

Contra-indications, Risks, and Safety Precautions for Stress Testing

- How safe is stress testing?
- Contra-indications
- Termination Criteria



Ellstad Chapt 5
ACSM Chpts 3-6

Data to Support Stress Testing

- **Seattle Heart Watch Study**
 - asymptomatic persons with 2 or more CAD risk factors have a 15 x greater risk of developing CAD
- **American Heart Committee**
 - Recommends stress testing persons older than 40 or with CAD risk factors before beginning a vigorous exercise program

ACSM guidelines, pg 20

	Low Risk	Moderate Risk	High Risk
Moderate Exercise	no	no	yes
Vigorous Exercise	no	yes	yes

Moderate exercise < 3-6 METS < 40-59% VO₂max
Vigorous exercise > 6 METS, > 60% VO₂max

Risk Classifications pg 27

- **Low Risk**
 - men < 45, women < 55 yrs
 - asymptomatic
 - 0 or 1 CAD risk factor
- **Moderate Risk**
 - Older
 - 2 or more risk factors
- **High Risk**
 - signs, symptoms, or known CV, pulmonary, or metabolic diseases



7 ACSM RISK FACTORS, pg 22

- Family history
- Cigarette smoking
- Hypertension
- Dyslipidemia
- Impaired fasting glucose
- Obesity
- Sedentary Lifestyle

7 ACSM RISK FACTORS

- **Family history**
 - (m > 55, f > 65)
- **Cigarette smoking**
 - (<6 mo)
- **Hypertension**
 - (≥140/90)
- **Dyslipidemia**
 - (TC >200 mg/dL, LDL > 130 mg/dL, HDL < 40 mg/dL, or on lipid lowering meds)

Risk Factors, cont.

- **Impaired fasting glucose**
 - (>100 mg/dL)
- **Obesity**
 - (>30 kg/m², wg > 102cm m or 88cm f, w/h ≥ 0.95 m or 0.86 f)
- **Sedentary Lifestyle**
 - (<30 min/d moderate PA)

Is Stress Testing Safe?

- **“Safety is an important aspect” in persons over 40 or with risk factors (Ellstad pg 86)**
- **“Even maximal testing is safe if the physician follows available guidelines” (Ellstad pg 86)**
 - Know when to stop
 - Know when not to start

Deaths during Stress Tests

- **1 in 10,000 (Rochimis and Blackburn)**
 - 170,000 tests in cardiac patients
 - 75% of tests at ~ 75% HRmax
 - 34% maximal tests
- **“Risks of serious complications seem reasonable, and with the use of established techniques and continuous monitoring can be minimized” Ellstad pg 99**

Risk during Maximal vs. Submaximal Tests

- **No further risk for maximal tests than submaximal**
- **Assumes appropriate screening and monitoring of subjects**



IRB proposal and Consent form issues

- **How would you describe the risk for maximal stress testing to the IRB?**
- **How would you describe the risk of a maximal stress test to a research subject?**
- **How would you describe the risk of a maximal stress test to a patient being screened for CAD?**

Contra-Indications

- **Absolute Contra-indications**
 - stress test should not be performed until the condition is stabilized or adequately treated
- **Relative Contra-indications**
 - may be tested only after careful evaluation of the risk/benefit ratio

Conflicting Guidelines?

- **Legally, safe if you go with “published standards”**
- **Go with laboratory standards**
 - Ellstad
 - ACSM
 - NASA
 - Exercise Physiology Lab
 - Rehabilitation site

ACSM Absolute Contra-Indications for testing pg 50

1. **EKG change suggesting recent MI, severe ischemia, or other significant cardiac event**
2. **Unstable angina**
3. **Uncontrolled cardiac arrhythmias causing symptoms**
4. **Severe symptomatic aortic stenosis**

Absolute Contra-Indications for testing, cont.

5. **Symptomatic heart failure**
6. **Pulmonary embolus or pulmonary infarction**
7. **Acute myocarditis or pericarditis**
8. **Suspected or known dissecting aneurysm**
9. **Acute systemic infection**

ACSM Relative Contra-Indications for testing (pg 50)

1. **Left main coronary stenosis**
2. **Moderate stenotic valvular heart disease**
3. **Electrolyte abnormalities**
4. **Hypertension, >200/110 at rest**
5. **tachyarrhythmias or bradyarrhythmias**

Relative Contra-Indications for testing, cont.

6. **Hypertrophic cardiomyopathy (other outflow tract obstructions)**
7. **Neuromuscular, musculoskeletal, rheumatoid disorders exacerbated by exercise**
8. **High-degree a-v block**

Relative Contra-Indications for testing, cont

9. **Ventricular aneurysm**
10. **Uncontrolled metabolic disease (diabetes, thyroid)**
11. **Chronic infectious disease (hepatitis)**
12. **Mental or physical impairment with inability to exercise**

Angina

- **Characteristics**
 - Substernal Pain
 - Precipitated by exertion
 - Promptly relieved by rest or nitroglycerin
- **Typical angina (patients with all three characters)**
- **Atypical angina (patients with 2)**
- **Nonanginal (patients with 1)**

(Roberts 97, pg 144)

Stable vs. Non-Stable Angina

- **Silent angina**
 - ST depression but no symptoms
- **Stable angina**
 - occurs predictably with progressive exercise at approximately the same rate-pressure product
- **Unstable angina**
 - abrupt increase in frequency or occurrence at rest

Anginal Symptom Scale

(ACSM pg 107)

- **+1 Light, barely noticeable**
- **+2 Moderate, bothersome**
- **+3 Severe, very uncomfortable**
- **+4 Most severe pain ever experienced**

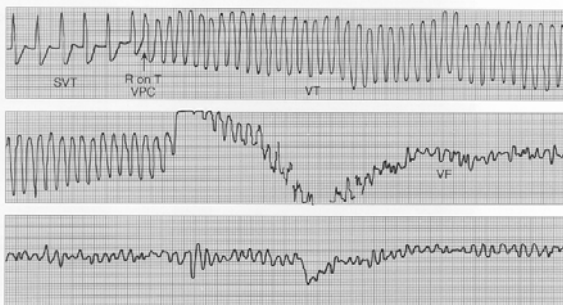
A rating of 3 or a degree that would cause the patient to stop normal daily activities or take a nitroglycerin tablet should be the test stopping point

ACSM Absolute Indications for Terminating a Test (Box 5-2, pg 106)

1. SBP $\downarrow \geq 10$ mmHg from baseline with \uparrow work rate and ischemia
2. Moderate or severe angina (>3)
3. \uparrow nervous system symptoms (ataxia, dizziness, near syncope)
4. Poor perfusion (cyanosis, pallor)
5. Hardware failure (EKG, BP)
6. Subject request
7. Sustained ventricular tachycardia
8. ST elevation ≥ 1 mm (not V_1 or aVR)

ACSM Relative Indications for Terminating a Test (Box 5-2, pg 106)

1. \downarrow SBP > 10 mmHg from baseline with \uparrow work rate but no ischemia
2. ST or QRS changes, > 2 mm horizontal or down-sloping ST segment depression or marked axis shift
3. Arrhythmias other than sustained ventricular tachycardia, including multifocal PVCs, Supra-ventricular tachycardia, heart block, or bradyarrhythmias



SVT = supraventricular tachycardia (rate > 120)
 VPC = ventricular premature contraction
 VT = sustained ventricular tachycardia (palpitations, weakness, dizziness, syncope, circulatory collapse.)
 VF = ventricular fibrillation

Relative Indications, cont.

4. Fatigue, shortness of breathe, wheezing, leg cramps, claudication
5. BBB or intraventricular conduction delay that cannot be distinguished from ventricular tachycardia
6. Increasing chest pain
7. SBP > 250 mm Hg and/or DBP > 115 mm Hg

Case Studies

- **Lessons learned**
 - don't test a person with unstable angina (most important contra-indication)
 - don't test a person with known, severe, left coronary artery disease
 - don't continue a test if bp falls with increase in work load

Conclusions

- **Is stress testing safe?**
 - When yes
 - When no
- **What can you do to make stress testing as safe as possible?**
 - When not to test?
 - When to stop?

