I-131 Thyroid Uptake

**Primary Indications:** Measurement of the thyroidal uptake of radioactive iodine is indicated (1) to aid in the determination of the dose of I-131 sodium iodide for therapy of hyperthyroidism; (2) for confirmation of the diagnosis of subacute thyroiditis and (3) for differentiation of hyperthyroidism due to toxic goiter from that due to painless thyroiditis or factitious hyperthyroidism.

**Rationale:** The thyroidal uptake of radioactive iodine is generally increased in patients with diffuse toxic goiter or toxic multinodular goiter. Calculation of the dose of I-131 needed for treatment of either of these conditions requires a measurement of the thyroidal uptake of radioactive iodine. The thyroidal uptake of radioactive iodine is generally depressed to very low levels in patients with subacute thyroiditis, painless thyroiditis, or factitious hyperthyroidism.

**Interfering Conditions:** Antithyroid-drug (propylthiouracil or methimazole) therapy within 3 days of the test; thyroid hormone therapy; and recent administration of iodinated contrast agents or other iodine-containing drugs will lower the thyroidal uptake of radioactive iodine. Recent administration of other radiopharmaceuticals can invalidate the measured thyroid uptake result.

**Contraindications:** I-131 administration is contraindicated in pregnant women because of the potential for substantial radiation exposure 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 on the day of I-131 administration). In some circumstances, documentation of non-pregnancy by careful clinical history will be sufficient if so judged by the responsible staff nuclear medicine physician. Administration of <30 uCi I-131 to measure thyroid uptake before the results of the pregnancy test are available is permissible (per direction of nuclear medicine staff physician) if the patient strongly denies the possibility that she could be pregnant. In those extremely unusual circumstances where thyroid uptake measurement is clinically necessary in a patient known to be pregnant, the test should be performed with I-123 (per direction of nuclear medicine staff physician) rather than with I-131.

I-131 administration 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. Additionally, I-131 administration should be delayed for 4 to 6 weeks postpartum or after cessation of breast feeding to allow breast tissue to return to a basal state (in order to minimize the dose to the patient’s breasts).

**Precautions:** None

**Radiopharmaceutical:** I-131 sodium iodide solution
**Adult Dosage:** 4-12 µCi. Prepared vials contain 12 µCi at the time of calibration. Dispense only one vial until activity decays to ≤4 µCi. Thereafter, dispense two vials so that administered dose is 4-8 µCi.

**Pediatric Dosage:** Same as adult dosage.

**Radiation Dosimetry:** Adult (for an average 8 µCi dose). Critical organ (thyroid): 6.22 rem with a normal uptake value of 15% and 23.4 rem with an elevated uptake value of 55%. Effective dose: 0.20 rem with 15% uptake and 0.71 rem with 55% uptake.

Infant (1 year; for an average 8 µCi dose). Critical organ (thyroid): 59.2 rem with a normal uptake value of 15% and 219 rem with an elevated uptake value of 55%. Effective dose: 1.84 rem with 15% uptake and 6.51 rem with 55% uptake.

**Route of Administration:** Oral

**Patient Scheduling:** Requests for I-131 thyroid uptake (which are most commonly scheduled in conjunction with I-131 Therapy of Hyperthyroidism) should be submitted by the referring physician using the “Physician Request Form for Radioiodine Uptake and/or Treatment”, which must be approved by a nuclear medicine attending physician. At the time of scheduling, arrangements should be made with the referring physician (or physician’s staff) regarding discontinuation of antithyroid medications and scheduling of pregnancy testing.

**Patient Preparation:** Treatment with propylthiouracil or methimazole should be discontinued at least 3 days before measurement of thyroid uptake.

**Equipment Setup:** Instrument: Capintec CAPTUS 500 Uptake Probe (Barnes-Jewish Hospital-South Campus)
Collimator: Single-bore uptake collimator
Energy Window: Multichannel-analyser acquisition.
336-396 keV.

**Patient Positioning:** Sitting erect

**Procedure:** 1. Before dispensing of I-131, the technologist should reconfirm that the patient has not received interfering medications (e.g., antithyroid drugs, thyroid hormone, contrast agents) or other radio-pharmaceuticals (especially previous administration of I-131). The latter should be checked by performing a survey count of the patient’s neck with a Geiger-Mueller (G-M) meter kept in the radiopharmacy. This is done as follows.

   a. In the dose administration room, first observe the background counting rate of the G-M meter for approximately 20 seconds and record the average value during the last 10 seconds.

   b. If average background exceeds 0.05 mR/hr, move to another room and repeat background measurement. Do not proceed until the background measurement is less than 0.05 mR/hr. Then place the GM detector probe against the patient’s thyroid region for approximately 20 seconds and record the average value during the last 10 seconds.

   c. If the patient’s neck reading is more than 0.05 mR/hr, it should be assumed that the patient has
previously received another radiopharmaceutical. The patient should be carefully questioned to determine the nature of the other radiopharmaceutical, and a "residual" count measurement of the patient's neck must be obtained for 300 seconds using the NaI Uptake Probe that has been peaked for the appropriate energy, before giving uptake dose.

d. If excess residual counts are detected, it may be necessary to increase the administered dosage of I-131 for the uptake measurement (per physician direction only). **Note that if the physician prescribes an increased I-131 dosage ≥30 µCi for this test, completion of a Written Directive, and compliance with all other requirements of the Division of Nuclear Medicine “Policy on Procedures Requiring a Written Directive” is necessary.**

e. The following information is recorded on the Endocrine System “Nuclear Medicine Medication Verification Form”:
   i. Background G-M count-rate
   ii. Patient G-M count-rate
   iii. Technologist initials

2. Following procedure outlined in Bench Manual attached to the system, perform Calibration (Test) of uptake probe to ensure constancy of the system.
3. Following procedure outlined in Bench Manual attached to the system, perform Background Count. Background counting should be performed for 300 seconds (5 minutes).
4. Following procedure outlined in Bench Manual attached to the system, perform Standard Count of neck phantom containing one I-131 uptake standard solution vial and of the patient’s neck (with the uptake probe centered over the standard solution vial and thyroid gland, respectively). Standard counting and patient neck counting should each be performed for 300 seconds (5 minutes).
5. Perform calculation of patient’s Thyroid Uptake by completing Thyroid Uptake spreadsheet. Enter the data on the appropriate section of the spreadsheet (attached). The spreadsheet automatically does decay correction, background subtraction, and % uptake calculation.

**Items Required For Complete Study:**

1. Printouts of data (Date and time of counting, Background, Standard and Patient Counts) from Uptake Probe.
2. Printout of the thyroid uptake spreadsheet.
3. Save the completed Thyroid uptake spreadsheet in the In Vitro Clinical folder on the G drive.