Procedure Guideline for Thyroid Scintigraphy: 1.0

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PART I: PURPOSE

The purpose of this guideline is to assist nuclear medicine practitioners in recommending, performing, interpreting and reporting the results of thyroid scintigraphy.

PART II: BACKGROUND INFORMATION AND DEFINITIONS

Thyroid scintigraphy consists of one or more planar images of the thyroid obtained within 15–30 min after intravenous injection of [^{99m}Tc]pertechnetate or 3–24 hr after the oral ingestion of radioactive iodine.

In this document, hyperthyroidism refers to an excess of thyroid hormone due to an overactive thyroid gland as well as due to other causes.

PART III: COMMON INDICATIONS

A. To relate the general structure of the thyroid gland (e.g., nodular or diffuse enlargement) to its function. This may be useful in distinguishing Graves' disease from toxic nodular goiter, a distinction of significance in determining the amount of ^{131}I to be given as therapy for hyperthyroidism.
B. To correlate thyroid palpation with scintigraphic findings to determine the degree of function in a clinically defined area or nodule (i.e., palpable).
C. To locate ectopic thyroid tissue (i.e., lingual) or determine whether a suspected "thyroglossal duct cyst" is the only functioning thyroid tissue present.
D. To assist in evaluation of congenital hypothyroidism.
E. To evaluate a neck or substernal mass. Radionuclide scintigraphy may be helpful to confirm that the mass is functioning thyroid tissue.
F. To differentiate thyroiditis (i.e., subacute or silent) and factitious hyperthyroidism from Graves' disease and other forms of hyperthyroidism.

PART IV: PROCEDURE

A. Patient Preparation
   1. Avoidance of Interfering Materials
      The concentration of radioiodine in the thyroid is affected by many factors.
      a. Medications such as thyroid hormones and antithyroid agents which affect the pituitary-thyroid axis.
      b. Iodine-containing food (e.g., kelp) and medications (e.g., iodinated contrast, amiodarone, betadine).

      Except under very specific circumstances (e.g., for determination if a nodule is autonomous), thyroid scintigraphy should be delayed for a period long enough to eliminate the effects of these interfering factors.
B. Information Pertinent to Performing the Procedure
   1. Possibility of interfering medications (e.g., thyroid hormone, antithyroid drugs, iodine-containing medications)
   2. Prior iodinated contrast
   3. Ingestion of iodine-rich foods
   4. Pertinent laboratory data including results of thyroid function tests
   5. Pregnancy/Lactation/Nursing status
   6. Results of prior thyroid imaging tests
   7. Results of prior thyroid uptake
   8. Recently administered radionuclides
C. Precautions
   None
D. Radiopharmaceutical

Comparison of Radiopharmaceuticals for Thyroid Scintigraphy

Radionuclide	Advantages	Disadvantages
[^{99m}Tc]pertechnetate	Less expensive More readily available More rapid examination	· Trapped but not organified · Activity in esophagus or vascular structures can be misleading · Poor image quality when uptake is low
[^{123}I]iodide	Better for visualization of retrosternal thyroid tissue Yields better images when uptake is low	· Higher cost · May be less convenient for patient as delayed imaging at 24 hr is often used · Is less readily available · Imaging times are generally longer

   2. Because of the large radiation dose to the thyroid (approximately 1–3 rad/μCi administered), the use of ^{131}I for thyroid scintigraphy should be discouraged except when a treatment with ^{131}I is planned.
   3. Radiation Dosimetry (see tables on page 1265)
   4. An intramuscular injection of [^{99m}Tc]pertechnetate can also be used when venous access is difficult.
E. Image Acquisition
   1. Instrumentation

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Radiation Dosimetry in Adults

Radiopharmaceutical	Administered activity MBq (mCi)	Organ receiving the largest radiation dose* mGy (rad)	Effective dose mSv (rem)
$Na^{131}I$-iodide†	1.85–7.4 p.o.	210 Thyroid	6.6
	(0.05–0.2)	(780)	(24.4)
$Na^{123}I$-iodide‡	7.5–25 p.o.	1.9 Thyroid	0.075
	(0.2–0.6)	(7.0)	(0.278)
[^{99m}Tc]pertechnetate§	75–370 i.v.	0.062 ULI	0.013
	(2-10)	(0.23)	(0.048)

*Per MBq (per mCi)
†ICRP 53, page 276, assuming 15% uptake (2).
‡ICRP 53, page 264, assuming 15% uptake (2).
§ICRP 53, page 199, no blocking agent (5).
ULI = upper large intestine.

Radiation Dosimetry in Children (Aged 5 yr)

Radiopharmaceutical	Administered activity MBq/Kg (mCi/Kg)	Organ receiving the largest radiation dose* mGy (rad)	Effective dose* mSv (rem)
$Na^{131}I$-iodide†	0.025–0.1 p.o.	1,100 Thyroid	34
	(0.0004–0.0016)	(4,070)	(40.7)
$Na^{123}I$-iodide‡	0.1–0.3 p.o.	9.8 Thyroid	0.35
	(0.003–0.01)	(36.3)	(1.3)
[^{99m}Tc]pertechnetate§	1–5 i.v.	0.21 ULI	0.04
	(0.015–0.07)	(0.78)	(0.15)

*Per MBq (per mCi)
†ICRP 53, page 276, assuming 15% uptake.
‡ICRP 53, page 264, assuming 15% uptake.
§ICRP 53, page 199, no blocking agent.
ULI = upper large intestine.

a. A gamma camera equipped with a pinhole collimator and an aperture 5 mm or less in diameter is conventionally used.
b. Rectilinear scanning of the thyroid may also be used for thyroid imaging.
Compared to gamma cameras, scanners are better able to estimate the size of the thyroid and correlate the location (relative to other anatomical landmarks) of thyroid nodules.

2. Patient positioning
The patient should be supine with the neck extended and supported by a pillow placed under the shoulders. In patients who are unable to lie supine, the sitting position may be used.
3. Timing of images
a. When [^{99m}Tc]pertechnetate is used, imaging should begin 15–30 min after injection.
b. When ^{123}I is used, images can be obtained as early as 3–4 hr after ingesting the tracer. Images obtained at 16–24 hr have the advantage of lower body background but the disadvantage of a lower count rate. Interpretable images can be obtained as long as 36 hr after ingestion.
c. When ^{131}I is used, the images should be obtained at 16–24 hr after ingesting the radioiodine.
4. Acquisition parameters
With ^{99m}Tc, an anterior image is acquired for 100,000–200,000 counts or 5 min, whichever occurs first. With ^{123}I, the corresponding parameters are generally 50,000–100,000 counts or 10 min. Both anterior oblique images should be obtained for the same amount of time as the anterior image. The distance between the pinhole aperture and the neck should be adjusted so that the image of the thyroid occupies the central two-thirds of the field of view.

The thyroid should be palpated with the patient in position for imaging. Radioactive or radiopaque markers may be used to identify anatomical landmarks (e.g., thyroid cartilage, sternal notch) and the location of palpable nodules. Localizing markers for nodules should be centered in the field of view to avoid parallax. Duplicate views should be obtained without the markers. Size markers should be used with caution since the pinhole collimator will cause geometric distortion with depth.

F. Interventions
Giving the patient water to drink is sometimes useful in eliminating esophageal activity.
G. Processing
None
H. Interpretation/Reporting
1. An adequate history and patient examination should be performed to permit appropriate diagnostic evaluation.
2. The scintigraphic findings should be correlated with the physical examination as to the size, shape and location of the thyroid gland and the size and location of thyroid nodules or neck masses.
3. The uniformity and intensity (thyroid/background) of uptake and the presence, absence, size and location of any areas of increased or decreased uptake should be described.
4. Autonomous hyperfunctioning (hot) nodules are easily identified by scintigraphy and are rarely malignant. Hypofunctioning nodules represent a nonspecific finding. The diagnosis of a thyroid nodule is dependent on palpatory, not scintigraphic, findings.

I. Quality Control
Routine quality control for cameras used for imaging, see *Society of Nuclear Medicine Procedure Guideline for General Imaging.*
J. Sources of Error
1. Local contamination (clothing, skin, hair, collimator, crystal)
2. Esophageal activity (hiatal hernia)

PART V: DISCLAIMER

The Society of Nuclear Medicine has written and approved guidelines to promote the cost-effective use of high quality nuclear medicine procedures. These generic recommendations cannot be applied to all patients in all practice settings. The guidelines should not be deemed inclusive of all proper procedures or exclusive of other procedures reasonably directed to obtaining the same results. The spectrum of patients seen in a

specialized practice setting may be quite different than the spectrum of patients seen in a more general practice setting. The appropriateness of a procedure will depend in part on the prevalence of disease in the patient population. In addition, the resources available to care for patients may vary greatly from one medical facility to another. For these reasons, guidelines cannot be rigidly applied.

Advances in medicine occur at a rapid rate. The date of a guideline should always be considered in determining its current applicability.

PART VI: ISSUES REQUIRING FURTHER CLARIFICATION

None

PART VII: CONCISE BIBLIOGRAPHY

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PART VIII: LAST BOARD OF TRUSTEES APPROVAL DATE

February 12, 1995

PART IX: NEXT REQUIRED APPROVAL DATE

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Procedure Guideline for Thyroid Uptake Measurement: 1.0

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Key Words: procedure guidelines; thyroid uptake measurement

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PART I: PURPOSE

The purpose of this guideline is to assist nuclear medicine practitioners in recommending, performing, interpreting and reporting the results of thyroid uptake measurements.

PART II: BACKGROUND INFORMATION AND DEFINITIONS

Thyroid uptake determination is the measurement of the fraction of an administered amount of radioactive iodine that accumulates in the thyroid at selected times following ingestion. Thyroid

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