

Feline Hyperthyroidism: The Treatment We Should All Be Doing

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Introduction & Overview

- **Prevalence & Significance:** Feline hyperthyroidism is the most common endocrine disorder in older cats. Untreated, it causes weight loss, cardiac strain, hypertension, and organ damage. The **gold standard treatment is radioiodine (I-131)**, which offers a cure by destroying hyperactive thyroid tissue.
- **Why I-131:** Unlike medical (methimazole) or dietary therapy, I-131 *cures* hyperthyroidism with a single injection in ~95% of cases. It targets only thyroid cells (iodine-avid tissue), leaving other tissues unharmed. No anesthesia or invasive surgery is needed, making it **safe and minimally stressful** for the cat.
- **Current Challenge:** Many practitioners still use empiric fixed dosing (e.g. 4 mCi for all cats) for I-131. This “one-size-fits-all” approach can lead to avoidable complications. **This talk will advocate for an individualized I-131 dosing protocol**, developed by Dr. Mark Peterson, to improve outcomes and minimize side effects.

Why Treat Sooner Rather Than Later?

- **Early Treatment Benefits:** Diagnosing and treating hyperthyroid cats early (soon after diagnosis) leads to **lower required I-131 doses, shorter hospital isolation, and fewer systemic complications** from prolonged hyperthyroidism. Early-stage disease means smaller thyroid tumors and less severe hormone elevation, so curative doses are lower. Cats treated earlier often need only ~1–2 mCi, versus higher doses for advanced cases. Lower doses not only reduce radiation exposure but can shorten the mandated hospitalization period for radiation safety.
- **Prevent Disease Progression:** Prolonged medical management or delayed definitive therapy allows thyroid tumors to grow. Benign adenomatous thyroid tissue can transform into carcinoma over time. In fact, >20% of cats on methimazole >4 years developed thyroid carcinoma. These malignant cases require *much higher I-131 doses* (often 5–10× higher) and longer isolation. Early I-131 prevents this progression.
- **Less Systemic Damage:** Shortening the duration of thyrotoxicosis spares organs. Hyperthyroidism causes hypertension and high cardiac output, which over time can lead to hypertrophic cardiomyopathy and kidney hyperfiltration. By treating early, we **reduce the cumulative strain on the heart and kidneys**, leading to better overall recovery. For example, cats treated soon after diagnosis have less severe weight loss and cardiac changes than those hyperthyroid for months or years.

I-131: Gold Standard Therapy

- **Mechanism:** Radioiodine (I-131) is selectively taken up by hyperfunctional thyroid cells and emits beta radiation to destroy them. A **single subcutaneous injection** of I-131 is given. Over 1–3 days, the radioiodine concentrates in the thyroid adenoma(s) and causes targeted necrosis of the abnormal tissue, reducing T4 secretion to normal. Surrounding tissues are largely unaffected due to the short range of beta particles.
- **Administration & Hospitalization:** The dose is given SC (some facilities use oral capsules). After injection, the cat must remain in a radiation isolation ward until safe levels are reached. Typical isolation is about 3–5 days in many centers (exact duration depends on local radiation safety regulations and the dose given). Lower doses often mean cats reach release criteria sooner. (In some institutions using higher or fixed doses, isolation can last up to 1–2 weeks.) During isolation, only minimal contact care is provided, so treating stable patients (or stabilizing them first) is important.
- **Effectiveness:** I-131 consistently cures ~95–98% of hyperthyroid cats with one treatment. This high success rate applies when dosing is done properly. Unlike surgery, it treats ectopic thyroid tissue (e.g. intrathoracic) as well. Unlike lifelong methimazole, it resolves the disease permanently in most cases, greatly improving quality of life for both cat and owner.
- **Fixed Dose Protocols (Old Approach):** Many I-131 facilities historically used a fixed dose (commonly ~4 mCi, or a tiered fixed scheme based on severity). While generally effective at curing hyperthyroidism, fixed dosing **ignores patient variability**. Every cat's thyroid tumor burden and iodine kinetics differ; thus, a fixed dose often overshoots in some cats and undershoots in others. We'll see why guessing the dose is problematic and how it can be improved.

The Problem with Fixed Doses: Hypothyroidism and Treatment Failures

- **Iatrogenic Hypothyroidism:** The goal of I-131 is to restore normal thyroid function (euthyroidism) without dropping the cat into hypothyroidism. **Fixed high doses frequently overshoot**, ablating too much thyroid tissue. Studies show **30–80% of cats become hypothyroid** (overt or subclinical) after standard fixed-dose radioiodine. One report found almost 70% of cats treated with 3–5 mCi became hypothyroid (18% overtly, ~48% subclinical). This was often overlooked in the past, as subclinical cases show no obvious signs initially.
- **Why Hypothyroid is a Problem:** Chronic hypothyroidism in cats, even subclinical, is **detrimental to health**. It lowers metabolic rate and **reduces glomerular filtration rate (GFR)**, which can *unmask or worsen kidney disease*. Overtly hypothyroid cats often develop azotemia from decreased renal perfusion. In one study, 72% of cats that became overtly hypothyroid post-I-131 developed azotemia, versus only ~14% of cats that remained euthyroid. Hypothyroidism has also been linked to **shorter survival times**: cats with pre-existing CKD that became

hypothyroid had significantly shorter median survival than CKD cats that stayed euthyroid. In other words, an otherwise successful cure can be ruined by accelerated kidney decline and reduced lifespan if we induce hypothyroidism.

- **Treatment Failures (Persistent Hyperthyroidism):** On the other end of the spectrum, a fixed dose may *underdose* cats with large or aggressive thyroid tumors. Approximately 5–10% of hyperthyroid cats *fail to be cured* by a single I-131 treatment and remain hyperthyroid. Many failures are likely due to insufficient dose for the individual cat's disease severity. For example, a cat with a huge thyroid adenoma or carcinoma may need >10 mCi, and giving only 4 mCi risks persistent hyperthyroidism requiring retreatment. Identifying these cats in advance is crucial – this is where individualized dosing and pre-treatment imaging help (e.g., a large tumor on scintigraphy is a red flag).
- **Bottom Line:** The traditional approach of “one dose fits all” yields a **moderate success with avoidable side effects** – some cats get **overdosed** (hypothyroid) and some **underdosed** (still hyperthyroid). We can do better by tailoring the dose to each cat.

Individualized I-131 Dosing Protocol (Mark Peterson's Method)

- **Personalized Medicine:** Dr. Mark E. Peterson has pioneered a cat-specific dosing algorithm to calculate the *lowest effective I-131 dose* for each hyperthyroid cat. The principle is to achieve cure (thyroid normalization) while **minimizing the risk of overshooting into hypothyroidism**. Instead of guessing, this protocol uses **quantitative data from each patient** to derive a dose. Key factors include:
- **Pretreatment T4 and T3 levels:** Indicate the hormonal severity of disease. Higher T4/T3 suggests more active or larger tumor requiring more I-131. T3 tends to accumulate more in malignant tissue.
- **Thyroid tumor size (volume):** Determined via thyroid scintigraphy imaging; larger thyroid mass needs higher dose (approx. 1 mCi per cm³ of tumor as a base).
- **99mTc-pertechnetate uptake (TcTU):** Thyroid scintigraphy also quantifies how much tracer the thyroid tissue takes up (% of injected pertechnetate). A higher uptake percentage (very “hungry” tumor) may indicate more active tissue.
- **Clinical severity factors:** Sometimes categorized as “mild vs severe” disease. Peterson's group defined severe hyperthyroidism as those with composite severity score ≥2.5 mCi (we will explain the score shortly) . Features like very high hormone levels or **multinodular/bilateral disease** contribute to severity.
- **Scintigraphy – The Game Changer: Thyroid scintigraphy (nuclear scan)** is crucial in this protocol. It confirms the diagnosis, shows if one or both lobes (or ectopic tissue) are affected, and measures both **thyroid size and function**. The scan's quantitative metrics (tumor volume and % uptake of pertechnetate) feed into the dose calculation. It also helps differentiate benign vs malignant behavior (e.g. very large, ectopic, or extremely high uptake tumors might be suspicious for carcinoma). Many facilities skip scans due to cost or lack of equipment, but **to individualize**

dosing, a scan is indispensable. It's considered the gold standard diagnostic for hyperthyroidism and guides treatment planning.

- **Dose Calculation Algorithm:** Peterson's algorithm assigns a "dose score" in mCi based on each major parameter (T4/T3, tumor volume, and Tc-99m uptake). For example, a moderate T4 ($\sim 8 \mu\text{g/dL}$) might correspond to ~ 1.9 mCi, a thyroid volume of 2 cm^3 gives ~ 2 mCi, and an uptake of 10% gives ~ 2.7 mCi. The three scores are averaged to yield a **composite dose**. This composite is essentially the "calculated required dose" to treat that cat's hyperthyroidism.
- **Initial Dose I-131 dose– 80% Rule:** Crucially, they **do not administer the full calculated dose at once**. To err on the side of caution and avoid overdosage, they give $\sim 80\%$ of the composite dose initially. The cat receives this injection on Day 1.
- **24-Hour I-131 Uptake Measurement:** One day after injection, we measure the cat's **thyroid uptake of the I-131**. This reveals what percentage of the administered radioiodine actually localized in the thyroid tumor. Cats can vary widely – some may retain a lot of the dose in the thyroid, others less (due to differences in iodine metabolism, renal excretion, tumor blood flow, etc.). **This step is critical:** it captures the cat's true iodine kinetics.
- **Dose Adjustment (Day 2 "Top-Up"):** Based on the 24-hr uptake result, an **additional dose is given if needed**. There is a predefined adjustment table: for instance, if $<6\%$ of the dose is in the thyroid at 24h, they multiply the remaining dose by 1.7 (essentially give 70% more). If uptake is, say, 15%, a smaller top-up factor (e.g. 1.1) is used. If uptake is very high ($>30\text{--}40\%$), they may not need to add any more (in fact, the initial 80% may have been sufficient or slightly high). In Peterson's cohort, **98.6% of cats** ended up needing a second injection on Day 2 – showing how commonly the two-step approach was utilized. This two-step dosing mirrors protocols in human hyperthyroid treatment and ensures each cat gets **precisely the dose needed to deliver an adequate radiation dose to the thyroid tissue**.
- **Example of Individualized Dosing:** To illustrate, consider two hyperthyroid cats at opposite ends of severity:
 - **"Mild case":** T4 is just $5 \mu\text{g/dL}$, small single thyroid nodule (0.5 cm^3), modest Tc uptake 2%. This cat's composite score might be ~ 1.5 mCi. We'd inject about 1.2 mCi initially. If 24h uptake is, say, 15%, we'd add a tiny supplement (factor $\sim 1.1 \rightarrow \sim 0.15$ mCi more). The cat might be cured with ~ 1.3 mCi total – a **very low dose**. A fixed 4 mCi would have been **over 3 \times what was needed**, likely destroying all thyroid tissue and causing hypothyroidism.
 - **"Severe case":** T4 is $20 \mu\text{g/dL}$, very large goiter (5 cm^3 between both lobes, perhaps intrathoracic extension), high Tc uptake 15%. Composite score might be ~ 8 mCi. Initial dose ~ 6.4 mCi given. If 24h uptake is low, say 5%, that indicates poor uptake – we'd multiply dose by 1.7 (as per table) and give an additional ~ 4 mCi. Total ~ 10.4 mCi to effectively irradiate the bulky tumor. If one had given only 4 mCi fixed, that cat would almost certainly remain hyperthyroid (treatment failure).

Individualized dosing “saves” both these cats – preventing hypothyroidism in the mild case and ensuring cure in the severe case.

- **Outcomes with the Algorithm:** Peterson’s 1,400-cat study demonstrated impressive results: Using the individualized protocol, **75% of cats achieved euthyroidism** with just one treatment, similar to historical cure rates, *despite using much lower median doses* (median ~1.9 mCi vs ~4 mCi in older protocols). Importantly, **only 4.1% became overtly hypothyroid and 17.1% subclinically hypothyroid**. In total ~21% developed any hypothyroidism, a drastic reduction compared to the 50–70% rates with fixed dosing. Overt hypothyroidism fell from ~18% (with fixed-dose) to ~4% with individualized dosing. This means far fewer cats needed thyroid supplementation post-treatment. And as expected, only ~4% remained hyperthyroid (a small subset, some of which could be carcinoma cases). These numbers prove that **we can maintain high cure rates while minimizing hypothyroid complications**.
- **Why 24h Uptake Matters – Avoiding Guesswork:** The 24-hour uptake measurement is what really sets this protocol apart. It accounts for biological variability that no pre-treatment test can perfectly predict. For example, two cats might have identical T4 and tumor size, but if Cat A’s thyroid takes up 50% of administered iodine and Cat B’s takes up only 5%, giving both the same dose would overdose A or underdose B. By **measuring actual uptake**, the protocol adjusts in real-time. In fact, cats with low I-131 uptake (<16%) had **3× higher odds of treatment failure** if not accounted for. Conversely, cats with extremely high uptake could easily become hypothyroid if given the full calculated dose – the 80% initial dosing mitigates that risk. The split-dose approach is a bit more labor-intensive (requiring an extra visit to the isolation ward and dose calculation on Day 2), but it **takes the guesswork out of I-131 therapy**. This is a key point to convey: *if you’re not measuring uptake, you’re essentially guessing the effective dose*.

Case Studies: Why Individualized Dosing Matters

- **Case 1 – Preventing Hypothyroidism:** “Whiskers,” a 13-year-old FS DSH, was diagnosed early in her hyperthyroidism course (T4 = 5.8 µg/dL, moderate clinical signs). Thyroid scintigraphy showed a **unilateral** left thyroid nodule, 1.2 cm³, with 2% Tc uptake; right thyroid was quiescent. Using the Peterson algorithm, her calculated dose was ~1.6 mCi. She received 1.3 mCi initially, and 24h uptake was 10% (slightly low), so an extra ~0.3 mCi was given. Whiskers became euthyroid within one month post-treatment and *stayed euthyroid* – T4 2.5 µg/dL, TSH normal, no azotemia. **No hypothyroidism, no kidney issues**. Had we used a fixed 4 mCi (common practice for many clinics), she likely would have received over double the necessary dose. Indeed, fixed-dose protocols have overt hypothyroidism rates near 1 in 5 cats. We might have turned a fairly healthy hyperthyroid cat into a hypothyroid cat needing lifelong levothyroxine. Instead, with individualized dosing, Whiskers was cured *and* maintained normal thyroid function.

- Case 2 – Ensuring a Cure in a Severe Case:** “*Tiger*,” a 15-year-old MN Maine Coon, had a **long-standing hyperthyroidism** (T4 off the charts >20 µg/dL despite high-dose methimazole). He was developing medication side effects. Scintigraphy revealed **bilateral** disease with massive thyroid enlargement (each lobe ~3 cm³, one extending into thoracic inlet), and 12% Tc uptake. This cat’s disease was severe (“SHIM-RAD” – severe T4, huge tumor, etc.). The algorithm calculated a dose of ~7.5 mCi. We administered ~6 mCi on Day 1. At 24h, his I-131 uptake was only 8% – indicating much of the dose had been excreted and not retained by the thyroid. Accordingly, we gave an additional ~1.5× dose on Day 2 (factor 1.5), for a total of about 9 mCi. Tiger responded well: within 3 months he was off methimazole, T4 was mid-normal ~2 µg/dL, and TSH normal. **He was cured with one treatment.** Now imagine if a standard 4 mCi dose had been used originally: With such large tumor burden, 4 mCi likely would not ablate enough tissue. Indeed, cats with very high severity scores and bilateral disease are the ones most likely to fail treatment if underdosed. Tiger could have remained hyperthyroid and needed a second (or even third) treatment, experiencing prolonged hyperthyroid state and owner frustration. Instead, by tailoring and adjusting the dose, we got it right the first time.
- Case 3 – The Importance of Monitoring:** A brief cautionary tale: “*Muffin*,” 14-year F Siamese, was treated at an outside facility with a fixed dose (4.5 mCi). Her hyperthyroidism resolved, but no one rechecked labs until 6 months later – at which point she had **severe renal azotemia** (CREA went from 1.8 pre-treatment to 4.5) and she had gained weight/lethargy. We found her T4 was <0.5 (low) and TSH was 10 (high): she was profoundly hypothyroid, likely since shortly after I-131. The hypothyroidism had gone untreated and **unmasked “pseudo-CKD.”** Once we recognized it, we started levothyroxine. Over the next 2 months, her T4 normalized and – tellingly – her creatinine dropped to 2.5. She was feeling better, more active. This case underscores **why post-treatment monitoring is vital** and why preventing iatrogenic hypothyroidism in the first place is ideal. If early T4/TSH checks had been done, she could have been supplemented sooner, sparing some kidney function. Even better, with an individualized approach, maybe her dose could have been lower and she might not have become hypothyroid at all.

Avoiding Post-Treatment Hypothyroidism

- Incidence with Individualized Dosing:** As noted, Peterson’s individualized protocol cut the combined hypothyroidism rate to ~21% of treated cats (with only ~4% overtly hypo). In comparison, traditional methods saw hypothyroidism (including subclinical) in well over half of cats. This is a huge improvement. But 1 in 5 cats still becoming at least subclinically hypothyroid is not trivial. We must **identify and manage** those cases to protect the kidneys and quality of life.
- Monitoring Plan: Always recheck thyroid levels about 1 month (4–6 weeks) after I-131 therapy,** and again at 3 and 6 months. At minimum, measure **T4 and TSH**. If the cat’s T4 is low-normal or low and TSH is elevated, you have subclinical or overt hypothyroidism respectively. Many cats with subclinical hypothyroidism (normal T4,

high TSH) appear clinically well, but they may have started to gain weight or have a slower heart rate. Importantly, check renal values too – if creatinine or SDMA is rising as TSH rises, that's a red flag.

- **Why TSH?** Total T4 alone can miss subclinical cases (T4 could still be within reference). TSH is very sensitive – a normal cat's TSH is usually *undetectable* if they are even mildly hyperthyroid; so any **detectable or high TSH post-treatment strongly suggests the cat has become hypothyroid**. In fact, having a detectable TSH *before* treatment (some hyperthyroid cats do, if their disease is mild) predicts those cats are more likely to get hypothyroid after I-131. Thus, measuring TSH pre- and post-treatment is extremely useful for guiding therapy and follow-up.
- **Managing Hypothyroid Cats:** If a cat is overtly hypothyroid (low T4, high TSH) or subclinical with rising azotemia, **don't hesitate to supplement with levothyroxine**. The goal is to restore normal thyroid levels to improve renal blood flow. Dr. Peterson notes that about **50% of subclinical cases may self-resolve** within a year (thyroid tissue partially recovers), so if the cat is not azotemic and TSH is only modestly elevated, one might monitor for a few months. But if there's any kidney impairment or significant TSH elevation, starting thyroid hormone is recommended to protect the kidneys. By preventing even mild chronic hypothyroidism, we keep GFR higher and *avoid that "masking" effect* where hypothyroidism makes kidney values look worse than the actual kidney disease.
- **Research on Outcomes:** A 2010 study (Williams *et al.*) showed cats that became hypothyroid after I-131 had **significantly shorter survival times** than those that remained euthyroid, especially if they developed azotemia. Another study documented that treating hyperthyroid cats and keeping them euthyroid led to better preservation of renal function over time. All this evidence shifted veterinary thinking: we no longer consider post-I-131 hypothyroidism "benign" or acceptable just because the hyperthyroidism is cured. **Preventing and correcting iatrogenic hypothyroidism is now recognized as critical to optimal care of these cats.**

Why Aren't All Vets Doing This (and Why They Should)

- **Myth: Fixed Dose is "Good Enough":** Some practitioners have stuck with simple dosing either out of habit or due to lack of access to nuclear scintigraphy. While it's true many cats do fine with standard doses, **too many do not** – up to 3/4 of cats on fixed-dose protocols may have impaired thyroid function afterward. Clients might not realize their cat's weight gain or new kidney issues a few months later are related to the I-131 treatment. As specialists armed with new data, we owe it to patients to do better.
- **Logistical Barriers:** Individualized dosing requires thyroid scans. Not all I-131 facilities have a gamma camera or the workflow to do two-step dosing. However, consider collaborating with referral centers that do offer scintigraphy and equally important do 24h I-131 uptakes. No human would receive I-131 without undergoing a 24h I-131 uptake and neither should a cat. As general vets, **push for thyroid imaging** when referring – it provides valuable information even beyond dosing (e.g.

confirms diagnosis in borderline cases, reveals if both lobes or ectopic tissue are involved, identifies large carcinoma requiring higher dose). Educate cat owners that Individualized I-131 dosing is the best standard of care before I-131.

- **Radiation Safety:** Using lower I-131 doses is actually *safer* for everyone – the cat, veterinary staff, and owners. Lower doses mean less radiation emitted and often a shorter hospital stay. In many states, if the retained activity falls below a threshold sooner, the cat can go home earlier with minimal risk. Reducing the typical dose from ~4–5 mCi to ~2 mCi in mild cases nearly halves the radiation exposure to the cat and clinic staff. The NRC and state regulations allow release based on residual radioactivity, so cats given small doses may be releasable in ~3 days versus ~5–7 days for larger doses. This is a tangible benefit: *shorter isolation = less stress* for the cat and lower cost for the facility (less time boarding).
- **Client Satisfaction:** Clients are increasingly aware of treatment side effects. Explaining that you use an individualized protocol – “We tailor the I-131 dose precisely to your cat’s needs to cure the hyperthyroidism while *avoiding making your cat hypothyroid*” – is a strong positive message. Owners want the best outcome with the fewest complications. Knowing that the vet is taking extra steps (like a thyroid scan and checking levels after treatment) gives them confidence. It can differentiate your practice or referral hospital as providing **state-of-the-art care**.
- **Evidence & Persuasion:** The body of evidence supporting individualized dosing is growing. Beyond Peterson’s landmark study, a 2017 clinical trial by Lucy *et al.* showed that even simply lowering the fixed dose from 4 mCi to 2 mCi in mild hyperthyroid cats led to **fewer hypothyroid cases without sacrificing efficacy**. In that study, the 4 mCi group had significantly more cats with elevated TSH and lower T4 (i.e. hypothyroid) compared to the 2 mCi group, and also showed greater increases in creatinine. Both doses cured the hyperthyroidism in the vast majority of cats (no difference in cure rate). This clearly demonstrates that **more is not better** when it comes to I-131 – the goal is the *lowest effective dose*. Individualized dosing takes this principle to its logical conclusion by finding the right dose for each cat, rather than arbitrarily picking “2 vs 4 mCi.”
- **Current Guidelines:** While formal guidelines are still catching up, many internal medicine specialists now advocate for routine T4/TSH monitoring post-I-131 and consideration of individualized dosing. The 2016 AAHA hyperthyroidism guidelines hinted at using the lowest dose that will achieve euthyroidism, and recent review articles echo the importance of avoiding hypothyroidism. Dr. Peterson’s work is at the forefront, and early adopters are reporting similar success in their practices. We should expect that in a few years, personalized radioiodine dosing will become the **standard of care**. By attending this lecture, you’re ahead of the curve in understanding and implementing this approach.

Conclusion

- **I-131 Remains the Gold Standard:** It's the only treatment that reliably cures feline hyperthyroidism in one shot for most cats. As veterinarians, **we should strongly recommend radioiodine therapy** to owners of hyperthyroid cats, ideally sooner rather than later. It improves longevity and quality of life – median survival of treated hyperthyroid cats is ~2+ years longer than untreated ones, and many live for many happy years if comorbidities are managed.
- **Individualize for Best Outcomes:** We've shown that by tailoring the radioiodine dose to the patient, we can **increase treatment success and decrease complications**. No more "blind guessing" – the technology and protocols are available to do this smarter. Preventing iatrogenic hypothyroidism is not just an academic exercise; it has real impacts on renal health and survival. Currently, when considering that:
 - 1) azotemic hypothyroid cats have a median survival time that is half of azotemic euthyroid cats,
 - 2) that conventional I-131 therapy is associated with up to 70% of overt or subclinical hypothyroidism,
 - 3) 75% of overt hypothyroidism is associated with azotemia and 39% of subclinical hypothyroidism is associated with azotemia
 - then you can conclude that **10% of your I-131 patients are living 50% less because they are not undergoing individualized I-131 therapy.**
 - As clinicians, embracing this approach means we truly put the cat's long-term welfare first.
- **Take-Home Message: Don't settle for the status quo.** If you aren't already, start incorporating individualized I-131 dosing in your practice or referral strategy. Use thyroid scintigraphy and 24-hour uptake when possible. Monitor and manage thyroid function after treatment. By doing so, you'll join leading experts like Dr. Peterson in **dramatically improving the care of hyperthyroid cats**. This is the treatment we should *all* be doing – precise, evidence-based, and compassionate to our feline patients' needs. Let's cure hyperthyroidism the right way and keep our cured patients healthy for the long run.