

**Clinical Protocol: NUCLEAR MEDICINE PARATHYROID IMAGING
(Tc99m Sestamibi)**

Date Last Reviewed: 01/30/2025

Responsible Division: Division of Nuclear Medicine, Department of Radiology, UT Southwestern

Policy Basis for Procedure: Establish a clinical protocol for parathyroid imaging

Description of Procedure: Parathyroid scintigraphy is used to assist in the detection and localization of hyperfunctioning parathyroid tissue in normal or ectopic locations in patients with clinical hyperparathyroidism as shown by elevated levels of serum-ionized calcium and parathyroid hormone (PTH).

Scope This policy applies to all individuals working in William P. Clements Jr. University Hospital and all hospital based clinics; Parkland Health & Hospital System (PHHS) facilities and hospital based clinics.

Indications

- Detect and localize parathyroid adenomas
- Localization of hyperfunctioning parathyroid tissue in patients with persistent or recurrent disease
- Localization of hyperfunctioning parathyroid tissue in primary hyperparathyroidism

Contraindications

- For the pregnant or potentially pregnant and breastfeeding mothers, a pregnancy screening form must be administered. The attending physician must be notified of a positive pregnancy test result and will provide instruction on how to proceed.
- Cessation of breastfeeding is not required but is recommended that to pump and discard milk for 4 – 24 hours post radiopharmaceutical injection.

Examination Time

- Explanation and administration: 15 minutes
- 1st Delay: 10 minutes
- 2nd Delay (+SPECT/CT): 60 minutes
- Imaging time:
 - 1st series: 10 minutes
 - 2nd series: 20 – 30 minutes

Patient Preparation

- Focused history regarding the reason for examination (symptoms, diagnoses, treatments, recent imaging examinations, history of parathyroid adenomas or malignancy, labs, etc.) should be noted and communicated to the reading physician/resident
- No dietary restrictions
- Instruct patient to stay hydrated and void frequently for at least 24 hours following administration of radiotracer to promote excretion and reduce radiation exposure.
- External attenuating (bra, jewelry, etc.) objects shall not be worn and should be removed if possible
- Void immediately prior to imaging to decrease radiation dose to the bladder and to maximize patient comfort

Radiopharmaceutical, Dose, & Technique of Administration

- Radiopharmaceutical: Tc-99m Sestamibi
- Dose: faculty may decrease dose amount among shortages

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- 25 mCi, +/- 20% (20 – 30 mCi is an acceptable range)
- Technique of Administration: standard intravenous injection using a 3 way stop-cock
 - Flush 1 cc 0.9% sodium chloride to confirm patent line, inject the radiopharmaceutical and upon completion aspirate 5 cc 0.9% sodium chloride into the radiopharmaceutical syringe then in a pulsating motion infuse into patient, then flush with remaining 0.9% sodium chloride. Additional flushing may be necessary for Sestamibi.

Equipment & Energy Windows

- Gamma camera: Large field of view, SPECT/CT
- Collimator: Low energy, high resolution, parallel hole.
- Energy windows: 20% window centered at 140keV

Patient Position & Imaging Field

- Patient position: Supine, pillow or rolled towel under the shoulders to hyperextend the neck.
- Imaging field: Include the tip, or at minimum, bottom of parotid glands, entire submandibular gland and all the way down to the mid portion of the heart; include the full mediastinum. Start at the base of the orbits in the SPECT/CT portion to minimize radiation to the eyes.

Acquisition Protocol

- Have patients remove any metal objects before image acquisition.
- Patient should void immediately prior to the image acquisition
- Any nonstandard position of the patient and any other deviation from the standard protocol (e.g., extravasation, movement of the patient, mobility issues, and premature termination of the scan) should be noted in patient's EMR.
- The acquisition time/counts will need to be increased for any patient receiving a decreased amount of radiopharmaceutical (i.e. due to shortages) to provide faculty/residents with optimal quality images required for proper interpretations.
- Immediate Imaging:
 - Anterior planar (1st series): 10 minutes post injection
 - FOV: Include the parotid glands, or at minimum, bottom of parotid glands, the entire submandibular glands and all the way down to the mid portion of the heart; include the full mediastinum. Start at the base of the orbits in the SPECT/CT portion to minimize radiation to the eyes.
 - If the patient has a long torso, it is preferred that the upper portion of the body that includes the parotid glands is more useful for interpretation and should take precedent over trying to include mid-section of the heart, in which case just the tip of the heart will suffice.
 - *~It is very important to note that the location of parathyroid glands can vary, especially the site of the lower glands. This is due to the longer pathway and more difficult migration process that the lower glands have to follow after their origin from the third pharyngeal pouch. So they can be intrathyroidal, within the thyrothymic ligament, within the thymus and in the mediastinum, or fail to migrate and remain very high in the neck*
 - Matrix : 256 x 256
 - Imaging time : 10 minutes
- Delayed Imaging (2nd series): 60 minutes post injection
 - SPECT / CT to be performed first
 - 10 minute anterior post SPECT CT (same parameters as immediate imaging)
 - 20 second – 1 minute anterior substernal notch marker utilizing a Tc99m or Co57 point source (varies on activity of marker) rested on the substernal notch for anatomic

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localization. Positioning the marker as center as possible to avoid overlapping the thyroid and/or possible adenomas.

- **SPECT:**
 - Degrees of rotation: 180° (dual head) for every 6°
 - 60 projections
 - Matrix: 128 x 128
 - Continuous motion
 - Time per image: 16 – 20 seconds
- **CT :**
 - Care Dose 4D to modulate mAs
 - Quality reference: 100 – 200 mAs
 - 120 kVp (ranging from 100 -140 kVp)
 - Rotation time 0.5s
 - Pitch: 0.5s
 - 5 mm slices in 256 x 256 matrix
 - Scan starting at the base of the orbits to prevent radiation exposure to the eyes
 - Include a narrow FOV of the CT (width of the chest, outer rib to outer rib).

Data Processing

- Label all processed images in accordance to ACR standards including the time of delays.
- Merge delayed and substernal notch images and label substernal notch with SSN and an arrow indicating its location.
- Reconstruct and fuse attenuated corrected images into transverse, sagittal, and coronal using soft tissue kernel.
- Send : raw and processed planar images, Topogram , Patient Protocol, Patient Dose Report, Statistics, AC CT, AC, NAC, recons, and all planes fused files to Sectra PACS, verify
- Send AC/NAC files and recons to Syngo

Optional Maneuvers

- Parathyroid autografts: May be evaluated for hyperfunction with the same technique as above. Image scar of inserted autograph on detector, patient seated in chair and resting arm on collimator. SPECT/CT is not acquired of autografted arm. Parameters to mimic immediate imaging.

Principle Radiation Emission Data:

- Physical half-life = 6.01 hours
- Radiation – Gamma
- Mean % per disintegration: 89.07%
- Mean energy 140.5 keV

Dosimetry – 25 mCi Tc99m Sestamibi

	<u>Effective dose</u>	<u>rems/25 mCi</u>	<u>mSv/925 MBq</u>
Whole body		0.838	8.38

Definitions:

- SPECT – Single Photon Emission Tomography
- CT – Computed Tomography

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- AC – Attenuated correction
- mAs – millampere - seconds
- kVp- kilovoltage

Applicable Forms:

- Pregnancy Screening form, if applicable

References:

1. Greenspan BS, Dillehay G, Intenzo C, Lavelly WC, O'Doherty M, Palestro CJ, Shreve W, Stabin MB, Sylvestros D, Tulchinsky M, : SNM Practice Guidelines for Parathyroid Scintigraphy 4.0 J Nuc Med Tech 40:1-8, 2012.
2. ACR-SPR practice parameter for the performance of parathyroid scintigraphy 2014
3. [Duration of Breastfeeding Interruption in Nuclear Medicine](#) Procedures (2023)
4. ACR-ACNM-SNMMI-SPR PRACTICE PARAMETER FOR THE PERFORMANCE OF PARATHYROID SCINTIGRAPHY (2024)

Review Date	Status	Name and Title	Approver; Date	Brief Summary
1/30/2025	Approved	Orhan Oz, MD, PhD, Daniel Lee, MD; Dr. Mi-Ae Park; Dr. Nima Kasraie; Trizzy Bui, Tech Sup (UT); Julie Eberting, Jacqueline Rolen (PHHS)	Dr. Orhan Oz; 4/23/2025	Formatting changes, addition of contraindications and dose range; Amendment to prep, acquisition protocol and include narrow FOV recon; updated references
10/2022	Reviewed	Brooke Pipes, Tech Sup	10/2022	No changes.
07/2019	Approved	Brooke Pipes, Tech Sup	07/2019	CT Slice thickness changed from 5mm to 2mm.
07/2018	Approved	Brooke Pipes, Tech Sup	07/2018	Changed delay from 60 to 90 minutes
07/2017	Approved	Brooke Pipes, Tech Sup	07/2017	Formatting changes, addition of SPECT/CT imaging