

A Monthly e Magazine
ISSN:2583-2212

March 2024 Vol.4(3),1184-1188

Popular Article

Canine hypothyroidism: Etiology, Diagnosis and Treatment strategies

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<https://doi.org/10.5281/zenodo.10895475>

Abstract

Canine hypothyroidism is a common endocrine disorder characterized by deficient thyroid hormone production, primarily affecting middle-aged to older dogs. The condition arises from various etiologies, including autoimmune thyroiditis, congenital abnormalities, and iatrogenic causes. Clinical manifestations often manifest subtly and can vary widely, encompassing lethargy, weight gain, hair loss, skin abnormalities, and neuromuscular signs. Diagnosis involves a combination of clinical assessment and laboratory tests measuring serum thyroid hormone levels, with thyroid imaging serving as adjunctive diagnostic tools. Levothyroxine replacement therapy remains the cornerstone of management, aiming to restore euthyroidism and alleviate clinical signs. Proper dosing and regular monitoring are essential to ensure therapeutic efficacy and minimize potential adverse effects.

Keywords: Canine hypothyroidism, thyroid hormones, diagnosis, treatment, levothyroxine, genetics, breed predisposition, veterinary medicine

Hypothyroidism, also known as underactive thyroid, is a condition where the thyroid gland doesn't produce enough thyroid hormones. In hypothyroidism, impaired production and secretion of thyroid hormones result in a decreased metabolic rate. This disorder is most common in dogs but also develops rarely in other species, including cats, horses, and other large, domestic animals.

Although dysfunction anywhere in the hypothalamic-pituitary-thyroid axis may result in thyroid hormone deficiency, >95% of clinical cases of hypothyroidism in dogs appear to result from destruction of the thyroid gland itself (primary hypothyroidism). The two most common causes of adult-onset primary hypothyroidism in dogs include lymphocytic

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thyroiditis and idiopathic atrophy of the thyroid gland. Lymphocytic thyroiditis, probably immune-mediated, is characterized histologically by a diffuse infiltration of the gland by lymphocytes, plasma cells, and macrophages and results in progressive destruction of follicles and secondary fibrosis. Idiopathic atrophy of the thyroid gland is characterized histologically by loss of thyroid parenchyma and replacement by adipose tissue.

In dogs, the most common cause of secondary hypothyroidism is destruction of pituitary thyrotrophs by an expanding, space-occupying tumor. Because of the nonselective nature of the resulting compressive atrophy and replacement of pituitary tissue by such large tumors, deficiencies of other (one or more) pituitary hormones also usually occur.

Other rare forms of hypothyroidism in dogs include neoplastic destruction of thyroid tissue and congenital (or juvenile-onset) hypothyroidism. Congenital primary hypothyroidism may result from one of various forms of thyroid dysgenesis (eg, athyreosis, thyroid hypoplasia) or from dysmorphogenesis (usually an inherited inability to organify iodide). Congenital secondary hypothyroidism (associated with clinical signs of disproportionate dwarfism, lethargy, gait abnormalities, and constipation) has been reported in Giant Schnauzers, Toy Fox Terriers, and Scottish Deerhounds. Congenital secondary hypothyroidism also has been reported in German Shepherds, with pituitary dwarfism associated with a cystic Rathke's pouch. However, the degree of TSH deficiency in these dogs is variable, and clinical signs are usually caused primarily by deficiency of growth hormone (rather than thyroid hormone).

Clinical findings

- Although onset is variable, hypothyroidism is most common in dogs 4–10 years old.
- It usually affects mid- to large-size breeds and is rare in toy and miniature breeds.
- Breeds reported to be predisposed to hypothyroidism include: Golden Retriever, Doberman Pinscher, Irish Setter, Miniature Schnauzer, Dachshund, Cocker Spaniel, Airedale Terrier
- There does not appear to be a sex predilection, but spayed females appear to have a higher risk of developing hypothyroidism than intact females.
- Many of the clinical signs associated with canine hypothyroidism are directly related to slowing of cellular metabolism, which results in development of mental dullness, lethargy, exercise intolerance, and weight gain without a corresponding increase in appetite. Mild to marked obesity develops in some dogs. Difficulty maintaining body temperature may lead to frank hypothermia; the classic hypothyroid dog is a heat-seeker. Alterations in the skin and coat are common. Dryness, excessive shedding, and retarded regrowth of hair are usually the earliest dermatologic changes.



Nonpruritic hair thinning or alopecia (usually bilaterally symmetric) that may involve the ventral and lateral trunk, the caudal surfaces of the thighs, dorsum of the tail, ventral neck, and the dorsum of the nose is seen in about two-thirds of dogs with hypothyroidism. Alopecia, sometimes associated with hyperpigmentation, often starts over points of wear. Occasionally, secondary pyoderma (which may produce pruritus) is seen.

- In moderate to severe cases, thickening of the skin occurs secondary to accumulation of glycosaminoglycans (mostly hyaluronic acid) in the dermis. In such cases, myxedema is most common on the forehead and face, resulting in a puffy appearance and thickened skin folds above the eyes. This puffiness, together with slight drooping of the upper eyelid, gives some dogs a “tragic” facial expression. These changes also have been described in the GI tract, heart, and skeletal muscles.
- In intact dogs, hypothyroidism may cause various reproductive disturbances: in females, failure to cycle (anestrus) or sporadic cycling, infertility, abortion, or poor litter survival; and in males, lack of libido, testicular atrophy, hypospermia, or infertility.

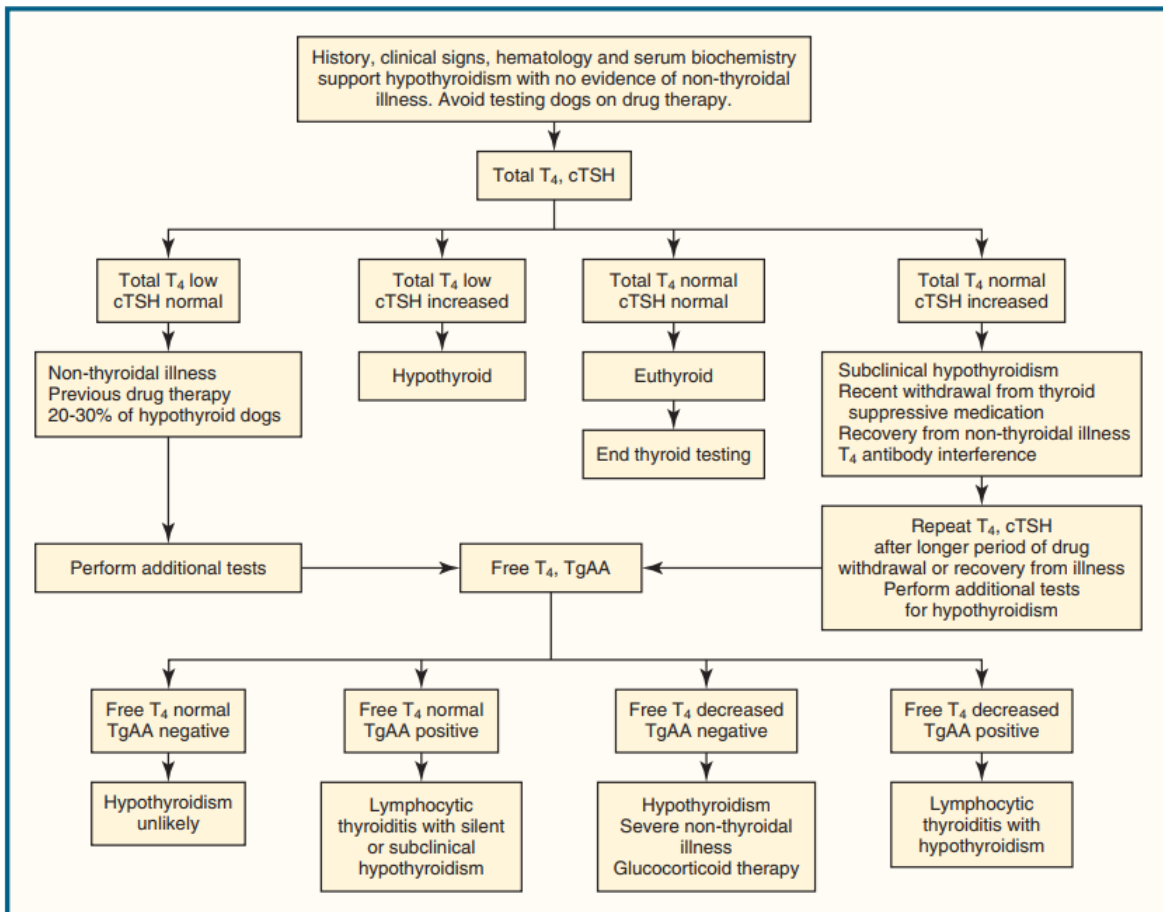
Clinical Abnormalities Associated with Hypothyroidism	
Metabolic signs	Lethargy Obesity or weight gain Exercise intolerance Cold intolerance
Dermatological abnormalities	Alopecia Dry/poor-quality coat Skin hyperpigmentation Pyoderma Seborrhea
Others	Various neuropathies, central vestibular disease, myxedema coma, subclinical myopathy, lipid corneal dystrophy, bradycardia, disproportionate dwarfism, decreased fertility, parturient problems, decreased tear production

Diagnosis:

Diagnosis of hypothyroidism is based on suggestive clinical findings and confirmed by serum thyroid hormone testing.

Definitive diagnosis of canine hypothyroidism requires careful attention to clinical signs and results of routine laboratory testing. Tests that may confirm the diagnosis include measurement of the serum concentrations of total T4, free T4, and TSH; provocative thyroid function tests (eg, TSH stimulation test); thyroid gland imaging; and response to thyroid hormone supplementation. Choice and interpretation of diagnostic tests is based heavily on the index of suspicion for hypothyroidism. The algorithm for diagnosing canine hypothyroidism depicted in following flowchart:





Algorithm for diagnosing hypothyroidism in dog; cTSH, Canine thyroid stimulating hormone; T₄, thyroxine; TgAA, thyroglobulin autoantibody. (From Mooney CT: Canine hypothyroidism. A review of the aetiology and diagnosis. N Z Vet J 59:105-114, 2011.)

The classic hematologic finding associated with hypothyroidism, found in 40%–50% of cases, is a normocytic, normochromic, nonregenerative anemia. The classic serum biochemical abnormality is hypercholesterolemia, which occurs in ~80% of dogs with hypothyroidism. The value of serum cholesterol determination as a screening test for hypothyroidism cannot be overemphasized, because cholesterol concentrations are a sensitive and inexpensive biochemical marker for this disease in dogs. Other clinicopathologic abnormalities may include high serum concentrations of triglycerides, alkaline phosphatase, and CK.

Treatment of hypothyroidism

- Standard treatment for hypothyroidism involves daily oral administration of the synthetic thyroid hormone levothyroxine (L-T₄). This oral medication restores adequate circulating thyroid hormone concentrations, reversing the clinical signs of hypothyroidism.

- Synthetic levothyroxine (L-T4) is the thyroid hormone replacement compound of choice in dogs and cats. With few exceptions, replacement therapy is necessary for the remainder of the animal's life; careful initial diagnosis and tailoring of treatment is essential. Replacement dosages for L-T4 in dogs and cats range from a total dosage of 22 mcg/kg/day, given once or divided twice daily without food (on an empty stomach).
- The most important indicator of the success of therapy is clinical improvement. Reversal of changes in coat and body weight should be assessed only after 1–2 months of therapy. When clinical improvement is marginal or signs of thyrotoxicosis are seen, the clinical observations can be supported by therapeutic monitoring of serum thyroid hormone concentrations (“post-pill testing”). With once-daily administration of T4, the peak serum concentration of T4 generally should be slightly high to high-normal 4–6 hours after dosing and should be low-normal to normal 24 hours after dosing. Animals on twice-daily administration probably can be checked at any time, but peak concentrations can be expected at the middle of the dosing interval (4–6 hours) and the nadir just before the next dose. After the dosage is stabilized, serum T4 (with or without T3) concentrations should be checked 1–2 times per year.

