Tc-99m Sestamibi/Tetrofosmin Stress-Rest Myocardial Perfusion Scintigraphy

**Primary Indications:** Evaluation of myocardial perfusion and viability in patients with known or suspected coronary artery disease. The most common indications include (1) diagnosing coronary artery disease in patients with clinical features indicating an intermediate probability of disease; (2) determining the pathophysiological significance of known coronary artery stenoses; (3) determining the extent of myocardial ischemia and assessing prognosis after myocardial infarction; (4) assessing for risk of cardiac events prior to noncardiac surgery; (5) detecting coronary re-stenosis after angioplasty and graft occlusion after bypass surgery; and (6) evaluating the effectiveness of medical therapy. In the situation where detecting viable myocardium in patients with ventricular dysfunction is requested, dual-isotope myocardial perfusion scintigraphy is preferred. Evidence-based guidelines on indications and appropriateness for myocardial perfusion imaging should be consulted for additional information.

**Rationale:** Following intravenous administration, Tc-99m sestamibi and tetrofosmin are distributed in proportion to regional myocardial perfusion. Imaging is performed 30 minutes after injection during exercise and 45-60 minutes after injection during rest or pharmacologic stress. Imaging is possible up to 4 hours after injection because there is no appreciable clearance of Tc-99m sestamibi and tetrofosmin from the myocardium. The myocardial uptake and retention and the blood clearance of Tc-99m sestamibi and Tc-99m tetrofosmin are similar, but the latter has more rapid clearance from the lungs and liver.

**Interfering Conditions:** The pharmacologic effects of intravenous dipyridamole, adenosine, or regadenoson are blocked by aminophylline and other methylxanthines (such as caffeine, which is found in coffee, tea, chocolate, and most soft drinks). Patients taking oral dipyridamole should undergo pharmacologic coronary vasodilatation with intravenous dipyridamole rather than with adenosine or regadenoson, because oral dipyridamole prolongs the pharmacologic effects of adenosine and regadenoson, and the combination can have marked side effects.

The sensitivity of exercise-stress myocardial perfusion imaging for detection of coronary artery disease is reduced in patients under treatment with beta-blocking drugs and some calcium-channel blocking drugs. Sensitivity will be improved if these drugs can be held for approximately 24 hours before the study. Pharmacologic stress is generally preferable to exercise stress in patients with left bundle branch block, because of the lower frequency of false-positive results. Also, pharmacologic stress is generally preferable to exercise stress in patients with pacemakers who are unable to achieve an adequate chronotropic response to exercise. Dobutamine may be preferred to dipyridamole, adenosine, lexiscan (regadenoson) in patients with emphysema or asthma.

**Precautions:** Assure intravenous position of the catheter before tracer administration. Subcutaneous extravasation of a significant portion of an administered dosage of Tc-99m sestamibi or tetrofosmin reduces the
diagnostic value of the study, since much of the radiopharmaceutical will not reach the myocardium at the time of suspected acute ischemia.

Radiopharmaceutical: Tc-99m sestamibi (Cardiolite®) or tetrofosmin (Myoview®) dispensed in a total volume of 2 mL non-bacteriostatic saline. Tc-99m sestamibi is preferred for exercise-stress imaging and Tc-99m tetrofosmin is preferred for pharmacologic-stress and rest imaging. This is because of the relatively greater hepatic uptake of either radiopharmaceutical when injected under resting and pharmacologic-stress conditions than during exercise; the more rapid clearance of Tc-99m tetrofosmin from the liver helps to minimize hepatic activity at the time of imaging.

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<thead>
<tr>
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<th>One Day-Study: Two Dosages</th>
<th>Two Day-Study: One Dosage Each Day</th>
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<tbody>
<tr>
<td>Adult Dosage</td>
<td>First Dosage: 8 mCi</td>
<td>Each Dosage: 20 mCi</td>
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<td>Second Dosage: 32 mCi</td>
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<tr>
<td>Adult Dosage with body weight ≥ 250 pounds</td>
<td>First Dosage: 12 mCi</td>
<td>Each Dosage: 30 mCi</td>
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<td>Second Dosage: 45 mCi</td>
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Pediatric Dosage: Consult attending physician

Radiation Dosimetry: Tc-99m sestamibi
- Adult. Critical organ (gallbladder): 5.1 rem.
- Effective dose: 1.3 rem.

Tc-99m tetrofosmin
- Adult. Critical organ (gallbladder): 4.3 rem.
- Effective dose: 1.1 rem.

Route of Administration: Intravenous through pre-established, freely infusing cannula. In adults, 22-gauge is the minimum recommended cannula size.

Patient Preparation: Whenever practical, the patient should have been fasting for 4 or more hours before the study. The patient will be allowed to have a light meal within 1 hour following the completion of the stress imaging portion of the examination.

Equipment Setup: Gamma Camera: Gated SPECT (with or without attenuation correction [AC]) is preferred over planar imaging for both adult and pediatric patients. Prone imaging, when needed, is acquired as a non-gated SPECT image. Patients with dextracardia and/or situs inversus may not be done on the Digirad Cardius. In patients who are unable to tolerate SPECT, planar imaging should be performed with a SMOV or zoomed-LFOV camera.
Collimator: Low-energy high-resolution (for conventional cameras)
Fan-beam low-energy all-purpose (for Digirad Cardius)
Energy Window: 140 keV with 20% window

**Patient Positioning:** SPECT or SPECT with x-ray AC: When using conventional dual-head cameras, the patient should be positioned supine, with the arms comfortably positioned above head; the arms should **NOT** be physically restrained above the head. In order to eliminate motion the patient should be positioned as comfortably as possible, a hand grip for the patient to hold and/or a wedge pillow placed under knees may be used. The arm should not be lowered midway through the study (e.g., after the camera passes one side). When using the Digirad camera, the patient should be seated in a comfortable upright position, with the arms resting on the cross-bar and the abdominal strap fitted snugly around the abdomen. It is essential that the patient remain motionless during the entire SPECT acquisition.

Planar: The patient will be placed in the supine position for the 35˚ left anterior oblique (LAO) view and anterior view. The patient will be placed in the right lateral decubitus position with the left arm above the head for the 70˚ LAO view.

**Procedure:** The stress and rest portions of this study will be performed on the same day (One-Day Study, Two Injections). The stress portion will be performed before the rest portion. **If a resting study is required on the same day as the stress study, the injection for the resting study should be administered no less than 3 hrs after the injection of radiopharmaceutical for the stress study. This is necessary to allow for sufficient decay of the activity remaining from the stress study.**

The patient is injected in the **upright** position, if possible. Imaging is performed 30 minutes after injection during exercise and 45-60 minutes after injection during pharmacologic stress or during rest. The patient may eat a light meal within an hour following the stress portion of the procedure. SPECT imaging should be performed in all patients who can tolerate SPECT. Gating (8 frames/RR interval) should be performed for the stress phase of the study. Three nuclear-medicine-computer electrocardiographic leads are attached to the patient and proper function of electrocardiographic gating is confirmed. The presence of an arrhythmia must be noted on the requisition.

In patients unable to tolerate SPECT, a standard set of three planar images in 35˚ LAO, anterior, and 70˚ LAO projections is to be performed.

The stress images should be processed immediately. If an inferior wall defect is present, prone imaging should be performed except in the situation where a prior myocardial perfusion imaging study has documented an inferior wall myocardial infarction. These images along with the finalized stress electrocardiogram report should be provided to the attending physician assigned to the cardiac nuclear medicine service that day to determine whether additional post-stress imaging acquisitions and/or rest imaging are required.
**View**  
**SPECT Acquisition**  
- 64 projection views covering 180° (45° RAO to 135° LPO); 64 x 64 word-mode.  
- Roving 1.5 (38cm) zoom (Cardiotrac)  
- Total imaging time  
- Dosage < 20 mCi  
  ≈14 minutes [25 sec/view x 32 views (with 2 heads)]  
- Dosage > 20 mCi  
  ≈11 minutes [20 sec/view x 32 views (with 2 heads)]  
- 8 Frames/RR interval, gating for stress images, whenever possible  

**SPECT Acquisition**  
- 60 projections covering 220° from a starting position of -45°  
- Pixel spacing is 6.5 x 6.5mm  
- No zoom  
- Total imaging time (add 2 minutes for AC sequence)  
- Use TruACQ Countbased Imaging **  
- 8 Frames/RR interval, gating for stress images, whenever possible  

**SPECT Reconstruction**  
- No attenuation correction  
- With attenuation correction  

**** TruACQ Countbased Imaging uses a cardiac region of interest to provide a suggested time per frame for cardiac SPECT studies that will meet the American Society of Nuclear Cardiology imaging guidelines. Before performing image acquisition with TruACQ recommended imaging times that are greater than 44 sec/frame for the low dosage (< 20 mCi) and 35 sec/frame for the high dosage (> 20 mCi), consult the attending physician interpreting cardiac studies.  

**View**  
**Digital Acquisition**  
- Planar Study (3 views)  
  - 35° LAO and anterior views with patient supine  
  - 70° LAO view with patient in right lateral decubitus position  
- 256 x 256 word-mode  
- Dosage > 20 mCi  
- 8-minute/image  
- Dosage < 20 mCi  
- 15-minute/image  

**Items Required For Complete Study:**
1. Processing of the SPECT, SPECT with AC and/or planar images.

2. SPECT Study: A) screen capture images of sinograms, “linograms”, and slices; B) image of ED, ES, motion and thickening bull's-eyes.

3. SPECT study with AC: Study: same as SPECT Study but add C) fusion image with 50% X-ray transmission/50% emission and D) x-ray transmission image only.

4. Prone Study: same requirements as for SPECT Study. However, the screen capture image of the slices generally compares the prone images with the stress images.

5. Planar Study screen capture of images.

6. Documentation of the successful loading of previous studies onto workstation.

7. Copy of finalized stress ECG report