

# THYROID UPTAKE MEASUREMENT (I-123 or I-131 as Sodium Iodide)

## Overview

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

## Indications

- Diagnosis of Grave's disease (1,2).
- Evaluation of subacute and chronic thyroiditis (3).

## Examination Time

- Initially: 20 minutes for radiopharmaceutical administration.
- Delayed measurement at 6 hours: 15 minutes.

## 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 (CT with intravenous contrast, IVP, myelogram, angiogram) for at least 3 weeks (1).
- Other agents may interfere, but usually only to a small extent (6).
- 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).
  - θ A gamma camera may be substituted for a dedicated uptake probe.
- Energy window:
  - > I-123: 20% window centered at 159 keV.
  - > I-131: 20% window centered at 364 keV.

- Neck phantom.

### **Radiopharmaceutical, Dose, & Technique of Administration**

- Radiopharmaceutical:
  - > 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) (7-9).
  - > If not part of an I-123 imaging study: I-123 or I-131 (7).
- Dose:
  - > Imaging plus uptake studies: I-123: 500  $\mu$ Ci (18.5 MBq).
  - > Uptake study only:
    - Ø I-123: 100  $\mu$  Ci ( 1.9 MBq) or
    - Ø I-131: 10  $\mu$ Ci (0.37 MBq).
- Technique of administration: Oral.

### **Patient Position & Imaging Field**

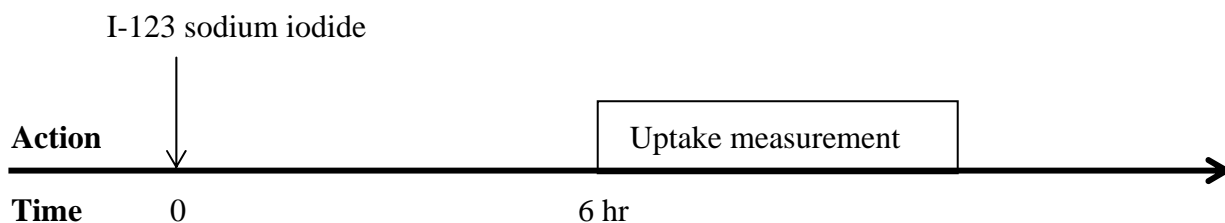
- Patient position: Sitting.
- Detector field of view: Neck.

### **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 and for 2 minutes for I-131; record the counts, time of acquisition, and time of day on the Thyroid Uptake Worksheet.
- Immediately administer the capsule(s) to the patient.
- At 6 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 and for 2 minutes for I-131; record the counts, time of acquisition, and time of day on the Worksheet.
- Position the probe over the thigh for 6 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 and for 2 minutes for I-131; record the counts, time of acquisition, and time of day on the Worksheet.

### Protocol Summary Diagram



### Data Processing

- Using the Thyroid Uptake Worksheet, calculate the 6 hour thyroid uptakes. Remember to correct the standard counts for decay.

### Optional Maneuvers

- Twenty four hour uptake measurement: May be performed, but adds little to
- Uptake measurement with a gamma camera: A gamma camera with a pinhole or parallel collimator may be substituted for an uptake probe (15).
- Thyroid uptake measurements may be determined using Tc-99m-pertechnetate (17).
- Perchlorate washout test may be used to detect iodide organification defects (18,19):
  1. Administer approximately 10  $\mu\text{Ci}$  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.

Radiation	Mean % per disintegration	Mean energy (keV)
Gamma-2	83.3	159.0
ce-K, gamma-2	13.6	127.2

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

Organ	rads/500 $\mu$ Ci	mGy/18.5 MBq
Thyroid	3.75	37.5
Stomach wall	0.12	1.2
Ovaries	0.02	0.2
Red marrow	0.02	0.2
Liver	0.01	0.1
Whole body	0.01	0.1
Testes	0.01	0.1

## Principle Radiation Emission Data - I-131 (22)

- Physical half-life = 8.04 days.

Radiation	Mean % per disintegration	Mean energy (keV)
Beta-4	89.4	191.5
Gamma-14	81.2	364.5

## Dosimetry - I-131 as Sodium Iodide (21)

Organ	rads/10 $\mu$ Ci	mGy/0.37 MBq
Thyroid	13.00	130.0
Stomach wall	0.01	0.1
Total body	0.01	0.1
Ovaries	0.01	0.1
Testes	0.01	0.1

## References

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#### Normal Values

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

# THYROID UPTAKE WORKSHEET

## Nuclear Medicine Department

**Institution** \_\_\_\_\_

Name \_\_\_\_\_ ID \_\_\_\_\_ Age \_\_\_\_\_ Sex \_\_\_\_\_  
 Referring physician \_\_\_\_\_ Date \_\_\_\_\_

### Zero Hour (time \_\_\_\_\_)

	counts per minute
Dose in phantom (standard)	
Background	-
Net (standard)	

### 6 Hour Uptake (time \_\_\_\_\_)

	counts per minute
Neck	
Thigh (background)	-
Net	

	counts per minute
Standard at zero time	
Decay correction factor	x
Corrected standard	
_____	

6 hour uptake = (net neck cpm / corrected standard cpm) x 100% = \_\_\_\_\_%

### 24 Hour Uptake (time \_\_\_\_\_)

	counts per minute
Neck	
Thigh (background)	-
Net	

	counts per minute
Standard at zero time	
Decay correction factor	x
Corrected standard	

24 hour uptake = (net neck cpm / corrected standard cpm) x 100% = \_\_\_\_\_%

- Normal Range: 6 hours = \_\_\_\_\_%; 24 hours = \_\_\_\_\_% •

Technologist \_\_\_\_\_