

STANDARDIZED PROCEDURE
CARDIAC STRESS TESTING-EXERCISE TESTING (Adult)

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I. Definition:

During the exercise test, the patient exercises on a bike or treadmill while being monitored with a 12 lead ECG, blood pressure device, pulse oximetry oxygen consumption, and perhaps imaging with Echocardiogram, or nuclear imaging. The purpose of exercise testing is used for the following:

- Detection of coronary artery disease (CAD) in patients with chest pain (chest discomfort) syndromes or potential symptom equivalents
- Evaluation of the anatomic and functional severity of CAD
- Prediction of cardiovascular events and all-cause death (risk stratification)
- Evaluation of physical capacity and effort tolerance
- Evaluation of exercise-related symptoms
- Assessment of chronotropic competence, arrhythmias, and response to implanted device therapy
- Assessment of the response to medical interventions

II. Background Information

A. Setting: The setting (inpatient vs outpatient) and population for the Advanced Health Practitioner (AHP) is determined by the approval of the privileges requested on the AHP Privilege Request Form.

B. Supervision: The necessity of this protocol will be determined by the Advanced Health Practitioner in collaboration with the supervising physician or his/her designee. Designee is defined as another attending physician who works directly with the supervising physician and is authorized to supervise the Advanced Health Practitioner. Direct supervision will not be necessary once competency is determined, as provided for in the protocol.

C. The AHP that has been privileged for this standardized procedure has the independent authority to determine which diagnostic practice is ~~appropriate~~^{best} for the patient undergoing the nuclear stress testing, ~~e.g. low-dose stress first imaging i.e. choosing resting vs one day stress vs stress only.~~

D. The Advanced Health Practitioner will notify the physician immediately upon being involved in any emergency or resuscitative events or under the following circumstances:

1. Patient decompensation or intolerance to the procedure
2. Outcome of the procedure other than expected

E. Indications:

To rule out cardiac ischemia, arrhythmias, evaluate exercise tolerance, patient symptoms, and medical and device therapies, as determined by the Attending Physician.

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F. Precautions:

Although not common, serious adverse reactions that may occur during stress cardiac testing include life threatening arrhythmias, syncope, myocardial infarction, bronchospasm, and rarely death.

III. Materials

Equipment and supplies are located in the department.

IV. Treadmill Test

A. Pre-treatment evaluation

1. Obtain brief history. Check as to appropriateness of ordered test. Read baseline ECG, note any baseline abnormalities and compare with previous ECG. If patient has prior cardiac stress test, obtain for comparison. Perform heart and lung exam, and document vital signs. Consult with attending physician as needed.

B. Set up

1. Confirm with technician that the 12 lead hook-up is correct and that the patient has been instructed as to how to get on and off the exercise equipment.
2. Place or check intravenous line for patency if using isotope for nuclear study or contrast for ECHO study.
3. Check resting ECHO, spirometry baseline or nuclear images as indicated and assure availability of ECHO technician and/or nuclear medicine technician.

C. Patient Preparation

1. Explain procedure to patient and/or parent/guardian. Discuss risks, benefits, and obtain informed consent.

D. Procedure

1. Begin exercise test, monitoring the 12 lead ECG, vital signs, oxygen saturation, and symptoms throughout the test.
2. For nuclear tests, have the isotope injected into the intravenous line at peak exercise as determined by symptoms, ECG changes, or peak exercise. If able, have the patient continue to exercise for about one minute post injection. If performing ECHO with stress test, ECHO images are obtained immediately after exercise is stopped.
3. During the recovery period, monitor the patient for 6-8 minutes or until symptoms and/or ECG and vital signs return to baseline.
4. If adverse hemodynamic responses occur, significant arrhythmias, ST depression greater than 2 mm or ST elevation greater than 1 mm occur, stop the test immediately. Perform emergency procedures as noted below. Any adverse effects or complications are reported to the attending physician immediately.

E. Emergency Procedures

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Though not common, serious adverse reactions that may occur during the stress testing procedure are:

1. Cardiopulmonary Arrest
2. Ischemia
3. Hypotension
4. Life Threatening Arrhythmias
5. Bronchospasm

1. Cardiopulmonary Arrest

Follow the "CODE BLUE" procedure in the nursing policy and procedure manual. Depending on the physical location of the stress lab, either overhead call a "Code Blue" or "Code White", or dial 911.

2. Ischemia

During the treadmill test with or without chest pain.

- a. Inject the isotope, if ordered, and stop the test. May obtain ECHO images as long as patient's vital signs are normal.
- b. Help the patient to the gurney.
- c. If ischemia and/or chest pain does not begin to resolve in 2-3 minutes, begin oxygen at 2-4 L/nasal prongs and start an IV of normal saline. If patient's blood pressure is greater than 110 systolic, give Nitroglycerine 0.4mg SL or 2 sprays and page the attending. May repeat nitroglycerine up to 3 times within ten minutes. If ST elevation occurs, then add 325 mg Aspirin p.o., if patient has not taken any that day. Continue to monitor patient until the Attending physician has arrived. Patient may require Morphine Sulfate and/or admission to the Emergency Department to R/O MI per Attending.

d. During **Dipyridamole/Adenosine/Regadenoson** infusion with or without chest pain.

- a. Inject the isotope immediately, stop the infusion, if still infusing, and reverse with aminophylline (up to 3mg/kg). Begin oxygen 2-4L/nc as indicated.
- b. If the ischemia persists and the blood pressure is greater than 110 systolic, give nitroglycerine 0.4mg SL or 2 sprays and page the Attending.

Consider Morphine Sulfate and/or Metoprolol IV. Continue monitoring the patient. May require admission to the hospital.

3. Hypotension

- a. Place the patient flat on the gurney or in Trendelenberg and start IV line and give 250ml bolus of normal saline.
- b. Page the attending physician
- c. Treat tachyarrhythmias or bradycardias per protocol below or per attending physician's recommendations.

4. Life Threatening Arrhythmias

- a. Ventricular Fibrillation: Follow "CODE BLUE"
- b. Sustained Ventricular Tachycardia
 1. Stop test and have patient cough until lying flat on gurney.
 2. Have technician page Attending physician STAT and bring "Crash Cart" into room.
 3. Obtain blood pressure and start an IV line and give 250ml bolus of normal saline.
 4. If still in VT, follow ACLS protocol
 5. If patient is hypotensive, prepare for cardioversion.

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F. Post-procedure

1. At the end of the test, the technicians remove the IV. All items contaminated by the isotope are placed in the appropriate container and are disposed of by the nuclear medicine staff.
2. The test is terminated after symptoms, ECG, and vital signs return to baseline.

V. Documentation

A. Documentation is in the electronic medical record

1. Documentation of the pretreatment evaluation
2. Record the consent, procedure, outcome, patient tolerance, medications given, and the plan in the note.

- B.** All abnormal or unexpected findings are reviewed with the supervising physician and documented. If referring provider is notified, document such.

VI. Competency Assessment

A. Initial Competence

1. The Advanced Health Practitioner will be instructed on the efficacy and the indications of this therapy and demonstrate understanding of such.
2. The Advanced Health Practitioner will demonstrate knowledge of the following:
 - a. Medical indication and contraindications of cardiac stress exercise testing, as well as the emergency procedures during stress testing.
 - b. Risks and benefits of the procedure
 - c. Related anatomy and physiology
 - d. Consent process
 - e. Steps in performing the procedure
 - f. Documentation of the procedure
 - g. Ability to interpret results and implications in management.
3. Advanced Health Practitioner will observe the supervising physician/ AHP perform each procedure 5 times and perform the exercise stress test for a total of **200** times under direct supervision.
4. Supervising physician/supervising AHP will document Advanced Health Practitioner's competency prior to performing procedure without direct supervision.
5. The Advanced Health Practitioner will ensure the completion of competency sign off documents and provide a copy for filing in their personnel file and a copy to the medical staff office for their credentialing file.

B. Continued proficiency

1. The Advanced Health Practitioner will demonstrate competence by successful completion of the initial competency.
2. Demonstration of continued proficiency shall be monitored through the annual evaluation.
3. A clinical practice outcomes log is to be submitted with each renewal of credentials. It will include the number of procedures performed per year and any adverse outcomes. If an adverse outcome occurred, a copy of the procedure note will be submitted.

VII. RESPONSIBILITY

Questions about this procedure should be directed to the Chief Nursing and Patient Care Services Officer at 353-4380.

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VIII. HISTORY OF POLICY

Revised February 2012 by Subcommittee of the Committee for Interdisciplinary Practice

Reviewed February 2012 by the Committee on Interdisciplinary Practice

Prior revision May 2009

Approved February 2012 by the Executive Medical Board and the Governance Advisory Council

Reviewed 2016 by the Committee on Interdisciplinary Practice

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According to the ASNC imaging guidelines for SPECT nuclear cardiology procedures: Stress, protocols, and tracers (Journal of Nuclear Cardiology, Henzlova et al 2016), for many patients, 2-day imaging is impractical, and thus stress and rest studies are usually performed using a 1-day protocol. This requires administration of a lower dose for the first injection and a higher dose for the second injection.

In patients without a high pre-test probability of a stress perfusion defect or left ventricular dysfunction or dilatation (no previous MI/**known CAD**, CABG, coronary intervention, low EF, LBBB, previous OHT, BMI>35), a low-dose stress/high-dose rest Tc-99m protocol is advantageous because a significant percentage of these patients will have normal stress imaging, thereby enabling obviating the need for the rest imaging with its additional radiation exposure, and permitting performance of stress-only imaging.

Henzlova, M, et al. (Feb 2016) ASNC Imaging Guidelines for SPECT nuclear cardiology procedures: Stress, protocols, and tracers. Journal of Nuclear Cardiology