Approach to the Patient with Chest Pain

Anthony J. Minisi, MD
Department of Internal Medicine,
Division of Cardiology
Virginia Commonwealth University
School of Medicine

Disorder of the Breast
William Heberden, M.D.R.F.S., read at the COLLEGE, July 21, 1768

There is a disorder of the breast, marked with strong and peculiar symptom, considerable for the kind of danger belonging to it, and not extremely rare, of which I do not recollect any mention among medical authors. The seat of it and sense of strangling and anxiety with which it is attended, may make it not improperly be called angina pectoris. Those, who are afflicted with it, are seized, while they are walking, and more particularly when they walk soon after eating, with a painful and most disagreeable sensation in the breast, which seems as if it would take their life away, if it were to increase or to continue. The moment they stand still, all this uneasiness vanishes. In all other respects the patients are at the beginning of this disorder perfectly well, and in particular have no shortness of breath, from which it is totally different.

Typical Characteristics of Angina Pectoris
- Sensation of pain, pressure, burning, tightness
- Location near sternum, left or right shoulder or arm, jaw, posterior neck, back, abdomen-radiates to left or right arm or shoulder, jaw
- May occur with dyspnea and/or feelings of anxiety or dread
- Related to exercise, cold, meals, emotion, coitus
- Duration is 30 seconds to 20-30 minutes
  - relieved by TNG in 1-5 min

Myocardial Ischemia

Myocardial Ischemia

Regulation of Coronary Blood Flow to Meet Increased Myocardial Oxygen Demand

Determinants of Myocardial Oxygen Demand

- Physical activity of the heart
- Myocardial Contractility
- Systolic Wall Tension
- Ventricular Volume
- Intra-Ventricular Pressure
- Heart Rate
- Myocardial O₂ Demand
- Increased Perfusion Pressure Gradient
- Increased Aortic Diastolic Pressure
- Decreased left ventricular diastolic pressure
- Autoregulation (metabolic factors)
- Decreased Coronary Resistance
- Neural Factors
- Pharmacological Agents
Myocardial Oxygen Balance Over 24 Hours

Normal Subject

Myocardial Oxygen Balance Over 24 Hours
Coronary artery obstruction and spasm

Tools for Diagnosis of Coronary Heart Disease

- Initial evaluation
  - history
  - physical exam
    - resting ECG
    - chest x-ray/fluoroscopy
  - lab studies
- Additional testing
  - exercise stress test
  - radionuclide studies
  - coronary arteriography
  - LV angiography

Indications for Exercise Stress testing

- Diagnosis
  - evaluation of atypical chest pain
- Prognosis
  - evaluate severity of established CAD
- Therapy
  - evaluate treatment efficacy
  - evaluate benefit of surgery
  - guide post-MI rehab
- Prevention
  - safety checkup prior to fitness program
- Screening
  - professionals charged with safety of others?
  - evaluate risk factor in asymptomatic individual?

Contradictions to Exercise Testing

- MI (impending, acute, or healing)
- Known ominous CAD
- Unstable angina
- Severe aortic stenosis
- Congestive heart failure
- Severe hypertension
- Uncontrolled arrhythmias
- Greater than first degree heart block
- Acute systemic illness
- No informed consent


Prognostic Variables in Exercise Stress Testing

- Exercise Duration
- Hemodynamic response to exercise
  - decreased or inadequate blood pressure response
  - maximum heart rate achieved
- Ventricular arrhythmias
- Subjective response to exercise
  - chest pain

Prognostic Variables in Exercise Stress Testing

- Electrocardiographic response to exercise
- ST depression
  - configuration
  - depth
  - duration
  - heart rate at onset
  - multiple ECG leads involved
- ST elevation
- T wave inversion

Exercise Electrocardiography Correlation with Coronary Anatomy


Prevalence of CAD

- Prevalence of coronary-artery disease (CAD) according to age, sex, and system classification

Pre- and Post-test Probability of CAD

Radionuclide Perfusion Tracers
- **Sestamibi**
  - irreversibly trapped in myocardial mitochondria
  - myocardial uptake requires
    - vascular delivery by intact coronary vasculature
    - cellular viability
  - Normal response in homogeneous uptake throughout the myocardium
  - perfusion defects indicate the presence of CAD
  - fixed vs. reversible perfusion defects

Indications for Exercise Stress Testing with Radionuclide Perfusion Studies
- Abnormal ECG
  - LVH
  - LBBB
- Pain on exercise without diagnostic ECG changes
- Estimate amount of myocardium at risk
- Enhance specificity for patients with high incidence of false positive exercise tests

Non-Exercise Stress Tests
- **Pharmacologic**
  - vasodilators
    - dipyridamole
    - adenosine
  - positive inotropes / chronotropes
    - dobutamine
- **Non-pharmacologic**
  - pacing
    - invasive
    - non-invasive

Vasodilator Stress

Cardiac Catheterization
- “Gold standard” anatomically
- Provides limited physiologic information
- More expensive than non-invasive testing
- Higher morbidity than non-invasive testing
- As initial testing modality, best reserved for “high risk” patients

High Risk Chest Pain Patients
- **Clinical factors**
  - signs of heart failure with chest pain
  - chest pain in unstable pattern:
    - increased frequency
    - increased intensity
    - increased duration
    - decreased response to nitrates
    - new rest pain or pain with less exertion
High Risk Chest Pain Patients

- Electrocardiographic factors
  - resting ST-T wave changes
  - marked ST changes during an episode of pain
- Stress studies
  - early positive stress test
  - fall in blood pressure during exercise
  - multiple or large perfusion defects

Indications for Coronary Arteriography

- Symptomatic patients
  - noninvasive test results inconclusive
  - evaluation/reassurance in unexplained chest pain
  - document coronary artery spasm
  - evaluation of indications for bypass surgery:
    - medically intractable angina
    - possible high-risk lesions
    - patients scheduled for valve replacement

Indications for Coronary Arteriography

- Asymptomatic patients
  - abnormal resting ECG in those responsible for safety of others
  - exercise ECG consistent with myocardial ischemia plus ≥ on major risk factor
  - MI in relatively young patient
  - post cardiac resuscitation