I-131 Whole Body scan and Uptake

Radiology Associates of Clearwater

Overview

The Thyroid Metastases Study with radioiodine demonstrates the distribution of functioning thyroid tissue, both residual normal tissue in the thyroid bed and functioning metastases. Small amounts of iodine accumulate in the salivary glands, nares, and stomach.

Indications

Evaluation for persistent or recurrent functioning thyroid cancer (1-3). Evaluation of elevated thyroglobulin or abnormal imaging study (i.e., bone scan, chest x-ray).

Examination Time

Initially: 20 minutes for radiopharmaceutical administration.

Imaging 72 hours later: 3 hours for whole body images.

Patient Instructions / Scheduling

Inform the patient that the scan will be performed three days after the I-131 dose is given.

Inform the patient that the study will take at least 1-2 hours of imaging time. Low iodine diet is recommended for at least three days prior to administration of I-131 (no seafood, no iodized salt). Patient should be NPO for 4 hours prior to dosing and one hour after (4).

Breast feeding women should not be given I-131 unless deemed necessary by the nuclear medicine physician.

The patient must be off all iodine supplements (including vitamins) and thyroid hormone or antithyroid drugs for 4-6 weeks. If the patient takes amiodarone, please inform interpreting physician.

Contrast dyes from x-rays or CT studies should not have been given 4 to 6 weeks prior to the exam. Additionally, notify the nuclear medicine physician if a myelogram has been performed, since this can produce prolonged interference with I-131 imaging (lasting months to years).

Generate an uptake request.
If a female patient is of age 55 and under a serum bHCG must be obtained within 7 days of dosing.

**Lab /Image Correlation**

The patient must have a TSH drawn within one week of the scan appointment. Notify the nuclear medicine physician of the TSH value. Usually the scanning will be delayed until the TSH is >35 µIU/ml, or a definite plateau is identified.

Thyroglobulin if available.

If a female patient is of age 55 and under a serum bHCG must be obtained within 7 days of dosing.

Obtain the patient's x-ray jacket, including all pertinent images (prior I-131 WB scans from this institution or outside institutions), chest x-ray (recent), bone scan or any other imaging studies.

**Patient Preparation**

The technologist records a pertinent, standard history on the Thyroid Information Sheet.

Record exact activity in administered dose (to be verified by the nuclear medicine physician) for subsequent estimation of uptake.

Remove all items of clothing, which may contain excreted radioactivity, which may cause artifacts, e.g. handkerchiefs from pockets (6,7).

If patient needs to return for additional images after the 72-hour views, then the patient should be instructed to use laxative one day prior to imaging to clear gut activity. Magnesium citrate, 1 bottle, used as instructed in the package insert, can be taken the evening before imaging, if not contraindicated (magnesium citrate should not be given to patients with renal failure) - check with nuclear physician.

**Equipment & Energy Windows**

- Gamma camera: Large field of view.
- Collimators: High energy, parallel hole collimator.
- Energy window: 20% window centered at 364 keV.

**Radiopharmaceutical, Dose, & Technique of Administration**
Radiopharmaceutical: I-131 as sodium iodide.

Dose: 2.0 mCi.

Technique of administration: Oral followed by water.

**Patient Position & Imaging Field**

Patient position: Supine.

Imaging field: Whole body; upper extremities and lower extremities below the knees may be omitted.

**Acquisition Protocol**

At 72 hours acquire ANT and POST images from the head to below the knees (3,15):

Whole body technique with a scan rate of 600sec per stop.

Perform neck counting using the thyroid probe and calculate the percent uptake.

SPECT/CT imaging of the neck and upper chest will be performed as well if ordered by the Nuclear Medicine Physician.

**Data Processing**

To calculate the 72-hour uptake in the thyroid bed, use the following equation:

a. \[
\frac{(\text{Thyroid measurement for Day 3 - Pt. background}) \times 100}{\text{(Est. adm. cts x .77) - Lab background}} = \% \text{ uptake}
\]

b. Multiply x 100.

c. 3-day decay factor = 0.7721.

d. Use a uniform counting time of 60 seconds for all measurements.

e. Use uniform activity. Change mCi administered to read in microcuries.

f. Determine estimated administered counts per minute for a 2 mCi or more dose. For example,

\[
\frac{4.5 \; \mu\text{Ci}}{10784 \; \text{cpm}} = \frac{2000 \; \mu\text{Ci}}{x}
\]
Addendum to I-131 Whole Body Scan Protocol 4.5 – Thyrogen Protocol

Pretreatment with Thyrogen (thyrotropin alfa or recombinant TSH)

Indications:

Same as protocol 4.5, with one of the following conditions:

Patients who cannot or will not tolerate withdrawal from thyroid hormone for diagnostic procedures.

Patients with progressive thyroid cancer, despite standard therapy, in whom thyroid hormone withdrawal and TSH elevation by T3/T4 deprivation is contraindicated.

Instructions to Patients:

Same as above except imaging will be performed at 48 hours rather than 72 hours. The patient will also receive two intramuscular injections of Thyrogen prior to dosing.

Scheduling and Procedure:

1. Thyrogen, 0.9 mg IM, is administered at 24-hour intervals. A 4 mCi I-131 imaging dose is given orally on the third day. Keep the patient for 15 min. after IM injection of Thyrogen for observation. One scenario includes injection of Thyrogen at 8-10 a.m. on Monday and Tuesday, I-131 dose on Wednesday and whole body scan on Friday. Other scheduling alternatives are possible, but the time intervals are “fixed”.

2. A diagnostic dose of 4 mCi I-131 should be administered orally approximately 24 hours after the last (second) dose of Thyrogen.

3. At 48 hours post I-131 dosing, WB I-131 scanning and 48-hour uptake measurement, following standard acquisition protocol, should be performed. If ordered the patient will have thyroglobulin / anti-thyroglobulin antibodies labs drawn on this day.

See attached manufacturers information sheet. The most common adverse effects are nausea (10.5%) and headache (7.3%). If the patient has active
cardiac disease (e.g., angina), discuss with nuclear medicine physician before scheduling. There is a single report of MI after administration of Thyrogen.

**Optional Maneuvers**

Whole body imaging with F-18-fluorodeoxyglucose is useful for demonstrating undifferentiated metastases that are not well seen with I-131 [See Tumor Glucose Metabolism Study in the Tumor Section].

Whole body imaging with TI-201 or Tc-99m-sestamibi (15,16):
1. The patient need not discontinue thyroid hormone medication.
2. Administer 4 mCi (148 MBq) of TI-201 or 25 mCi (925 MBq) of Tc-99m-sestamibi intravenously.
3. Acquire whole body images as outlined above at 20-30 minutes after injection.

Medullary thyroid cancer: This cancer has been successfully imaged with Tc-99m-DMSA (17,18).

Hurthle cell thyroid cancer: This cancer has been successfully imaged with Tc-99m-sestamibi (19).

**Principle Radiation Emission Data - I-131 (20)**

Physical half-life = 8.04 days.

<table>
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<th>Radiation</th>
<th>Mean % per disintegration</th>
<th>Mean energy (keV)</th>
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<tr>
<td>Beta-4</td>
<td>89.4</td>
<td>191.5</td>
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<tr>
<td>Gamma-14</td>
<td>81.2</td>
<td>364.5</td>
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</table>

**Dosimetry - I-131 Sodium Iodide (21)**

<table>
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<th>Organ</th>
<th>rads/10 mCi</th>
<th>mGy/370 MBq</th>
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<tbody>
<tr>
<td>Thyroid</td>
<td>16,000.0</td>
<td>160,000.0</td>
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<tr>
<td>Stomach wall</td>
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<td>140.0</td>
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<tr>
<td>Whole body</td>
<td>7.1</td>
<td>71.0</td>
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<tr>
<td>Ovaries</td>
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<tr>
<td>Testes</td>
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**References**


### Normal Findings


Note: This protocol is in agreement with the Society of Nuclear Medicine Procedure Guidelines Manual, 1999.