



# What is Hyperthyroid Disease?

## Hyperthyroidism

Normal thyroid function requires oral intake of the element iodine (iodine is a normal part of both human and cat diets and is commonly added to salt); once ingested, iodine is taken up by the thyroid gland, where the iodine becomes incorporated into thyroid hormone.

Hyperthyroidism is an overproduction of thyroid hormone by the thyroid gland. It is typically caused by a benign hyperplasia (overgrowth) of the thyroid gland. When hyperactive thyroid tissue develops, normal thyroid tissue atrophies because thyroid hormone production by the abnormal tissue is excessive. Excessive amounts of thyroid hormone cause a hyper metabolic state.

Malignant thyroid tumors also cause hyperthyroidism, but are very rare (an estimated 2-5% of cases). Radioactive iodine treatment is the best hyperthyroid treatment for cats with malignant thyroid cancer. In cats with a thyroid carcinoma, extension or metastasis to the thoracic cavity is common, so physical palpation alone will grossly underestimate the full extent of these malignant tumors.

Elevated thyroid hormone levels cause increased metabolism and the other common clinical signs of hyperthyroidism: weight loss, appetite changes, increased water consumption, vomiting, diarrhea, rapid heart rate, heart murmur, elevated blood pressure, increased vocalization, muscle weakness, and poor hair coat. Hyperthyroidism tends to be a gradual onset disorder with many cats losing weight over several months or a few years.

Hyperthyroidism is a common disease condition of older cats (average age is 12 to 14 years old). The majority of these cats will have abnormalities on routine chemistry panels reflecting damage to the liver, kidneys and muscle. Most hyperthyroid cats will have some degree of hypertrophic cardiomyopathy (which is a condition where the heart muscle becomes thickened). Since cats with the most common signs of hyperthyroidism (weight loss, appetite changes and vomiting) can also have other problems such as kidney disease, diabetes and inflammatory bowel disease, a thorough physical examination, blood testing and urinalysis are usually indicated to allow diagnosis of hyperthyroidism. Radiographs, cardiac ultrasonography and blood pressure determination are also sometimes performed.

Cats with both hyperthyroidism and chronic renal failure may have an increase in kidney waste products (azotemia) after treatment for hyperthyroidism. For the recently diagnosed hyperthyroid cat, the option of trial therapy with Tapazole should be considered so that the effect of treatment on renal functions can be evaluated.

Some thyroid nodules or tumors can be found by physical palpation of the thyroid gland in most cats, but about a third of hyperthyroid cats have thyroid tumors located within the thoracic cavity and cannot be palpated. Most of the hyperthyroid cats without palpable cervical nodules have thyroid tumors (adenomas or carcinomas) that have become extremely large. Because of the chronic effects of gravity on the progressively enlarging thyroid mass, these tumors migrate into the thoracic cavity. Some cats develop hyperthyroidism secondary to adenomas of ectopic, intrathoracic, thyroid tissue.

If this disease goes untreated multiple organ systems may be affected and damaged. Untreated, the increased metabolism will eventually cause organ failure (heart, kidney, and blindness due to retinal detachment) and premature death.

## Options For Treating Hyperthyroidism

There are 3 possible treatments used for hyperthyroidism: medical management, surgical removal, and radioactive iodine-131.

## **Medical therapy with methimazole (Tapazole or Felimazole)**

Medical therapy acts by inhibiting thyroid hormone synthesis with drugs such as methimazole. Medical therapy requires administration of medication (usually twice a day) for the rest of the cat's life. Methimazole (Tapazole or Felimazole) is the most common drug, and usually controls hyperthyroidism. These medications can be oral or transdermal antithyroid medications. Tapazole works by temporarily blocking the synthesis of thyroid hormone; it reduces excessive thyroid hormone secretion. Over-secretion of thyroid hormones will return if therapy is discontinued which means that twice daily medications are needed for the life of the cat.

While methimazole or tapazole are able to control symptoms of the thyroid tumor, they are not curative. It is important to remember that while medical therapy "blocks" production of thyroid hormone secretion, the thyroid tumor(s) will still grow and enlarge over time. With long-term medical therapy, the signs of hyperthyroidism recur when the tumor becomes so large that the medication can no longer effectively block thyroid hormone secretion. Hyperthyroid cats being maintained on antithyroid medicines should have regular blood testing (every 4 to 6 months) for the remainder of their lifetime. Some of these thyroid tumors will also transform from benign to a cancerous thyroid over time (months to years).

Medical therapy works in most cats, but there are several reasons it may not be the best choice. Some cats are difficult or impossible to pill. Some owners may not want to have to medicate their cat daily for the rest of his or her life, especially if the cat is young or middle-aged. Mild reactions (e.g., loss of appetite and vomiting) are common, and a few cats develop serious adverse reactions to the medication (blood or liver problems). Side effects include: abnormalities of white blood cells, platelets, or red blood cells.

Side effects serious enough to warrant discontinuing using these medications occur in up to 10% of cats taking them and can include loss of appetite, vomiting, diarrhea, liver dysfunction disease, bone marrow suppression, immune-mediated disease and allergic skin reactions. Because of these side effects, it is necessary to periodically monitor the cat's condition with blood tests.

Methimazole treatment usually controls the signs of hyperthyroidism, but it is not a cure (i.e., the drug will block thyroid hormone secretion but will not remove or destroy the thyroid tumor).

## **Surgery**

Surgery cures the hyperthyroid condition by removing part or all of the thyroid gland. Surgery can be the treatment of choice in the rare hyperthyroid cat with severe medically unresponsive and life threatening congestive heart failure because one can achieve resolution of hyperthyroidism in a matter of hours. Cats with very large thyroid nodules (more than 3-4cm in diameter) can also require surgery to debulk (remove) their thyroid masses before they begin treatment with <sup>131</sup>I. There is a considerable risk that the surgery will not completely cure the hyperthyroidism, or that the condition will recur (i.e., radioiodine has a much smaller chance for recurrence). Surgical excision of the affected tissue is curative as long as additional overactive thyroid tissue has not migrated to other areas. After surgery, some cats develop hypothyroidism and require treatment with thyroid hormone pills for a period.

Following successful surgical treatment for hyperthyroidism, 10% – 20% of cats will become hyperthyroid again in their lifetime. There may be other areas of the hyperfunctioning thyroid tissue that can be missed at the time of surgery or that cannot be surgically removed, resulting in failure of the surgery to cure the hyperthyroidism. Recurrence of the problem is common if only one thyroid gland is removed or there is ectopic thyroid tissue (thyroid tissue that grows outside of the thyroid gland). Older cats who develop hyperthyroidism may also be poor anesthetic/surgical candidates.

As with any surgery, both anesthesia and surgical complications can occur and this form of treatment is currently not considered optimal. Surgery may be very risky in hyperthyroid cats, many of whom are older and debilitated by their disease. For example, many cats with hyperthyroidism have heart problems and thus have more risks with anesthesia.

Surgery to remove the thyroid gland(s) involves general anesthesia risk and can result in serious calcium regulation difficulties after surgery if the parathyroid glands, or their blood supply, are inadvertently damaged during surgery. Parathyroid glands are very important in regulating the body's calcium metabolism. If there is damage to the parathyroid glands (4 little glands located within or adjacent to the thyroid) during thyroid surgery, the result is hypocalcemia (low blood calcium); this complication can be life-threatening. This will require several days of hospitalization, monitoring and lifelong supplementation with an active form of vitamin D.

### **Radioactive Iodine-131**

Radioiodine is not a new or experimental treatment—it has been used for over 30 years.

Radioiodine (radioactive iodine; I-131) is a radioactive form of stable iodine. The 131-I will be taken up preferentially into the “most active” thyroid cells, which are the thyroid cells in the nodule(s) or tumor(s) that are overproducing thyroid hormone.

This therapy takes advantage of the fact that dietary iodine is used in the body only by cells of the thyroid glands. When radioactive iodine (131) is given as a single injection under the skin, it is rapidly absorbed by the hyperfunctioning thyroid tissue. The thyroid tumor tissue takes up the radioiodine just as readily as normal, nonradioactive iodine (the kind in iodized salt). All thyroid tumor tissue will take up the radioiodine in this fashion, no matter where in the body it is located. This is an important feature of radioiodine therapy because up to a third of hyperthyroid cats have thyroid tumors in the chest cavity, where surgical removal is not feasible. The radioiodine emits radiation, destroying the overactive thyroid tumor cells.

The radiation emitted from the 131-I will actually destroy the abnormal thyroid tissue (because the normal tissue is usually not working in hyperthyroid cats, it is not affected). In its radioactive state, it naturally decays, giving off two types of radiation: gamma rays (similar to X-rays) and beta particles (electrons). The half-life of 131-I is 8 days; in other words, one-half of the radioiodine decays every 8 days.

The initial dose is usually 2-5mCi depending on the cat's highest thyroid blood test result, careful physical examination of the thyroid gland(s), the duration of the hyperthyroidism and any previous antithyroid medication, body weight, age and kidney function. Cats with very large thyroid masses or malignant disease can require larger doses and longer hospitalization periods. Tumor size can be accurately estimated by physical palpation of the thyroid gland in most cats, but about a third of hyperthyroid cats have thyroid tumors located within the thoracic cavity and cannot be palpated. Following 131-I administration, cats are housed in individually ventilated large cages in a shielded radiation safety room for 4 days to allow most of the radioactive iodine to be excreted and remain behind at the clinic in a special waste storeroom.

Radioiodine therapy has some distinct advantages over medical or surgical treatment, and virtually all authorities consider it to be the treatment of choice for hyperthyroidism. There is no need for anesthesia and the risk of postoperative hypocalcemia is eliminated, there is no risk to the parathyroid glands. Because almost all hyperthyroid cats have some residual, normal thyroid tissue, this means that cats rarely develop an underactive thyroid gland (hypothyroidism) after radioiodine therapy. After treatment, the residual (normal) thyroid tissue resumes full function within 1 to 3 months. Hyperthyroid cats of any age can be successfully treated with radioiodine, as long as they have no other life-threatening medical conditions.

There may be a transient inflammation of the thyroid region as the 131-I does its work, which may result in increase salivation or difficulty swallowing. 1% – 2% of treated cats can exhibit a sore throat for up to 8 days following 131-I therapy, and can be managed with short-term anti-inflammatory medications. These signs are very mild, uncommonly seen, and if this does occur, it will occur during the time your cat is hospitalized. As the hyperthyroidism is resolving many cats will become somewhat quiet or sleepy for the first few weeks. The major draw back is that after receiving radioiodine, the cat must be kept in the hospital for a period (usually 3 to 5 days).

As with other treatments for hyperthyroidism, decreases in renal function may be observed following 131-I therapy.

Resolution of hyperthyroidism can un-mask pre-existing kidney disease.

Development of azotemia following implementation of Tapazole treatment is not a contraindication for 131-I treatment, but does create management concerns that may impact the decision to treat with 131-I. It is generally felt that if serum BUN and creatinine concentrations remain unchanged with normalization of T4 after Tapazole treatment, the hyperthyroidism therapy with surgery or 131-I is unlikely to be associated with worsening of renal function post-treatment.

Hypothyroidism is uncommonly observed; but if hypothyroidism occurs, thyroid supplementation may be required.

Clinical signs can be lethargy, obesity, heat-seeking, poor haircoat, and constipation.

131-I is considered the safest treatment available for hyperthyroidism. Anesthesia or sedation are not required for 131-I therapy. Age is not a contraindication for 131-I therapy if your cat is otherwise in good health. A single injection of 131-I cures 95% – 99% of the cats treated. Most cats return to normal thyroid function within 1 to 3 months after treatment. 90% of cats have normal T4 levels by one month and 97% have normal T4 levels by three months. There are a few cats in whom it can take as long as 6 months for resolution of hyperthyroidism.

Rarely, some cats may require two or more treatments. Following successful 131-I therapy, only 0.3% (1 in 300) cats will become hyperthyroid again in their lifetime. If your cat has significant kidney failure, advanced heart disease or a malignant cancer, 131-I can resolve the hyperthyroidism, but may be unable to prolong your cat's life because of the poor prognosis of the other disorders.

Most owners notice a significant improvement in their cats within the first month of treatment (weight gain, normalization of food and water intake, etc.). The long-term prognosis for hyperthyroid cats treated with radioiodine is excellent. Many owners are hesitant to treat older cats with radioiodine. But remember, old age is not a disease. Almost all cats (including cats of all ages) return to normal health and live a completely normal life after radioiodine therapy.

### **Pre-requisites for starting I-131**

Since cats with the most common signs of hyperthyroidism (weight loss, appetite changes and vomiting) can also have other problems such as kidney disease, diabetes and inflammatory bowel disease, a thorough physical examination, blood testing and urinalysis are usually indicated to allow diagnosis of hyperthyroidism.

Your cat should have a history and physical examination, x-rays or ultrasound (sometimes both), and recent blood work (e.g., complete blood count [CBC], serum biochemical profile, urinalysis, and serum thyroid hormone tests) done within 30 days of your appointment for radioiodine treatment. These results can be faxed or e-mailed to our office for review. We need a current serum T4 off methimazole to help determine the correct dose of radioiodine to administer to your cat. Radiographs, cardiac ultrasonography and blood pressure determination are also sometimes performed.

Cats with both pre-existing kidney insufficiency or failure and hyperthyroidism may experience deterioration of their kidney function following treatment of the hyperthyroidism. This does not mean hyperthyroidism should not be treated in cats with kidney disease, because if left untreated hyperthyroidism itself is a very debilitating and eventually life-threatening disease. The veterinarian will discuss these issues with you and make specific recommendations regarding monitoring and managing the kidneys during and after the treatment for hyperthyroidism.

It is sometimes necessary for cats to complete a "Tapazole trial" before undergoing 131-I therapy. For the Tapazole trial, the cat takes methimazole or Tapazole for 3 weeks. After normalization of thyroid levels with the antithyroid medication and while still taking the methimazole or Tapazole, blood tests (CBC, chem panel and T4) are performed by the referring veterinarian to evaluate the adequacy of the cat's kidney function. If no dramatic worsening of kidney function is detected in the "Tapazole trial", then the cat is considered a good candidate for 131-I therapy.

Tapazole trial should be performed if the following apply to the hyperthyroid cat: more than 16 years old, has a poor appetite, has lost more than 40% of original bodyweight, has elevations of kidney function tests (BUN or creatinine) on lab work establishing the hyperthyroid diagnosis.

In recently diagnosed hyperthyroid cats receiving methimazole, the drug is generally discontinued 3 to 5 days before treatment with radioiodine but you do not need to repeat your cat's thyroid test; however, in some cats (especially those with a concurrent illness), the veterinarian may want you to continue methimazole treatment up until the day your cat is admitted for radioiodine therapy.

Most other drugs that your cat may be receiving are fine, but please check with our office to make sure that these medications will not interfere with the radioiodine treatment. Please bring your cat to the hospital in a carrier at the scheduled time.

## **Hospitalization**

You will be asked to read and sign the form entitled "Consent to Treat with Radioactive Iodine." You should feed your cat normally the week before admission to the hospital and that morning (fasting is not necessary). Please bring your cat to the hospital in a carrier at the scheduled time.

Once you have completed the required paperwork, you and your cat will meet with the veterinarian who will examine your cat and review the medical records and tests performed by your regular veterinarian, and he will answer any questions you have concerning the treatment or long-term care.

Radioactive iodine treatment itself occurs in a single injection and only takes a matter of minutes; however, we must hospitalize your cat until radioactivity declines to levels deemed acceptable for release by the California Department of Radiologic Health Services. Length of time for hospitalization (usually 3 to 5 days) is variable and depends on many factors including the size and activity of the thyroid gland and the individual metabolism of the cat. Cats with very large thyroid masses or malignant disease can require larger doses and longer hospitalization periods.

Following <sup>131</sup>I administration, cats are housed in individually ventilated large cages in a shielded radiation safety room for 3 to 5 days to allow most of the radioactive iodine to be excreted and remain behind at the clinic in a special waste storeroom. Each cat will have plenty of soft bedding and a litterbox. Fresh food and water is always available and the litter boxes are checked and cleaned several times each day.

It is preferable to feed cats exactly what they are used to eating at home during their hospital stay as they tend to be fussy eaters. Please bring an 8 day supply of your cat's food. You may bring your cat's favorite snacks or treats if you wish. As cat owners ourselves, we know that boarding your cat for radioiodine treatment is typically much more stressful to the owner than to the cat. Daily interaction with their human caretakers benefits hospitalized cats; spending a few minutes each day petting, brushing and speaking to them in a soft, calming voice, provides comfort to the cats. You may bring an old toy or blanket if you wish, but they must be disposed of as radioactive waste after your cat's release—you will not get them back. Please don't bring anything you'd be heartbroken not to get back.

Radiation Protection statutes prohibit visitors in the restricted area of the clinic where the cats are housed, and your cat is not allowed out of the treatment area as mandated by federal and state guidelines. Once admitted for therapy, your cat cannot under any circumstances be discharged until current state radiation levels are achieved.

We will do our best to address any serious medical concerns prior to giving the radioactive iodine, but an unexpected problem could arise. If your cat should become seriously ill during the treatment, either due to the effects of hyperthyroidism, or some other separate disease process, we will be limited in the amount of critical care that can be provided, because of radiation safety concerns.

## **Home Care & Follow-up**

After you pick up your cat, we will send your veterinarian a letter summarizing your cat's treatment and recommending monitoring strategies. Your veterinarian can also contact us if he or she has any further questions. The vast majorities of cats require minimal aftercare.

Your cat's behavior may change within a few weeks, but some cats require as much as 2 to 3 months for all the clinical signs to disappear. As the metabolic rate returns to normal, body functions slow down. Your cat will become calmer. Along with a slower heartbeat and respiration, changes may include weight gain, better grooming, less vomiting, reduced appetite, fewer visits to the litter box, and more sleeping. Some cats gain one or more pounds in the first month, whereas other cats put lost weight on more slowly. Most owners notice a significant improvement in their cats within the first month of treatment (weight gain, normalization of food and water intake, etc.).

Your cat will be temporarily and slightly radioactive when discharged home to your care, although 90% – 95% of the administered <sup>131</sup>I will have been excreted by then. The amount of radiation you might receive from your cat would be roughly equivalent to that received when you fly round-trip across the country. Even though the level of radioactivity is very low (much lower than the level at which human patients are discharged from the hospital) radiation safety precautions must be observed for approximately 2 weeks after discharge to comply with state rules.

The goal of the precautions you must observe is to keep radiation exposure for members of the general public as low as reasonably possible. Keep your cat confined to your home as other individuals are not aware of the necessary precautions. If you follow our instructions, you and your family will receive almost no exposure whatsoever.

Discharge instructions will include guidelines on special handling of urine and feces, and maintaining the cat at a safe distance from small children and pregnant women for two weeks post release. If you or a family member is pregnant, you cannot prevent contact between your cat and children, or you cannot keep your cat from sleeping on the bed with you at night, we recommend that your cat either remain hospitalized or be boarded with your veterinarian during these two weeks. Their staff would follow the same radiation safety guidelines you would, including properly handling the cat litter and avoiding close, prolonged contact with your cat. If you cannot board with your primary veterinarian, we would be happy to continue boarding your cat at our facility.

These discharge instructions may seem alarming, but they are an extremely cautious and conservative approach. If you or your family were to receive radioiodine therapy, the restrictions after treatment would be much less severe. The major reason for this discrepancy between cats and people is that human patients always flush their waste down the toilet, removing any radioactive contamination from the home; in contrast, cats generally use a litter box, keeping the radiation in the home.

The amount of radiation that your other pets will receive by contact with your cat or by using the litter box is negligible. If you have multiple cats sharing the same litter box, however, we do recommend that you clean the box at least 2 to 3 times a day to remove the contaminated litter clumps from the box. Based on Federal, State, and City guidelines, you do not need to quarantine your cat from other pets.

After you pick up your cat, we will send your veterinarian a letter summarizing your cat's treatment and recommending monitoring strategies. Your veterinarian can also contact us if he or she has any further questions.

T4 (thyroid hormone) levels will be checked by a blood test at 1 and 3 months after the treatment. The levels should be back to normal range by 3 months; some cats may take as long as 6 months. If the level is still high at the 3 month check-up, a plan will be discussed for further monitoring. If hyperthyroidism persists after the 3-month period, retreatment with radioiodine may be considered. In most cases, your veterinarian should check the thyroid function 3 months after radioiodine therapy, then once a year after that.

If your cat is in the small minority that is not cured within 3 months after treatment, we generally recommend retreatment with radioiodine as the best treatment method. Virtually all cats that remain hyperthyroid after the first treatment are cured by the second treatment. Although it is very uncommon (less than 5% of treated cats), hyperthyroidism can recur. These recurrences usually develop 3 years or more after the hyperthyroidism was first treated. Therefore, such relapses may stem from a new thyroid tumor, rather than the first tumor re-growing. Those cats that are not completely cured after initial treatment will still improve clinically because most of these cats have some decrease in their circulating thyroid hormone concentration. If your cat is in the small minority that is not cured

within 3 months after treatment, we generally recommend retreatment with radioiodine as the best treatment method.

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