

# What every clinician should know about canine thyroid disease



Thyroid disease is common in the pet population. In dogs, the vast majority of thyroid disease is in the form of decreased thyroid function, or hypothyroidism. This condition is most prevalent in middle-aged dogs, and both males and females can be affected. As inappropriate thyroid hormone concentrations can impact many aspects of an animal's life, early screening for this treatable condition can help with early diagnosis and ensure the patient's continued well-being.

## 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<sub>4</sub>, 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<sub>4</sub> (fT<sub>4</sub>), can enter cells to exert its physiologic effects and control TSH production in a negative feedback fashion. Triiodothyronine, or T<sub>3</sub>, is another thyroid hormone formed from T<sub>4</sub>. While all T<sub>4</sub> comes from the thyroid gland, only 20% of T<sub>3</sub> originates from this site.

In general, thyroid hormones impact numerous body functions, in particular those related to the metabolic rate and oxygen consumption of most organs. In addition, they regulate cholesterol and lipid metabolism and red blood cell production. Thyroid hormones are needed for the development of the nervous system. Furthermore, thyroxine is necessary for skeletal and heart muscle growth and maintenance of muscle contractility.

## Prevalence

Hypothyroidism affects about 1 in every 100 dogs, and both males and females can be affected. Doberman pinchers and golden retrievers are thought to be predisposed, but other breeds are not immune to the condition. The median age of onset is 7 years, but younger dogs can be affected as well.

Hypothyroidism is most commonly caused by thyroid gland atrophy due to immune-mediated damage or of unknown cause. The condition is typically acquired. Rarely, congenital hypothyroidism and hypothyroidism because of pituitary hypofunction (secondary hypothyroidism) are observed.

## Clinical signs and associated findings

Clinical signs are nonspecific and are typically attributable to decreased metabolic rate. Signs may include lethargy, unexplained weight gain, heat-seeking behavior, and mental dullness. Skin disease is also commonly observed, with many dogs showing alopecia along the body trunk and tail, seborrhea, hyperpigmentation, and recurrent skin infections. Poor wound healing and myxedema, accumulation of proteinaceous material in the dermis, giving the face a swollen appearance, has also been associated with subnormal thyroid hormone concentrations.

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## Common clinical signs

Lethargy, unexplained weight gain, recurrent skin infections, otitis, hair loss, cold and exercise intolerance

## Less common clinical signs

Weakness, decreased fertility, coma, cranial nerve dysfunction

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Less common clinical signs are myopathies and possible peripheral neuropathy or neuromuscular disease, which manifests as weakness, abnormal ambulation or, in more severe cases, paralysis. Decreased fertility and litter size may also be seen in breeding females. Myxedema coma is a rare manifestation of disease. Dogs may present with only one sign or a subset of these.

The most common clinicopathologic alterations in complete blood count (CBC) and serum biochemistry analysis are hypercholesterolemia, hypertriglyceridemia, and a mild normocytic normochromic nonregenerative anemia. Performing initial blood work and urinalysis raises the index of suspicion for hypothyroidism (by documenting these abnormalities) and can help rule out other conditions.

## Diagnosis

As with all endocrine assays, testing for hypothyroidism is most useful in patients that exhibit clinical signs of the disease. Measuring total T<sub>4</sub> concentrations in serum is an excellent screening test for hypothyroidism because of its high sensitivity in identifying most dogs that are potentially hypothyroid. A dog with total T<sub>4</sub> concentrations well within the reference interval is unlikely to have hypothyroidism. Dogs with low-normal or below-normal concentrations may have hypothyroidism. It is important to consider the patient's age, breed, stage of heat cycle, and other concurrent diseases, as these may impact test interpretation.

Nonthyroidal illness can impact the results of thyroid assays by suppressing thyroid hormone concentrations. As such, dogs affected with other clinical conditions may have thyroid hormone concentrations similar to dogs with hypothyroidism. It is recommended that nonthyroidal illness be addressed before testing for thyroid disease, whenever possible.

A recent study evaluated the effect of short-term anti-inflammatory doses of prednisone. While fT<sub>4</sub> and TSH appeared unaffected by the use of this corticosteroid, results suggested that total T<sub>4</sub> may

decrease early during treatment course, particularly with daily dosing. Alternate day dosing did not appear to have significant effects on thyroid hormone concentrations.

When total T<sub>4</sub> is low and there is a clinical suspicion of hypothyroidism, confirmatory tests should be pursued. Additional tests for hypothyroidism include free T<sub>4</sub> (fT<sub>4</sub>), TSH concentrations and a TSH stimulation test. Free T<sub>4</sub> is more tightly regulated, and it is less affected by nonthyroidal disease than total T<sub>4</sub>. TSH concentrations are often increased in dogs with hypothyroidism, and documenting a pattern of low T<sub>4</sub> and fT<sub>4</sub>, as well as high TSH concentrations, helps support a diagnosis of hypothyroidism. The TSH stimulation test evaluates the pituitary-thyroid axis and is a measure of thyroid gland capacity; a subnormal thyroid hormone concentration in the face of stimulation is confirmatory for hypothyroidism. Measuring concentrations of thyroglobulin autoantibodies (TgAA) can document active immune-mediated thyroiditis. Other less commonly used assays include nuclear scintigraphy and thyrotropin-releasing hormone (TRH) response tests. It is important to recognize that these tests are not used in place of total T<sub>4</sub>, rather they provide additive information to confirm a diagnosis of hypothyroidism.

## Treatment

Dogs diagnosed with hypothyroidism can have an excellent quality of life, provided they are treated and monitored. Treatment is in the form of a twice- or once-daily pill or liquid; supplementation protocols may vary depending on the manufacturer and the patient. Once hormone concentrations and clinical signs are under control, rechecking thyroid hormone concentrations 4–6 hours post-pill annually or semiannually is usually sufficient to ensure adequate treatment.

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Thyroid hormones are stable for up to 5 days at 37°C in serum stored in plastic tubes. Turnaround time of results varies with the tests ordered but averages 2–4 days.

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## Total T<sub>4</sub> measurement in serum is an excellent screening test for hypothyroidism.

- A dog with total T<sub>4</sub> concentration well within the reference interval is unlikely to have hypothyroidism.
- Dogs with low-normal or below-normal concentrations may have hypothyroidism.
- The classic hypothyroid dog will have low total T<sub>4</sub> and fT<sub>4</sub> and high TSH.

Consider age, breed, heat cycle, and other concurrent illness or treatments while interpreting test results.

## Recommended reading

Scott-Moncrieff JCR. Hypothyroidism. In: Ettinger SJ, Feldman EC. *Textbook of Veterinary Medicine: Diseases of the Dog and Cat*. 7th ed. St Louis, MO: Elsevier Saunders; 2010;1761–1778.

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