

What every clinician should know about feline thyroid disease

Feline thyroid disease is the most common endocrine disorder in cats. Unlike thyroid dysfunction in dogs, it is manifested in cats as hyperthyroidism, which is usually the result of benign thyroid tissue proliferation. Older cats are at increased risk. Because increased circulating thyroid hormones can impact many body systems and cause significant changes, it is important to identify this condition early before severe disease ensues. With appropriate management, cats can have a good quality of life and normal lifespan.

Physiology and pathogenesis

The thyroid gland produces thyroid hormones in response to thyroid-stimulating hormone (TSH) from the pituitary gland, which is in turn controlled by the hypothalamus. Thyroxine, or T_4 , is the biologically active thyroid hormone, and it is estimated that 99% of it circulates bound to blood proteins. Only unbound thyroid hormone, free T_4 (fT_4), can enter cells to exert its physiologic effects and control TSH production in a negative feedback fashion. Triiodothyronine, or T_3 , is another thyroid hormone formed mainly by intracellular deiodination of T_4 . While all T_4 comes from the thyroid gland, only 20% of T_3 originates from this site.

Thyroid hormones impact numerous body functions, in particular, those related to the metabolic rate and oxygen consumption of most organs. These hormones increase cardiac contractility and heart rate and enhance receptors involved in the “fight-or-flight” response. In addition, thyroid hormones regulate cholesterol and lipid metabolism as well as red cell production. They are also needed for the growth and development of the nervous system and skeletal muscles.

Prevalence

Hyperthyroidism, or thyrotoxicosis, is the clinical manifestation of increased circulating thyroid hormones, T_4 and T_3 , produced by dysfunctional thyroid tissue. It was first documented and described in 1979 and has since increased in frequency, partly from enhanced awareness and pet screening in an aging companion pet population, but other unknown factors are likely involved. Both thyroid lobes are involved in 70% of the cases; unilateral disease represents the other 30%. While the exact cause is not well characterized, diet and the use of litter boxes have also been implicated. Regardless of the potential causes, biopsies from affected cats typically show adenomatous hyperplasia, a benign increase in biologically active tissue mass. This condition affects middle-age to older cats. The average age is 12–13 years. However, cats as young as 4 years old have been diagnosed. Prevalence in the older cat population varies from country to country—from

4% in China to 17% in the UK. There does not appear to be a sex predilection, and it is thought that Siamese and Himalayan cats are at a decreased risk.

Common clinical signs

Palpable thyroid nodule, weight loss, decreased muscle mass, increased drinking and urination, tachycardia, tachypnea, systemic hypertension, heart murmur, vomiting/diarrhea, unkempt hair coat

Less common clinical signs

Apathy, inappetance, lethargy

Clinical signs and associated findings

Because of the widespread effects of thyroid hormones, almost any organ can be affected. The number of clinical signs observed from one cat to the other varies, depending on the duration of disease and individual variation. Weight loss despite a healthy or voracious appetite is commonly noted. Cats will also neglect their grooming habits and often show hyperactivity and irritability. On physical exam, a heart murmur, tachycardia and/or arrhythmia, and a nodule along the ventral neck are also commonly documented. Increased thirst and urination may be noted as well.

Cardiorespiratory signs are common in hyperthyroid cats. An increase in β -adrenergic activity causes increased heart rate and myocardial contractility and induces systemic vasodilation and activation of the renin-angiotensin-aldosterone system. Systemic hypertension due to hyperthyroidism may not be accompanied by clinical signs, and it should be ruled out in all hyperthyroid cats by blood pressure measurement. Excess thyroid hormones have both direct and indirect effects on the heart. Hyperthyroidism, along with associated systemic hypertension, may result in secondary cardiac changes, which may be reflected in an elevated NT-proBNP and in echocardiographic changes. Concurrent primary cardiac disease may be present but is difficult to distinguish from secondary changes seen with hyperthyroidism. Cardiac changes that are secondary to thyrotoxicity may resolve following return to a euthyroid state. Recheck with a Cardiopet® proBNP Test 3 months following control of hyperthyroidism. If still elevated or if cardiorespiratory signs persist, evaluation for primary cardiac disease with echocardiography is recommended.

About 50% of hyperthyroid cats present with polyuria and polydipsia. This is believed to be primarily due to increased glomerular blood flow, which reduces the osmotic gradient and thus water reabsorption in the distal tubules and collecting ducts of the kidneys. Primary polydipsia due to hypothalamic changes

has also been described. Concurrent chronic kidney disease (CKD) can also occur in these often geriatric cats. In the untreated hyperthyroid cat, increased glomerular blood flow may result in normalization of glomerular filtration markers (such as symmetric dimethylarginine [SDMA] or creatinine), masking concurrent CKD.

Cats exhibiting these clinical signs benefit from a complete blood count (CBC), serum biochemistry analysis and urinalysis, as well as blood pressure evaluation. These patients are older and concurrent disease is common, so this can provide a more complete picture of the patient's current overall health status and integrity of other organ functions, such as liver, kidney, and heart.

Observed clinicopathologic abnormalities may include increased red cell mass, leukocytosis, and elevated liver enzymes. Heinz bodies without anemia may also be identified. Half of all hyperthyroid cats will have fructosamine levels below the reference interval due to increased protein catabolism.

Diagnosis

Serum total T_4 measurement should be the first thyroid test performed in suspected cats as it has excellent specificity and very good sensitivity. Finding elevated total T_4 in the symptomatic cat is consistent with hyperthyroidism. Patients suspected to have the disease but with midrange or high-normal total T_4 levels may still be hyperthyroid, in which case, retesting at a later time or performing additional tests, such as free T_4 or T_3 suppression tests, may be considered. Technetium scan ($^{99m}\text{TcO}_4^-$) may also be used for diagnosis and to look for ectopic thyroid tissue, but it may not be available in all regions. As with any other endocrine test, results should be interpreted together and in light of the patient's clinical signs, history, and other available information.

Treatment

The treatment of choice depends on the individual, the extent of thyroid tissue affected and presence of ectopic thyroid tissue, as well as cost and availability of different treatment modalities. Most cats are initially managed with methimazole. The dose is titrated while the patient is monitored closely for side effects and potential unmasking of renal disease; this is done via physical examination and periodic blood work. Patients are maintained on the least effective dose that provides the most resolution of clinical signs and improvement in well-being. Methimazole can be administered for the life of the cat with periodic hormone-level checks to ensure adequate treatment. Iodine-restricted diets

are now available commercially, but they must be the only food fed in order to be effective. More permanent therapies include thyroidectomy, intralesional ethanol injection, and radioactive iodine treatment. Radioactive iodine is considered by many to be the quickest, safest, and most effective treatment. With appropriate management, cats can have a good quality of life and normal lifespan.

Total T_4 measurement in serum is an excellent screening test for hyperthyroidism.

- + Finding elevated total T_4 in the symptomatic cat is consistent with hyperthyroidism.
- + A normal total T_4 level does not necessarily rule out hyperthyroidism; consider fT_4 and T_3 suppression tests for additive information.

During early phases of treatment, cats should have periodic checks of thyroid hormone levels and blood work.

- + Renal disease is often "unmasked" during management and should be factored into patient management.

Recommended reading

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