

Diagnosis and treatment of canine hypothyroidism

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ABSTRACT

Hypothyroidism is the most common endocrinopathy in dogs. The diagnosis of canine hypothyroidism is often challenging as clinical signs are slow to onset, non-specific and identified in dogs with other non-thyroidal diseases. Therefore, hypothyroidism should be a clinical diagnosis based on a combination of compatible signalment, clinical signs, physical examination findings and clinicopathological abnormalities, supported by specific endocrine testing.

Total thyroxine (T₄) is a very sensitive screening test for hypothyroidism, meaning a result in the reference range makes a diagnosis very unlikely. The identification of a total T₄ or free thyroxine below the reference range, along with an elevated thyrotropin (thyroid-stimulating hormone; TSH), provides the greatest specificity for diagnosis, although these results can also be seen in dogs with other diseases.

Once a diagnosis of hypothyroidism is made, synthetic sodium levothyroxine is the treatment of choice and the recommended initial dose is 0.02mg/kg twice a day. Measurement of total T₄ and TSH is recommended for therapeutic monitoring because it provides better long-term assessment of the adequacy of treatment. Treatment of hypothyroidism should lead to complete resolution of clinical signs, but long-life monitoring is required as dosage adjustments may be necessary.

Hypothyroidism is the most common endocrinopathy in dogs and 95% of cases are caused by lymphocytic thyroiditis or idiopathic atrophy of the thyroid gland, leading to a decrease in thyroid hormone production.

Thyroid neoplasia, congenital hypothyroidism and secondary and tertiary hypothyroidism account for the remaining 5% of hypothyroidism cases¹.

Metabolic	Dermatologic	Neuromuscular	Others
<ul style="list-style-type: none"> ● lethargy ● inactivity ● weight gain ● cold intolerance ● mental dullness 	<ul style="list-style-type: none"> ● endocrine alopecia ● seborrhoea ● dry hair coat ● pyoderma ● hyperpigmentation ● facial myxoedema 	<ul style="list-style-type: none"> ● polyneuropathy/myopathy ● vestibular signs ● cranial nerve deficits 	<ul style="list-style-type: none"> ● bradycardia ● female infertility ● corneal lipidosis

Table 1. Clinical manifestation of hypothyroidism in the adult dog.

The diagnosis of canine hypothyroidism is challenging, as many clinical signs are non-specific and identified in dogs with other non-thyroidal diseases.

Additionally, the most commonly used assay, total thyroxine (T₄), is non-specific and will decrease in many dogs without hypothyroidism. Therefore, hypothyroidism should be a clinical diagnosis based on a combination of compatible signalment, clinical signs, physical examination findings and clinicopathological abnormalities, supported by specific endocrine testing.

Diagnosis

Signalment

Hypothyroidism is diagnosed in middle-aged to older dogs with a mean age of diagnosis at seven years without apparent sex predisposition. Dobermanns and golden retrievers have been reported to be predisposed, based on US data². However, similar findings have not been identified in the UK³.

Clinical signs

Thyroid hormones regulate cellular metabolism and, therefore, clinical signs in hypothyroid dogs are due to the decreased metabolic rate in different body systems (**Table 1**).

Common clinical signs include lethargy, mental dullness, reluctance to exercise, cold intolerance and weight gain without polyphagia. Dermatological signs, especially endocrine alopecia, seborrhoea, scaly skin and superficial pyoderma, are present in 60% to 80% of hypothyroid dogs.



Figure 1. Bilaterally symmetrical alopecia and hyperpigmentation on a six-year-old boxer with hypothyroidism.



Figure 2. “Rat tail” appearance in a dog with hypothyroidism.

Alopecia is first evident in areas of wear, such as the lateral trunk, ventral thorax, neck and tail (the latter causing the typical “rat tail” appearance) and usually progresses to bilaterally symmetric truncal alopecia (**Figures 1 and 2**). The head and extremities are usually unaffected and pruritus is absent unless concurrent pyoderma exists, which is not uncommon. Coat colour dilution may occur and failure of hair to regrowth after clipping is common.

Other dermatological changes include hyperkeratosis, hyperpigmentation, comedone formation, hypertrichosis and poor wound healing⁴. Myxoedema (non-pitting oedema) is occasionally seen and is due to the deposition of glycosaminoglycans and hyaluronic acid within the dermis, which bind water. This results in a non-pitting oedema of the skin, particularly in the face and jowls, giving a “tragic” facial expression (**Figure 3, 4 and 5**)⁵.

The CNS and peripheral nervous systems can be affected in hypothyroid dogs. The most common neurological manifestation of hypothyroidism is diffuse peripheral neuropathy causing generalised weakness, ataxia and decreased reflexes.

A subclinical myopathy has also been reported in hypothyroid dogs. Cranial nerve dysfunction (facial, trigeminal and vestibulocochlear), with or without abnormal gait, has also been reported. Neurological signs may be multifocal, acute or chronic, static or progressive, and may occur without other clinical signs of hypothyroidism¹.

The causal relationship between laryngeal paralysis or megaesophagus and hypothyroidism is unclear because thyroid supplementation does not consistently improve laryngeal or oesophageal function⁵.

Cardiovascular signs can include sinus bradycardia and a weak apex beat. The ECG of hypothyroid dogs may reveal reduced amplitude R waves and, infrequently, arrhythmias, such as first-degree atrioventricular block, atrial fibrillation and occasional ventricular premature ectopic beats.

Other clinical signs observed in hypothyroid dogs include reproductive (such as female infertility, prolonged parturition and periparturient mortality) and ocular abnormalities (such as corneal lipidosis and decreased tear production; **Figure 6**).

Myxoedema coma is an uncommon, but life-threatening, presentation of hypothyroid dogs characterised by profound obtundation to coma, hypothermia without shivering, skin myxoedema and severe bradycardia; although not all of these signs occur concurrently in cases described in dogs.



Figure 3. An eight-year-old akita inu with myxoedema of the face and drooping of the eyelids due to hypothyroidism. Image: © Diana Ferreira.



Figure 4. Non-healing hock wound on a Dalmatian recumbent for a short period of time and subsequently diagnosed with hypothyroidism. Image: © Jane Coatesworth.



Figure 5. “Tragic expression” due to facial myxoedema in a hypothyroid boxer. Image: © Jane Coatesworth.

Haematology and serum biochemistry

Haematology reveals a non-regenerative anaemia in up to 50% of cases. The most common abnormality observed in the serum biochemistry is hyperlipidaemia due to hypercholesterolaemia and hypertriglyceridaemia seen in 75% of hypothyroid dogs. Mild increases in alkaline phosphatase and creatinine kinase are not uncommon.

Endocrine testing

Endocrine testing should be reserved for those dogs suspected to be hypothyroid based on compatible clinical signs and clinicopathological findings to avoid misdiagnosis.

Table 2. Various drugs affecting thyroid function tests			
Drug	Total T₄	Free T₄	Thyrothropin
Glucocorticoids	Decrease	Mild decrease or no change	No change
Phenobarbital	Decrease	Decrease	No change or mild increase
Sulphonamides	Decrease	Decrease	Increase

Table 2. Various drugs affecting thyroid function tests.

Measurement of total T₄ is a very sensitive and useful screening test for hypothyroidism. A total T₄

in or above the reference range makes a diagnosis of hypothyroidism very unlikely unless anti-total T_4 antibodies causing a spurious total T_4 increase. However, total T_4 is very non-specific as concurrent diseases and some drugs can decrease total T_4 concentration (**Table 2**).

It should also be taken into consideration total T_4 concentration is lower in medium-breed and large-breed dogs, declines with age, and sight hounds and sled dogs have lower concentrations than the established laboratory reference ranges.

Free T_4 concentration measured by equilibrium dialysis is more specific than total T_4 for the diagnosis of hypothyroidism and is not affected by the presence of anti-total T_4 antibodies. Other methods to measure free T_4 exist, such as radioimmunoassay and chemiluminescent assays, but are less accurate and their use discouraged. However, severe non-thyroidal disease, certain drugs and breed variability can still decrease free T_4 concentration.

Measurement of basal thyrotropin (thyroid-stimulating hormone; TSH) has been suggested as first-line test, along with total T_4 , for the diagnosis of hypothyroidism. TSH would be expected to increase in cases of primary hypothyroidism, and a combination of low total T_4 /free T_4 and increased TSH is highly specific for hypothyroidism.

However, up to 38% of hypothyroid dogs have TSH concentrations in the reference range and TSH concentration may also be increased in dogs with normal thyroid function⁶. Again, this highlights the importance of thyroid testing exclusively in dogs with a clinical suspicion of hypothyroidism.

In a dog with compatible clinical signs and clinicopathological findings with a low total T_4 or free T_4 , but a TSH in the normal limits, performing a TSH stimulation test can be considered. The TSH stimulation test is considered the gold standard for assessment of thyroid function in dogs; however, TSH is difficult to source and expensive.

Alternatively, a therapeutic trial can be considered and can be the most practical approach to confirm a diagnosis of hypothyroidism. If therapy leads to an improvement of clinical signs in an appropriate time frame, treatment should be temporarily discontinued to determine a recurrence of clinical signs, which would be compatible with hypothyroidism.

If there is no response to treatment after 8 to 12 weeks of therapy and a total T_4 is in the therapeutic range, therapy should be withdrawn and other diagnoses pursued. If repeated thyroid function testing is attempted, it is generally recommended thyroid hormone supplementation should be discontinued for six to eight weeks beforehand.

However, the time between the discontinuation of thyroid hormone supplementation and the acquisition of accurate results regarding thyroid gland function depends on the duration of treatment, the dose and frequency of administration of the thyroid hormone supplement, and individual variability¹.

Thyroid imaging

Ultrasonography may be useful in the assessment of dogs with hypothyroidism. The thyroid gland is usually smaller and less echogenic in dogs with hypothyroidism than in dogs with non-thyroidal diseases. However, there is some overlap between groups and finding a low thyroid volume is insensitive for the diagnosis of hypothyroidism.

Nuclear scintigraphy allows assessment of thyroid function and has a high discriminatory power in differentiating hypothyroid dogs from dogs with non-thyroidal diseases. However, the availability of scintigraphy is limited to a few specialised hospitals⁶.

Treatment and monitoring options

The treatment of choice for hypothyroidism is synthetic sodium levothyroxine (L-thyroxine). L-thyroxine has an oral bioavailability of ~50%, which is further decreased if administered with food, hence it is preferred to be administered on an empty stomach.

However, owners could also give levothyroxine with food as long as they are consistent, but the dose needed to reach euthyroidism would be higher. The use of thyroid extracts, thyroglobulin or combinations of L-thyroxine and liothyronine are not recommended because the bioavailability is variable, making accurate dosing difficult⁴.

Various licensed L-thyroxine products are available that have starting dose recommendations of once or twice a day.

One study indicated initial twice-daily administration at a dosage of 0.02mg/kg improves the likelihood of response to treatment⁴. If clinical signs resolve and total T₄ concentration is in the therapeutic range, then L-thyroxine could be decreased to once daily.

Clinical signs and clinicopathological abnormalities associated with hypothyroidism should resolve within an appropriate time frame with adequate therapy. An increase in mental alertness and activity usually occurs in the first week of treatment and is an early indicator of correct hypothyroidism diagnosis. Dermatological signs may take several months to completely resolve. Neurological deficits usually improve rapidly after treatment, but complete resolution may take up to three months⁴.

Therapeutic monitoring is recommended six to eight weeks after starting L-thyroxine supplementation, in addition to when thyrotoxicosis develops or after a poor response to therapy. Therapeutic monitoring is also recommended two to four weeks after adjusting L-thyroxine dose or if a different brand of L-thyroxine is used, due to differences in potency and bioavailability⁴.



Figure 6. Corneal lipid deposits in a Weimaraner with hypothyroidism.

Serum total T_4 concentration should be measured four to six hours after L-thyroxine administration in dogs treated twice a day and before L-thyroxine administration in dogs treated once a day.

The measurement of TSH, alongside total T_4 , increases the cost of therapeutic monitoring. However, it is generally recommended as TSH provides a longer-term assessment of the adequacy of treatment – unlike total T_4 , which only provides information regarding the time of blood sampling⁷.

For otherwise healthy dogs, the aim is to obtain a total T_4 in the upper half or slightly above the therapeutic range four to six hours after dosing and, if once-daily treatment is being used, pre-pill total T_4 should be in the lower end of the therapeutic range.

TSH should be low or in the reference range. The dose of L-thyroxine should be adjusted based on total T_4 and TSH concentrations, but also taking into consideration clinical response, age, presence of concurrent disease and concurrent drug administration.

Once clinical signs have resolved and total T_4 concentration is in the therapeutic range, long-life monitoring at least every six months is recommended as the development of concurrent diseases and differences in gastrointestinal absorption may lead to significant variations in total T_4 concentration.

It is not uncommon for hypothyroid dogs to have or develop concurrent diseases given their age. It is unknown what is the appropriate therapeutic range in hypothyroid dogs with concurrent diseases or receiving drugs, such as glucocorticoids or phenobarbital, but it is likely to be lower than the range for otherwise healthy dogs⁴.

Measurement of TSH alongside total T₄ may help provide treatment recommendations, as a persistently elevated TSH indicates inadequate supplementation or poor compliance. On the other hand, if TSH is in the reference range, even in the face of a low total T₄, and clinical signs attributable to hypothyroidism are absent, there is no need to increase L-thyroxine dose to increase total T₄ concentration to the therapeutic range.

Treatment of dogs with concurrent cardiomyopathy or hypoadrenocorticism deserves special mention. Thyroid hormone supplementation increases myocardial oxygen demand, which may lead to cardiac decompensation. Therefore, the recommended initial dose in these cases should be 25% to 50% of the routine starting dose, with progressive dose increments according to the therapeutic monitoring, clinical signs and re-evaluation of cardiac function.

Dogs with concurrent hypothyroidism and hypoadrenocorticism should have the latter disease stabilised first because levothyroxine supplementation increases the basal metabolic rate, which may exacerbate electrolyte imbalances in the unstable dog with hypoadrenocorticism⁵.

Early recognition and treatment of hypothyroid dogs with myxoedema coma is critical for survival. Treatment includes L-thyroxine supplementation administered intravenously (5 mg/kg every 12 hours) along with intensive supportive care, which involves fluid therapy, slow and passive re-warming and ventilatory support, if respiratory depression is profound. As concurrent disorders commonly precipitate myxoedema coma, diagnosis and treatment of these disorders is critical¹.

Treatment failure

The most common cause of treatment failure is an incorrect diagnosis as other diseases (such as flea allergic dermatitis and hyperadrenocorticism) have similar clinical signs that mimic hypothyroidism and can cause a decrease in thyroid hormones, particularly total T₄. In these cases, thorough investigations for the diagnosis of another disease should be undertaken.

Less common causes of treatment failure include poor owner compliance or poor gastrointestinal absorption, which can be identified by routine therapeutic monitoring. In cases where there is poor gastrointestinal absorption of L-thyroxine, oral synthetic liothyronine can be used instead.

However, close therapeutic monitoring would be recommended because the risk of iatrogenic hyperthyroidism would be higher¹.

The prognosis of dogs with primary hypothyroidism receiving appropriate therapy should be excellent with resolution of clinical signs, improved quality of life and normal life expectancy. The prognosis of dogs with myxoedema coma is dependent on early diagnosis and aggressive treatment.

References

- Scott-Moncrieff JCR (2015). Hypothyroidism. In Feldman EC, Nelson RW, Reusch CE and Scott-Moncrieff JCR (eds), *Canine and Feline Endocrinology* (4th edn), Elsevier Saunders, Missouri: 77-135.
- Panciera DL (1994). Hypothyroidism in dogs: 66 cases (1987-1992), *J Am Vet Med Assoc* **204**(5): 761-767.
- Dixon RM, Reid SW and Mooney CT (1999). Epidemiological, clinical, haematological and biochemical characteristics of canine hypothyroidism, *Vet Rec* **145**(17): 481-487.
- Scott-Moncrieff JCR (2012). Thyroid disorders in the geriatric veterinary patient, *Vet Clin Small Anim* **42**(4): 707-725.
- McCann T (2015). Canine hypothyroidism, *Comp Anim* **20**(10): 573-578.
- Scott-Moncrieff JCR (2010). Hypothyroidism. In Ettinger SJ and Feldman EC (eds), *Textbook of Veterinary Internal Medicine* (7th edn), Elsevier Saunders, Missouri: 1,751–1,761.
- Mooney CT and Shiel RE (2012). Canine hypothyroidism. In Mooney CT and Peterson ME (eds), *BSAVA Manual of Canine and Feline Endocrinology* (4th edn), BSAVA, Gloucester: 63–85.