Iodine-131 basics

Radioactive iodine therapy (I-131) is considered the treatment of choice for a variety of thyroid lesions due to its relatively simple, effective, and safe profile with minimal morbidity or mortality.\(^1\) Similar to stable/dietary iodine and pertechnetate, radioiodine is trapped by the thyroid follicular cells and concentrated within the colloid. Thus, radioactive iodine has the major advantage of the ability to target tumor tissue regardless of tumor location including ectopic sites. If a treatment fails, there is also the potential to administer sequential treatments if needed.

Like the radiopharmaceutical used in thyroid scintigraphy, I-131 emits gamma rays. However, it also emits beta particles, which contain a much higher amount of energy and are capable of causing damage to tissue and DNA via direct and indirect methods. Beta particles emitted from the I-131 travel a maximum distance of 2 mm into the surrounding tissue, further enhancing the precision of this therapy.\(^1\) 80% of thyroid tissue destruction is mediated by beta emission, the other 20% by gamma rays.\(^1\)

The safety of I-131 treatment is further improved by the normal pathophysiology of hyperthyroidism: pituitary secretion of thyroid stimulating hormone is decreased in hyperthyroid cats by the clinical thyrotoxicosis. This results in suppression of any normal thyroid tissue and subsequently decreased uptake of I-131. Thus, theoretically, I-131 should only be taken up by and cause damage to hyperfunctioning thyroid tissues while sparing normal follicular thyroid cells, resolving the hyperthyroidism without inducing hypothyroidism.
I-131 requirements
While I-131 is a very effective therapy, not all cats are good candidates. Since most hyperthyroid cats are usually senior felines, a number of other concurrent conditions or intensive supportive care can prevent a cat from safely receiving I-131. The following is the list of pre-requisites to keep in mind when referring for I-131. Diagnostics can be performed at MSU if needed.

- Current CBC, chemistry, urinalysis – rule out concurrent illness, evaluate renal status.
- T₄ levels indicating hyperthyroidism – MSU DCPAH offers a “thyroid panel” including a free T₃ level measured by equilibrium dialysis, the gold standard test.
- Current 3-view thoracic radiographs – rule out presence of metastatic disease. This is a poor prognostic indicator and may necessitate a higher I-131 dose.
- Relatively good temperament – treatment requires handling and injection of a highly radioactive substance; very fractious cats are poor candidates for therapy.
- No/minimal medications or treatments – contact with cats once injected with I-131 is limited to feeding and changing litter to keep personnel radiation exposure to a minimum. As I-131 is excreted by the salivary glands cats must be able to eat any medications in food.
- If currently using methimazole, discontinue use at least 10 days prior to therapy – this medication increases normal thyroid uptake of I-131 resulting in tissue destruction and subsequent hypothyroidism post-treatment.

Treatment protocol
Cats are taken to an isolation ward with cinderblock walls and a negative pressure ventilation system designed to contain any radiation emitted by the cats. Cats are sedated (if necessary) and restrained. A 4mCi dose of I-131 is injected into the subcutaneous tissues between the shoulders, then placed into kennel containing food, water, a little box, and hiding dome. As the cat is at its maximum radioactive level at this time, personnel leave the room immediately. Cats are checked by radiation-safety trained personnel in the mornings and evenings post-injection; they are visually assessed, provided fresh food and water, and have their litter changed at these times. Cats are scanned for radioactivity using an ion chamber in the evenings. Per federal regulations, cats must emit less than 2mR/hr of detectable radiation at 30cm from the thyroid in order to be discharged. This typically takes 3-4 days following injection with I-131; injections are usually performed on Mondays so cats can leave prior to the weekend. Owners are advised that their cats are still technically radioactive following discharge with the remaining radioactivity gradually eliminated over 2-4 weeks through radioactive decay and excretion in urine and feces. This means that owners should take basic precautions such as limiting time spent with the animal and using gloves and a dedicated container for any pet waste.
I-131 literature
This therapy has been in use for the past couple decades and multiple studies have shown its
safety and efficacy, particularly in the treatment of feline thyroid adenomatous hyperplasia.
The median survival time following treatment is 2 years, with some cats surviving up to 6 years
post-treatment.\(^2\) There is a low occurrence (2%) of induced hypothyroidism necessitating daily
medication.\(^2\) Treatment failure (requiring methimazole post-treatment or a second I-131
treatment) is also rare, occurring in only 2.5% of cases.\(^2\) Other side effects such as a transient
dysphagia or sialoadenitis are often due to localized tissue inflammation from the effects of I-
131 and are extremely rare.\(^1\)
Caution is recommended in cats with known renal disease at time of I-131 treatment, as this is
associated with a shorter median survival time.\(^3\) It is estimated that ~25% of cats with have
some worsening of renal function post-treatment; this fact and its potential consequences
should be discussed with owners prior to treatment.\(^1\) In the few cats where hypothyroidism
has been induced by treatment with I-131, these cats were more prone to developing azotemia
as well as having decreased survival times.\(^4\)
I-131 has also been used in the rare occurrences of feline thyroid carcinoma. A 2009 study
found that a dose of 30mCi (~10x’s the normal dose) was successful in treating 75% of cats with
thyroid carcinoma.\(^5\) The median survival time for successfully treated cats was 3 years.\(^5\) These
patients typically will become hypothyroid following treatment due to the high doses of
radiation needed to eliminate the neoplastic tissue.\(^6\)

References/additional reading
3. Milner RJ, Channell CD, Levy JK, Schaer M. Survival times for cats with hyperthyroidism
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4. Williams TL, Elliott J, Syme HM. Association of iatrogenic hypothyroidism with azotemia
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6. Guptili L, Scott-Moncrieff CR, Janovitz EB, Blevins WE, Yohn SE, DeNicola DB. Response to
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