Thyroid diseases in cats and dogs Anno 2023

Sylvie Daminet

PhD, DACVIM, DECVIM-CA

Ghent University

Belgium

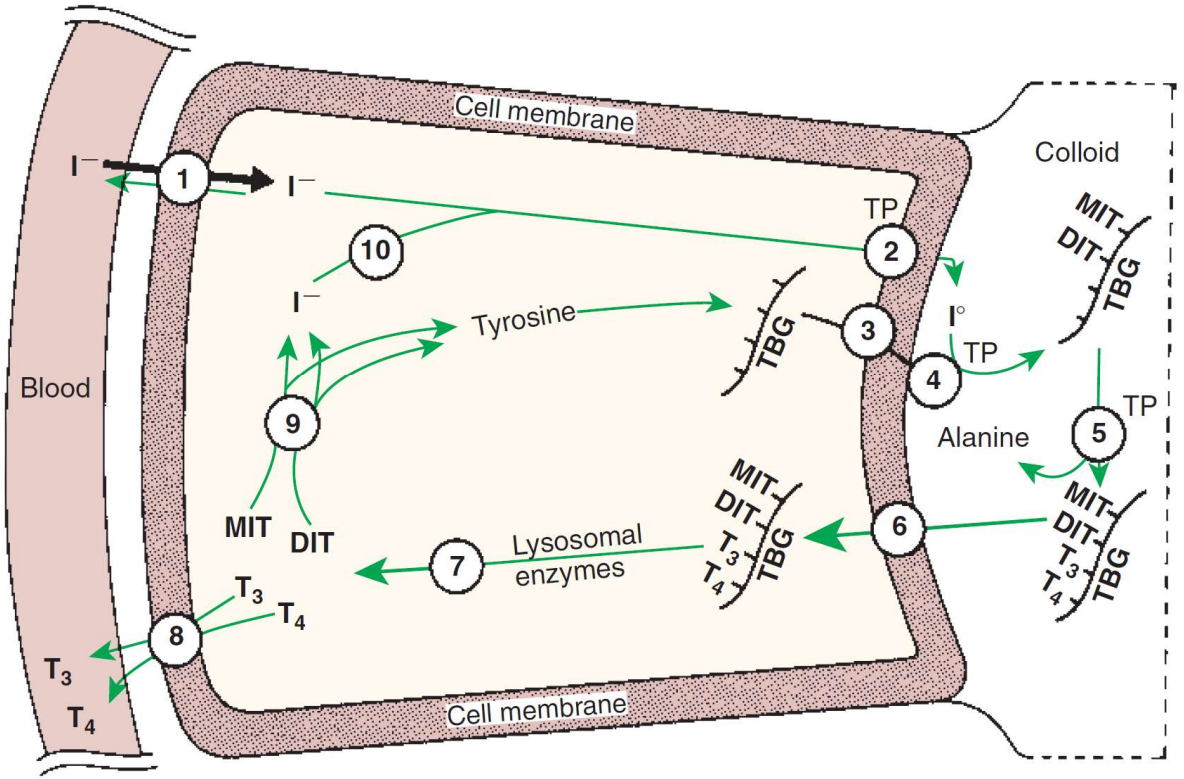


FIGURE 34-3 Depiction of follicular cell showing steps in the synthesis and release of triiodothyronine *(T_3)* and thyronine *(T_4).* The numbers identify the major steps: *1,* trapping of iodide; *2,* oxidation of iodide; *3,* exocytosis of thyroglobulin; *4,* iodination of thyroglobulin; *5,* coupling of iodotyrosines; *6,* endocytosis of thyroglobulin; *7,* hydrolysis of thyroglobulin; *8,* release of T_3 and T_4; *9,* deiodination of monoiodotyrosine *(MIT)* and diiodotyrosine *(DIT);* and 10, recycling of iodide. *TBG,* Thyroxine-binding globulin; *TP,* thyroperoxidase. (From Hedge GA, Colby HD, Goodman RL: *Clinical endocrine physiology,* Philadelphia, 1987, Saunders.)

Cunningham Veterinary Physiology

Fig. 632. — Goitre exophtalmique.

Weight loss, poor hair coat

Acute blindness

Increased liver enzymes

Palpable cervical nodule(s)

Tachycardic

Systolic heartmurmur

Increased T4

Vomiting

Hyperactive, PU/PD, weight loss

Senior cats with weight loss
Mean age 13 years (6-25)

PUPD, polyphagia

Vomiting
Diarrhea

Acute blindness

Palpable cervical nodule

Tachycardia
Heart murmur

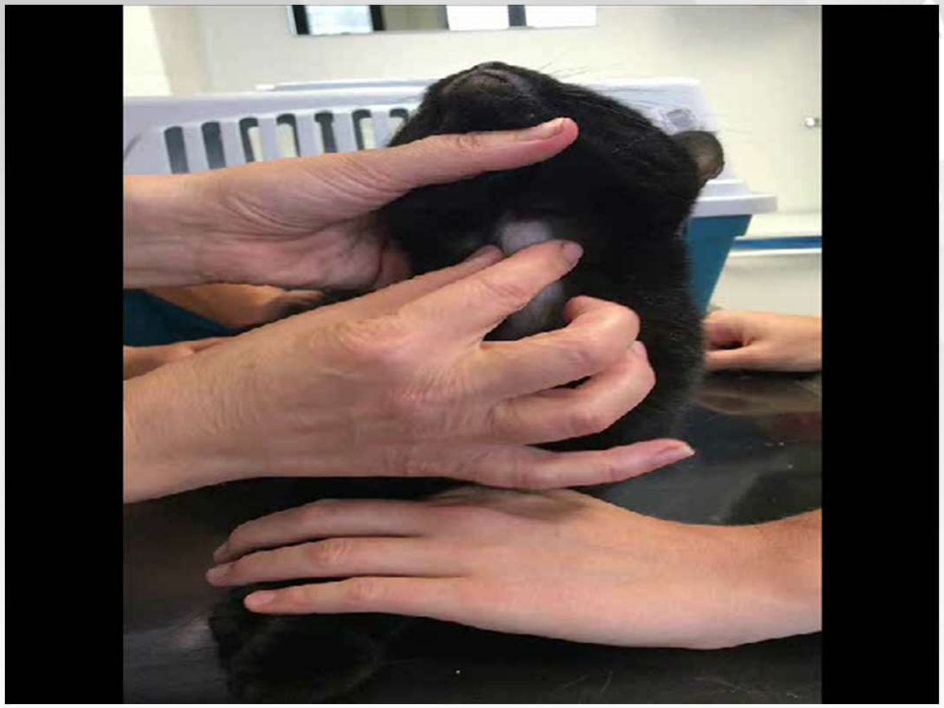
Tachypnea, panting

Increased liver enzymes

CKD frequent

Behavioral changes

Cervical palpation



90 % have palpable nodule(s)

70 % bilateral

20 % ectopic (neck or thorax)

Muis, DSH, 10 years, 4,9 kg

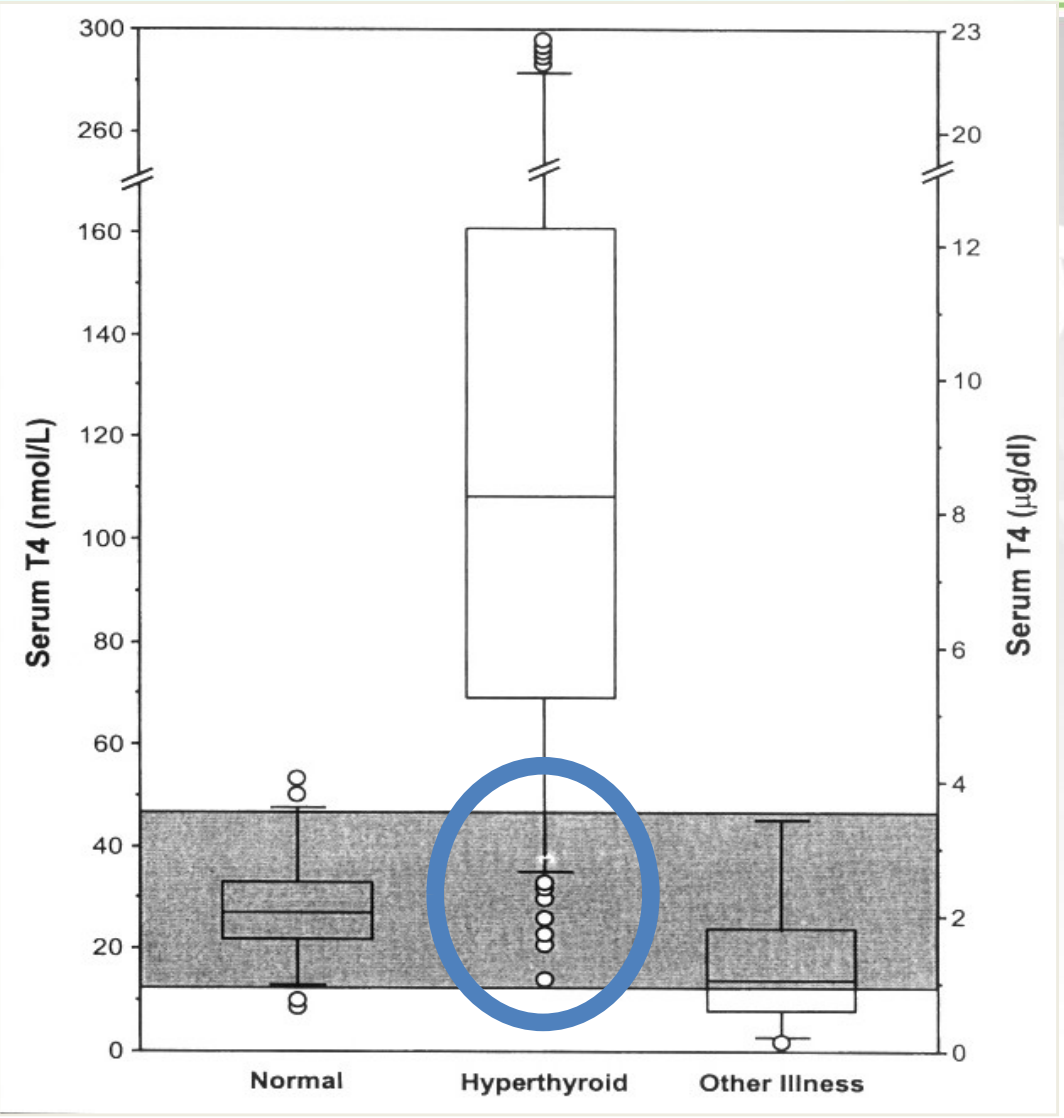
- Obesity (BCS 7/9)
- Weight loss noticed by ref. vet. during annual health check (200 g)
- Small thyroid nodule
- TT4 3,7 (0,8-3,5) µg/dl
- TT4 47 (10,3-45) nmol/L
- Is this patient hyperthyroid ?

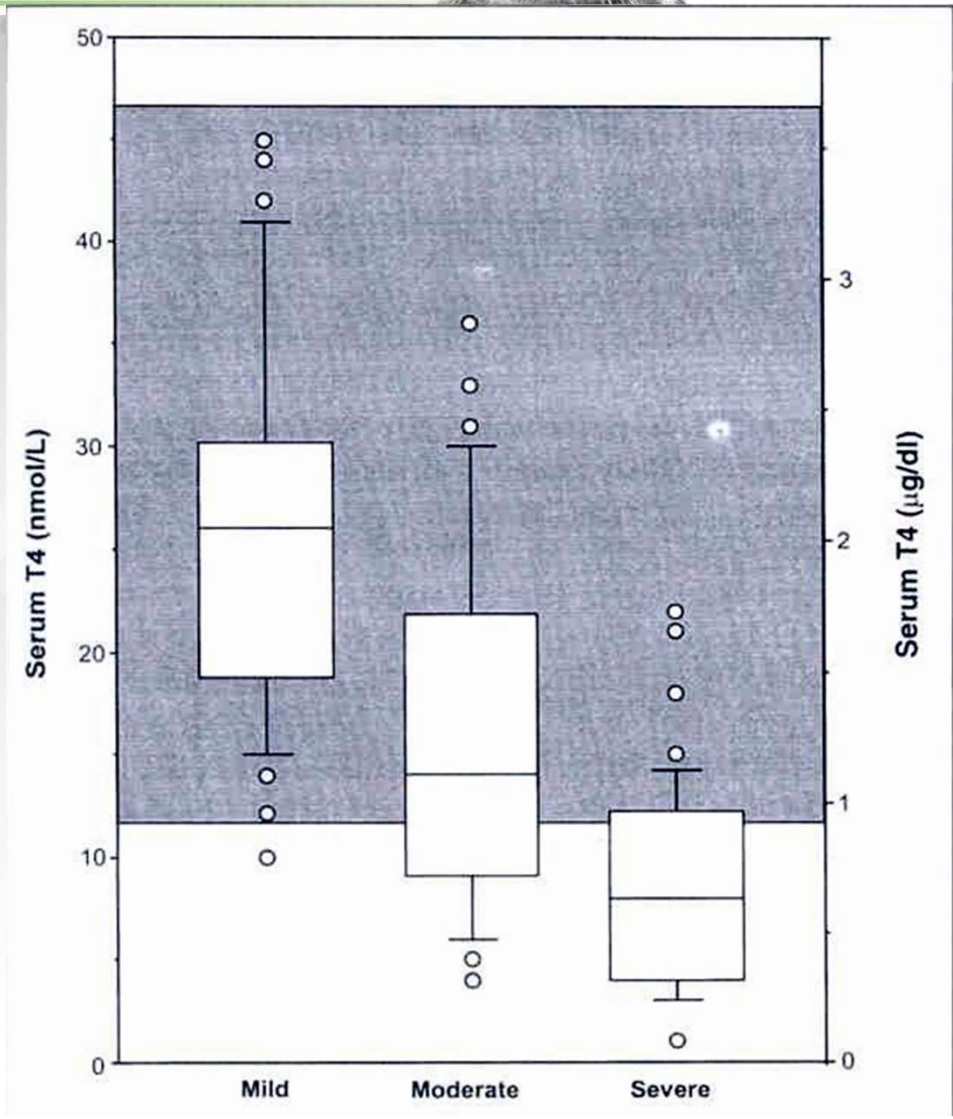
left	right	mm	score
n.p.	n.p.	0	0
			1
			2
			3
			4
			5
			6

Boretti et al., 2009; Paepe et al., 2008

- Palpation is reliable
- The larger the nodule, the higher the chance to be hyperthyroid
- If nodule ≤ 3 and many clinical signs → probably ectopic
- Also important in follow-up of treated cats
- A euthyroid cat with a small nodule has an increased chance of becoming hyperthyroid

Total thyroxine (TT4)

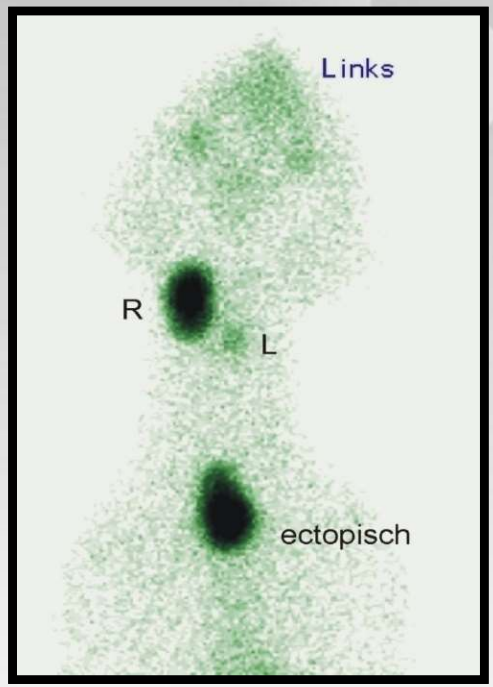


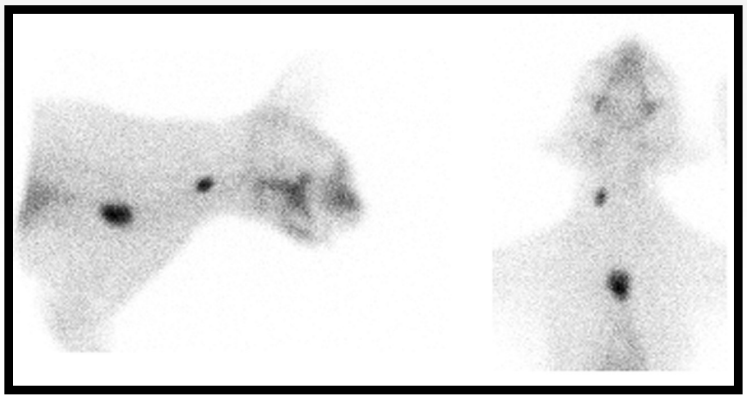


Peterson *et al.*, 2001

Thyroid tests available

- TT4
- FT4
- cTSH
- Scintigraphy





Original Article

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2015, Vol. 17(6) 537–542

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jfms.com
SAGE

Concurrent diseases in hyperthyroid cats undergoing assessment prior to radioiodine treatment

Jordi Puig[1], Isabelle Cattin[2] and Mayank Seth[1]

Non azotemic hyperT4 cats referred for I131
Thought to be otherwise healthy by referring vet
18% concurrent disease !
Especially GI lymphoma and IBD
Need for careful and individual assessement prior to I131

Abstract

Hyperthyroidism
retrospective st
for radioiodine
cats were inclu
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for all hyperthyr

This
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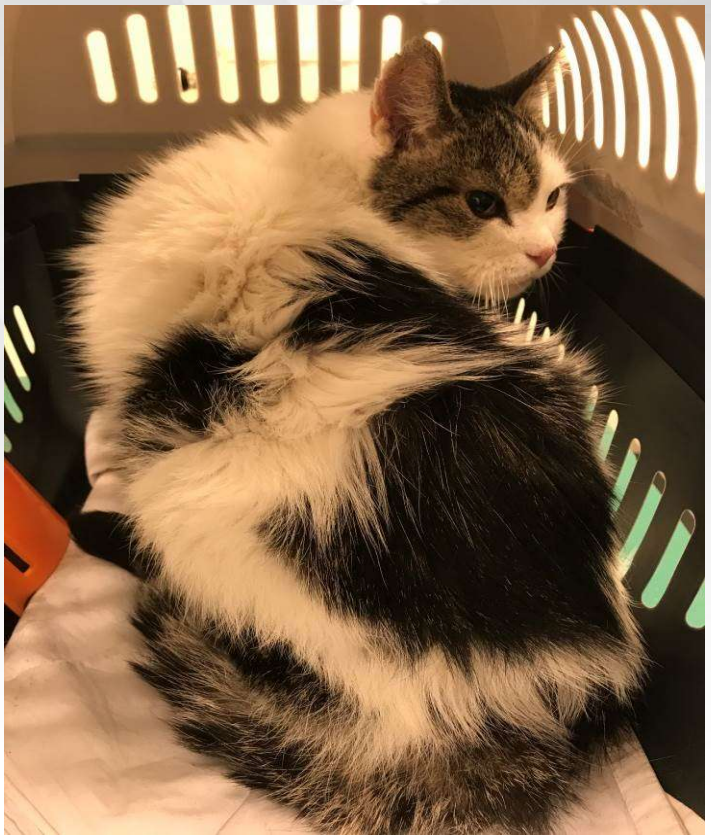
Hyperthyroid cats with lethargy and hyporexia



Tikiwi, 17 years, 1,6 kg, BCS 2/9

Hyperthyroid cat treated for 4 years
Fixed cervical mass
Anorexia and regurgitation

Mass 5x4 cm (also cyst)

! Renal function

! Under-treatment

! Over-treatment

Iatrogenic Hypothyroidism

Therapy

- Anti-thyroid
- Nutrition
- Thyroidectomy
- Radioactive iodine

Reversible

Irreversible

Stabilize before !

Monitoring

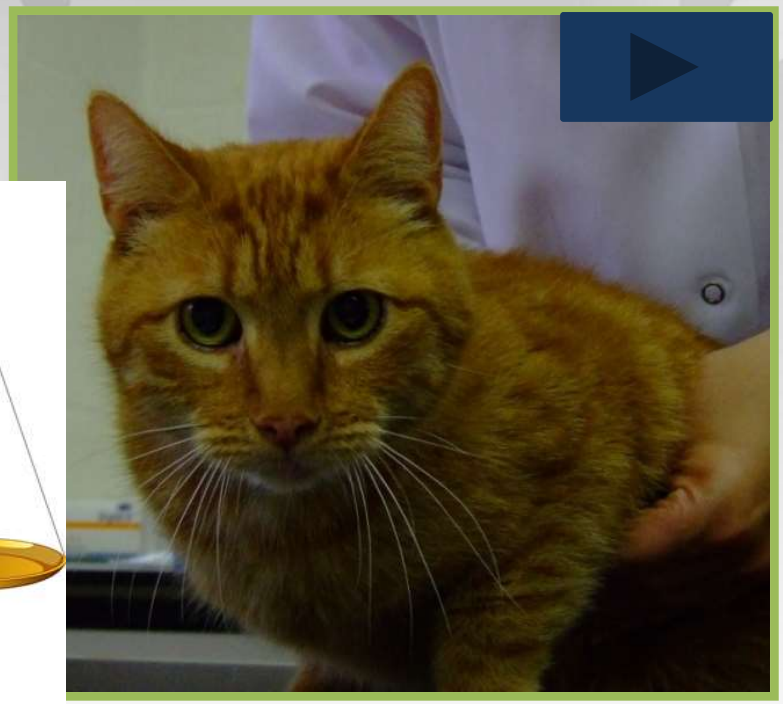
TABLE 14.5. Monitoring of hyperthyroid cats treated with antithyroid drugs. ××: recommended; ×: optional; –: if adverse event suspected or if inadequate resolution of clinical signs.

	Pre-treatment	2 to 3 weeks after the start of antithyroid drugs First check	1 month later (if euthyroid at previous test)*	3 months later (if euthyroid at previous test)*	Every 6 months (once stable)
History	××	××	××	××	××
Physical examination	××	××	××	××	××
Body weight, muscle and body condition score	××	××	××	××	××
Total T_4	××	××	×	××	××
Complete blood count (CBC)	××	–	–	–	–
Full biochemistry profile	××	–	–	–	–
Liver profile	××	×	×	×	×
Renal profile	××	××	××	××	××
Urinalysis (USG, dipstick, sediment, culture)	××				
Blood pressure (ideally, and/or ophthalmic examination	××	××	××	××	××

* If not euthyroid, then the dose of antithyroid drugs should be adjusted and the T_4 checked every 3 weeks until the target value (T_4 concentration in half of reference interval) is reached.

Daminet et al 2014, 2019

Hyperthyroidism and CKD



Renal function in hyperthyroidism

- Hyperthyroidism
  1) ↑ GFR → ↓ Cr → Cr under estimated
  2) Muscular mass ↓ → Cr under estimated
  3) Impaired conversion creatine to creatinine → Cr under estimated

- Treatment of hyperthyroidism → 'normalisation' of RBF, GFR and therefore Cr (↑)
  - Often without consequences …
  - Sometimes CKD is 'unmasked'
  - If already azotemic → worsens

Hyperthyroidism WITH azotemia
2 different scenarios

Initially	Prognosis	Treatment	Remark
Both are present when diagnosis of hyperT4 is made	Guarded	CKD IRIS guidelines Try treating hyperT4 with reversible treatment	Assess global effect on the cat Monitor (weight, creatinine, BP, etc…)
Mild post-treatment azotemia	Unchanged	Hyperthyroidism: yes ! CKD IRIS guidelines	Usually mild azotemia (IRIS 2) Avoid iatrogenic hypothyroidism Do not decrease therapy to restore normal creatinine

Prognosis ?

When to monitor ?

When to intervene for IH ?

SDMA in hyperthyroidism ?

Assessment of symmetric dimethylarginine as a biomarker of renal function in hyperthyroid cats treated with radioiodine

Eva Buresova[1] | Emmelie Stock[2] | Dominique Paepe[1] | Lisa Stammeleer[1] | Eva Vandermeulen[2] | Pascale Smets[1] | Luc Duchateau[3] | Herve P. Lefebvre[4] | Sylvie Daminet[1]

- n=47 non azotemic hyperthyroid cats + ^{131}I
- T0 and 1 month
- n=10 also GFR
- Correlation between GFR and SDMA was moderate

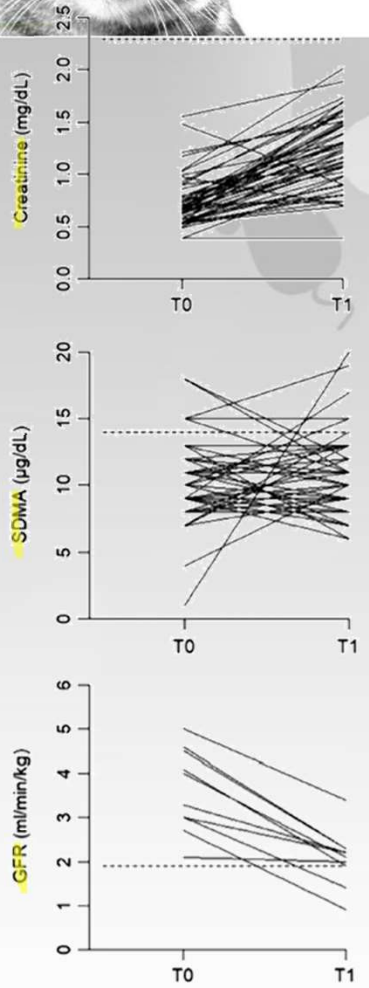


FIGURE 1 Serum creatinine, serum SDMA, and GFR before (T0) and 1 month after (T1) radioiodine treatment. Dotted lines show upper limit of reference interval for SDMA and creatinine and borderline low cutoff value for GFR. GFR, glomerular filtration rate; SDMA, symmetric dimethylarginine

Measuring endogeneous TSH?

- Human medicine
  - TSH often used as first line screening
  - assay more sensitive
- TSH in cats
  - Commercial feline kit not available (96% homology with canine TSH)
  - Helps in detection of iatrogenic or congenital hypothyroidism
  - Peterson et al. JVIM 2015:
    - 98% of hyperthyroid cats have suppressed TSH
    - 70 % euthyroid cats have detectable TSH
    - very sensitive, but not specific

Role is more important in detection of iatrogenic hypothyroidism

If used; always with TT4

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ACVIM American College of Veterinary Internal Medicine

STANDARD ARTICLE

Association of recessive c.430G>A (p.(Gly144Arg)) thyroid peroxidase variant with primary congenital hypothyroidism in cats

Mario Van Poucke[1] | Emilie Van Renterghem[2] | Mark E. Peterson[3] | Marit F. van den Berg[2] | Emmelie Stock[4] | Luc J. Peelman[1] | Sylvie Daminet[2]

[1]Department of Veterinary and Biosciences, Faculty of Veterinary Medicine, Ghent University, Merelbeke, Belgium
[2]Department of Small Animals, Faculty of Veterinary Medicine, Ghent University, Merelbeke, Belgium
[3]Animal Endocrine Clinic, New York, New York, USA
[4]Department of Morphology, Imaging, Orthopedics, Rehabilitation and Nutrition, Faculty of Veterinary Medicine, Ghent University, Merelbeke, Belgium

Correspondence
Sylvie Daminet, Department of Small Animals, Faculty of Veterinary Medicine, Ghent University, Salisburylaan 133, B-9820 Merelbeke, Belgium.
Email: sylvie.daminet@ugent.be

Abstract

Background: Primary congenital hypothyroidism (CH) is a rare endocrine disorder in cats with a largely unknown genetic cause.

Objectives: Describe the clinical presentation of CH in 11 affected cats and identify the causal genetic variant.

Animals: Eleven CH-cats from 10 unrelated families, 11 CH-free family members, 21 unrelated CH-free cats, and 155 unrelated nondiagnosed cats from different breeds.

Methods: Case control study of CH-cats and their siblings (2019-2021). Diagnosis was based on low to low-normal serum thyroxine (T4) concentrations, high thyroid-stimulating hormone (TSH) concentrations and clinical signs compatible with CH. We identified the causal variant using Sanger sequencing, genotyping via PCR-RFLP and variant interpretation using A

Results: All CH-cats (5 weeks
not palpable in all. Thyroid sc
high uptake by thyroid glands
mally low uptake, compatible
dase (TPO). All cases were ho
(p.(Gly144Arg)), while none o
erozygous for this recessive
estimated allele frequency of

Conclusions and Clinical Imp
TSH and abnormally low to l
cats. All cases had dyshormo
novel *TPO* missense variant (not described in humans) causes CH in cats and awareness of it can assist in diagnosis and breeding.

FIGURE 3 Pictures of kittens with primary CH. Notice clear disproportionate dwarfism in case 4 (right) with a large, broad head, small ears, a round body, a short neck and short limbs, compared to the more subtle changes in case 1 (left)

Conclusions and Clinical Importance: Disproportionate dwarfism, abnormally high TSH and abnormally low to low-normal T4 concentrations are diagnostic for CH in cats. All cases had dyshormonogenesis demonstrated by thyroid scintigraphy. This novel *TPO* missense variant (not described in humans) causes CH in cats and awareness of it can assist in diagnosis and breeding.

Before treatment

After treatment

TT4: 7 nmol/L

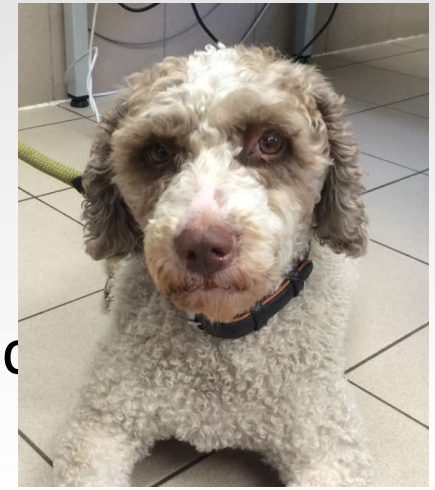
TSH: 1.2 ng/ml

Monitoring: clinical signs resolve + T4 (No TSH)
Standardise meal and timing blood sampling

Clinical response

- Activity level: 7 days
- Weight loss: 2-4 weeks
- Anemia: 2-4 weeks
- Dermato: 2-4 months
- Neuro: 2-3 months

Should be SPECTACULAR



- Thyrotoxicosis?
  - Not frequent
  - Careful with hepatic or renal insufficienc

Hormonal – monitoring - TT4

- Major individual variation of L-thyroxine absorption → TT4 should be followed
- When ?
  - After ± 1 month
  - After stabilization: 2 x /year
  - 2 à 4 h after administration of L-thyroxine (peak)
  - Administer L-thyroxine: always with or without food
  - Standardize timing of blood sampling

Standardize

Dermatological changes,...

- Slow hair growth after shaving,...
- Low TT4 and high TSH

Total T4
TSH
Free T4
TGAA, anti-T4, anti-T3 Ab
TSH stimulation test
Scintigraphy

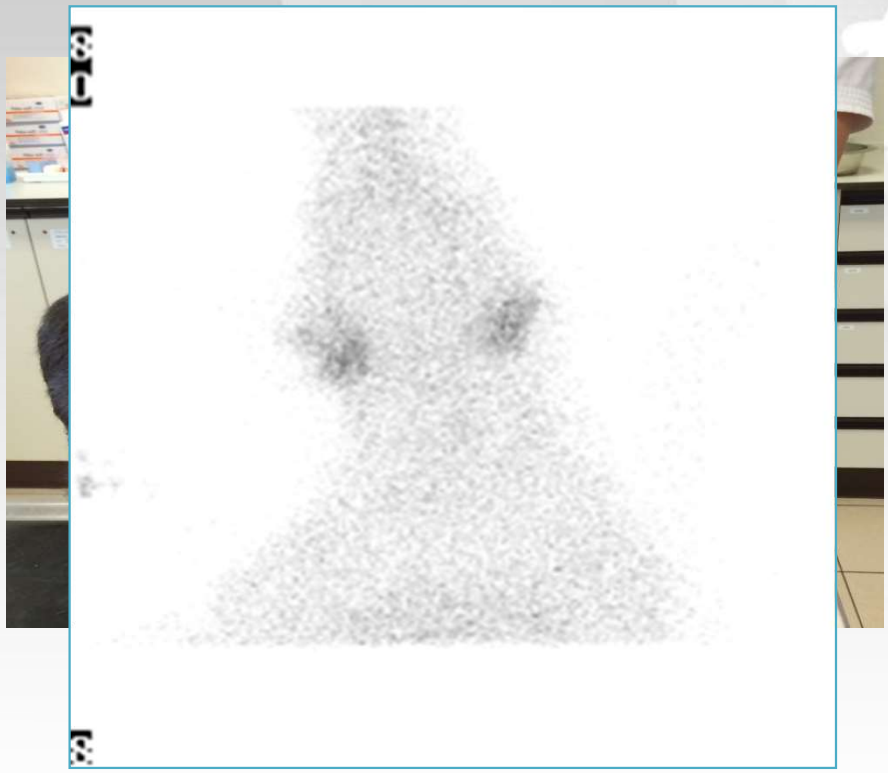
- Physiologic factors (breed: sighthounds!)
- Systemic non thyroidal illness (disease → low T4)
- Medication (influence on T4 and sometimes TSH)

Venice, Mini Schnauzer MC 12 years

- Epilepsy since 1 year; pexion since last 2 months (clusters)
- More quiet, now restlessness
- PCV 27 %
- TT4 <6,45 nmol/l (6,45-43)
- TSH 0.04 ng/ml (<0.5)

Low T4, without increased TSH = frustration !

Venice, Mini Schnauzer MC 12 years



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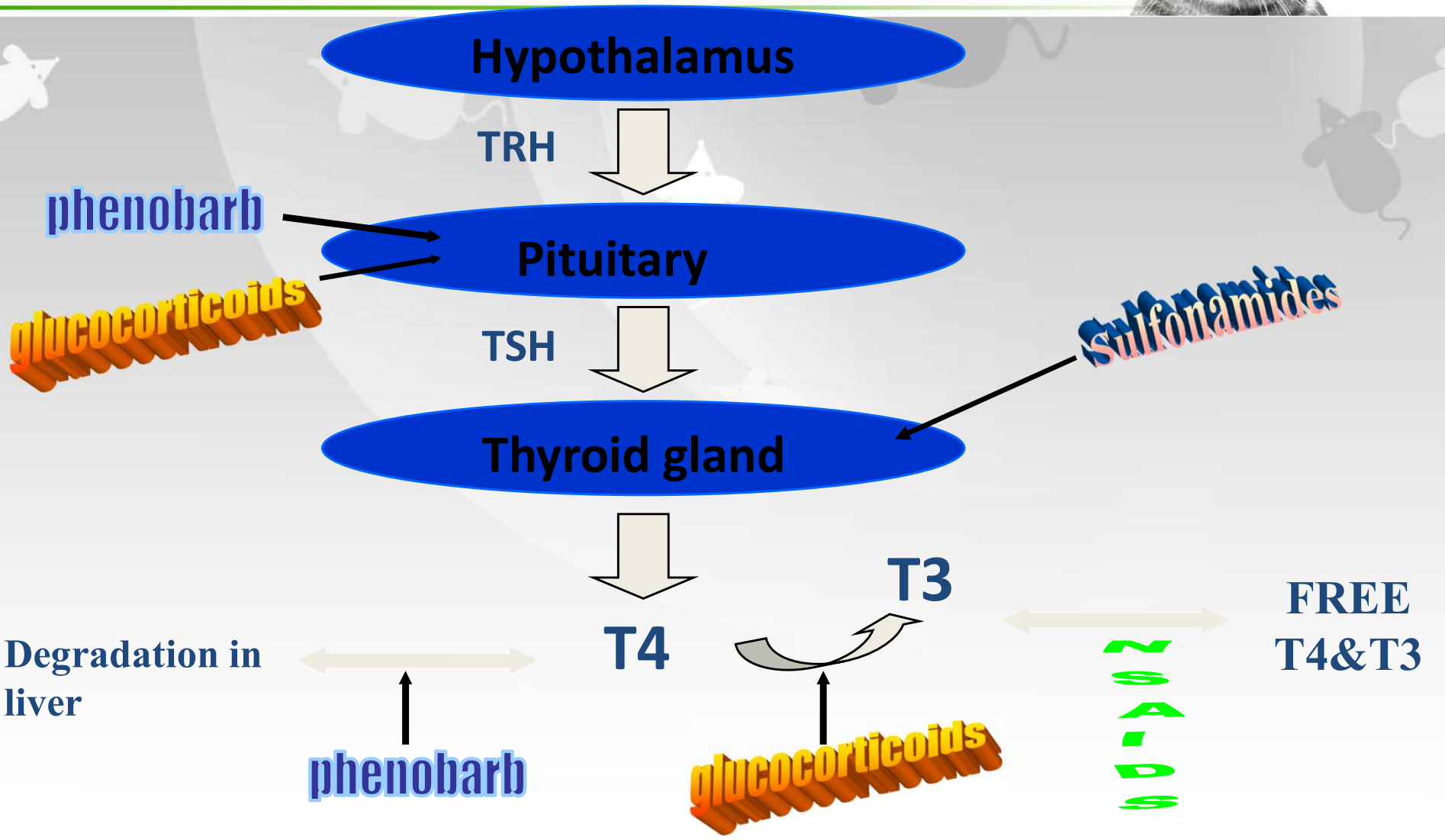
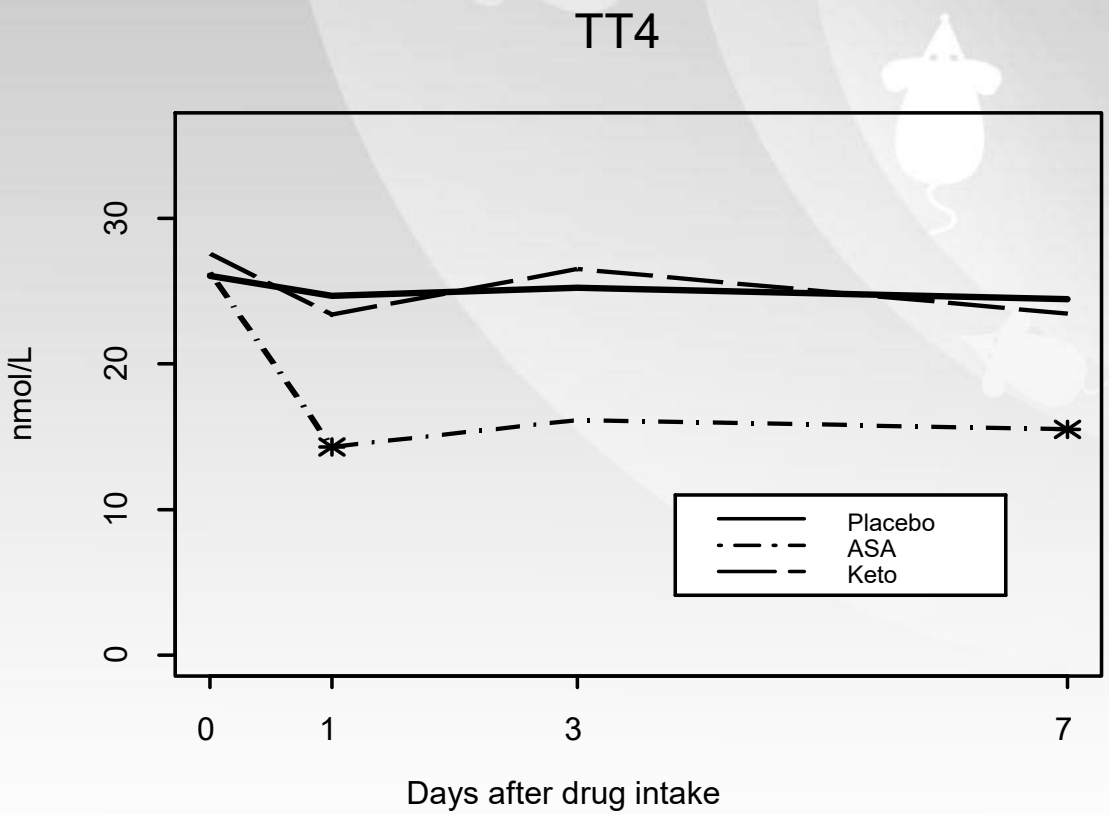
Influence of drugs



Aspirine and ketoprofen



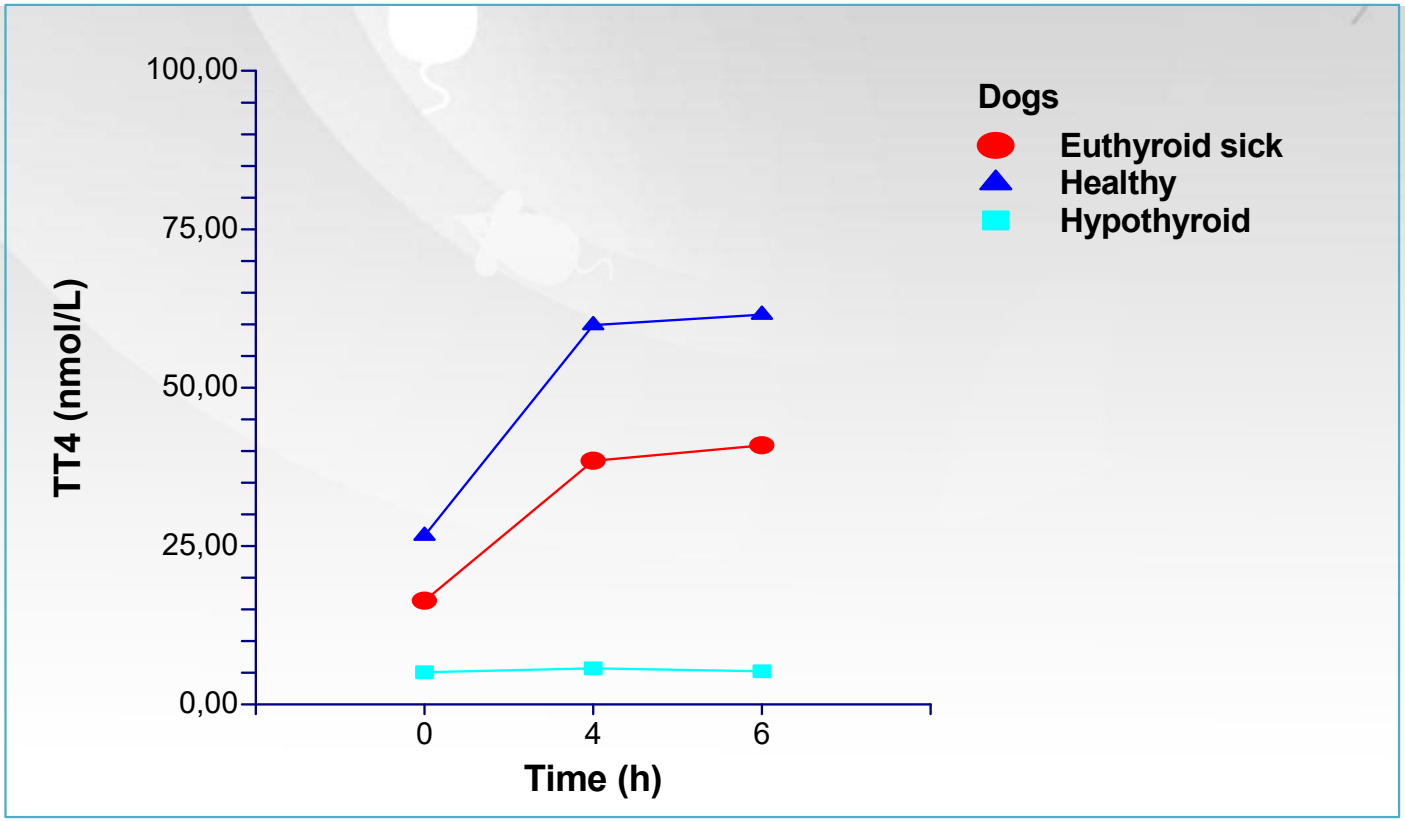
Daminet et al., Vet J, 2003

	TT4	FT4	TSH	TSH Stim
GC (↑)	↓	↓	=	↓
KBr	=	=	=	=
Feno	↓	= or ↓	= of ↑	NS
TMS	↓	↓	↑	↓
Propranolol	=	=	=	=
Carprofen	= or ↓	= (or ↓)	= or ↓	NS
ASA	↓	=	=	NS
Meloxicam	=	=	=	NS
Ketoprofen	=	=	=	NS
Etodolac	=	=	=	NS
Clomipramine	↓	↓	=	NS

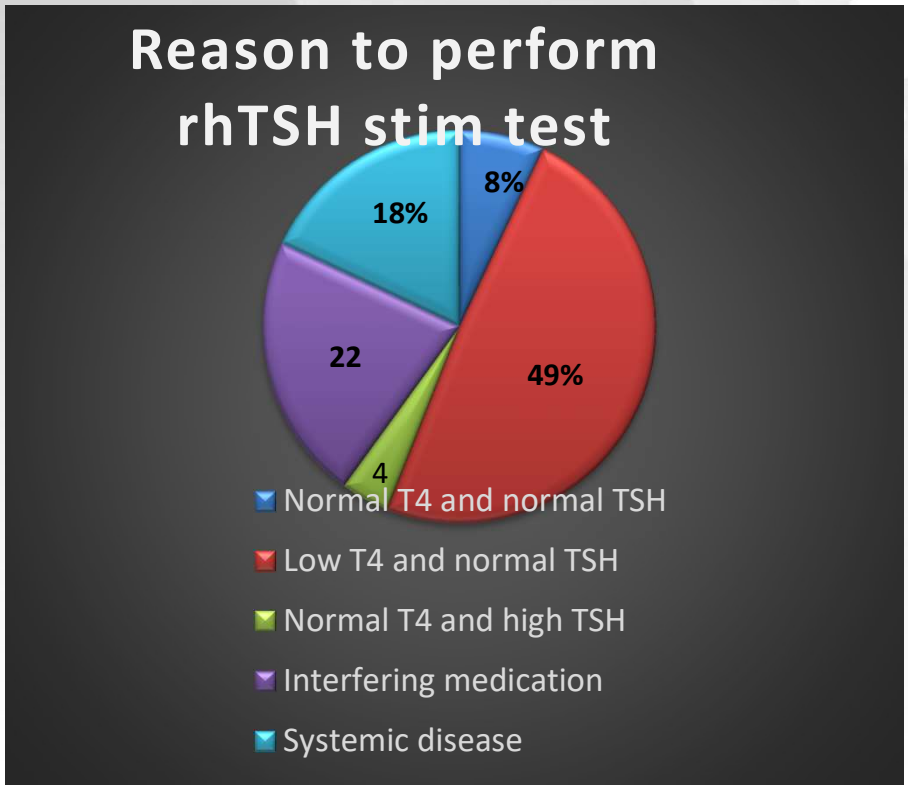
Use of recombinant human thyroid-stimulating hormone for thyrotropin stimulation test in healthy, hypothyroid and euthyroid sick dogs

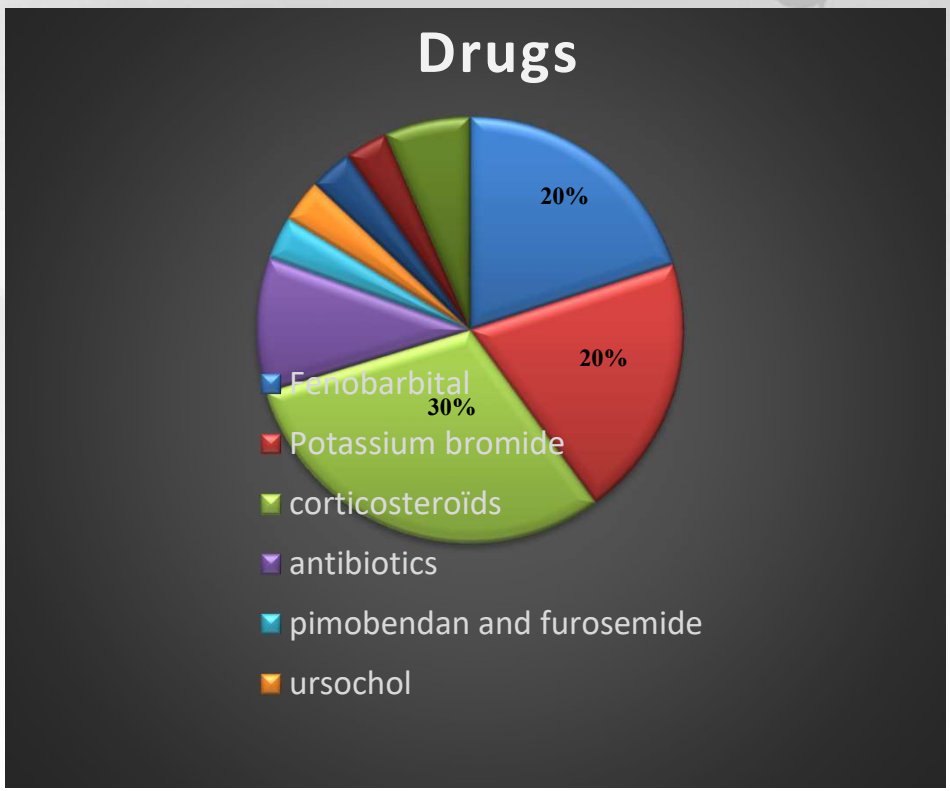
Can Vet J 2007;48:1273–1279

Sylvie Daminet, Lyanne Fifle, Manon Paradis, Luc Duchateau, Maxim Morea



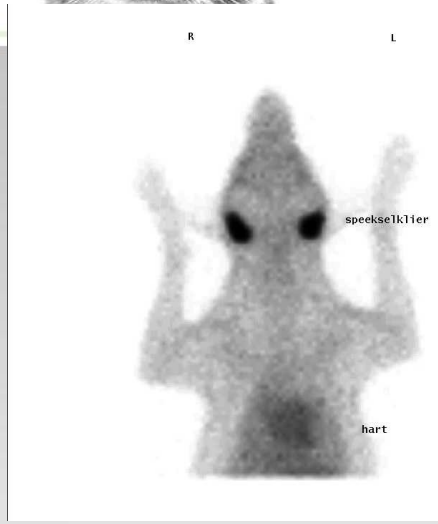
Retrospective study – Use of rhTSH - Results





Missault Astrid et al.

Thyroid scintigraphy



- Reliable

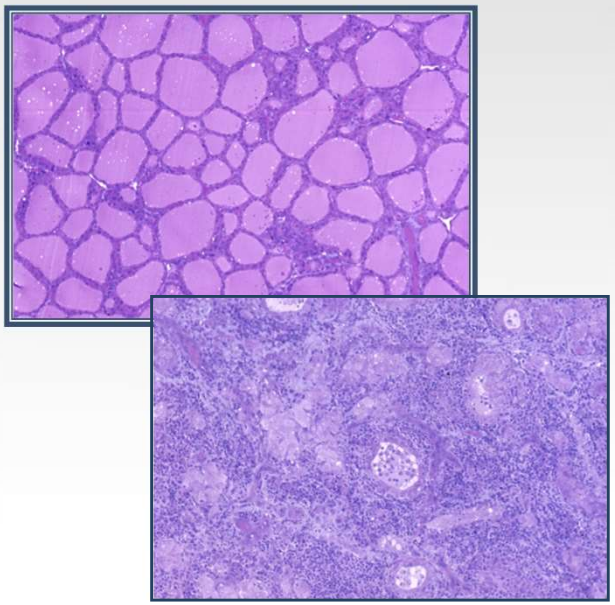
- Cost price
- Sometimes sedation
- Only in specialized centers
- Radioactivity

75% → Clear
Other 25 % → ideally further work up

Hypothyroidism in dogs

Symptoms not specific
Tests are not perfect
Some factors influence test results

- Frequent ?
- Overdiagnosed?
- Acquired
- Lymphocytic thyroiditis
- 2-8 years old
- Esp. middle- to larger breeds
- Breed predisposition → ↑ suspicion



Quid breed ?

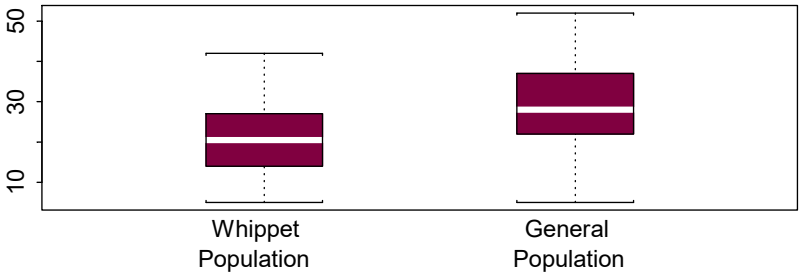
- Greyhound, Scottish Deerhound
- Whippet, Basenji, Sloughi, Saluki, Shar-pei

Shiel et al. Vet Rec 2007
Seavers et al. AVJ 2008
Panakova et al. JVIM 2008
Van Geffen et al. Vet J
Lenfest 2022

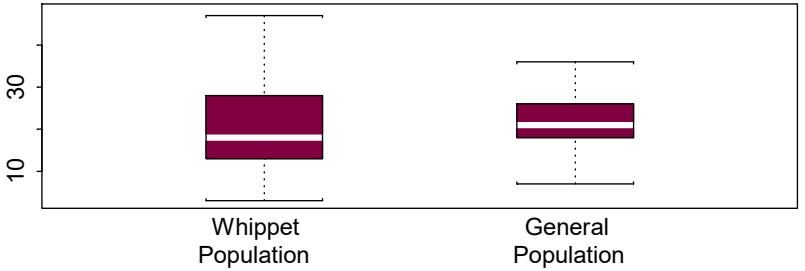
Serum thyroid hormone concentrations and thyroglobulin autoantibodies in trained and non-trained healthy whippets

Cindy van Geffen [a,*], Valérie Bavegems [a], Luc Duchateau [b], Katrien De Roover [a], Sylvie Daminet [a]

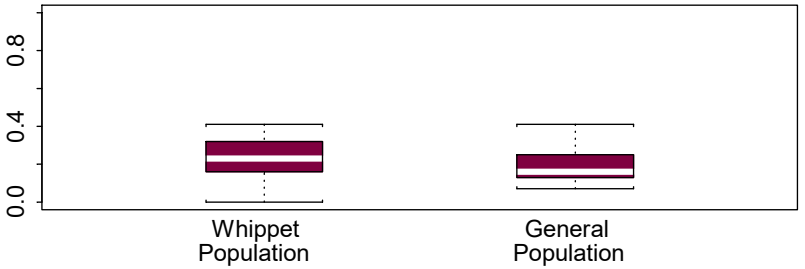
Total thyroxine (nmol/L)



Free thyroxine (pmol/L)

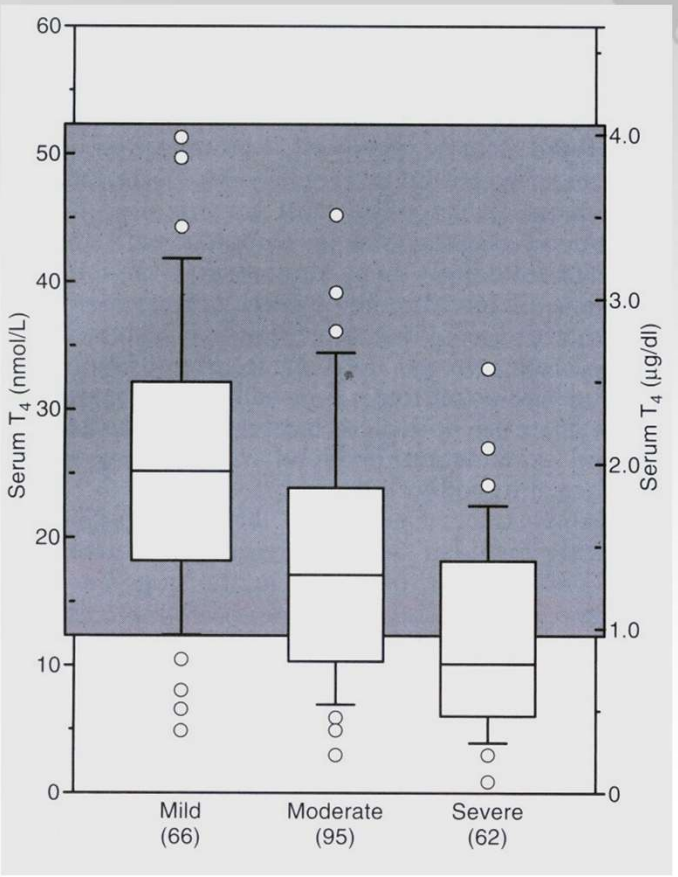


Canine thyroid stimulating hormone (ng/mL)



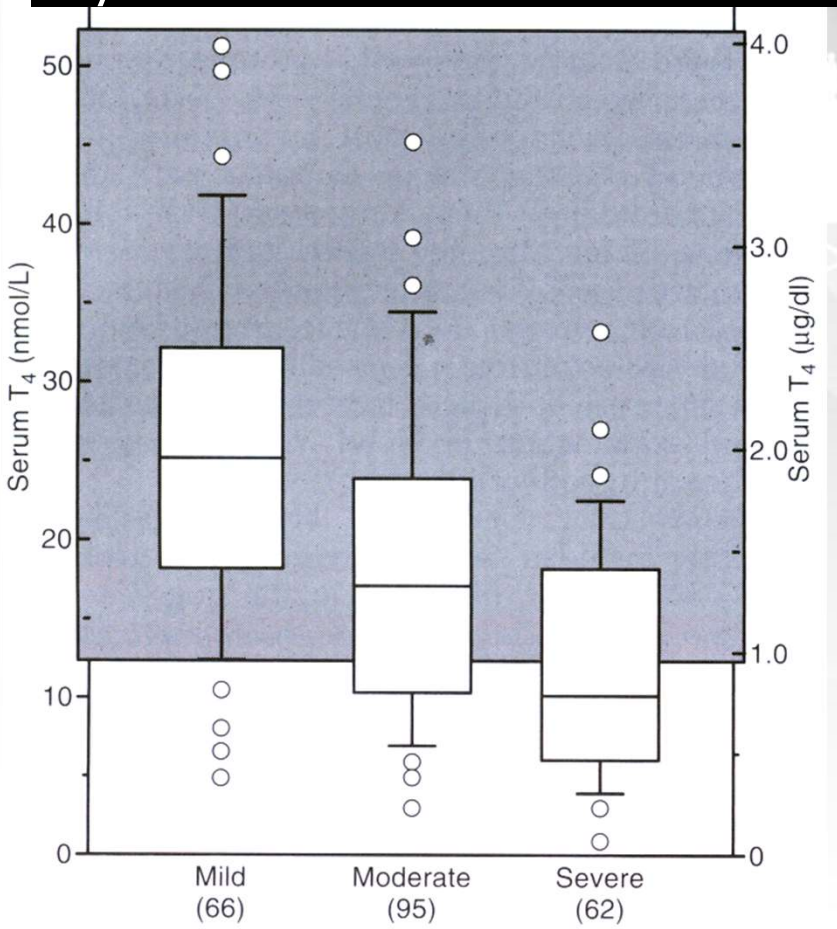
Quid low TT4 ?

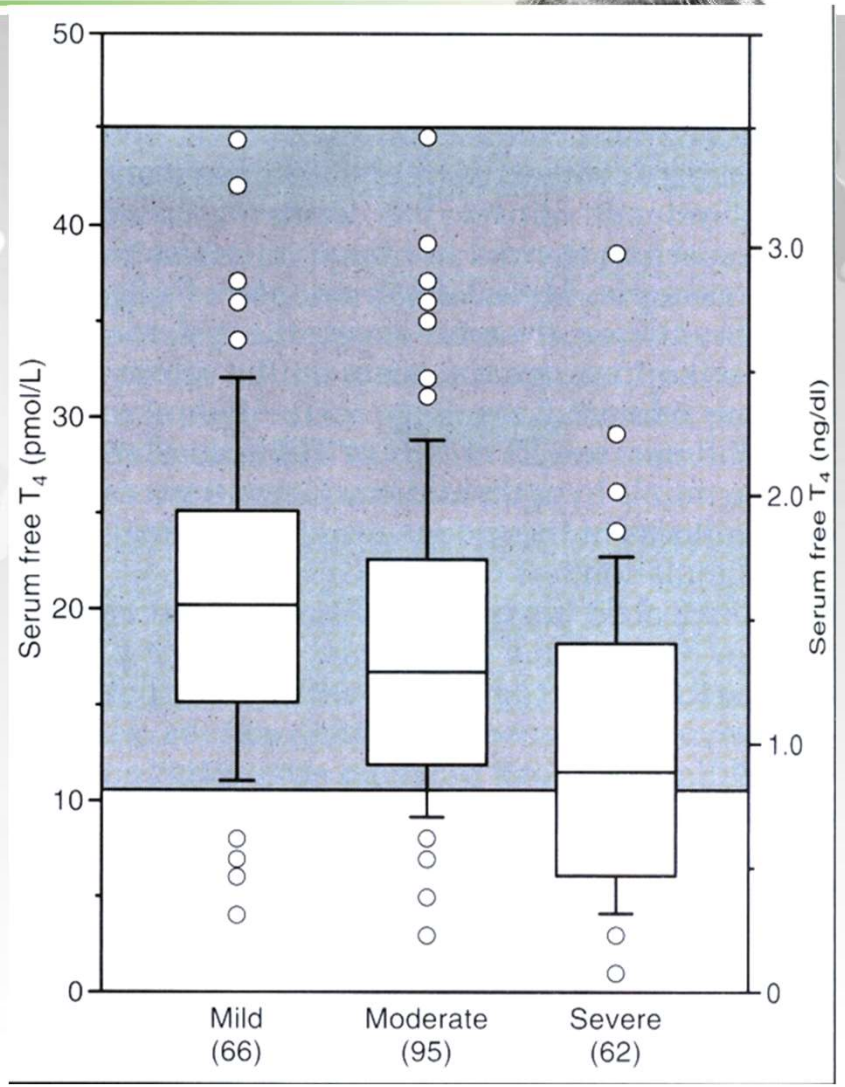
- ‘Systemic disease‘ can also
  → ↓ T4
- “Non thyroidal illness“



Kantrowitz, 2001

TT4 and FT4 in presence of systemic disease





Kantrowitz et al., JAVMA, 2001

Research in Veterinary Science

journal homepage: www.elsevier.com/locate/rvsc

Free thyroxine measurement by analogue immunoassay and equilibrium dialysis in dogs with non-thyroidal illness

Michael Bennaim [a,1], Robert E. Shiel [a], Helen Evans [b], Carmel T. Mooney [a,*]

[a] University College Dublin Veterinary Hospital, University College Dublin, Belfield, Dublin 4, Ireland
[b] NationWide Veterinary Specialist Laboratories, Cambridge, United Kingdom

ARTICLE INFO

Keywords:
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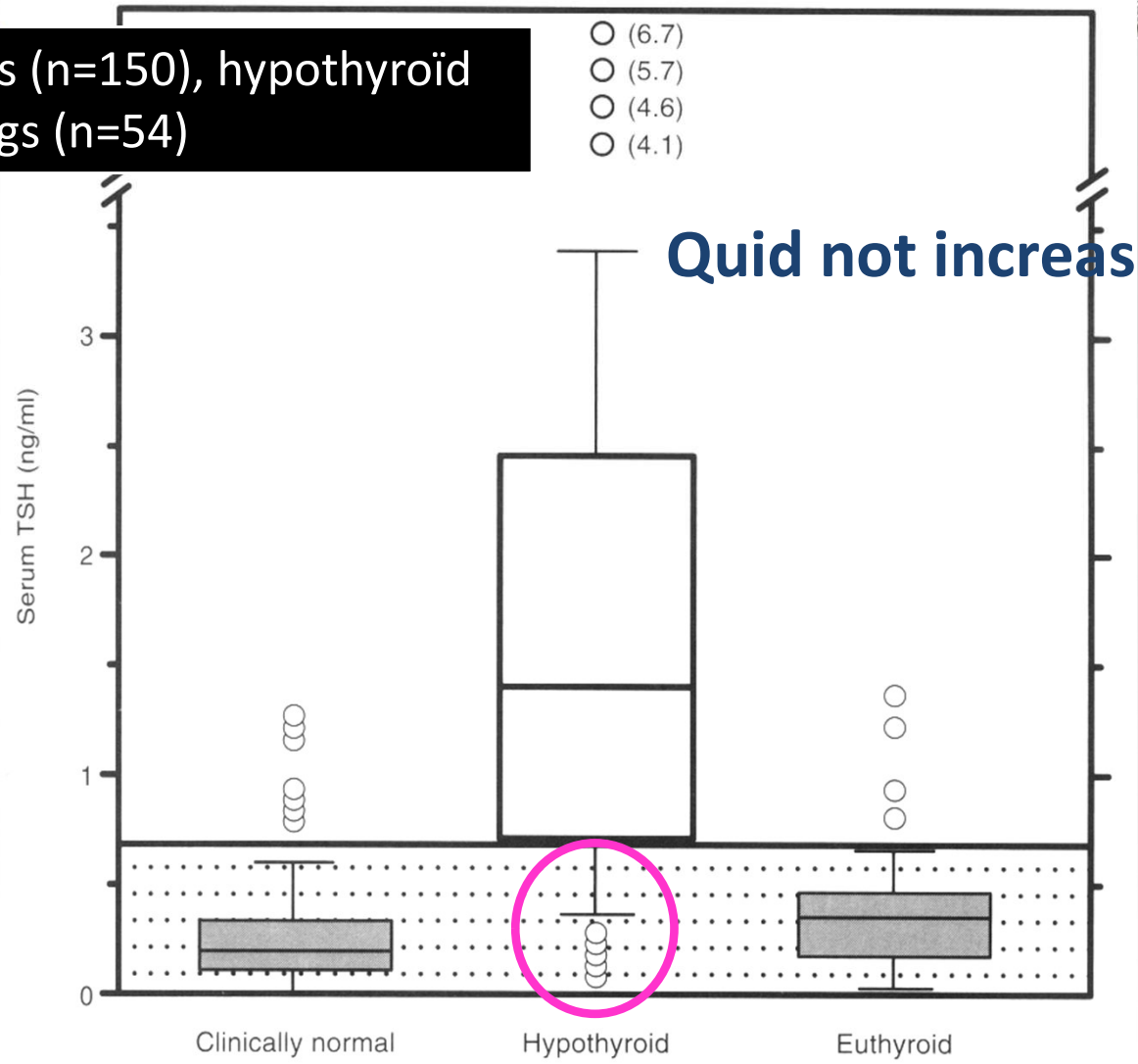
Canine
Hypothyroidism

ABSTRACT

Objectives: Measurement of free T4 by analogue immunoassay (fT4a) is popular but its ability to differentiate hypothyroidism from non-thyroidal illness (NTI) is unclear. The aims were to assess fT4a concentrations in dogs with NTI and to explore diagnostic agreement with total T4 and free T4 measured by equilibrium dialysis (fT4d).
Methods: fT4a was measured in dogs classified with mild, moderate and severe NTI. Total T4 and fT4d were measured in a subgroup of these dogs.
Results: 146 dogs were included of which 84, 35 and 27 had mild, moderate and severe NTI, respectively. Median (range) fT4a concentrations (pmol/L) were significantly lower ($P = 0.023$ and $P < 0.001$) in dogs with severe (3.86 (3.86–23.60)) compared with moderate (11.10 (3.86–34.70)) and mild (15.25 (3.86–48.60)) NTI. Overall, 49 (33.6% [95% CI, 26.4–41.6]) dogs had low fT4a concentration. All thyroid hormones were measured in 74 dogs. Agreement was substantial between total T4 and fT4a (κ=0.79 [95% CI, 0.65–0.92]) and fT4a and fT4d (κ =0.63 [95% CI, 0.47-0.79]) but moderate between total T4 and fT4d (κ=0.49 [95% CI, 0.32–0.66]). Of 42 dogs with low total T4 concentration, five (11.9% [95% CI, 5.19–24.99]) and 18 (42.9% [95% CI, 29.12–57.80]) had fT4a and fT4d within reference interval, respectively.
Conclusions and clinical importance: fT4a and fT4d cannot be used interchangeably. Measurement of fT4a provides limited further diagnostic information over measurement of total T4 in dogs with NTI. This study raises concerns regarding the ability of fT4a to differentiate NTI from hypothyroidism in dogs with low total T4 concentrations.

Free T4 analogue immunoassay and Free T4 after equilibrium dialysis can NOT be used interchangeably

TSH in normal dogs (n=150), hypothyroïd (n=54) and sick dogs (n=54)



Quid not increased TSH ?

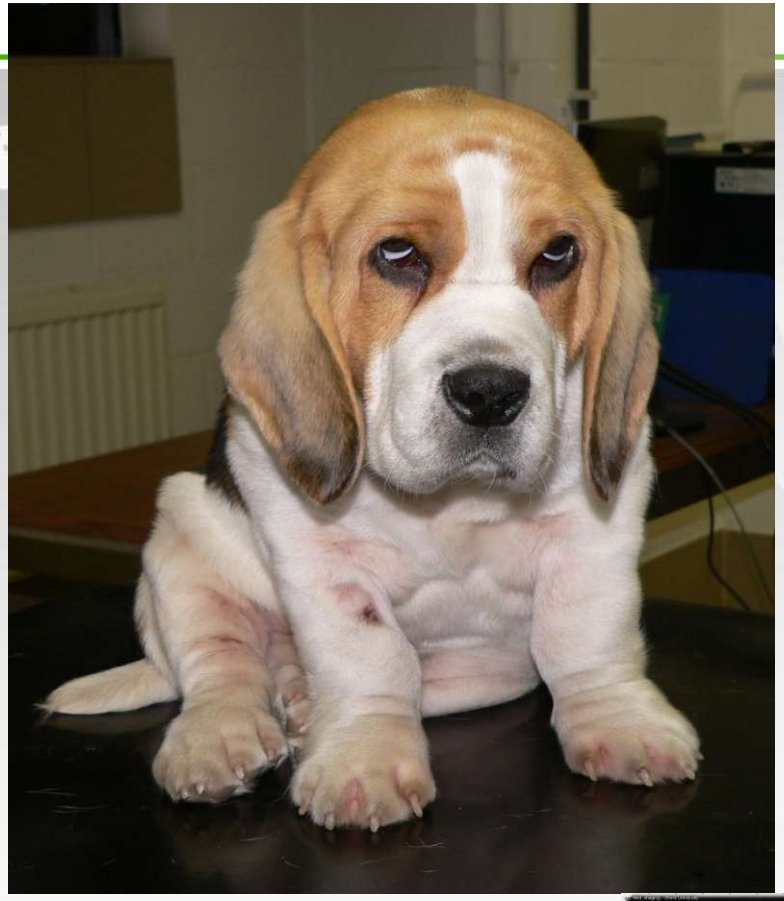
Peterson et al., JAVMA 1997

Interpretation of T4 values in dogs

TT4

Low	**Normal**	**High**	
Confirm hypothyroidism with TSH	Hypothyroidism almost excluded	Ab interfere	-Hyperthyroidism -Food related (BARF) -Neoplasia

Diagnosis unclear: rhTSH stimulation test or scintigraphy

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