

Procedure Guideline for Extended Scintigraphy for Differentiated Thyroid Cancer: 1.0

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PART I: PURPOSE

¹The purpose of this guideline is to assist nuclear medicine practitioners in recommending, performing, interpreting and reporting the results of extended scintigraphy for differentiated thyroid cancer.

PART II: BACKGROUND INFORMATION AND DEFINITIONS

Scintigraphy for detection of thyroid metastasis and/or residual functioning thyroid tissue consists of obtaining images of the body, 2–6 days following the oral ingestion of ¹³¹I. Other radiopharmaceuticals such as ¹²³I, ²⁰¹Tl and ^{99m}Tc-sestamibi may also provide useful information, but their effectiveness has not been established.

PART III: COMMON INDICATIONS

To determine the presence and location of residual functioning thyroid tissue and/or functioning thyroid cancer.

PART IV: PROCEDURE

The patient should be seen by the nuclear medicine physician sufficiently early to assure the appropriate diagnosis has been made, patient suitability for scintigraphy, the necessary laboratory studies have been obtained and low-iodine diet instructions have been given. This initial appointment is important for establishing the doctor/patient relationship.

A. Patient Preparation

1. Avoidance of Interfering Materials

The concentration of radioiodine in the thyroid is affected by many factors such as:

- Medications such as thyroid hormones and antithyroid agents which affect the pituitary-thyroid axis
- Iodine-containing food (e.g., kelp) and medications (e.g., iodinated contrast, amiodarone, betadine)

Imaging should be delayed for a period long enough to eliminate the effects of these interfering factors. A low iodine diet is sometimes followed for 3–10 days before the radioiodine is given (see Ref. 1)

- Maximum sensitivity of whole-body scintigraphy for detection of functioning metastases can only be achieved in the absence of significant residual normal thyroid,

since it requires a TSH level of 30–50 μ IU/ml or more. This level of TSH can be reached by waiting 4–6 wk or more after thyroidectomy or after stopping treatment with thyroxine (T4). To avoid prolonged hypothyroidism, patients may be maintained on triiodothyronine (T3) until 2 wk prior to administration of the radioiodine.

- Serum TSH level should be measured prior to the time of the radioiodine administration. Ideally, the TSH levels should be greater than 30–50 μ IU/ml unless there is significant residual functioning thyroid tissue.
- The sensitivity of whole-body scintigraphy can be further improved if the patient follows a strict, low iodine diet starting 3–10 days prior to administration of the radioiodine tracer and continuing throughout the period of imaging (and treatment) (see Ref. 1).
- Since iodine is excreted primarily in the urine and secondarily in the gastrointestinal tract, a mild laxative is sometimes given on the evening before imaging to decrease the amount of activity within the colon, decrease the radiation dose to the colon and simplify image interpretation.

B. Information Pertinent to Performing the Procedure

- Patient's compliance with a low iodine diet (see Ref. 1)
- TSH level
- History of thyroid hormone withdrawal
- Measurement of serum thyroglobulin levels may also be helpful
- Description of operative procedure (extent of thyroidectomy)
- Tumor pathology, including presence or absence of capsular invasion and lymph node involvement
- Results of other imaging procedures
- Physical findings
- History of prior ¹³¹I treatment
- Results of prior radioiodine extended scintigraphy
- History of prior contrast administration
- Menstrual history/Pregnancy test
- Nursing/Lactation history

C. Precautions

Patients receiving more than 2 mCi of ¹³¹I should follow the same precautions as patients treated with ¹³¹I for hyperthyroidism.

D. Radiopharmaceutical

- Oral ¹³¹I is generally preferred. Doses of 5 mCi or less are preferred due to the possibility of stunning (decreased uptake by residual functioning thyroid tissue or tumor of the activity administered for treatment due to dysfunction caused by the activity administered for diagnosis).

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2. Thallous chloride i.v. or ^{99m}Tc-sestamibi i.v. have been used in some circumstances, although their effectiveness has not been as well established as the effectiveness with ¹³¹I.

Potential advantages: (a) no patient preparation is required (i.e., thyroid hormone does not need to be withdrawn), (b) accumulates in most of the 25% of differentiated thyroid cancers that do not concentrate radioiodine and in some thyroid cancers that rarely concentrate radioiodine (e.g., Hurthle cell and medullary carcinomas) and (c) may demonstrate metastases when TSH is normal or suppressed.

Disadvantages: (a) does not provide information needed for subsequent ¹³¹I treatment about the avidity of the tumor for radioiodine and (b) may not be as sensitive as ¹³¹I for detection of metastases of functioning well-differentiated thyroid cancer.

3. Radiation Dosimetry (see dosimetry table)

E. Image Acquisition

1. Instrumentation

For ¹³¹I, a large field of view camera or rectilinear scanner and a high energy collimator. For ¹²³I, ²⁰¹Tl and ^{99m}Tc, a low-energy collimator and a large field of view camera are preferred.

2. Patient positioning

Lying supine on an imaging table.

3. Timing of the Images

- For ¹³¹I, images are obtained 48–72 hr after the radiopharmaceutical administration. Later images, when background is diminished, often provide better definition of low-activity lesions. Imaging 1–2 wk after a therapeutic dose of ¹³¹I can be helpful in demonstrating poorly functioning metastasis.
- For ²⁰¹Tl and ^{99m}Tc-sestamibi, images are obtained 15 min after radiopharmaceutical administration.
- For ¹²³I, images are obtained 24 hr after radiopharmaceutical administration.

4. Image acquisition

- Anterior and posterior images of most of the body are obtained. Spot images should be obtained for approximately 5–10 min per view. Longer imaging times may be helpful for images obtained more than 3 days after administration of the radioiodine.
- If images are obtained with a whole-body scanner, the scan speed should be adjusted so that whole-body imaging takes approximately 30 min per view.
- Pinhole and/or rectilinear images of the neck in combination with adequate anatomic markers and careful palpation are useful in differentiating between normal residual thyroid tissue, salivary gland uptake, residual thyroid cancer and lymph node metastasis.

F. Interventions

Giving the patient water to drink is sometimes useful in eliminating mouth and esophageal activity.

G. Processing

None

H. Interpretation/Reporting

- An adequate patient examination and history should be performed to permit appropriate diagnostic evaluation.
- The report should include the size, intensity and location of any areas of uptake that correspond to any functioning thyroid tissue (including tumor). Comparison with prior images is useful. The results of TSH and thyroglobulin assays are useful in the interpretation of the scintigraphic findings.

Radiation Dosimetry in Adults

Radiopharmaceutical	Administered activity MBq (mCi)	Organ receiving the largest radiation dose* mGy (rad)	Effective dose* mSv (rem)
Na ¹²³ I-iodide [†]	37–74 p.o.	0.09	0.013
	(1–2)	Bladder wall (0.333)	(0.048)
Na ¹³¹ I-iodide [‡]	74–370 p.o.	0.61	0.072
	(2–10)	Bladder wall (2.257)	(0.27)
²⁰¹ Tl-chloride [§]	110–185 i.v.	0.57	0.23
	(3–5)	Kidney (2.1)	(0.85)
^{99m} Tc-sestamibi [¶]	370–740 i.v.	0.039	0.0085
	(10–20)	Gallbladder wall (0.144)	(0.0315)

*Per MBq (per mCi).

[†]ICRP 53, page 263, 0% uptake.

[‡]ICRP 53, page 275, 0% uptake.

[§]ICRP 53, page 373.

[¶]ICRP 62, page 23, resting.

I. Sources of Error

- Local contamination (clothing, skin, hair, collimator, crystal)
- Esophageal activity
- Asymmetric salivary gland uptake
- Nonspecific uptake in pulmonary infections
- Breast uptake in a lactating female

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

- What is the best dose of ¹³¹I for whole-body imaging that would provide the most diagnostic information and would avoid stunning? (See section IV.D.1. above).
- The role of ¹²³I in whole-body surveys for metastatic disease should be considered, particularly considering the decreased stunning and radiation exposure associated with this isotope. The increased cost of a whole-body scanning dose of this isotope must also be considered.
- How important is compliance with a strict low-iodine diet? (See section IV.A.1.b. above).

4. Lithium administration may promote retention of radioiodine in metastatic foci.

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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