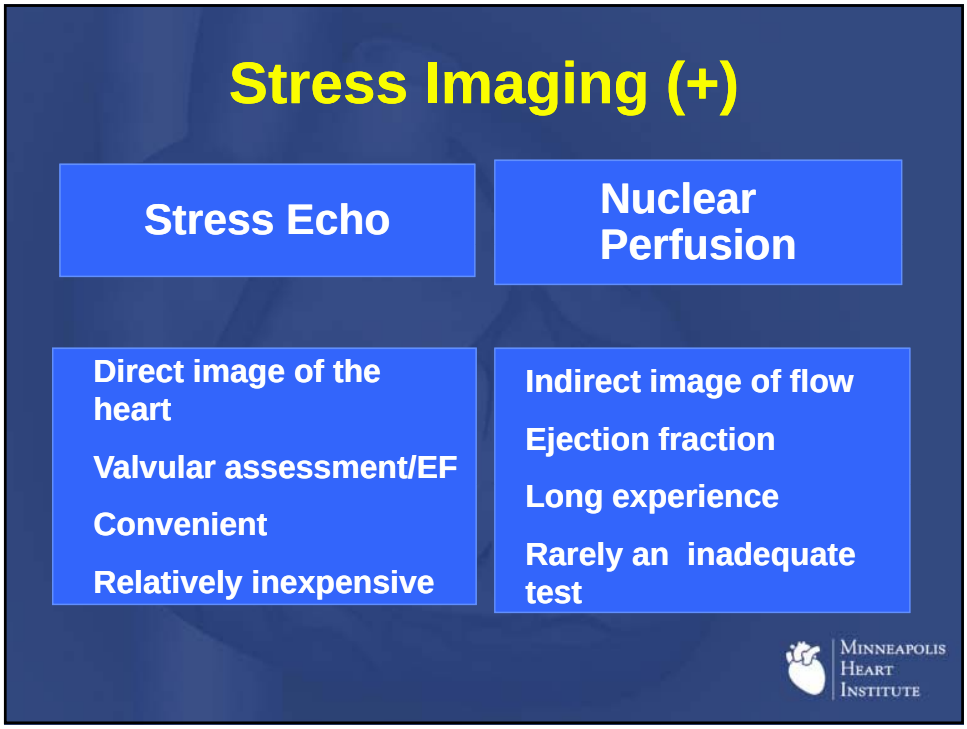
Stress Imaging (+)
Stress Echo
Nuclear Perfusion
Direct image of the heart
Valvular assessment/EF
Convenient
Relatively inexpensive
Indirect image of flow
Ejection fraction
Long experience
Rarely an inadequate test
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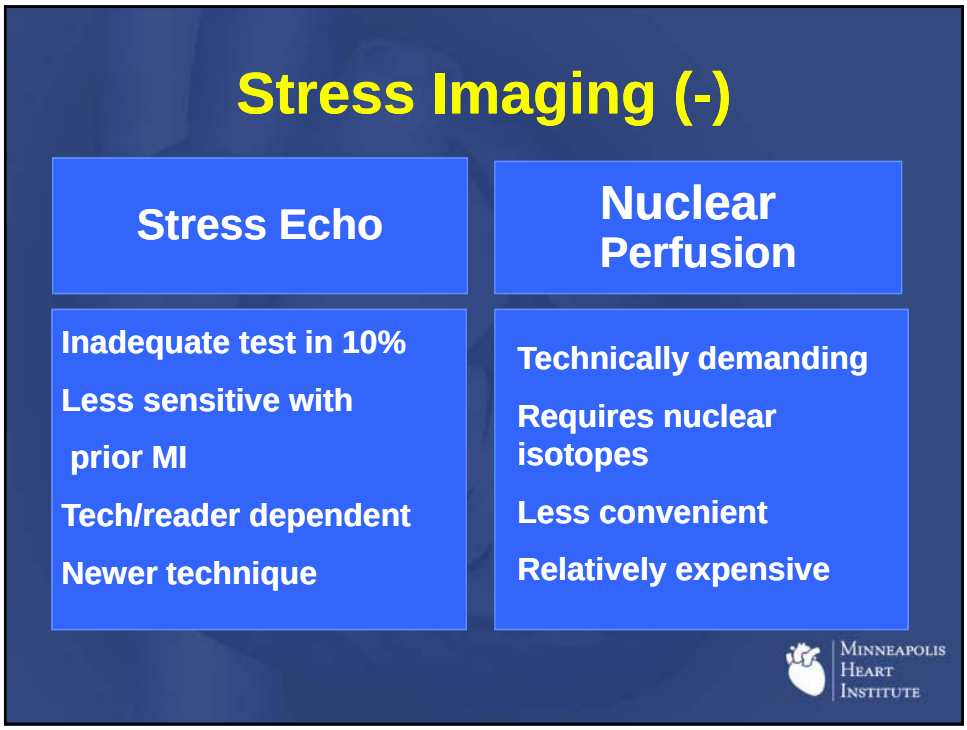
Stress Imaging (-)
Stress Echo
Nuclear Perfusion
Inadequate test in 10%
Less sensitive with prior MI
Tech/reader dependent
Newer technique
Technically demanding
Requires nuclear isotopes
Less convenient
Relatively expensive
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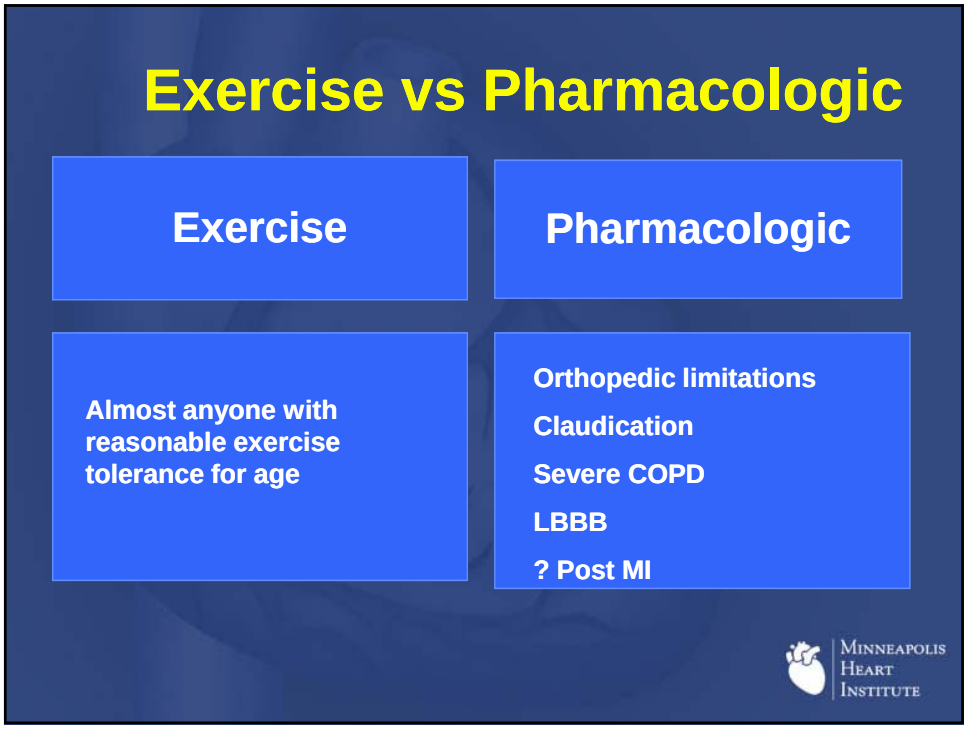
Exercise vs Pharmacologic
Exercise
Pharmacologic
Almost anyone with reasonable exercise tolerance for age
Orthopedic limitations
Claudication
Severe COPD
LBBB
? Post MI
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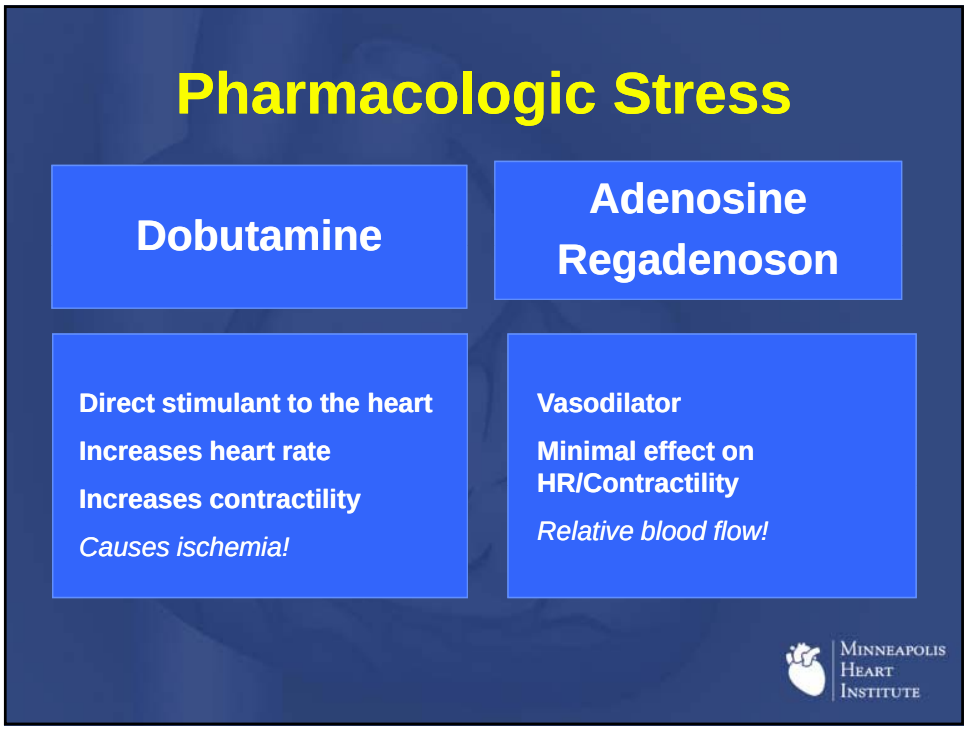
Pharmacologic Stress
Dobutamine
Adenosine
Regadenoson
Direct stimulant to the heart
Increases heart rate
Increases contractility
Causes ischemia!
Vasodilator
Minimal effect on HR/Contractility
Relative blood flow!
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Who gets what?

Treadmill Stress

- Male or female < 35 years old with normal EKG
- Low risk male with normal EKG
  - <55 years old
  - None or one CAD risk factor (non-diabetic)
  - No prior h/o CAD

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Who gets what?

Stress Echo

- Suspect, or want to rule-out, another cardiac condition
- Women under 55 with chest pain and presumed normal LV.
- No prior MI
- Likely to have good images (Non-obese, No COPD).

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Who gets what?

Nuclear Perfusion

- Prior MI
- Left ventricular dysfunction
- Left bundle branch block (adenosine)
- Significant HTN with left ventricular hypertrophy
- Likely poor echocardiographic images
- ? Single vessel CAD

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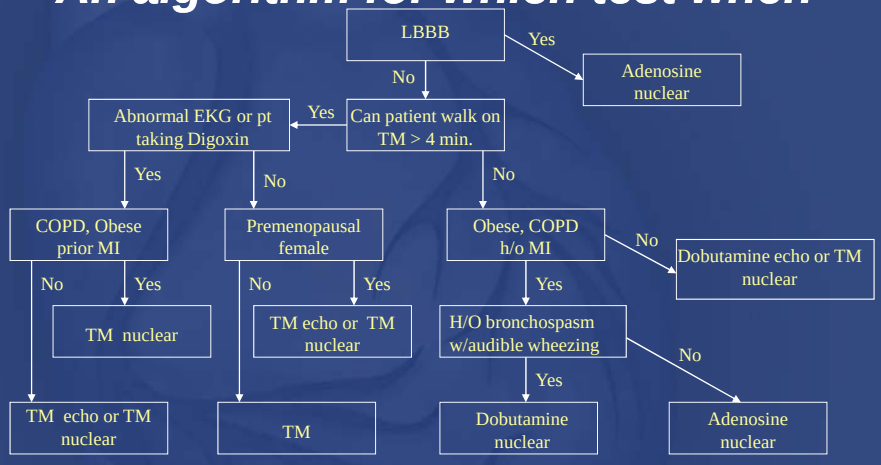
Diagnosis

An algorithm for which test when



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What Test Would You Choose?

- 60-year-old man with prior inferior infarction is admitted with chest pain in the setting of acute bronchitis with active wheezing. He has COPD, barrel chest with limited exercise capacity.
- Risk: prior MI, old smoking, D.M., family history.
- EKG at rest: NSR, old inferior wall MI

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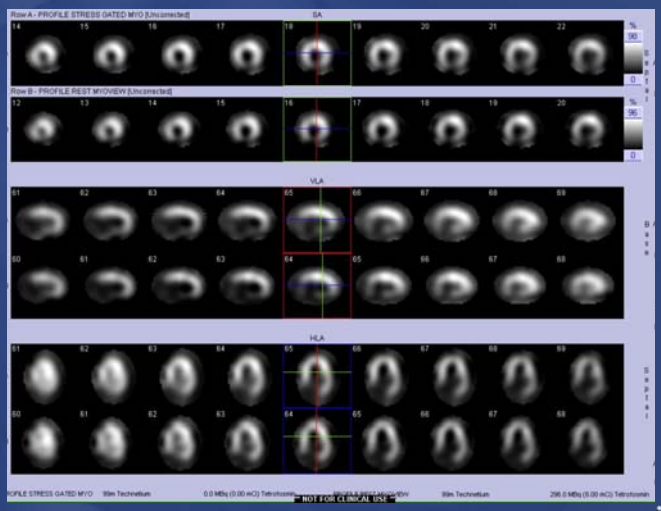
60-year-old man with prior inferior infarction and bronchitis



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60 yo with CP & prior IMI

- Dobutamine nuclear perfusion performed and able to obtain a HR of 138 with minor chest discomfort and 1.5 mm inferior ST depression
- Perfusion images reveal a fixed inferior defect c/w infarction and no evidence of ischemia.

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What Test Would You Choose?

- 72-year-old woman with atypical angina. She is awaiting hip replacement for DJD.
- Risk: HTN, family history, smoking
- EKG at rest: NSR, NS-ST-T changes

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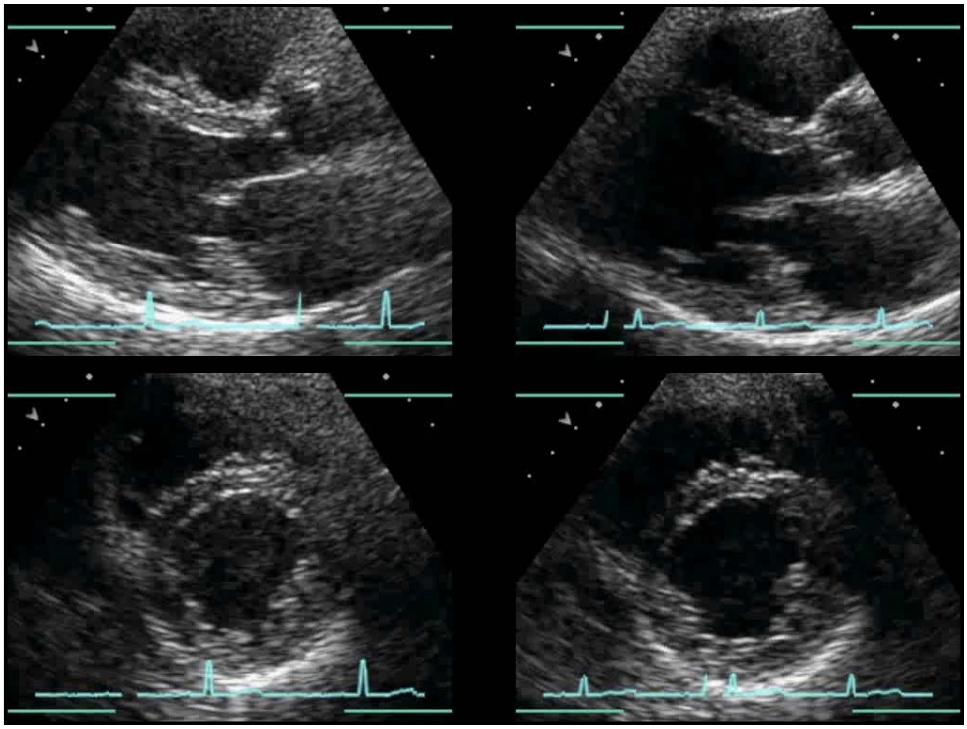

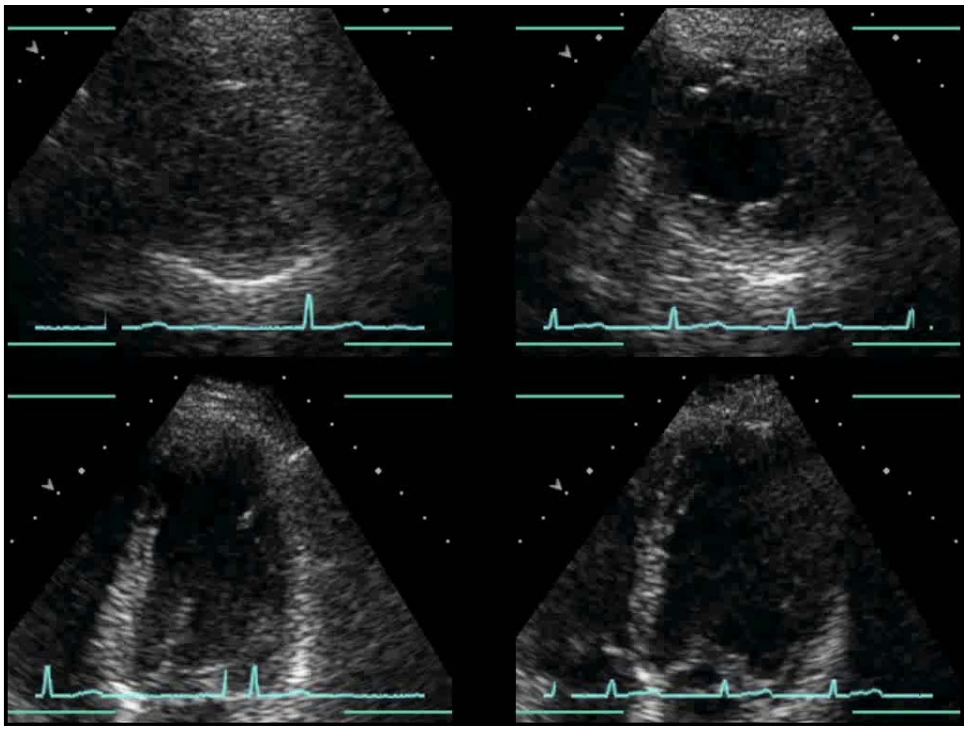

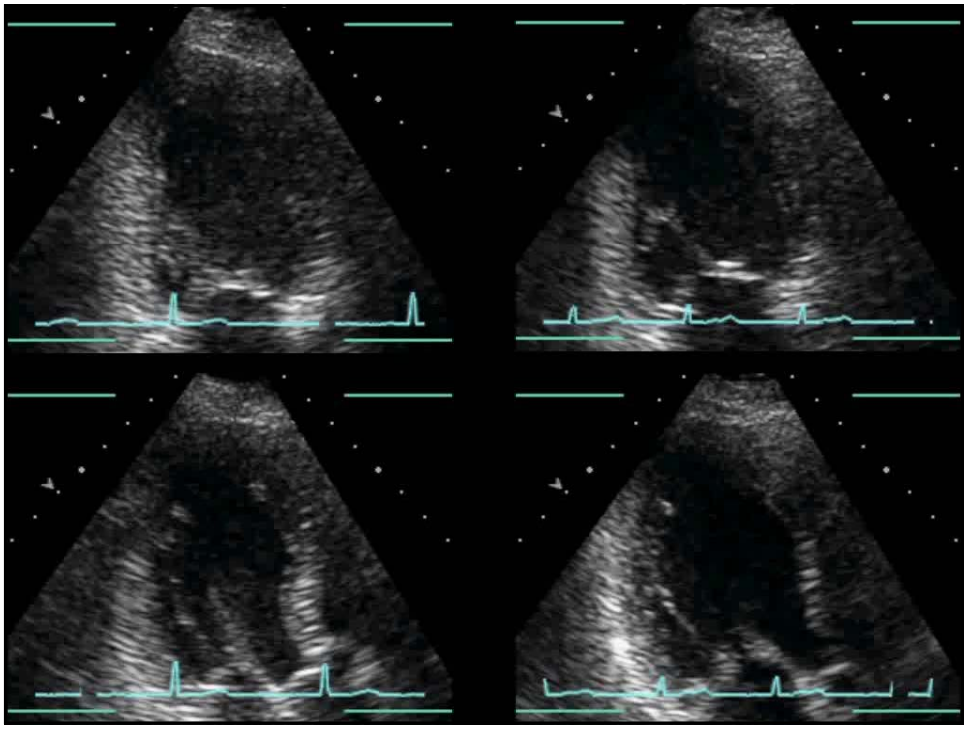

72 yo woman for THA with CP

- Dobutamine echo performed achieving a HR of 140 with 2 mm of lateral ST depression.
- Echo images reveal a large area of moderate anterior and apical ischemia
- Angio reveals 3 vessel CAD

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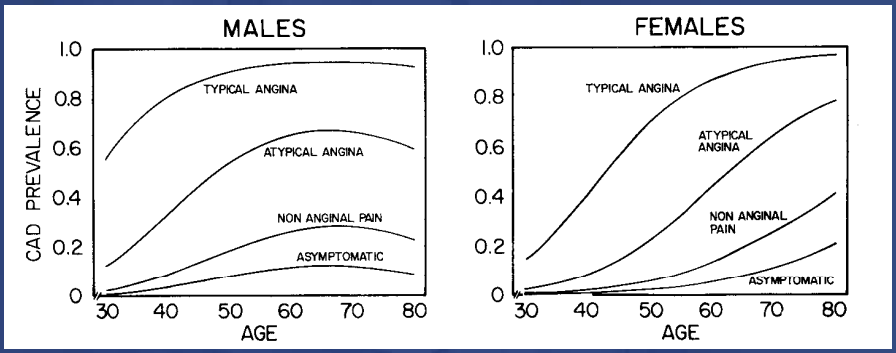
Diagnosis

Women are different



Diamond et al. J Am Coll Cardiol 1983;1:444-455

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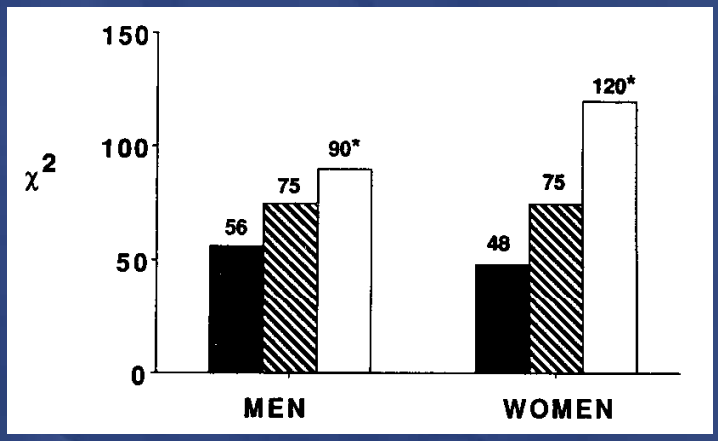
Diagnosis

Women are different



Berman et al. J Am Coll Cardiol 1995;26:639-647

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What Test Would You Choose?

- 70-year-old man has CAD with prior stent to LAD and is awaiting elective abdominal aneurysm resection.
- Risk: smoking, HTN, family history
- EKG at rest: LBBB, NSR

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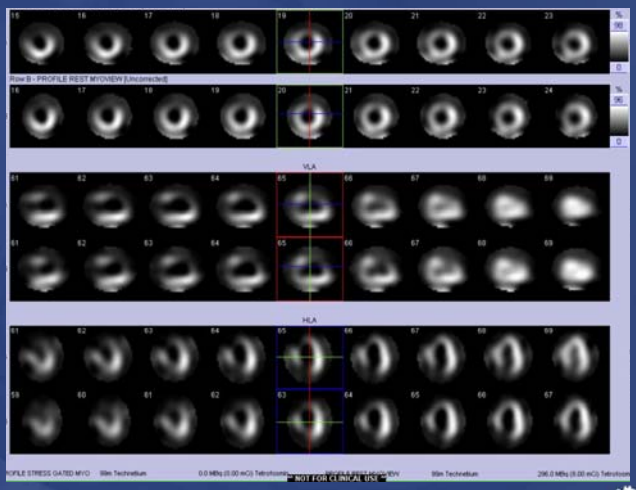
70-year-old man has CAD with prior stent to LAD



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What Test Would You Choose?

- 58 yo man with a recent ER visit for atypical chest pain, but prior RCA stent
- Obese, hypertensive and smokes.
- Pain occurs with emotional stress and exertion.
- Baseline EKG shows some T wave flattening

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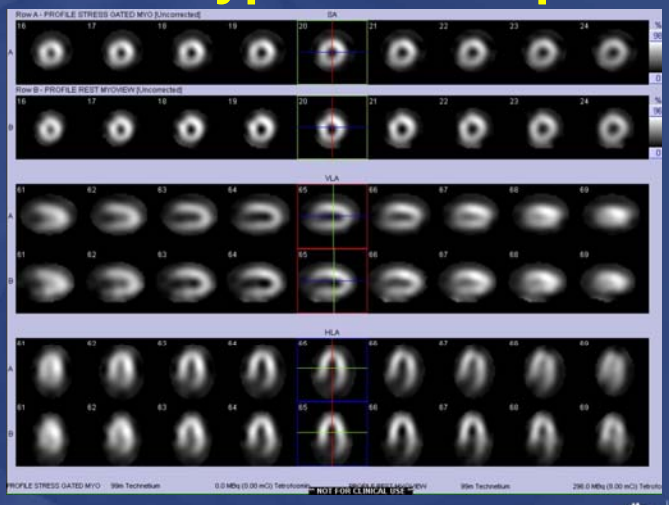
58 yo man with a recent ER visit for atypical chest pain



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58 yo man with a recent ER visit for atypical chest pain

- Exercises 6 minutes on the Bruce protocol with a HR=150. He has no chest pain and the EKG shows 1.0-1.5 mm ST depression in V5.
- Nuclear images are normal
- EF=62%

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What test would you choose?

- 38 yo man with atypical pain
- Risks: Smokes, FH

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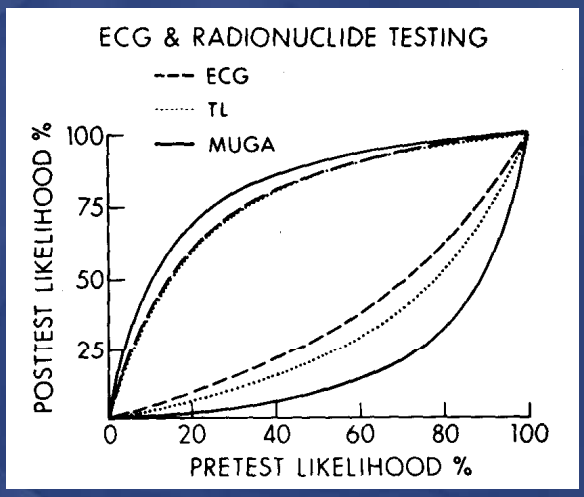
Bayes' Theorem



Epstein et al. Am J Cardiol 1980;46:491

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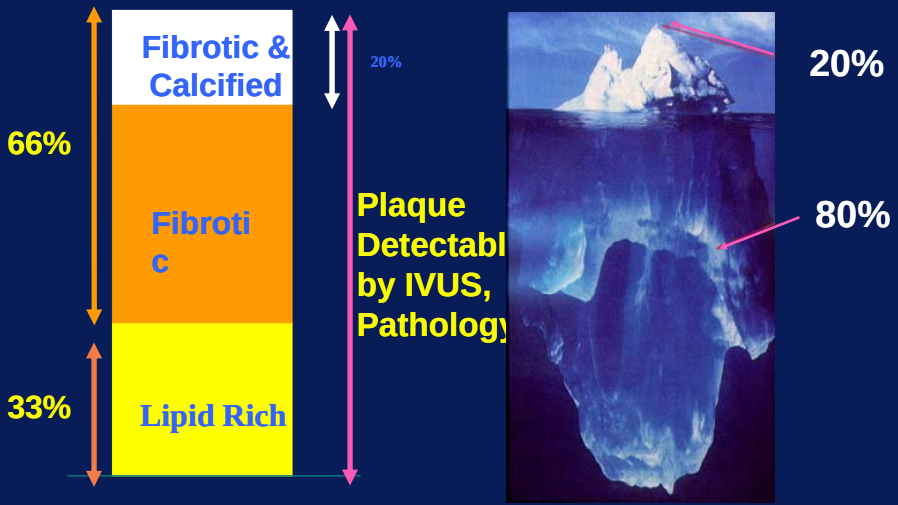
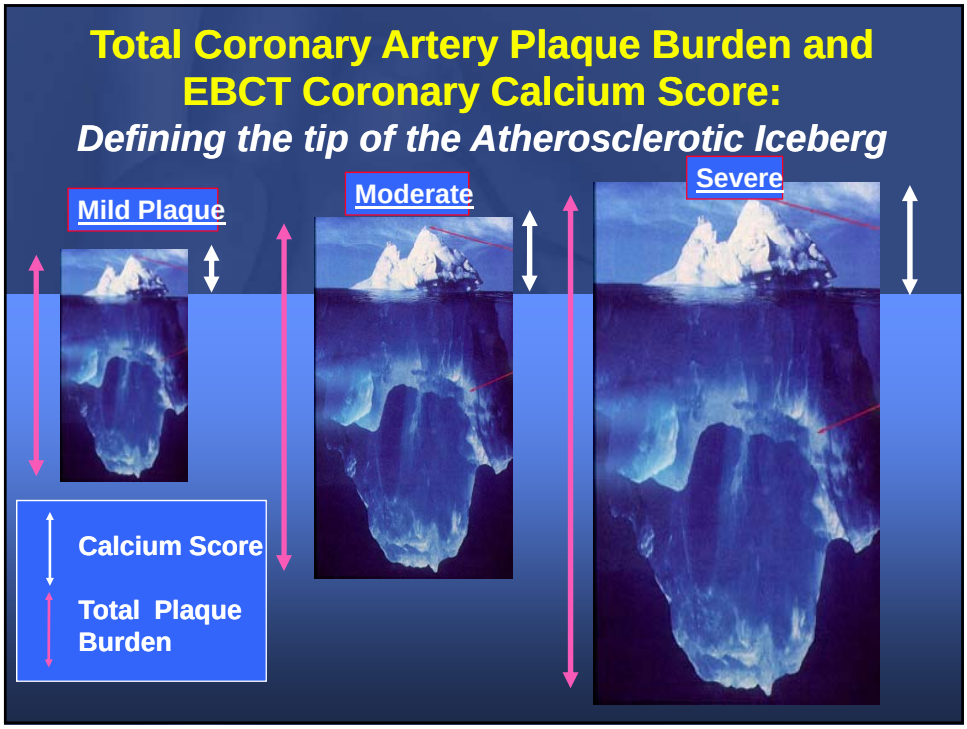
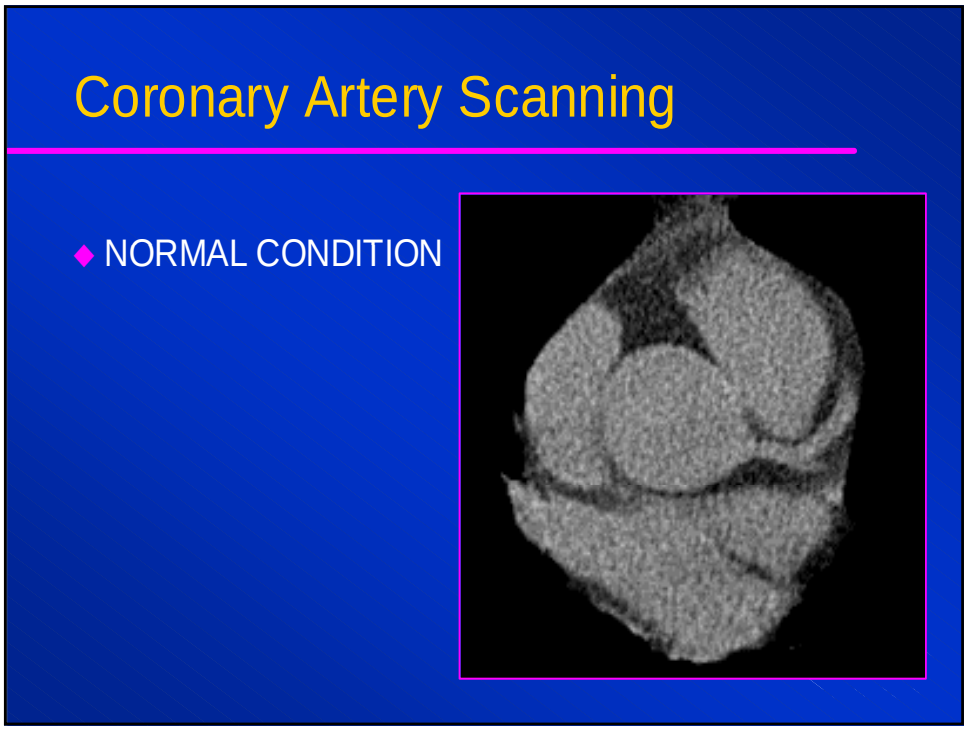
Total Coronary Artery Plaque and EBCT Coronary Calcium

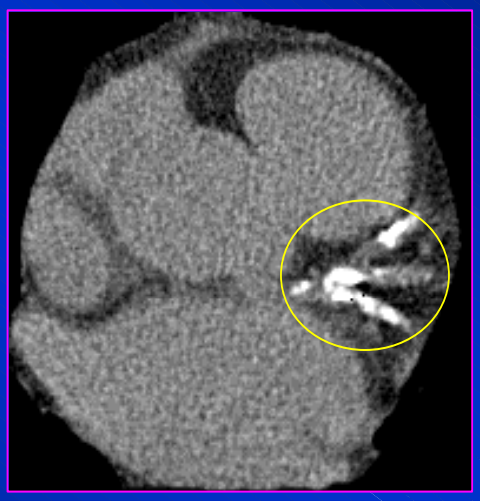



Total Coronary Artery Plaque Burden and
EBCT Coronary Calcium Score:
Defining the tip of the Atherosclerotic Iceberg
Mild Plaque
Moderate
Severe
Calcium Score
Total Plaque Burden


Coronary Artery Scanning
NORMAL CONDITION

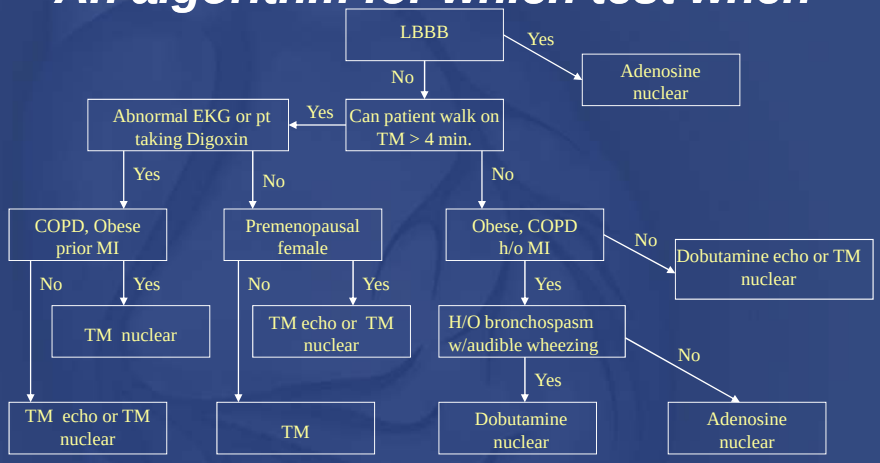
Coronary Artery Scanning

- SEVERE CALCIFICATION



Diagnosis

An algorithm for which test when



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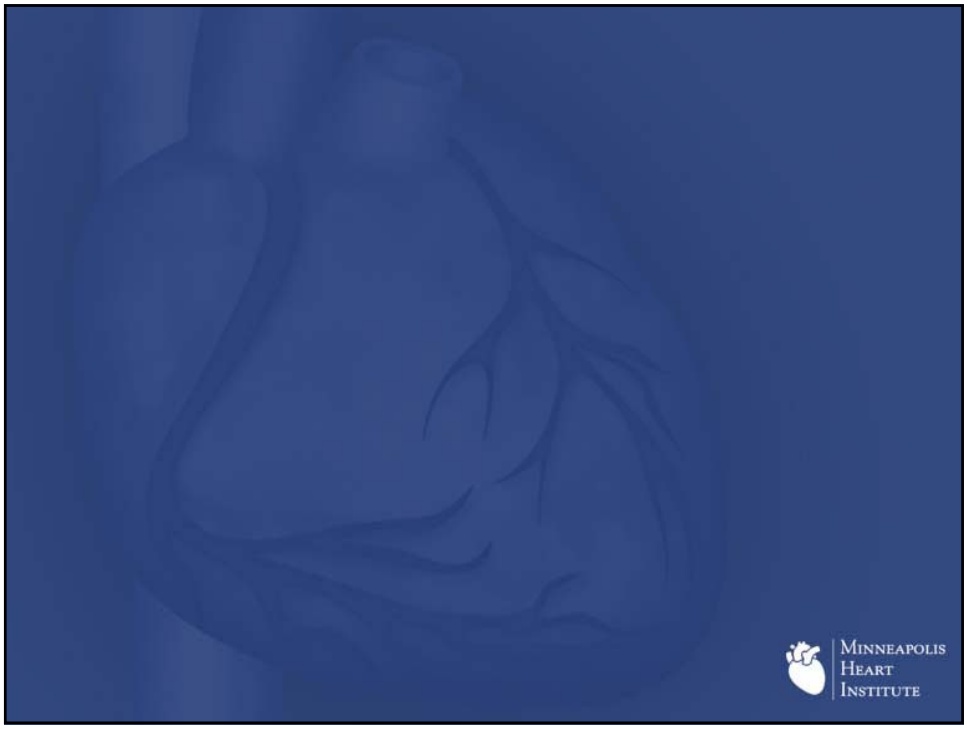
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