Whole-Body I-131 Scintigraphy

**Primary Indications:** (1) Post-operative evaluation of patients with thyroid carcinoma to determine if there are local or distant sites of tumor. Imaging in such cases is occasionally performed in conjunction with Measurement of Whole-Body I-131 Retention to aid in the determination of the maximum therapeutic dosage of I-131 that can be administered to a patient with thyroid carcinoma who is to be released immediately in accordance with NRC regulations governing such release (10 CFR 35.75). (2) Imaging of the extent of tumor after high-dose I-131 therapy performed for ablation of normal residual tissue or tumor.

**Rationale:** (1) Radioactive iodine is taken up by normal thyroid tissue and tumors that are iodine-avid (including almost all papillary, follicular and mixed tumors, but not medullary or anaplastic tumors). (2) Following administration of a large, therapeutic dosage of radioiodine, typically 100-150 mCi, small tumor deposits may be detected that are not evident by imaging with the standard diagnostic dosage.

**Interfering Conditions:** Thyroid hormone therapy; recent administration of iiodinated contrast agents or other iodine-containing drugs; non-elevated TSH (see Patient Preparation, below).

**Contraindications:** Whole-body I-131 scintigraphy is contraindicated in pregnant women because of the potential for ablation of the fetal thyroid gland (which begins to accumulate radioiodine at 8-10 weeks gestational age). Accordingly, it must be documented that a female patient is not pregnant (or does not have child-bearing potential) before administration of I-131, by establishing that the patient is premenarchal or postmenopausal; has had tubal ligation or hysterectomy; or has had a negative serum (or urine) pregnancy test (qualitative beta-HCG) performed within the previous 3 days (and preferably within 1 day before I-131 administration). In some circumstances, documentation of non-pregnancy by careful clinical history will be sufficient if so judged by the responsible attending nuclear medicine physician.

Whole-body I-131 scintigraphy is contraindicated in women who are breast feeding because a large fraction of the administered activity will be secreted in breast milk, which when ingested will cause radiation exposure to the infant’s thyroid gland (potentially resulting in thyroid ablation or radiation-induced thyroid carcinoma). Additionally, I-131 administration should be delayed for 3 or more months postpartum or after cessation of breast feeding to allow breast tissue to return to a basal state (in order to minimize the radiation exposure to the patient’s breasts).

**Precautions:** In a patient with a history of nausea and vomiting, appropriate precautions should be taken to avoid environmental contamination in the event vomiting occurs soon after I-131 administration. Pretreatment with an antiemetic should be considered in some patients.

**Radiopharmaceutical:** I-131 sodium iodide solution or capsule.

**Adult Dosage:** Per physician prescription as specified in a written directive. The standard adult dosage is 5 mCi.
Pediatric Dosage: Per physician prescription as specified in a written directive. The standard pediatric dosage is 70 µCi/kg (minimum dosage to be determined by the attending physician; maximum dosage is 5 mCi.)

Radiation Dosimetry: Assuming 0% thyroid uptake. (If any functioning thyroid tissue is present, this will be the tissue receiving the highest dose.)
Adult. Critical organ (bladder): 11.3 rem. Effective dose: 1.3 rem.

Route of Administration: Oral

Pharmacologic Drug: Thyrotropin alfa (Thyrogen®); see Patient Preparation

Pharm. Drug Dosage: 0.9 mg on each of two successive days

Pharm. Drug Route: Intramuscular

Patient Scheduling: Requests for I-131 therapy of hyperthyroidism should be submitted by the referring physician using the “Physician Request Form for I-131 Whole Body Imaging” (attached), which must be approved by a nuclear medicine attending physician. At the time of scheduling, arrangements should be confirmed regarding: thyroid hormone withdrawal (or thyrogen administration); scheduling of TSH measurement; and, if necessary, pregnancy testing.

Patient Preparation: 1. Thyroid hormone therapy should be withdrawn according to one of the following two schedules:
   A. Substitute T3 (Cytomel) for T4 (Synthroid) for 4 weeks, followed by discontinuation of all thyroid hormone for 2 weeks. A TSH measurement should be obtained 10 days after stopping T3;
   B. Discontinue all thyroid hormone 3 weeks before the imaging study. A TSH measurement should be obtained 16 days after stopping thyroid hormone.

As an alternative to thyroid hormone withdrawal, the patient can be pretreated by administration of Thyrogen® on two successive days (with scheduling of I-131 administration on the third day).

2. With either schedule for hormone withdrawal, the TSH level generally should be > 30 µU/ml before administering I-131. TSH elevation of this magnitude may not occur in patients with significant amounts of residual normal thyroid tissue or functioning metastatic thyroid carcinoma; scintigraphy may still be performed in such patients per physician direction. It is not necessary to measure the serum TSH level in patients who are pretreated with Thyrogen®.

3. The patient should be given a copy of “Instructions for Patients Receiving Radioiodine” (attached) and orally instructed in radiation precautions by a physician before the radioiodine is administered.

4. The patient should be given 2 bisacodyl (Dulcolax) tablets (or substitute laxative per physician prescription) to be taken on the evening before imaging.
Dosage Administration: Written Directive. Before administration of sodium iodide I-131 for Whole-Body I-131 Imaging, a written directive must be prepared by, or under the supervision of an authorized user/staff nuclear medicine physician (in accordance with the Division of Nuclear Medicine "Policy on Procedures Requiring a Written Directive” and the “Radiopharmaceutical Administration Policy for I-131 Sodium Iodide and for Radiopharmaceutical Therapy”). A “Radioiodine Written Directive” form (see Administrative Policies and Procedures) must be completed in its entirety. The top portion of this form (including patient name; birth date; sex; requisition number, accession number, and/or medical record number; prescribed dosage of I-131 sodium iodide; and purpose of administration) must be signed and dated by a staff nuclear medicine physician, nuclear medicine resident or radiology resident. The center portion of the form (including the drug lot number; volume; and dose calibrator reading) is to be completed by the nuclear medicine technologist or radiopharmacist who dispenses the I-131 sodium iodide. Finally, an authorized user/staff nuclear medicine physician must complete the bottom portion of the form and thereby confirm (1) the order from the referring physician; (2) the non-pregnant status of the patient; (3) the non-lactating status of the patient; (4) instruction of the patient in radiation safety; (5) the vial identity and lot number; (6) the final dose calibrator reading and concordance with prescribed dosage; and (7) identification of the patient by more than one method (see below). The authorized user must then sign and date this form.

Patient Identification. Before administering the dosage of I-131 sodium iodide, both the responsible staff physician and the administering technologist must verify the identity of the patient as the individual named in the written directive by more than one method following the “Patient ID Policy” (see Administrative Policies and Procedures).

Administration of I-131 Sodium Iodide Dispensed from Bulk Solution. For administration of the dosage of I-131, the patient should be seated in front of the fume hood in the radiopharmacy. The patient’s chest and lap should be draped with plastic-lined absorbent pads. Place paper medicine cup in lead cup holder. Add 5-10 mL water to cup. Gently discharge contents of the syringe containing the I-131 dosage into the medicine cup. Rinse the syringe with water from another cup and discharge into the cup containing the dosage. Repeat rinse. Have the patient drink the dose through a flexible straw. The cup and straw should be held by the technologist (not by the patient!). Rinse the cup with water and have the patient drink contents through the straw. Repeat. Dispose of cup and straw in I-131 radioactive waste bin. Remove drapes from the patient and dispose. After the patient leaves the dosing area, monitor the area for contamination with a Geiger counter.

Administration of I-131 Sodium Iodide Capsule. An I-131 sodium iodide capsule of the activity prescribed by the authorized user/staff nuclear medicine physician for a specific patient will be ordered from a commercial radiopharmacy for administration to inpatients at Barnes-Jewish Hospital or St. Louis Children's Hospital who cannot be transported to the radiopharmacy at Barnes-Jewish Hospital-South Campus for administration of I-131 solution. The lead container in which the capsule was delivered should be vented in the fume hood and then the activity of the capsule should be measured in the dose calibrator (and the assay checked by an authorized user/staff nuclear medicine physician). The capsule should then be returned to its container and transported to the patient's location. The patient’s chest and lap (and the bed, if appropriate) should be draped with plastic-lined absorbent pads. The capsule should be transferred into a paper medicine cup, and patient should ingest into mouth without touching capsule. Water is then added to the cup to be drunk by patient while swallowing capsule. The empty container should be returned to the radiopharmacy. The empty cup, as well as
dresses and gloves used during the administration should be transferred to a plastic bag and transported back to the radiopharmacy for disposal in I-131 radioactive waste bin.

Patients with Swallowing Disorders. In neurologically or mentally impaired patients who are unable to swallow (or who expectorate involuntarily), the I-131 solution may be given by nasogastric tube per physician direction. A two-tube technique (feeding tube within nasogastric tube) is recommended to minimize the chances for external contamination.

A dosage verification card is given to each patient receiving I-131 sodium iodide for presentation at security checkpoints (e.g., in airports or government buildings that are equipped with radiation detectors). Patients should keep this card available for 3 months to provide instructions for security personnel to contact the hospital in order to obtain verification that I-131 was given for medical purposes.

**Equipment Setup:**
- **Gamma Camera:** Dual-head whole-body camera. LFOV camera for optional pinhole images if requested by the physician.
- **Collimator:** High-energy parallel-hole. Pinhole collimator if requested by the physician.
- **Energy Window:** 364 keV with 20% window

**Patient Positioning:** Supine with arms at the side. For the spot images of the head and neck and the optional pinhole images, a pillow should be placed under the patient's shoulders to extend the neck.

**Procedure: Measurement of whole-body I-131 retention:** Patients who are scheduled for imaging after administration of a 5-mCi dosage of I-131 will also occasionally undergo “Measurement of Whole-Body I-131 Retention” according to the separate procedure for this test. This will require measurement of whole-body patient counts with a thyroid uptake probe immediately after oral administration of I-131 and again when the patient returns for imaging.

**Routine whole-body imaging:** Image 48 hours after administration of the radiopharmaceutical. [If I-131 is administered on Friday, imaging may be performed instead on Monday, at 72 hours.] The standard examination consists of: anterior and posterior whole-body images (head to knees) (usually acquired at 4 cm/min—typically requires ~ 30 minutes); both lateral images of the head and neck and an anterior image of the head and neck with the head in the extended position. The patient should be asked to drink a glass of water before the spot images to clear activity from the esophagus. Collect the spot images for 10 min each.

**Imaging after high-dosage I-131 therapy generally will be performed at 72-120 hours.** The standard examination consists of: anterior and post-erior whole-body images (head to knees) (usually acquired at 6 cm/min—typically requires ~ 20 minutes); Collect the spot images for 5 min each.

**Optional imaging:** Pinhole Images- If requested by the physician, obtain 10-min images of the neck at a distance of 14 cm with and without a sternal-notch marker.

SPECT or SPECT/CT Imaging- As requested by the physician
<table>
<thead>
<tr>
<th>Anterior and posterior whole-body images</th>
<th>Philips Cameras- Hi Res., Fixed Display Mode, word mode Siemens Cameras- 256 x 1024, word mode</th>
<th>Dual intensity anterior and posterior images on one film</th>
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</thead>
<tbody>
<tr>
<td>Anterior and both lateral images of the head and neck</td>
<td>256 x 256 matrix, word mode</td>
<td>Images on one film</td>
</tr>
<tr>
<td>Pinhole images</td>
<td>256 x 256 matrix, word mode</td>
<td>Anterior images</td>
</tr>
<tr>
<td>SPECT or SPECT/CT Imaging</td>
<td>See SPECT or SPECT/CT Acquisition and Filtering Guidelines</td>
<td>Staff physicians will film the SPECT data or create save-screens</td>
</tr>
</tbody>
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**Items Required For Complete Study:**

1. Anterior and posterior whole-body images and head/neck spot images. Pinhole views of the neck, SPECT or SPECT/CT, if requested by the physician.

2. All digital data transferred to the appropriate clinical reading station.

3. If applicable, printouts of data (Background, Initial Patient Count and 48-Hour (or 72-Hour) Patient Count) from Uptake Probe.

4. If applicable, completed Whole-Body I-131 Retention Worksheet.