Diagnosis of Thyroid Disease for Canine & Feline

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Contents

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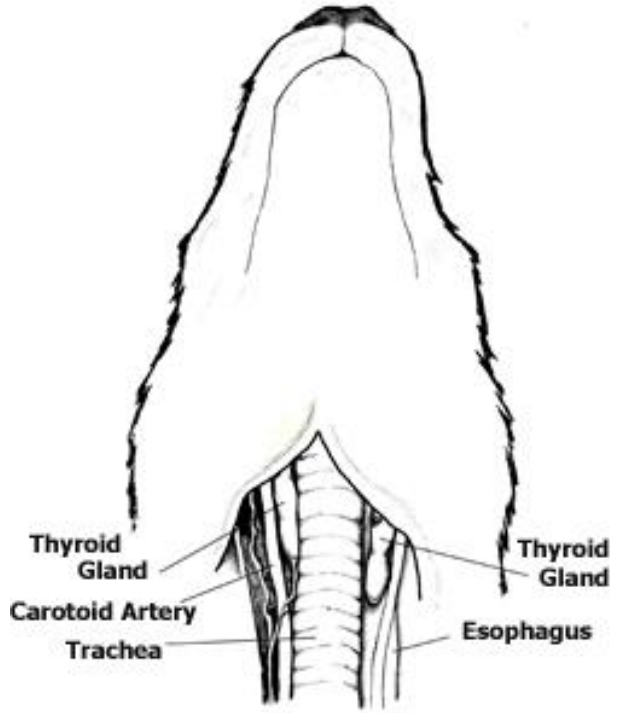
a. Thyroid Structure and Function

Thyroid

- ❑ The largest endocrine gland in the body
- ❑ Synthesis and secretion of thyroxine (T4) and triiodine thyrogenic acid (T3)

Thyroxin Function

- ❑ Promotes metabolism
- ❑ Promotes growth and development, bone, brain, etc.
- ❑ Improves central nervous system excitability, heart rate, etc



b. Thyroid Modulation

Illustrations:

- ❑ Hypothalamus - Pituitary - Thyroid
- ❑ TRH: Thyrotropin-releasing hormone
- ❑ TSH: Thyroid stimulating hormone

b. Thyroid Modulation

T4, fT4 and T3

- ❑ The thyroid gland secretes large amounts of T4, small amounts of T3 and trace amounts of rT3
- ❑ After entering the circulation, more than 99 % of T4 is bound to protein as a storage pool
- ❑ 0.02% of unbound free T4 is biologically active (fT4)

b. Thyroid Modulation

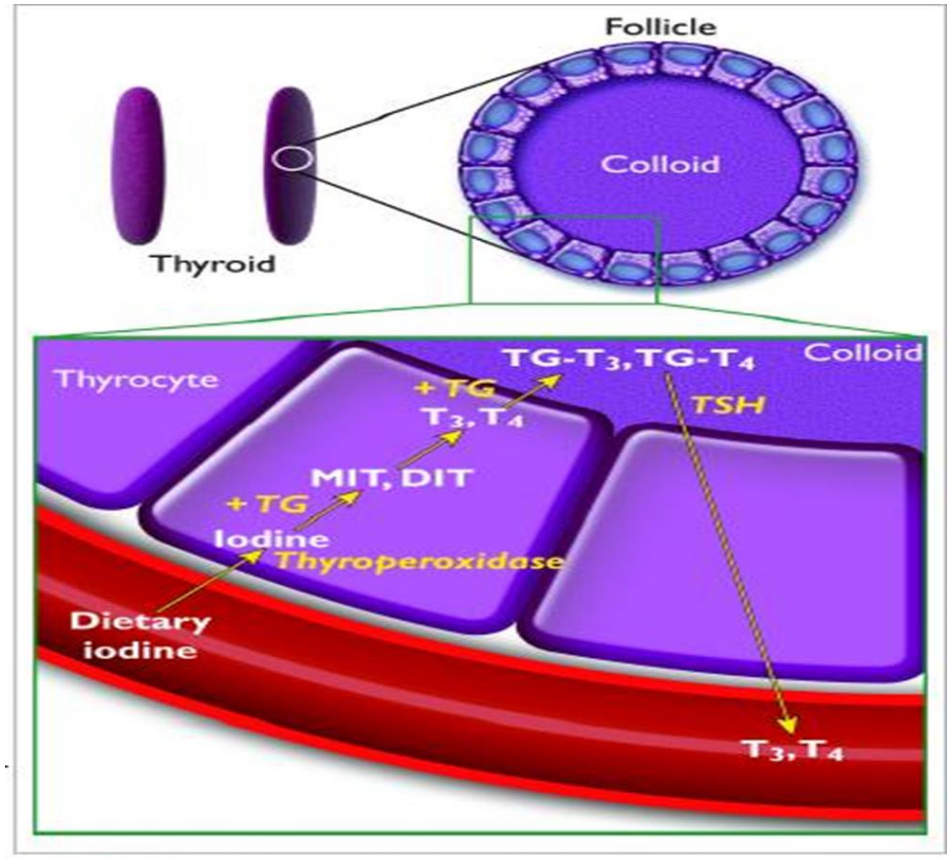


Figure 1. Thyroid hormone synthesis. Iodine is transported into thyroid follicular cells and oxidized. It binds to tyrosine residues and forms monoiodotyrosine *(MIT)* and diiodotyrosine *(DIT)*. MIT and DIT combine to form T_3 (MIT–DIT) and T_4 (DIT–DIT), which are bound to thyroglobulin *(TG)* for storage. Under the influence of thyroid-stimulating hormone *(TSH)*, TG undergoes proteolysis, and T_3 and T_4 are released.

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b. Thyroid Modulation

TSH

- Thyrotropin TSH, produced by the pituitary gland, regulates the endocrine function of the thyroid gland. The thyrotropin receptor is found mainly in the follicular cells of the thyroid gland and stimulation of this receptor increases the secretion of T3 and T4.

- The levels of thyroid hormones (T3 and T4) in the blood affect the release of TSH by the pituitary gland. When T3 and T4 are low, thyrotropin release increases and vice versa, i.e. a negative feedback regulation.

- Thyrotropin-releasing hormone (TRH) is secreted by the hypothalamus and its increase stimulates the secretion of thyrotropic hormone.

b. Thyroid Modulation

TSH

In dogs, low T4 levels and high TSH levels suggest hypothyroidism but normal or low TSH results do not necessarily rule it out. Approximately 70% of dogs with true hypothyroidism have high TSH levels. However, elevated TSH levels are occasionally found in dogs without signs of hypothyroidism.

Older cats without signs of hyperthyroidism also usually have low TSH levels.

b. Thyroid Modulation

Diagnosis of Thyroid Function

- ❑ T4
- ❑ T3
- ❑ freeT4
- ❑ freeT3
- ❑ TSH
- ❑ TgAA

b. Thyroid Modulation

Thyroid Function Diagnosis – T4 and TSH

- T4 – Thyroid function is evaluated primarily by measuring the basal serum thyroxine concentration which is the sum of protein-bound and free T4 in the blood circulation. Most of the hormones secreted by the thyroid gland are T4. The detection of serum total T4 concentration can be used as an initial test for the diagnosis of hypothyroidism and individual serum T4 values cannot be used to determine whether the thyroid gland is functioning normally.

- T3, Free T3 – Most T3 and fT3 are formed outside the thyroid gland, particularly in the liver, kidneys and muscles by deiodination of T4. T3 is found primarily intracellularly and is secreted in small amounts by the thyroid gland relative to T4, making it unsuitable for evaluating thyroid function. Measurement of serum T3, fT3 and rT3 is not recommended for evaluation of canine thyroid function.

- Free T4 – The measurement of fT4 is preferred for the evaluation of canine thyroid function.

- TSH – In combination with serum TSH concentrations, this can be used to evaluate suspected hypothyroidism.

b. Thyroid Modulation

Thyroid Function Diagnosis – T4 and TSH

- TgAA: The presence of circulating thyroglobulin (Tg) autoantibodies is thought to be associated with lymphocytic thyroiditis. It has an important guiding role in breed monitoring.

- False-negative results are likely to occur in dogs with 8% high T3AA, T4AA levels, as well as in dogs that have received thyroxine supplementation in the previous 90 days. False-positive results are common in dogs that have received rabies vaccination in the previous 30-45 days.

c. Canine Hypothyroidism

Epidemiologic Features:

- ❑ No specificity
- ❑ No gender difference
- ❑ Middle-aged and older dogs are susceptible, average age 7 years
- ❑ Breed – Golden Retriever, Doberman Pinscher susceptible
- ❑ Immune-mediated and unknown causes of thyroid atrophy are common in the acquired form and rare in the congenital form

'Sluggishness', abdominal hair removal

c. Canine Hypothyroidism

Canine Clinical Signs:

- Metabolic – Drowsiness, unresponsiveness, inactivity, weight gain, cold intolerance
- Dermatological – Endocrine alopecia, symmetrical or asymmetrical, "rat tail", dry, increased brittleness of the coat, hyperpigmentation, dry or oily seborrhea, or dermatitis, pyoderma, otitis externa, mucous edema
- Neurological Symptoms – Weakness, elbow joint prominence, ataxia, circling, vestibular symptoms, facial nerve palsy, convulsions, laryngeal paralysis
- Reproductive Symptoms – Persistent absence of oestrus, weak or no oestrus, prolonged oestrus bleeding, abnormal mammary overflow or male mammary gland development, testicular atrophy, lack of libido
- Cretinism – Hypothyroidism in puppies is known as cretinism, a developmental delay and a psychological developmental disorder. Cretinous dogs are usually mentally sluggish, lethargic and do not show the playful nature of normal puppies. Other symptoms include retained hair, hair loss, loss of appetite, delayed teething and goiter.
- Immunoendocrine syndrome

c. Canine Hypothyroidism

Clinical Examination

- ❑ Bradycardia, skin pigmentation, impaired myocardial contractility, mucinous oedema, neuropathy, pyoderma, testicular atrophy.
- ❑ Symmetrical non-pruritic hair loss on the ventral and bilateral sides of the trunk, caudal side of the thighs, dorsal side of the tail, dorsal side of the nose and ventral side of the neck.

Laboratory Tests

- ❑ CBC – Mild non-regenerative anaemia
- ❑ Biochemical Indicators – Elevated cholesterol, decreased ALT, AST, Ca and CK
- ❑ T4 – <1.2 µg/dL
- ❑ TSH – Elevated or normal concentrations
- ❑ Free T4 – Decreased

c. Canine Hypothyroidism

Thyroid Function Tests

- Determination of basal serum thyroxine T4 concentration
- Basal serum T4 concentration refers to the sum of protein-bound T4 and free T4 in the blood circulation. The sum of protein-bound T4 and free T4 in the circulation i.e., TT4.
- Thyroid Function Combinations – TT4, fT4, TSH and lymphocyte thyroid antibody TgAb test

c. Canine Hypothyroidism

	Total T4 Reduction	Total T4 Normal
Normal Serum TSH	❑ ESS (Euthyroid Sick Syndrome) ❑ After medication for hypothyroidism ❑ 20% of dogs with hypothyroidism Retest after waiting or conduct second-line test	❑ Normal thyroid End of the survey for hypothyroidism
Elevated Serum TSH	❑ Hypothyroidism Treatment of hypothyroidism	❑ Sulfa drug treatment ❑ ESS recovering ❑ T4 antibody interference Discontinue and retest, wait for full recovery of ESS and retest. Test for free T4 to rule out interference from T4 antibodies.

c. Canine Hypothyroidism

Effect of Drugs on T4 and TSH

Drugs	TT4	FT4	TSH	TSH stimulation test
Glucocorticoids (immunosuppressive dosage)	↓	= or ↓	=	Blunted at high dose and duration
Potassium bromide	=	=	=	=
Phenobarbital	↓	= or ↓	= or↓	
Sulfonamides	↓	↓	↓	↓
Propranolol	=	=	=	=
Carprofen	= or ↓	= (↓)	= or ↓	Not studied
Aspirin	↓	=	=	Not studied
Meloxicam	=	=	=	Not studied
Ketoprofen	=	=	=	Not studied
Etodolac	=	=	=	Not studied
Clomipramine	↓	↓	=	Not studied

c. Canine Hypothyroidism

Treatment

- ❑ Initial therapeutic dose of levothyroxine 0.02 mg/kg once every 12 hours, twice a day
- ❑ After 6-8 weeks of dosing, the drug concentration was adjusted according to the TT4 concentration and clinical symptoms
- ❑ After clinical remission, drug maintenance dose adjusted to at least 1 dose per day
- ❑ In the future, it is recommended to review TT4 once in 6 - 12 months and to check TSH if necessary

d. Feline Hyperthyroidism

Epidemiological Characteristics:

- UK 17 %
- Middle-aged and older cats, average age >7 years
- No gender difference
- 70 % bilateral lesions, 30 % unilateral
- Risk Factors – environment and canned food

d. Feline Hyperthyroidism

Clinical Symptoms:

- ❑ Increased appetite
- ❑ Behavioural changes
- ❑ Diarrhoea
- ❑ Respiratory distress
- ❑ Excessive hair loss and loss of luster
- ❑ Heat intolerance
- ❑ Hyperexcitability
- ❑ Hyperventilation
- ❑ Panting
- ❑ PU/PD
- ❑ Restlessness
- ❑ Increased respiration
- ❑ Hair loss
- ❑ Vomiting
- ❑ Weakness
- ❑ Weight loss

Physical Characteristics:

- ❑ Arrhythmia
- ❑ Single or two goiters
- ❑ Gallop rhythm
- ❑ Enlarged lymph nodes
- ❑ Pallor
- ❑ Systolic murmur
- ❑ Tachycardia

d. Feline Hyperthyroidism

Laboratory Tests

- ❑ Biochemical Indicators – Elevated ALT, AST, alkaline phosphatase, BUN, CREA, Ca, Glu, phosphorus, bilirubin and lactate (30% showed elevated crea, bun and 20% showed elevated phosphorus)
- ❑ T4 – >3.9 µg/dL
- ❑ Elevated free T4
- ❑ Triiodothyronine Suppression Test – >1.5 µg/dL
- ❑ TRH Response Test – No or very slightly elevated T4
- ❑ Trypsin Immunoreactivity Assessment Test – Decreased TSH

d. Feline Hyperthyroidism

Treatment

- ❑ Thyroidectomy
- ❑ Oral anti-thyroid medication
- ❑ Radioiodine therapy
- ❑ Surgery and radioactive iodine therapy are designed to permanently cure the disease while oral antithyroid drugs only suppress hyperthyroidism and must be administered daily to maintain their effectiveness

InSight V-IA®

Thyroxime (T4)
Rapid Quantitative Test

Woodley have developed a rapid, accurate and reliable, highly sensitive detection method for T4 in cats or dogs.

The InSight V-IA Thyroxine (T4) Rapid Quantitative Test is a fluorescence immunoassay used with the InSight V-IA Veterinary Immunoassay Analyser for quantitative determination of canine or feline T4 concentration in canine or feline serum or plasma.

The test is used to assist in the evaluation of thyroid function.

It can be stored at room temperature.

Thyroid-Stimulating Hormone (TSH) Rapid Quantitative Test

Woodley have developed a rapid, accurate and reliable, highly sensitive detection method for TSH in cats or dogs.

The InSight V-IA TSH Rapid Quantitative Test is a fluorescence immunoassay used with the InSight V-IA Veterinary Immunoassay Analyser for quantitative determination of TSH concentration in canine or feline serum or plasma.

The test is used as an aid to diagnose thyroid function.

It can be stored at room temperature.

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Thank You

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