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

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PART VIII: LAST BOARD OF TRUSTEES APPROVAL DATE

February 12, 1995

PART IX: NEXT REQUIRED APPROVAL DATE

February 1997

ACKNOWLEDGMENTS

We thank Wendy Smith, MPH, Associate Director, Commission on Health Care Policy, Society of Nuclear Medicine, for project coordination, data collection and editing; members of the Guideline Development Subcommittee David Brill, MD and Robert Hattner, MD who contributed their time and expertise to the development of this information.

Procedure Guideline for Thyroid Uptake Measurement: 1.0

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Key Words: procedure guidelines; thyroid uptake measurement

J Nucl Med 1996; 37:1266–1268

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

Received Apr. 19, 1996; accepted May 6, 1996.

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uptake can also be determined using intravenously administered [^{99m}Tc]pertechnetate and a gamma camera.

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. Assist in determining the amount of ^{131}I to be administered to patients for therapy of hyperthyroidism due to Graves' disease or toxic nodular goiter. The uptake should be performed as close in time as possible to the treatment (see Ref. 4).
B. Differentiate subacute or painless thyroiditis and factitious hyperthyroidism from Graves' disease and other forms of hyperthyroidism.
C. Measurement of the radioiodine uptake is of limited value in diagnosing hypothyroidism.

PART IV: PROCEDURE

A. Patient Preparation
   1. Avoidance of Interfering Materials.
      The concentration of radioiodine in the thyroid is affected by many factors such as:
      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).
      Uptake measurement usually 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.
   2. Large meals can slow absorption of ingested radioiodine and may interfere with early uptake measurements.
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 the results of thyroid function tests.
   5. Pregnancy/Nursing status.
      Elective studies using ^{131}I in lactating women should be postponed for at least 2 wk to decrease the radiation dose to the breast. Breastfeeding following the administration of ^{131}I should be stopped to keep the radiation dose to the infant to less than 1 mSv (100 mrems) (see Ref. 6).
   6. Results of prior thyroid imaging tests.
   7. Results of prior thyroid uptake.
   8. Recent administration of radionuclides.
C. Precautions
   1. Prolonged discontinuation of antithyroid medication may be hazardous in some patients.
D. Radiopharmaceutical
   1. Radioiodine is generally preferred.
   2. Uptakes may be performed in conjunction with [^{99m}Tc]pertechnetate thyroid imaging. Careful validation of this technique is required.
   3. Radiation Dosimetry (see tables on page 1267).
E. Data Acquisition
   1. Instrumentation
      A probe with a 2-inch thick sodium iodide crystal at least 2 inches in diameter with suitable shielding and a flat-field collimator providing a field 10 cm in diameter at the surface of the patient's neck should be used (see Ref. 3).
   2. Measurement of Uptake

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†	0.15–0.37 p.o.	360	11
	(0.004–0.01)	Thyroid (1332)	(40.7)
Na^{123}I-iodide‡	3.7–7.4 p.o.	3.2	0.11
	(0.1–0.2)¶	Thyroid (11.8)	(0.41)
[^{99m}Tc]pertechnetate§	74–370 i.v.	0.062	0.013
	(2–10)	ULI (0.229)	(0.048)

*Per MBq (per mCi).
†ICRP 53, page 277, assuming 25% uptake.
‡ICRP 53, page 265, assuming 25% uptake.
§ICRP 53, page 199.
¶0.4 mCi may be used to measure biological half-life.
ULI = upper large intestine.

Radiation Dosimetry in Children (Aged 5 yr)

Radiopharmaceutical	Administered activity MBq(mCi)	Organ receiving the largest radiation dose* mGy (rad)	Effective dose* mSv (rem)
Na^{131}I-iodide†	0.15–0.37 p.o.	1900 Thyroid	56
	(0.004–0.01)	(7030)	(207)
Na^{123}I-iodide‡	3.7–7.4 p.o.	16	0.54
	(0.1–0.2)	Thyroid (59.2)	(2.0)
[^{99m}Tc]pertechnetate§	37–185 i.v.	0.21 ULI	0.04
	(1–5)	(0.777)	(0.148)

*Per MBq (per mCi).
†ICRP 53, page 277, assuming 25% uptake.
‡ICRP 53, page 265, assuming 25% uptake.
§ICRP 53, page 199.
ULI = upper large intestine.

      a. The measurement of thyroid uptake is usually performed 24 hr after administration of the radioiodine. In some circumstances, it may be performed between 2 and 6 hr after radioiodine ingestion as well as 24 hr after ingestion.
      The uptake is usually measured with 25–30 cm between the face of the crystal and the anterior neck or phantom. Neck counts, lower thigh counts and counts of a calibrated standard in a neck phantom and background counts are preferably obtained at each counting session. Alternatively, the radioiodine capsule can be counted in the neck phantom before oral administration and the counts obtained can be corrected for decay at each patient counting session (see Refs. 1 and 9).
      The ORINS, IAEA or a comparable neck phantom is recommended.
      b. Thyroid uptake can be measured using a scintillation camera, LEAP collimator and appropriate regions of

interest. Validation of gamma camera techniques by comparison with a reliable standard is recommended (see Refs. 2, 7 and 8).

F. Interventions

None

G. Processing

The radioiodine uptake (RAIU) is calculated using the following relationship:

$$\text{RAIU} = \frac{\text{Neck counts (cpm)} - \text{Thigh counts (cpm)}}{\text{Administered counts (cpm)} - \text{Background counts (cpm)}} \times 100\%$$

Administered counts are obtained either by counting the tracer actually administered to the patient or by counting a standard in a neck phantom, with correction for decay if necessary.

H. Interpretation/Reporting

1. Knowledge of the patient's history, medications, laboratory data and physical examination are important for appropriate diagnostic evaluation.
2. Since it is not possible for each facility to determine values for radioiodine uptake in euthyroid individuals, values from the older literature are generally used. In the literature, the customary normal range of values is usually given as between 10% and 35% for the 24-hr radioiodine uptake and between 6% and 18% for the 4-hr uptake (see Ref. 5).

I. Quality Control

1. Energy spectrum of the probe should be examined approximately yearly.
2. Absolute sensitivity (cpm/μCi) should be determined approximately monthly.

J. Sources of Error

1. Variations in neck-to-detector distance
2. Inappropriate neck phantom
3. Improper centering of the probe over the patient's neck
4. Electronic instability
5. Background variation
6. Interfering food/Medications
7. Contamination of the neck phantom
8. Recent administration of other radionuclide
9. Radioactivity in an adjacent area.

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.

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PART VI: ISSUES REQUIRING FURTHER CLARIFICATION

Stunning

Thyroid follicular cells are sensitive to even relatively low doses of radiation which can interfere with such cell functions as collection of radioiodine. Radiation emitted by diagnostic tracers can potentially decrease ("stun") subsequent thyroid uptake measurements by such effects and this possibility should be considered in evaluating the validity of uptake obtained with large tracer amounts of ^{131}I.

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PART VIII: LAST BOARD OF TRUSTEES APPROVAL DATE:

February 12, 1995

PART IX: NEXT REQUIRED APPROVAL DATE:

February 1997

ACKNOWLEDGMENTS

We thank Wendy Smith, MPH, Associate Director, Commission on Health Care Policy, Society of Nuclear Medicine, for project coordination, data collection and editing; members of the Guideline Development Subcommittee David Brill, MD and Robert Hattner, MD who contributed their time and expertise to the development of this information.