Canine hypothyroidism

Clinical signs, diagnosis and treatment

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CHUV

Canine hypothyroidism: Introduction

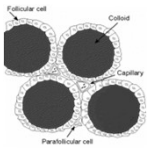
- One of the most frequent endocrinopathy
- Commonly misdiagnosed endocrinopathy
  - Hypothyroidism remains a disease difficult to diagnose accurately in many instances
- Myriad of clinical signs but none are specific
- No perfect diagnostic test available

Canine hypothyroidism: Plan of the presentation

- Brief review of pathophysiology of the thyroid gland
- Canine hypothyroidism
  - Clinical features
  - Diagnostic tests
  - Treatment and Monitoring

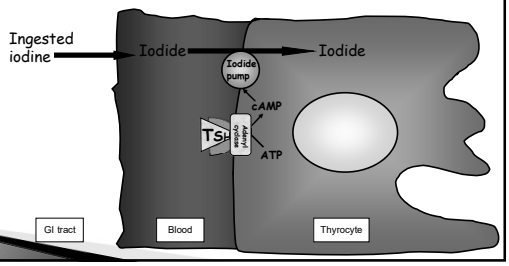
Synthesis and secretion of the thyroid gland

- The thyroid gland synthetize and secrete:
  - Thyroxine (T4)
  - Triiodothyronine (T3)
  - reverse T3 (rT3)
  - Calcitonin
  - Thyroglobulin



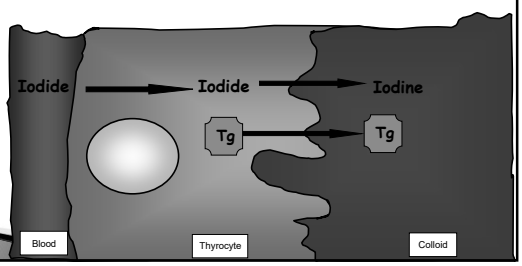
Synthesis of thyroid hormones

- Ingested iodine is converted in iodide in the GI tract and absorbed into the circulation and then iodide is trapped into the thyrocytes



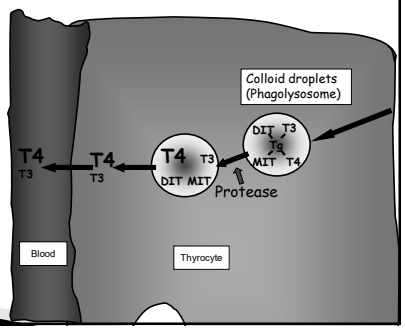
Synthesis of thyroid hormones

- Afterward, iodide is transported from the thyrocytes into the lumen of thyroid follicles (colloid) along with thyroglobulin



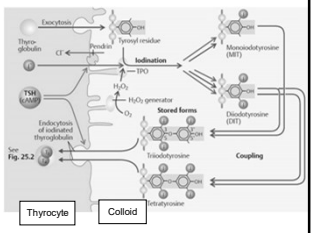
Secretion of thyroid hormones

- Proteolysis of thyroglobulin liberates large amounts of T4, but small amounts of T3 into the cytosol
- Free T4 and T3 are then released into the blood stream



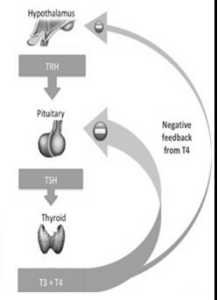
Synthesis of thyroid hormones

- After synthesis of TH, each thyroglobulin molecule contains up to 30 T4 molecules and a few T3 molecules
- TH are stored in this form in the follicles in a sufficient amount to supply body requirements for 2 to 3 months



Thyroid hormone action

- >99% of TH bind with plasma proteins which will slowly release them to target tissues
- In the healthy euthyroid dog, < 1% of TH are free
  - Only free TH enter cells to produce a biological effect
  - Only free TH have a negative feedback effect on pituitary and hypothalamus
- T3 is the major metabolically active TH in the dog



Biological effects of thyroid hormones

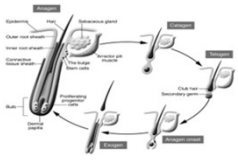
- Myriad of physiologic effects
  - Necessary for normal cell metabolism of virtually every tissues and organs
  - Essential for normal growth and development of the neurological and skeletal systems
  - Act on many different cellular processes via specific ligand-receptor

Biological effects of thyroid hormones

- Profound effect of increasing the metabolic rate of the body
  - Complete lack of TH secretion: BMR ↓ 40 to 50% below normal
  - Extreme excesses of TH secretion: BMR ↑ 60 to 100% above normal
- Inotropic and chronotropic effects on the heart
- Anabolic (in physiological quantities)
- Catabolic effects on muscle and adipose tissues (in excess)
  - e.g., hyperthyroidism
- Stimulate erythropoiesis
- Regulate cholesterol synthesis and degradation

Biological effects of thyroid hormones

- Play a major role in:
  - Differentiation and maturation of skin
  - Maintenance of normal cutaneous function
- Regulate the cornification process and sebaceous glands secretion
- Are required for initiation of anagen phase of the hair follicle cycle



Biological effects of thyroid hormones

- In hypothyroidism:
  - Epidermal atrophy and abnormal keratinization
    - Due to ↓ protein synthesis, mytotic activity and O_2 consumption
  - Abnormal lipogenesis and ↓ sterol synthesis by the keratinocytes
  - Sebaceous gland atrophy and ↓ sebum excretion rate
  - Glycosaminoglycans accumulate in the dermis (myxoedema)

Biological effects of thyroid hormones

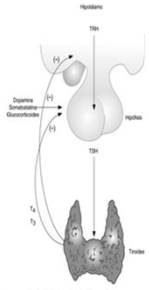
- Are required for normal development of lymphoid tissue
- Thyroidectomy leads to hypoplasia of lymphoid organs and thymus
- Depletion of thyroid hormones results in impaired neutrophils and B and T-lymphocytes function

Biological effects of thyroid hormones

Normal state	Deficiency
Catabolic effect on muscular and adipose tissues	*Predispose to weight gain*
Stimulate erythropoiesis	*Non-regenerative anemia*
Regulate cholesterol synthesis and degradation	*Hypercholesterolemia*
Required for initiation of anagen phase of the hair follicle cycle	*Hair cycle arrest (hypotrichosis, alopecia)*
Regulate the cornification process and sebaceous glands secretion	*Cornification disorder*
Required for normal development and function of lymphoid tissue	*Infection*

Etiopathology of canine hypothyroidism

- Hypothyroidism is the result of a ↓ production of T4 and T3 by the thyroid gland
- Can be acquired (most cases) or congenital (rare)



Tertiary Hypothyroidism
↓ TRH from the hypothalamus

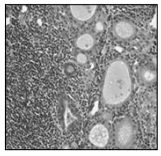
Secondary Hypothyroidism
↓ TSH from the pituitary gland
< 5% of cases

Central Hypothyroidism

Primary Hypothyroidism
Destruction of the thyroid gland
> 95% of cases
Lymphocytic thyroiditis**

Etiopathology of canine hypothyroidism

- Lymphocytic thyroiditis
  - Most frequent etiology (more than 95% of cases)
  - Highly heritable in many breeds
  - Immune mediated disorder characterized histologically by a diffuse infiltration of lymphocytes, plasma cells, and macrophages in the thyroid gland
  - Clinical signs develop between 3 and 8 years (~ never in dogs < 2 years)
  - Breed predisposed: Doberman, Golden retriever, Boxer, Gorden setter, English setter, OESD, etc..



Etiopathology of canine hypothyroidism

- The progressive destruction of thyroid follicles (and secondary fibrosis) eventually leads to a failure of thyroid hormone production
- > 70% of the thyroid tissue needs to be destroyed before changes in laboratory measures of thyroid function is seen
- This process can take months or years to cause clinical signs of hypothyroidism

Etiopathology of canine hypothyroidism

Onset of lymphocytic thyroiditis
⇩
Progressive destruction of thyroid gland
⇩
TgAA +, +/- T4AA + and T3AA +
⇩
↑ TSH, TT4 and FT4 normal
⇩
↑ TSH, ↓ TT4, ↓ FT4
⇩
Overt clinical signs
(TgAA may become -)

May take one to several years

Etiopathology of canine hypothyroidism

- Congenital hypothyroidism (cretinism)
  - Can be primary, secondary or tertiary
  - Dysgenesis of the thyroid gland (aplasia, hypoplasia, ectasia)
  - Dyshormonogenesis (lack of iodine organization)
  - Poor dietary iodine intake
  - Mutation in the TPO gene
    - Congenital hypothyroidism with goiter
    - Autosomal recessive inheritance in wire fox terriers and rat terriers
    - Genetic testing available to identify carrier

Non-thyroidal illness syndrome
(Euthyroid sick syndrome)

- Refers to changes in serum TH levels observed in sick animal in the absence of hypothalamic–pituitary–thyroid primary dysfunction
- Causes a ↓ TT4, TT3 and a ↑ rT3
  - ↓ production of T3 and T4 and ↓ degradation of rT3
- Metabolic change in sick animals
- Prevents excessive calorigenic effect of T3 in a catabolic state
- Frequent source of misdiagnosis
- Do not supplement in Levothyroxine!!!

Canine hypothyroidism: clinical features

- Myriad of clinical signs
- Dermatological signs in ~ 80% of cases
- Most organs or tissues are affected
- No clinical signs is pathognomonic
- Apparition is gradual and insidious

Canine hypothyroidism: clinical features

- Dermatological signs
  - Alopecia tail and bridge of the nose

Canine hypothyroidism: clinical features

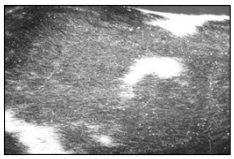
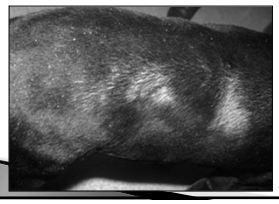
- Dermatological signs
  - Alopecia tail and bridge of the nose
  - Other areas of friction

Canine hypothyroidism: clinical features

- Dermatological signs
  - Alopecia tail and bridge of the nose
  - Other areas of friction


Canine hypothyroidism: clinical features

- Dermatological signs
  - Dry, dull and sparse hair coat
  - Scalling (dry or waxy)

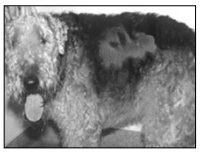




Canine hypothyroidism: clinical features

- Dermatological signs

  Complete truncal alopecia ~ never !

  … in spite of the fact that photos of hypothyroid dogs in Internal medicine textbook and in Endocrinology textbooks often look like this →

Canine hypothyroidism: clinical features

- However, simultaneous hypothyroidism and recurrent flank alopecia is possible!

Paradis M. Canine flank alopecia. *Derm Dialogue. Summer 1998 pp10-13.*

→ Concomitant hypothyroidism in 6 of 120 dogs suffering recurrent flank alopecia

Daminet S, Paradis M. Evaluation of thyroid function in dogs suffering from recurrent flank alopecia. Can Vet J 2000;41:699-703

Abstract — Thyroid function was assessed in euthyroid dogs (*n* = 20), dogs suffering from canine recurrent flank alopecia (CRFA, *n* = 18), and hypothyroid dogs (*n* = 21). Blood samples obtained from all dogs in each group were assayed for total thyroxine (TT4), thyrotropin (TSH), and thyroglobulin autoantibody (TgAA) serum concentrations. Total T4 and TSH serum concentrations were significantly decreased and increased, respectively, in the hypothyroid group compared with the other 2 groups. No significant differences in TT4 and TSH serum values were found between the euthyroid and CRFA groups. Thyroglobulin autoantibodies were detected in 10, 11.1, and 61.9% of euthyroid dogs, dogs with CRFA, and hypothyroid dogs, respectively. In conclusion, dogs suffering from CRFA have a normal thyroid function, and the determination of TT4 and TSH serum concentrations allows differentiation of these dogs from dogs with hypothyroidism, in most cases. Occasionally, the 2 diseases can be concomitant.

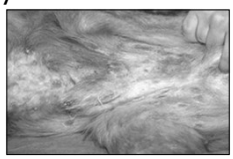
Canine hypothyroidism: clinical features

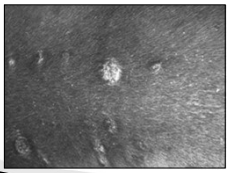
- Dermatological signs
  - Failure to regrowth hair after clipping
  - Often a fortuitous finding


5 months post-clipping for a knee surgery

Canine hypothyroidism: clinical features

- Dermatological signs
  - Secondary pyoderma
    - Reported in < 10% of cases
    - Mainly observed in severe, chronic cases






Canine hypothyroidism: clinical features

- Dermatological signs
  - Secondary pyoderma
    - Mainly observed in severe, chronic cases




Canine hypothyroidism: clinical features

- Dermatological signs
  - Chronic or recurrent otitis externa secondary to hypothyroidism~ never! (unless suffering concomitant illness such as allergy)

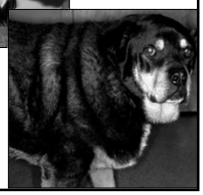
… in spite of the fact that it is frequently mentioned in the literature …

Canine hypothyroidism: clinical features

- Metabolic signs
  - Lethargy
  - Weakness, exercise intolerance, etc…
  - Bradicardia
  - ↓ body T°

Canine hypothyroidism: clinical features

- Metabolic signs
  - Obesity or weight gain (with low caloric intake)
    - Most hypothyroid dogs are not obese … and
    - Most obese dogs are not hypothyroid !

Canine hypothyroidism: clinical features

- Myxoedema (tragic look)
  - Mucin (mucopolysaccharide) accumulation in the dermis


Canine hypothyroidism: clinical features

- Myxoedema (tragic look)
  - Mucin (mucopolysaccharide) accumulation in the dermis



Hypothyroidism: clinical features

Common	Uncommon	Rare
• Dull, dry, brittle hair coat	• Truncal hypotrichosis	• Truncal alopecia
• Scaling (dry or waxy)	• Pyoderma	• Ceruminous otitis externa
• Alopecia of tail and bridge of the nose	• Facial myxedema (tragic look)	• Hypothermia
• Lack of hair regrowth post clipping	• Weakness	• Bradycardia
• Weight gain/obesity without polyphagia	• Cold intolerance	• Ocular disorders (corneal lipid deposits)
• Lethargy/mental dullness	• Exercise intolerance	• Reproductive disorders
• Non-regenerative anemia	• Hyperlipidemia (incidental finding)	• Behavior disorders
• Hypercholesterolemia		• Neurological disorders (facial nerve paralysis)
		• Myxoedema coma

J Vet Intern Med 2001;15:539-546

The Effects of Thyroid Hormones on the Skin of Beagle Dogs

K. M. Credille, M. R. Slater, K. A. Moriello, R. F. Nachreiner, K. A. Tucker, and R. W. Dunstan

Abstract
The effects of hypothyroidism on canine skin were determined by comparing morphologic, morphometric, and hair cycle differences in skin biopsy samples from 3 groups of age- and gender-matched Beagle dogs: (1) euthyroid dogs; (2) dogs made hypothyroid by administration of 131I; and (3) dogs made hypothyroid and maintained in a euthyroid state by treatment with synthetic thyroxine. After 10 months of observation, there was slower regrowth of hair 2 months after clipping in the untreated-hypothyroid dogs. Untreated-hypothyroid dogs had a greater number of follicles in telogen and fewer hair shafts (ie, a greater number of hairless telogen follicles) than did the control group. The control dogs had a greater number of telogen follicles but the same number of hair shafts as the treated-hypothyroid group. Treated-hypothyroid dogs had the greatest number of follicles in the growing stage of the hair cycle (anagen).
This study suggests that, at least in Beagles, induced hypothyroidism does not affect the pelage as dramatically as has been described in naturally occurring disease. This is because normal Beagles retain hair shafts in follicles for long periods, and the alopecia of hypothyroidism appears to evolve slowly because of the prolongation of this haired telogen stage.
The evaluation of thyroxine-treated hypothyroid dogs demonstrates that thyroid hormone supplementation of Beagle dogs with induced hypothyroidism stimulates hair growth.

→ None of the untreated hypothyroid dogs had discernable alopecia after 10 months, despite having 1/3 fewer hair shafts than healthy beagles

J Vet Intern Med 2001;15:539-546

The Effects of Thyroid Hormones on the Skin of Beagle Dogs

K. M. Credille, M. R. Slater, K. A. Moriello, R. F. Nachreiner, K. A. Tucker, and R. W. Dunstan

- 3 groups of Beagles were studied during 10 months
  - Euthyroid
  - Untreated hypothyroid
  - Treated hypothyroid
- In untreated hypothyroid beagles
  - No hair growth after trimming
  - None developed symmetrical alopecia
  - Some developed scaling
  - 2 developed alopecia over the bridge of the nose

53

J Vet Intern Med 2012;26:326–333

Reproductive Effects of Prolonged Experimentally Induced Hypothyroidism in Bitches

D.L. Panciera, B.J. Purswell, K.A. Kolster, S.R. Werre, and S.W. Trout

Background: Hypothyroidism has detrimental effects on reproduction in females of many species. Studies of hypothyroidism in bitches are limited and results conflicting.
Hypothesis: Hypothyroidism interferes with reproductive function and health of offspring in bitches.
Animals: A total of 9 healthy mixed-breed bitches (control) and 9 mixed breed bitches with hypothyroidism induced by radioactive iodine administration.
Methods: Dogs in both groups were bred 20.9 ± 4.0 and 56 ± 7.6 weeks after radioiodine administration in the hypothyroid group and again after levothyroxine was administered for 37 ± 14 weeks to hypothyroid dogs. Measures of the estrus cycle, fertility, gestation, whelping, and pup health were evaluated at each breeding. Comparisons were made between hypothyroid and control dogs as well as within groups between times.
Results: Pregnancy was documented in all dogs in both groups at the 1st breeding, 4/8 and 6/6 untreated hypothyroid and control dogs, respectively, at the 2nd breeding, and 6/6 and 5/6 treated hypothyroid and control dogs, respectively, at the 3rd breeding. Periparturient mortality was higher and birth weight was lower in pups born to untreated hypothyroid dogs compared with control dogs or treated hypothyroid dogs. There was no difference in interestrus interval, gestation duration, breeding behavior, interval between birth of pups, or serum progesterone concentrations at any breeding between or within groups. Resolution of hypothyroidism reversed the detrimental effects of thyroid hormone deficiency on reproduction.

→ Hypothyroidism causes reversible periparturient mortality and low birth weights in offspring. Further investigation is necessary to determine if fertility is affected.

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journal homepage: www.journalvetbehavior.com

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Research

The effect of thyroid replacement in dogs with suboptimal thyroid function on owner-directed aggression: A randomized, double-blind, placebo-controlled clinical trial

Nicholas H. Dodman[a,*], Linda Aronson[a], Nicole Cottam[a], Jean W. Dodds[b]

The efficacy of thyroid hormone replacement therapy (THRT) as treatment for owner-directed aggression in client-owned dogs with borderline low thyroid hormone levels was evaluated by means of a 6-week-long, parallel design, double-blind placebo-controlled study. The designation of "borderline hypothyroid" was made if the dog's free normal thyroxine (T4) value was frankly low or in the bottom 20th percentile of the normal range and either total T4, total triiodothyronine (T3), or free T3 was frankly low or in the bottom 30th percentile of the normal range. The presence of thyroid autoantibodies also qualified a dog for enrollment. Owners recorded the number of aggressive episodes directed toward family members on a daily basis for 8 weeks (2-week baseline phase and 6-week study phase). Twenty-nine dogs completed the study; 14 in a treatment group and 15 in a placebo group. The median number of aggressive episodes per day decreased significantly from baseline in both treated and placebo group dogs in weeks 1-2, 3-4, 5-6, and week 6 (treatment, χ^2 = 24.8, P < 0.001; placebo, χ^2 = 20.2, P < 0.001), however the median frequency of aggression was significantly lower in the treatment group (1.21 episodes/day) than in the placebo group (1.71 episodes/day) during week 6 of the study (χ^2 = 4.047, P = 0.044). Three thyroxine-treated dogs had borderline-low thyroid levels on the final day of the study (day 42). When aggression frequency was compared between the treatment and placebo groups after the removal of 3 thyroxine-treated dogs, the treatment group did not have a significantly lower aggression frequency than the placebo group during week 6 (Kruskal–Wallis statistic: χ^2 = 3.035, n = 26, P = 0.08). The authors discuss the role of thyroid hormones in the regulation of aggression and other cognitive issues and provide rationale for using THRT in dogs exhibiting owner-directed aggression that also have low normal or baseline thyroid hormone levels.

→ The benefits, if any, of using thyroid hormone to treat aggression and other behavior disorders remain to be proven

Journal of Veterinary Internal Medicine

Open Access

J Vet Intern Med 2015;29:141–149

The Role of Hypothyroidism in the Etiology and Progression of Dilated Cardiomyopathy in Doberman Pinschers

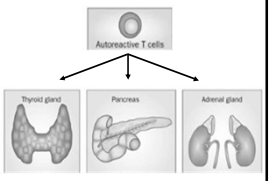
P. Beier, S. Reese, P.J. Holler, J. Simak, G. Tater, and G. Wess

Background: Hypothyroidism and dilated cardiomyopathy (DCM) are both common diseases in Doberman Pinschers. A possible influence of hypothyroidism on the etiology and progression of DCM is controversial.
Objectives: Evaluation of the role of hypothyroidism in etiology and progression of DCM.
Animals: A total of 175 Doberman Pinschers.
Methods: In this longitudinal prospective study, echocardiography and 24-hour ambulatory ECG recordings were performed in all dogs as screening tests for DCM. Total thyroxine (TT_4) and thyroid ultrasonography served as initial screening tests for hypothyroidism and low TT_4 values were followed up by a thyroid stimulating hormone (TSH) test or free total thyroxine (fT_4)/cTSH measurements. Additionally, a follow-up study of dogs affected by both DCM and hypothyroidism under optimal treatment for hypothyroidism was conducted.
Results: A total of 107 dogs were healthy, 45 dogs had DCM, 11 hypothyroidism, and 12 dogs had both DCM and hypothyroidism. TT_4 values as well as the thyroid volumes were equivalent in the healthy dogs and in those with DCM. Neither ventricular premature complexes nor echocardiographic parameters differed between healthy and hypothyroid dogs. Dogs with DCM had a 2.26-fold ($CI_{0.95}$ = 1.1–4.8) higher risk of also being affected by hypothyroidism. Despite optimal thyroid treatment of dogs with hypothyroidism and DCM, there was a progression of the heart disease.

→ This study did not confirm the role of hypothyroidism in the etiology or progression of DCM. Treatment of hypothyroidism did not improve the outcome.

Canine hypothyroidism: clinical features

- Auto-immune polyglandular syndrome (Schmidt syndrome in humans)
  - Hypothyroidism + hypoadrenocorticism
  - Hypothyroidism + diabetes mellitus
  - Different from "euthyroid sick syndrome"



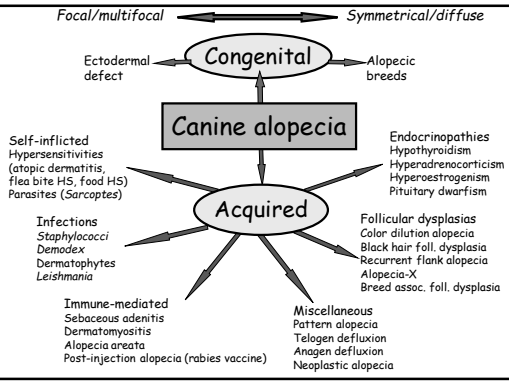
Target organs

Canine hypothyroidism: clinical features

- Congenital hypothyroidism
  - Disproportionate dwarfism
    - Affected puppies have shorter limbs and shorter, broader heads than their littermates
  - Delayed skeletal maturation
  - Mental retardation (cretinism)
  - Affected puppies retain their coats and show the same dermatologic findings as adult hypothyroid dogs
  - Goiter in some dogs (Fox terrier)

Canine hypothyroidism: Differential diagnosis

- Most non-inflammatory alopecias (« Hair cycle arrest »)
  - Endocrinopathies
  - Follicular dysplasias
  - Pattern alopecia
  - Telogen defluxion
- Anagen defluxion
- Sebaceous adenitis



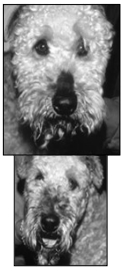
Tail alopecia


Hypothyroidism Hyperadrenocortism Alopecia X

Alopecia on the bridge of the nose


Hypothyroidism


Alopecia and melano-derma of Yorkshire T.

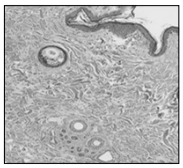

CRFA (rare)

Alopecia on the bridge of the nose

Alopecia X

Canine hypothyroidism: diagnosis

- Nonspecific laboratory findings
  - Hemogram
    - Non-regenerative anemia: ~30% of cases
  - Biochemical panel
    - Fasting hypercholesterolemia in ~75% of cases often with hypertriglyceridemia
  - Skin biopsy
    - Non-specific changes of endocrinopathies
    - Dermal mucinosis in presence of myxedema
    - Useful to differentiate from some follicular dysplasias and sebaceous adenitis



Biological exploration of thyroid function

Baseline serum hormones
- Total thyroxine (TT4)
- Free thyroxine (FT4)
- Total triiodothyronine (TT3)
- Free triiodothyronine (FT3)
- Reverse T3 (rT3)
- Endogenous canine TSH (cTSH)

Dynamic tests
- TSH stimulation test
- TRH stimulation test

Miscellaneous
- Thyroglobulin autoantibodies (TgAA)
- TH autoantibodies (T4AA & T3AA)
- Thyroid biopsy
- Thyroid scintigraphy
- Thyroid ultrasound

Total thyroxine (TT4)

- TT4 = FT4 + protein-bound T4
- Commonly measured
- Significant overlap between hypothyroid and euthyroid dogs
  - Diagnostic errors in ~20-30% ?
- Often ↓ following certain drugs or NTI
- Declines with age
- Lower reference range in Sighthounds
  - Greyhound, Scottish Deerhound, Salukis, Afghan hounds, Whippets, Borzois, etc.
- Must be validated for dogs

Total thyroxine (TT4)

- May decreases with:
  - Drugs
    - Sulfa-trimethoprim (dermatologic dose), Phenobarbital
    - Glucocorticoids, Clomipramine, Aspirin
  - Non-thyroidal illnesses (NTI)
    - Renal, Cardiac and Hepatic failures, Hyperadrenocorticism, Diabetes mellitus, Neoplasm, Pyoderma

Total thyroxine (TT4)

- Before measuring TT4:
  - Avoid glucocorticoid excess (endogenous or exogenous)
  - Avoid drugs or NTI known to influence TT4
  - Age of the dog?
  - Compatible clinical signs?

Total thyroxine (TT4)

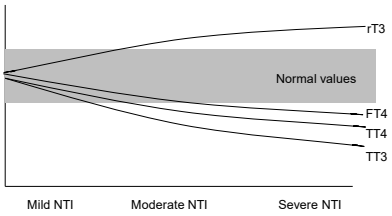
- Interpretation:
  - > 99 % of dogs with a TT4 > 15 nmol/L are euthyroid
  - > 95 % of dogs with a TT4 < 5 nmol/L are hypothyroid
  - TT4 between 5-15 nmol/L = Grey zone

(example of reference values: ~ 15-45 nmol/L)

Free thyroxine (FT4)

- FT4 = active fraction, unbound to proteins
- < 1% of TT4
- Less overlap between euthyroid and hypothyroid dogs (?)
- Less influenced by drugs and NTI
- Preferably measured by equilibrium dialysis
  - Diagnostic precision > TT4 (in a small % of cases)
  - Not affected by T4AA
  - $$$
- Usefulness similar toTT4 if FT4 is measure by other techniques

Effect of non-thyroidal illness (NTI) on thyroid function



Endogenous canine TSH (cTSH)

- Commercial cTSH assays since 1995
- Poor specificity and sensitivity
  - Remains within normal in ~25% of Hypothyroid dogs
  - ↑ into hypothyroid zone in ~10% of Euthyroid dogs
- Reference values ~ 0.02 to 0.6 ng/ml
- Always combine with TT4 or FT4

Thyroglobulin autoantibodies (TgAA)

- Positive in ~ 50-60% of hypothyroid dogs (~ 3% of euthyroid dogs)
  - TgAA may become negative after thyroid glands are destroyed
- TgAA strongly suggest the presence of an auto-immune lymphocytic thyroiditis but not necessarily hypothyroidism
  - It requires at least 75% of thyroid gland destruction for clinical signs
- Use for screening breeding stock
  - Breeds with hereditary predisposition for lymphocytic thyroiditis
  - OFA certification: FT4 (ed), TgAA and cTSH

Current recommendations

- Before testing, make sure that:
  - Compatible clinical signs ?
  - At least 2-year-old ?
  - Systemic illnesses ?
  - Drugs : glucocorticoids, sulfas, phenobarbital, clomipramine?
- Postpone testing after resolution of the systemic illness or withdrawal of the drug, if possible
- Use a Veterinary diagnostic laboratory that use canine kit and that has established reference values

Current recommendations

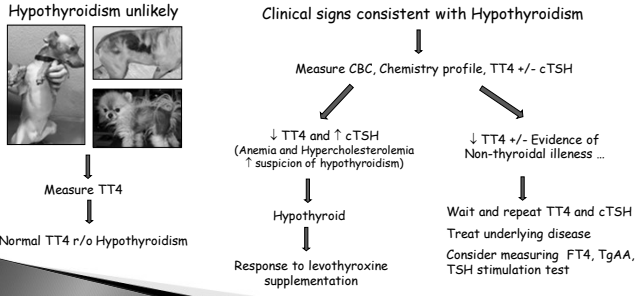
- In humans, TSH is often use as screening and diagnostic accuracy is ~ 100% with combined measurements of TSH and FT4
- In dogs, no perfect test available and recommendations depend on availability of tests and reasons for testing
  - TT4 +/- cTSH
  - FT4 by equilibrium dialysis
  - TT4 or FT4 + TgAA
  - Thyroid (7 parameters) profile (Michigan state University VDL)
  - CBC and biochemistry profile including fasting cholesterol
  - TSH stimulation test
  - OFA certification: FT4 (ED) + cTSH + TgAA…

Current recommendations

- Reasons for testing:
  - Suggestive C/S, but hypothyroidism unlikely
    - Screening with TT4: rules out hypothyroidism if WNL
  - Suggestive C/S and hypothyroidism probable
    - TT4 + cTSH + CBC and Chemistry profile
  - Screening and OFA certification for breeding stock
    - FT4, cTSH and TgAA

* Always interpret results carefully and with a healthy dose of skepticism!

Algorithm for hypothyroid testing



Canine hypothyroidism: diagnosis

- Definitive diagnosis is confirmed with a combination of:
  1. Compatible clinical signs
  2. Thyroid test results compatible with hypothyroidism
     - p.e.j., very low T4T and elevated cTSH (in absence of NTI)
  3. Response to treatment
     - Very important to make sure the dog is truly hypothyroid
     - Return of mental and physical activity within 2 weeks of starting levothyroxine supplementation usually confirms the diagnosis

Canine hypothyroidism: Treatment

- Levothyroxine
  - Starting dose: **20-22 µg/kg** (or 500 µg/m^2) **q12-24h**
  - After 4-6 weeks or when all C/S have resolved:
    - 4-6 hours post-pill TT4 concentration
    - Aim for high end of reference values
  - Maintenance dose: **20-22 µg/kg** (or 500 µg/m^2) **q24h** for the majority of dogs
  - Co-ingestion with food may cause decrease absorption
  - Try to administer at consistent time

Canine hypothyroidism: Treatment

- Yearly recheck and TT4 measurement (?)
- Monitoring with FT4(ed) or cTSH ?
  - More expensive and no real benefit
- Thyrotoxicosis is rare in dogs
  - Pu/Pd, weight loss, panting, nervousness, tachycardia

Canine hypothyroidism: Take home message

- Clinical hypothyroidism almost never seen before 2-3 years of age
- Does not cause severe trunk alopecia or chronic otitis
- When monitoring with TT4, always verify if and when levothyroxine was administered
- Avoid supplementing dogs with "Euthyroid sick syndrome (NTI)"
- Most dogs are well control with q24h levothyroxine administration

Canine hypothyroidism

The end