THYROID UPTAKE MEASUREMENT (I-123)
Radiology Associates of Clearwater

Overview

The Thyroid Uptake Measurement measures the metabolic activity of the thyroid gland as reflected in its extraction of iodine from the blood.

Indications

Diagnosis of Hyperthyroidism (1,2).

Evaluation of subacute and chronic thyroiditis (3).

*Exams ordered for indications which are not listed above need to be discussed with the Nuclear Medicine Physician.

Examination Time

Initially: 20 minutes for radiopharmaceutical administration.

Delayed measurement at 24 hours: 15 minutes. In some cases a 4hr uptake may be performed.

Patient Preparation

Must be off thyroid hormones (4,5):
1. Thyroxine (T-4) for at least 10 days.
2. Triiodothyronine (T-3) for at least 3 days.

Must not be taking antithyroid medications (4,5):
1. Propylthiouracil (PTU) and tapazole for at least 3 days.

Must not have had intravenous or intrathecal iodinated contrast material (IVP, CT with contrast, myelogram, angiogram) for at least 3 weeks (1).

Other agents may interfere, but usually only to a small extent (1).

NPO after midnight the night before and for at least 1 hour after ingesting the radiopharmaceutical.

Equipment & Energy Windows

Detector: Uptake probe (single crystal probe with flat field collimator).
Energy window (6):
I-123: 20% window centered at 159 keV.

Neck phantom.

Radiopharmaceutical, Dose, & Technique of Administration

Radiopharmaceutical: (* A written directive is required prior to administering)

If part of an I-123 imaging study: The same radiopharmaceutical is used for both studies (The radiopharmaceutical should have minimal amounts of I-124 contamination) (6-9)

Dose: Imaging plus uptake studies: I-123: 100-200 uCi.
Uptake study only: I-123 100-200 uCi

Technique of administration: Oral.

Patient Position & Imaging Field

Patient position: Sitting.

Detector field of view: Neck.

Acquisition Protocol

Place radiopharmaceutical capsule(s) in neck phantom and position probe perpendicular to phantom with the positioning bar centered on capsule(s) at a standard distance, usually 20 cm (10).

Acquire counts for 1 minute for I-123; record the counts, time of acquisition, and time of day on the Thyroid Uptake Worksheet.

Immediately administer the capsule(s) to the patient.

At 24 hours position the probe in front of the patient's neck with the positioning bar perpendicular to the neck and with the bar centered half way between the thyroid cartilage and the suprasternal notch.

Acquire counts for 1 minute for I-123; record the counts, time of acquisition, and time of day on the Worksheet.

Position the probe over the thigh for a 24 hour "background" measurement. The positioning bar should be perpendicular to the thigh with the bar
centered just above the knee. The patient should void before counting over the thigh and the bladder must be clearly outside of the field of view.

Acquire counts for 1 minute for I-123; record the counts, time of acquisition, and time of day on the Worksheet.

**Data Processing**

Using the Thyroid Uptake Worksheet, calculate the 4 hour thyroid uptakes. Remember to correct the standard counts for decay.

**Optional Maneuvers**

Four hour uptake measurement: May be performed, but adds little to accuracy and is inconvenient for the patient (11-14).

Perchlorate washout test may be used to detect iodide organification defects (18,19):
1. Administer approximately 10 µCi of I-131 orally.
2. At 2 hours determine thyroid uptake value.
3. Give 1,000 mg of perchlorate orally (600 mg for children).
4. At 3 hours (1 hour later) determine a second thyroid uptake value.
5. An abnormal response is a decrease in the uptake value of greater than 5%.

**Principle Radiation Emission Data - I-123** (20)

Physical half-life = 13.2 hours.

<table>
<thead>
<tr>
<th>Radiation</th>
<th>Mean % per disintegration</th>
<th>Mean energy (keV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gamma-2</td>
<td>83.3</td>
<td>159.0</td>
</tr>
<tr>
<td>ce-K, gamma-2</td>
<td>13.6</td>
<td>127.2</td>
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</tbody>
</table>

**Dosimetry - I-123 as Sodium Iodide** (21)

<table>
<thead>
<tr>
<th>Organ</th>
<th>rads/500 µCi</th>
<th>mGy/18.5 MBq</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thyroid</td>
<td>3.75</td>
<td>37.5</td>
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<tr>
<td>Stomach wall</td>
<td>0.12</td>
<td>1.2</td>
</tr>
<tr>
<td>Ovaries</td>
<td>0.02</td>
<td>0.2</td>
</tr>
<tr>
<td>Red marrow</td>
<td>0.02</td>
<td>0.2</td>
</tr>
<tr>
<td>Liver</td>
<td>0.01</td>
<td>0.1</td>
</tr>
<tr>
<td>Whole body</td>
<td>0.01</td>
<td>0.1</td>
</tr>
<tr>
<td>Testes</td>
<td>0.01</td>
<td>0.1</td>
</tr>
</tbody>
</table>

**Principle Radiation Emission Data - I-131** (22)
Physical half-life = 8.04 days.

<table>
<thead>
<tr>
<th>Radiation</th>
<th>Mean % per disintegration</th>
<th>Mean energy (keV)</th>
</tr>
</thead>
<tbody>
<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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**Dosimetry - I-131 as Sodium Iodide** (21)

<table>
<thead>
<tr>
<th>Organ</th>
<th>rads/10 μCi</th>
<th>mGy/0.37 MBq</th>
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</thead>
<tbody>
<tr>
<td>Thyroid</td>
<td>13.00</td>
<td>130.0</td>
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<tr>
<td>Stomach wall</td>
<td>0.01</td>
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</tr>
<tr>
<td>Total body</td>
<td>0.01</td>
<td>0.1</td>
</tr>
<tr>
<td>Ovaries</td>
<td>0.01</td>
<td>0.1</td>
</tr>
<tr>
<td>Testes</td>
<td>0.01</td>
<td>0.1</td>
</tr>
</tbody>
</table>

**References**


Normal Values


> Normal thyroid uptake values in Denver, Colorado: 6 hours = 7-20%, 24 hours = 14-30%. University of Colorado Medical School, Unpublished data, 1981.