

# **THYROID IMAGING STUDY**

## **(Tc-99m as Sodium Pertechnetate)**

### **Overview**

- The Thyroid Imaging Study with Tc-99m-pertechnetate demonstrates the distribution of tissues that take up anions. Such tissues include the thyroid, salivary glands, and stomach.

### **Indications**

- Evaluation of hyperthyroidism (1-3).
- Evaluation of enlarged glands or glands with nodules (4,5).
- Evaluation of patients who had irradiation of the head and neck in childhood with or without palpable nodules (6).
- Evaluation of primary congenital hypothyroidism (7).

### **Examination Time**

- 1 hour.

### **Patient Preparation**

- The patient must be off thyroid hormones (8):
  1. Thyroxine (T-4) for at least 7 days.
  2. Triiodothyronine (T-3) for at least 3 days.
- The patient must not have had intravenous or intrathecal iodinated contrast agents (IVP, CT with contrast, myelogram, angiogram) for at least 3 weeks (8).
- The technologist records a pertinent, standard history on the Thyroid Information Sheet (see below). The nuclear medicine physician records his/her palpation findings on the same form.

### **Equipment & Energy Windows**

- Gamma camera: Small or large field of view.
- Collimator: Pinhole with 5 mm insert (9).
- Energy windows: 20% window centered at 140 keV.

### **Radiopharmaceutical, Dose, & Technique of Administration**

- Radiopharmaceutical: Tc-99m as sodium pertechnetate (10,11).
- Dose: 5 mCi (185 MBq).
- Technique of administration: Standard intravenous injection.

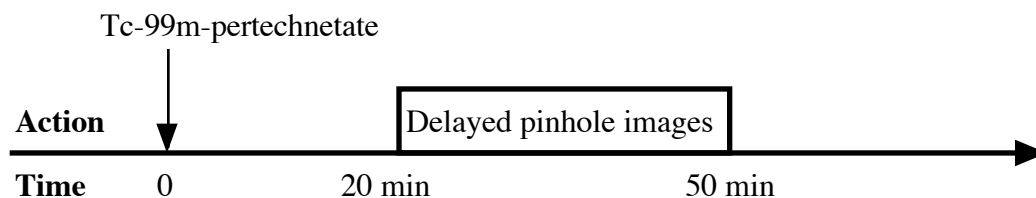
## Patient Position & Imaging Field

- Patient position: Supine.
- Imaging field: Neck with chin tilted up.

## Acquisition Protocol

- Begin imaging 20 minutes following injection of the radiopharmaceutical.
- Acquire a 5 minute ANT image of the thyroid with the collimator 6 cm from the patient's neck and with a 4 cm radioactive ruler in the field of view (11,12):
  1. A 6 cm long block can be made as a convenient measuring device.
  2. A 4 cm ruler can be constructed by marking a 4 cm distance on a 5 cm long strip of aluminum. Drops of pertechnetate are then placed at the 4 cm marks and allowed to dry.
  3. The strip is placed vertically in the midline so that the inferior marker is over the suprasternal notch.
- Acquire a second ANT image with the distance between the collimator and patient's neck adjusted so that the thyroid gland fills three quarters of the field of view. Use the persistence scope to determine this distance. Acquire this image for approximately 5 minutes.
- Acquire RAO and LAO oblique images at 35°; again with the thyroid gland filling approximately three quarters of the field of view (13). Acquire these images for approximately 5 minutes.
- If there is a palpable nodule, an additional ANT image should be acquired for the same time as the other images, but with a radioactive marker placed on the skin immediately over the palpable nodule. The camera must be positioned so that its central ray (a line perpendicular to the crystal and passing through the pinhole) passes through the palpable nodule (14).

## Protocol Summary Diagram



## Data Processing

- None.

## Optional Maneuvers

- Follow up I-123 study for functioning nodules: If 1 or 2 functioning nodules are identified, a repeat study with radioactive iodine should be performed since some thyroid cancers concentrate Tc-99m-pertechnetate, but not radioactive iodine (15,16).

- Thyroid suppression test (17):
  1. Performed to determine if a functioning nodule is autonomous.
  2. Place the patient on 25  $\mu\text{g}$  of triiodothyronine four times a day for three days and repeat the thyroid imaging study.
- Imaging of suppressed thyroid tissue with Tl-201 (18):
  1. Perform at least 1 day after Tc-99m-pertechnetate study.
  2. Inject 2 mCi thallous Tl-201 chloride intravenously.
  3. Wait 15 minutes.
  4. Acquire 10 minute ANT image of thyroid using pinhole or converging collimator.
- SPECT imaging: SPECT imaging of the thyroid with a pinhole collimator may be performed (19).

### Principle Radiation Emission Data - Tc-99m (20)

- Physical half-life = 6.01 hours.

Radiation	Mean % per disintegration	Mean energy (keV)
Gamma-2	89.07	140.5

### Dosimetry - Tc-99m-Pertechnetate as Sodium Pertechnetate (21)

Organ	rads/5 mCi	mGy/185 MBq
Thyroid	0.65	6.5
Large intestine	0.60	6.0
Bladder wall	0.43	4.3
Stomach	0.26	2.6
Ovaries	0.15	1.5
Whole body	0.06	0.6
Testes	0.05	0.5
Red marrow	0.01	0.1

### References

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#### Normal Findings

- > Hegedus L, Perrild H, Poulsen LR, et al: The determination of thyroid volume by ultrasound and its relationship to body weight, age, and sex in normal subjects. J Clin Endocrinol Metab 56:260-263, 1983

# THYROID INFORMATION SHEET

## Nuclear Medicine Department

Institution \_\_\_\_\_

Name \_\_\_\_\_ ID \_\_\_\_\_ Age \_\_\_\_\_ Sex \_\_\_\_\_

Referring physician \_\_\_\_\_ Date \_\_\_\_\_

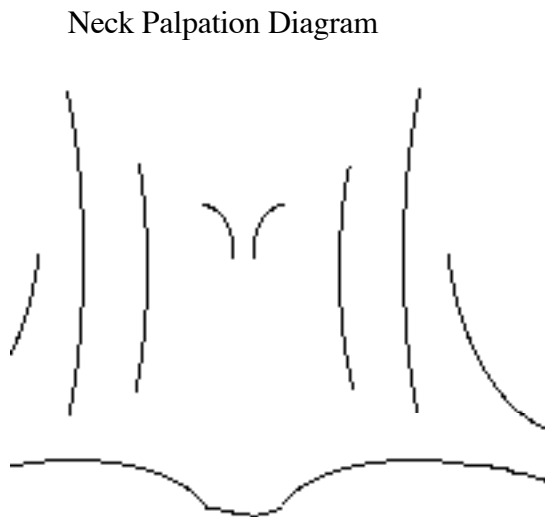
### TECHNOLOGIST TO COMPLETE

Did the patient notice a problem with his/her thyroid or neck? Yes\_\_\_ No\_\_\_  
Has the patient had previous thyroid problems? Yes\_\_\_ No\_\_\_  
Has the patient had any thyroid surgery? Yes\_\_\_ No\_\_\_  
Did the patient have radiation treatments to the face/neck as a child? Yes\_\_\_ No\_\_\_  
Has the patient taken thyroid hormones or antithyroid medicines? Yes\_\_\_ No\_\_\_  
Has the patient had any intravenous x-ray contrast in the last month? Yes\_\_\_ No\_\_\_  
If the patient is having an uptake study, have he/she eaten since last night? Yes\_\_\_ No\_\_\_

Additional pertinent thyroid history: \_\_\_\_\_

Technologist \_\_\_\_\_

### PHYSICIAN TO COMPLETE



Check as Appropriate

Normal \_\_\_\_\_  
Size: x1\_\_\_, x1.5\_\_\_, x2\_\_\_, x3\_\_\_  
Contour: smooth\_\_\_, irregular\_\_\_,  
multinodular\_\_\_  
Firmness: normal\_\_\_, firm\_\_\_,  
hard\_\_\_  
Single nodule\_\_\_  
Moves with swallowing\_\_\_  
Firm\_\_\_  
Gland tender\_\_\_

Physician \_\_\_\_\_

## NOTES