

VETERINÆRDAGENE 2025
 12.-14. mars, Trondheim Tema: Beredskap

DEN NORSKE VETERINÆRFORENING

Feline Hyperthyroidism

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EBVS and RCVS Recognised specialist in Small Animal Internal Medicine

PLAKENTIA

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History

- Feline Hypothyroidism (FH) A multisystemic disorder from excessive circulating concentrations of thyroxine (T4) and triiodothyronine (T3)
- Middle – to old – aged cats
- No breed predisposition
- Siamese and Burmese breeds have a decreased risk of developing the disease
- Relatively 'new disorder'
- First report in 1979 in USA
- The prevalence has steadily increased worldwide since those first reports, and the disease is now diagnosed in 1.5–11.4% of older cats around the world

Spontaneous hyperthyroidism in the cat
 June 1979
 Conference Proceedings of the American College of Veterinary Internal Medicine, AC
 Seattle, Washington
 Mark S. Nelson, DVM, MS, DACVIM, UC, Berkeley, U.S.A.

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Hyperthyroidism in the Cat: Ten Cases

J. Alvarado, PhD, A. Thomas, VMD, J. L. DePreter, DVM, M. G. Healy, VMD, A. J. Forster, DVM

SUMMARY

In one practice diagnosed with 10 feline hyperthyroidism (FH) cases, hyperthyroidism was indicated by hyperproteinemia, tachycardia, weight loss, polyuria, polydipsia, and hyperkalemia. In addition, hyperthyroidism was associated with hyperproteinemia and hyperkalemia. The prevalence of hyperthyroidism was estimated to be 1.5–11.4% of older cats. The authors concluded that hyperthyroidism is a multisystemic disorder that should be considered in the differential diagnosis of older cats with hyperproteinemia, tachycardia, weight loss, polyuria, polydipsia, and hyperkalemia. The authors also noted that hyperthyroidism was associated with hyperproteinemia and hyperkalemia.

INTRODUCTION

Hyperthyroidism (FH) is a multisystemic disorder characterized by excessive circulating concentrations of thyroxine (T4) and triiodothyronine (T3). The disease is most commonly diagnosed in middle-aged to old cats. The prevalence of hyperthyroidism has steadily increased worldwide since the first reports in 1979. The disease is now diagnosed in 1.5–11.4% of older cats around the world.

CLINICAL CASES

Case 1: A 12-year-old male cat presented with weight loss, polyuria, polydipsia, and hyperkalemia. The cat was diagnosed with hyperthyroidism based on clinical signs and laboratory findings.

Case 2: A 10-year-old female cat presented with tachycardia, weight loss, and hyperkalemia. The cat was diagnosed with hyperthyroidism based on clinical signs and laboratory findings.

Case 3: A 14-year-old male cat presented with hyperproteinemia, tachycardia, and weight loss. The cat was diagnosed with hyperthyroidism based on clinical signs and laboratory findings.

Case 4: A 11-year-old female cat presented with polyuria, polydipsia, and hyperkalemia. The cat was diagnosed with hyperthyroidism based on clinical signs and laboratory findings.

Case 5: A 13-year-old male cat presented with hyperproteinemia, tachycardia, and weight loss. The cat was diagnosed with hyperthyroidism based on clinical signs and laboratory findings.

Case 6: A 10-year-old female cat presented with polyuria, polydipsia, and hyperkalemia. The cat was diagnosed with hyperthyroidism based on clinical signs and laboratory findings.


Case 7: A 12-year-old male cat presented with hyperproteinemia, tachycardia, and weight loss. The cat was diagnosed with hyperthyroidism based on clinical signs and laboratory findings.

Case 8: A 11-year-old female cat presented with polyuria, polydipsia, and hyperkalemia. The cat was diagnosed with hyperthyroidism based on clinical signs and laboratory findings.

Case 9: A 13-year-old male cat presented with hyperproteinemia, tachycardia, and weight loss. The cat was diagnosed with hyperthyroidism based on clinical signs and laboratory findings.

Case 10: A 10-year-old female cat presented with polyuria, polydipsia, and hyperkalemia. The cat was diagnosed with hyperthyroidism based on clinical signs and laboratory findings.


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Pathogenesis

- Autonomous secretion of thyroid hormones by the adenomatous thyroid tissue
- Functional thyroid adenomatous hyperplasia (or adenoma) in 95% of FH cases
- In 70% of cats bilateral thyroid lobes are affected
- Thyroid carcinoma is a less common cause of hyperthyroidism in cats, with a prevalence of less than 5% of FH
- The prevalence of thyroid carcinoma in hyperthyroid cats receiving long-term methimazole treatment increases considerably

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Risk factors

- Nutritional deficiencies or excesses in cat foods
 - Canned food (in particular fish, liver, giblets)
 - Iodine excess or deficiency
 - Selenium deficiency
- Thyroid – disruption compounds present in the environment, drinking water or diet
 - Cans with plastic lining in easy open (pop-top) may contain bisphenol A (BPA)
 - Soy isoflavones (low-cost source of protein) is a goitrogen
 - Polybrominated diphenyl ethers (PBDEs)
 - Pesticides or herbicides
 - Many others
- Genetic mutations in the TSH receptor gene may be involved

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Clinical signs

- Weight loss
- Polyphagia
- Polyuria/Polydipsia
- Behavioural changes (usually but not always hyperactivity)
- Vomiting/Diarrhoea
- Unkempt coat / alopecia
- Tachypnoea, tachycardia
- Palpable thyroid goitre




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Clinical signs

The owner often appreciates the hyperactivity as a positive sign and this may delay the visit to the vet.


- *'My cat feels great and is acting like a kitten again'*
- *'My cat is losing weight because it is so much more active'*
- *'I think my cat has dementia'*

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Physical examination

- Low body condition score
- Low muscle condition score
- Dull coat
- Distinct facial features
- Palpable thyroid goitre
- Stressed / hyperactive
- Heart murmur and arrhythmias



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2016 AAEP Guidelines for the Management of Feline Hyperthyroidism



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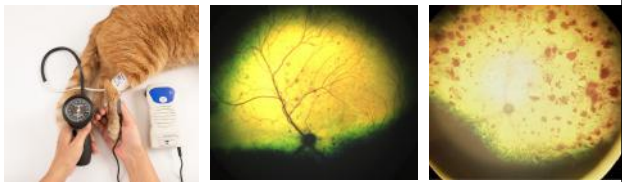
Blood pressure measurement

- 20% of FHT cats have concurrent hypertension
- Hypertension is a common comorbidity in senior cats
- Hyperactivity associated with FHT may make measurement difficult
- Gabapentin (10-20mg/kg the night before and 2 hours prior to the appointment) can significantly reduce the stress-induced (situational) hypertension
- Concurrent urine UPC measurement and fundic exam can increase suspicion (target organ damage)



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Hypertensive retinal changes



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Differential diagnoses

- Diabetes mellitus
- Gastrointestinal malabsorption due to gastrointestinal disease
 - Inflammatory enteropathy
 - Neoplasia
- Chronic kidney disease
- Heart disease



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Clinicopathological abnormalities



Haematology	Biochemistry	Urinalysis
<ul style="list-style-type: none"> Erythrocytosis Macrocytosis or microcytosis Heinz body anaemia High mean platelet size Eosinopenia Lymphopenia 	<ul style="list-style-type: none"> Increased ALT Increased ALP Underestimated renal values Hyperphosphataemia Ionized hypocalcaemia Low vitamin B12 	<ul style="list-style-type: none"> Low urine specific gravity Proteinuria (UPC > 0.4)

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Available endocrine tests



Total thyroxine (TT4)	Free T4 (fT4)	TSH	T3 suppression test
<ul style="list-style-type: none"> First-line test Increased in 91% of cases No other tests needed when TT4 is increased Normal in some cases due to non-thyroidal illness or daily fluctuation 	<ul style="list-style-type: none"> The fraction of TT4 not bound to proteins High sensitivity (98% of cases) Less affected by non-thyroidal illness 12% of cats with non-thyroidal illness may have increased serum fT4 concentrations! – Lower specificity Equilibrium dialysis is preferred 	<ul style="list-style-type: none"> Undetectable in spontaneous FH Good sensitivity Poor specificity (Canine TSH assay is used) Increased in iatrogenic hypothyroidism (during treatment) 	<ul style="list-style-type: none"> Administration of exogenous T3 suppressed TSH secretion and TT4 (normal cats) In FH exogenous T3 has little effect

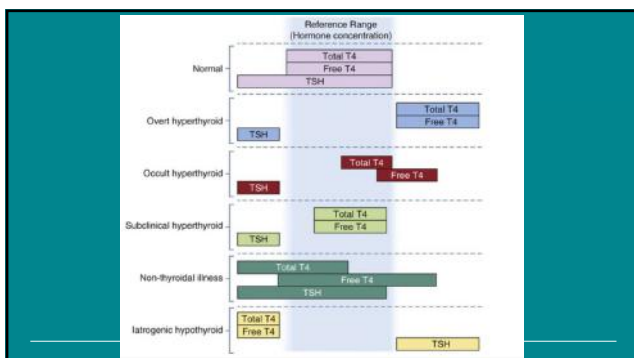
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T3 suppression test - protocol




- Blood is collected, serum separated, and stored frozen or refrigerated
- T3 is administered (25 mcg/cat PO q 8 h for 2 days = 7 doses)
- On the morning of day 3, the cat is given its seventh dose of T3 and then returned to the clinic for post-T3 blood sampling.
- Both the pre- and post-T3 samples are assayed for TT4 and TT3 on the same assays to mitigate intra-assay variation
- TT4 should be suppressed if non-FHT
- If owners were successful in administering T3, the serum concentration of TT3 is higher in the second sample (the only reason TT3 is measured).

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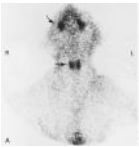


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Thyroid scintigraphy

- Thyroid pertechnetate uptake is increased in FH
- The use of these tests is limited by their availability
- 99% of FH cats had a thyroid-to-salivary ratio of >1.5 versus healthy cats' ratio of <1




A. Healthy cat



C. FH cat


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Diagnosis – classic clinical disease

- Compatible clinical signs
- Persistently increased total thyroxine
- Treatment for hyperthyroidism is indicated

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Diagnosis – FHT with concurrent non-thyroidal disease 


- Compatible clinical signs with FHT
- Clinical signs of concurrent additional disease
- Total thyroxine normal (usually in the upper half of the reference interval)
- Measurement of fT4 by equilibrium dialysis
- Control comorbidities and repeat testing in a few weeks (T4 + fT4)
- TSH should be undetectable if measured

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Incidentally identified goiter without clinical signs 


- Monitor for clinical signs
- If T4 in the reference interval recheck in a few weeks and then twice a year

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Subclinical FHT 

- Increased TT4 in Cats without overt clinical signs
- With or without compatible Physical examination findings
- Falsely increased T4 values may occur, repeat testing using external laboratory (radioimmunoassay or chemiluminescent assay)
 - Repeat testing in a few weeks at an external laboratory, if still elevated then treatment is indicated


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Additional imaging

<p>Thyroid ultrasound / CT scan</p> <ul style="list-style-type: none"> • Not all cats with FHT will have detectable nodules • Useful for staging prior to definitive treatment such as surgery 	<p>Thoracic radiographs</p> <ul style="list-style-type: none"> • Identify comorbidities • Subclinical respiratory pathology is common in senior cats • Tachypnoea investigation • Metastatic spread in thyroid carcinoma • Ectopic thyroid tissue 	<p>Abdominal ultrasound</p> <ul style="list-style-type: none"> • Characterize renal disease if present • Subclinical gastrointestinal disease is common • Investigate further the increases in liver enzyme activity 	<p>Echocardiography</p> <ul style="list-style-type: none"> • Concurrent or secondary heart disease is common • Indicated at diagnosis and then once or twice a year for monitoring
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Comorbidities – Heart disease

- Thyroxine has positive inotropic and chronotropic effects
- FH induced tachycardia, heart murmurs, arrhythmias
- Myocardial changes are common and may be reversible with treatment
- FH - induced Hypertension may exacerbate heart disease as well
- Common echocardiographic abnormalities include left ventricular thickening, left atrial enlargement


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Comorbidities – Chronic kidney disease (CKD)

- FH and chronic kidney often occur concurrently
- FH cause protein catabolism and artificial increases in renal flow and glomerular filtration rate (GFR)
- FH also causes muscle mass loss
- Due to all of the above, serum creatinine and urea can be falsely underestimated at FH diagnosis and CKD may be masked
- Successful treatment of hyperthyroidism reduces GFR and allows a better estimation of urea, creatinine
- Iatrogenic hypothyroidism may exacerbate renal disease


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Comorbidities – CKD and SDMA

- Promising early marker of kidney disease in comparison to creatinine
- Affected less from the muscle mass in comparison to creatinine
- Initial studies have suggested promising specificity of SDMA for identifying renal dysfunction in hyperthyroid cats
- Subsequent studies have shown SDMA concentrations to change inconsistently after radioiodine treatment. SDMA did not correlate with GFR before and after radioiodine treatment
- SDMA and creatinine did not agree in their classification of IRIS CKD staging


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Comorbidities – CKD and SDMA

- Thyroid status, renal function and SDMA have a complex interplay.
- SDMA cannot be used in isolation in FH
- SDMA is best interpreted with serial measurements and used concurrently with the classical renal biomarkers creatinine and urea.
- The desirable predictive marker of pre-existing CKD in hyperthyroid cats is not yet found


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Treatment options

Definitive therapy <ul style="list-style-type: none"> • Preferred option in all cases without comorbidities • Cats experiencing adverse effects on anti-thyroid medications <ol style="list-style-type: none"> 1. Thyroideclomy 2. Radioactive iodine 	Non-definitive therapy <ul style="list-style-type: none"> • Initial stabilization prior to definitive therapy • Preferred option in cases where hypothyroidism may be detrimental or definitive treatment is too risky <ol style="list-style-type: none"> 1. Iodine – restricted diet 2. Oral anti-thyroid medications 3. Transdermal anti-thyroid medications 	Symptomatic care <p>Control concurrent comorbidities</p> <ol style="list-style-type: none"> 1. Hypertension 2. Proteinuria 3. Cardiac disease 4. Renal disease
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Anti-thyroid medications

- Methimazole
 - 1.25-2.5 mg / cat PO BID
 - Higher doses may be needed in some cats
- Carbimazole ('pro-drug', converted to methimazole after administration)
 - 10-15 mg / cat PO SID
- Oral or transdermal (requires high quality compounding pharmacy)
- Inhibitors of thyroid peroxidase necessary for hormone synthesis
- They do not prevent tumor growth – the tumor continues to grow


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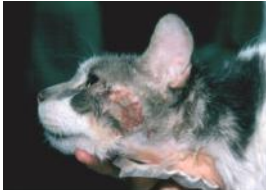
Anti-thyroid medications Adverse effects

Non-life threatening	Life threatening	Overdose – iatrogenic hypothyroidism
<ul style="list-style-type: none"> • May be transient or necessitate dose reduction or drug discontinuation <ol style="list-style-type: none"> 1. Anorexia 2. Vomiting 3. Lethargy 4. Dermatological changes e.g. facial/neck excoriations 5. Mild leukopenia, eosinophilia, lymphocytosis 6. Peripheral lymphadenopathy 	<ul style="list-style-type: none"> • Require immediate discontinuation of the drug <ol style="list-style-type: none"> 1. Hepatotoxicity with icterus 2. Severe neutropenia 3. Thrombocytopenia or other bleeding tendencies 4. Aplastic anaemia or haemolytic anaemia 5. Myaethenia gravis 	<ul style="list-style-type: none"> • Lethargy, poor appetite, weight gain, dermatological issues or asymptomatic • Azotaemia may worsen • Diagnosis with low TT4 and high TSH • Dosage reduction required


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Facial excoriations due to methimazole




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Monitoring

- In 2 and 4 weeks after initiation of treatment
- Monthly thereafter for the first 2 months
- Weight check
- History, physical examination
- Haematology, biochemistry, TT4 (+ TSH if iatrogenic hypothyroidism suspected)
- Blood pressure and proteinuria monitoring
- 3-monthly thereafter


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Iodine restricted diet

- Iodine is a necessary component of thyroid hormones
- Strict chronic restriction in diet will reduce hormone concentrations
- Needs to be fed exclusively
- Major advantage is the lack of adverse effects
- Drawbacks
 - The cat may not like to food
 - Serum TT4 decreases to reference interval in only 50-70% of cats


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Radioactive iodine (RI)

- Permanent cure of FH with one simple subcutaneous (or oral) administration
- Required specially licensed facilities and nuclear medicine equipment
- The patient expresses radioactivity afterwards and hospitalization for a few days afterwards is required (3-14 days depending on legislation for each country)
- RI dosage can be variable
- Often causes iatrogenic hypothyroidism


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Surgery (thyroidectomy)

- Technically simple for experienced surgeons
- Bilateral thyroidectomy can cause iatrogenic hypocalcaemia due to accidental parathyroid gland removal
- Surgery can be staged (one lobe at a time)
- Intravenous calcium administration can cause severe tissue damage if extravasated and for this reason prophylactic central venous catheter is recommended at surgery
- Hospitalisation for calcium monitoring is recommended for 2-5 days post-operatively

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Hypertension treatment

- Amlodipine besylate dose 0.625-1.25mg PO SID
 - Alternative: Telmisartan 2mg/kg PO SID
- Monitor renal function, risk of GFR decrease
- Treatment goal is to reduce target organ damage risk with a gradual decrease in blood pressure
- Rapid changes in blood pressure are life-threatening

SBP (mm Hg)	Substage of SBP	Risk of future TOD
<140	Normotensive	Minimal
140 - 159	Prehypertensive	Low
160 - 179	Hypertensive	Moderate
≥180	Severely hypertensive	High

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Survival

- Most cats have a good prognosis
- If undertreated or under-monitored, the disease can be severely debilitating
- RI offers longer median survival times as compared to drugs
- Pre-treatment renal azotaemia is negatively associated with survival

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Summary

- FH is a common endocrine disorder in cats
- Early diagnosis is associated with better prognosis
- Hypertension, cardiac disease and renal disease are common comorbidities
- RI is the treatment of choice in the long-term if available
- Anti-thyroid drugs may induce various adverse effects and close monitoring is recommended



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Thank you very much for your attention!

Any questions?

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