Austin Radiological Association

Nuclear Medicine Procedure

THERAPY FOR THYROID CANCER
(I-131 as Sodium Iodide)

Overview

- I-131 therapy for Thyroid Cancer, of the papillo-follicular type, is intended to ablate residual functioning thyroid tissue, either remaining normal thyroid tissue in the thyroid bed or functioning thyroid cancer anywhere in the body. The maximum effect is achieved when the residual functioning tissue is maximally stimulated by a high thyroid stimulating hormone (TSH) level and when the circulating non-radioactive iodine level is relatively low. Thyroid cancer that has become undifferentiated will take up relatively little radioiodine.

Indications

- Ablation of residual normal thyroid tissue post subtotal thyroidectomy in:
  1. Patients with a primary cancer larger than 1-1.5 cm.
  2. Patients with a primary cancer of any size with extrathyroidal spread or multicentricity.

- Treatment of residual functioning thyroid cancer.

- Treatment for a rising serum thyroglobulin antibody level in the absence of abnormal uptake in the whole body I-131 study.

Procedure Time

- Initially: 60 minutes for obtaining informed consent and administering the dose.

- Later (if requested) whole body imaging 5 – 10 days post treatment for 60 minutes.

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Patient Preparation

- The patient must discontinue iodide containing preparations and medications that could potentially affect the ability of thyroid tissue to accumulate iodide.

Medication	Time of withdrawal
Antithyroid medication (propylthiouracil, methimazole, carbimazole)	3-5 days
Multivitamins	6 weeks

Expectorants, kelp, agar, carageen, topical iodide	3 weeks
Radiographic contrast agents	4 weeks
Amiodarone	3 months

- The patient must undergo thyroid stimulating hormone (TSH) stimulation by either:
  - Withdrawal of thyroid hormones for a period of time. TSH > 30.

Hormone	Time of withdrawal
Triiodothyronine (T-3)	2 weeks
Thyroxine (T-4)	4 weeks

  - Pretreatment with recombinant TSH (rTSH) .9mg IM each day over two days.

- For women of child bearing age, a serum pregnancy test must be performed within 7 days of administration of treatment. Pregnancy is an absolute contraindication.

- The nuclear medicine physician explains the expected benefits and possible complications.

- The nuclear medicine physician obtains written informed consent for treatment and for treatment as an outpatient. Completed before dose is ordered.

- TSH levels unless patient is receiving Thyrogen.

- Pathology report on thyroidectomy.

- Ask if referring physician wants post-treatment whole body scan and TG lab testing. Give laxative for post-treatment imaging.

Post Treatment Restrictions

- Outpatient treatment (for those patients whose home living situation allows them to meet the requirements for keeping exposure to relatives and the public below the 0.5 rem limit):
  1. A member of the nuclear medicine department reviews the requirements established by the treating institution with the patient. If the patient agrees to follow all of the requirements, the patient may be discharged following administration of the radiopharmaceutical.
  2. Requirements are listed in the patient instruction forms based on administered dose.

- Hospitalization (for those patients who cannot meet the requirements for outpatient treatment).

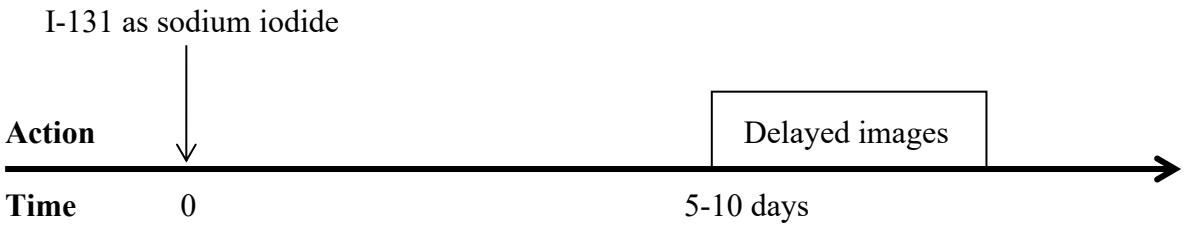
Radiopharmaceutical, Dose, & Technique of Administration

- Radiopharmaceutical: I-131 as sodium iodide.
- Dose:
  - > Ablation of residual functioning thyroid tissue post thyroidectomy: 50-150 mCi (2,590-5,550 MBq). Pedi dose by NACG chart.
  - > Treatment of persistent or recurrent functioning thyroid cancer: 100- 200 mCi (3,700-7,400 MBq). Pedi dose by NACG chart.
- Technique of administration: Oral.

Acquisition Protocol

- Perform whole body imaging 5-10 days following administration of the treatment dose of I-131.

Protocol Summary Diagram



Post Treatment Restrictions

- There are post-treatment restrictions related to the distance between the patient and other persons, and the patient's bodily fluids.

Complications

- In general, the risk of complications from I-131 therapy increases as the cumulative dose from I-131 increases and as the amount of residual post-operative thyroid tissue increases.

Complication	Time of onset	Frequency (%)
Acute radiation sickness, e.g. nausea	< 24 hrs.	30
Prolonged I-131 retention	< 24 hrs.	rare
Thyroid tissue pain & swelling	< 48 hrs.	20
Salivary and lacrimal gland dysfunction	< 1 wks.	20-30

Taste dysfunction	< 1 wk.	20
Hyperthyroidism	< 1 wk.	rare
Radiation pneumonitis	< 1 wk.	rare*
Impaired spermatogenesis	< 2 wks.	common
Facial nerve palsy	< 2 wks.	rare
Marrow suppression	years	1
Solid cancers	years	1
Miscarriages, birth defects	years	rare

*Only in patients with diffuse lung metastases.

Optional Maneuvers

- Low iodine diet: Some improvement in uptake of radioactive iodine in functioning thyroid tissue can be obtained by placing the patient on a low iodine diet for approximately 1 week prior to treatment.

- Pretreatment with diuretics: Pretreatment with diuretics may lower the blood iodide level more than a low iodine diet.

- Individualized dose based treatments: The treatment dose may be determined by calculating the maximum safe amount of radioiodine based empirically on an upper limit of 200 rads to the blood and a maximum of 120 mCi of I-131 retained at 48 hours (80 mCi if the patient has pulmonary metastases).

- Pretreatment of dedifferentiated thyroid cancer with isotretinoin: Pretreatment of dedifferentiated thyroid cancer with isotretinoin may restore the cancer's ability to take up iodine.

- Renal failure/dialysis: Patients in renal failure may be treated with I-131 with some modifications in the protocol.

- Radioprotection of salivary glands: Give 300 mg/m2 of amifostine (Ethyol) intravenously before the radioiodine (35).

- Letter documenting radioactive treatment: If the patient triggers a radiation detector in a public facility, it is useful for him/her to have a letter documenting the cause.

Method for timely correction of Data Analysis and reporting errors and notification of referring parties

- Data Analysis and reporting errors are reported to the interpreting physician and appropriate clinic manager for timely correction and notification of the referring physician via report addendum or STAT call if error is significant.

Principle Radiation Emission Data - I-131

- 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

Organ	rads/150 mCi	mGy/5,550 MBq
Thyroid	39,000.0	390,000.0
Stomach wall	255.0	2,550.0
Salivary glands	105.0	1,050.0
Total body	36.0	360.0
Red marrow	21.0	210.0
Ovaries	21.0	210.0
Testes	12.6	126.0