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COORDINATES IN THE PARACLINICAL DIAGNOSIS IN FELINE HYPERTHYROIDISM

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Abstract

Hyperthyroidism represents a total increase in thyroid hormones (T3 and T4) - due to benign (adenomatous) or malignant (hyperplastic) changes. The study included 14 adult and geriatric cats, presented to the practice with suspected hyperthyroidism. Data collected included approximate age and medical history, clinical signs (weakness, tachycardia, neurologic signs, thyroid size on palpation), thyroid palpation (thyroid lobe size assessment) and eventually TT4 (total T4) values measured by standard laboratory methods. Group A included 9 cats diagnosed with hyperthyroidism with clinical signs, age mostly over 10 years (geriatric category). The clinical signs registered were progressive weakness (n=9), tachycardia (n=9), neurological signs (agitation, tremor, excessive vocalization (n=7), or postural modifications n=3). TT4 median values 6.7 µg/dL. Group B included 3 cats with enlarged thyroid, age adult (7 and 8 years). Clinical signs: mild or absent, only thyroid palpation shows moderate enlargement.
The specific determination of TT4 registered a within normal limits (but in the upper half on retest in some individuals). Possible interpretation: incipient or "occult" hyperthyroidism and requires further monitoring (TT4 retest, fT4 and/or T3 suppression test, TSH). Group C was represented by 1 cat with increased TT4, the age 9 years old, and the absence of clinical signs with good general condition, no weight loss or behavioural changes and TT4 above reference limits with 5.5 µg/dL value. This paper highlights the diversity of clinical and laboratory presentations of feline hyperthyroidism, emphasizing the need for continuous monitoring and further investigations in atypical cases.

Key words: *cats, diagnosis, hyperthyroidism.*

INTRODUCTION

Hyperthyroidism represents a total increase in thyroid hormones (T3 and T4) - due to benign (adenomatous) or malignant (hyperplastic) changes (Boland and Barrs, 2017; Graves, 2017; Mclean et al., 2017; Codreanu et al., 2021).
According to the latest NRC guidance, a 4-kg (8.8-lb) cat eating 250 kcal of food formulated with 350 µg of iodine per 1,000 kcal of ME would consume about 87.5 µg of iodine per day - equivalent to roughly 21.9 µg of iodine per kilogram of body weight daily (Peterson, 2020; Scott-Moncrieff, 2015) .
T4 measurement is considered a very good indicator of thyroid function in cats because T4 is the only thyroid hormone secreted by thyroid cells. However, in early hyperthyroidism (HT) or in cats with non-thyroid disease, the total T4 (TT4) level may remain within the reference range - often in the upper third - resulting in so-called occult hyperthyroidism. In such cases, it is advisable to repeat the TT4 measurement over several months or to perform additional tests (e.g., free T4, TSH, T3 suppression test) (Van Der Kooi et al., 2014)
A normal TT4 in a cat that is in fact hyperthyroid can be explained by daily T4 fluctuations, hypoproteinaemia (reduced binding proteins), or chronic diseases that suppress thyroid hormones. Indeed, 25% of hyperthyroid cats can have a normal T4 value. Among hyperthyroid cats with normal TT4, 25% have a concurrent non-thyroid disease, and 75% show incipient hyperthyroidism (reflecting daily TT4 fluctuations) (Peterson et al., 2017).
Furthermore, certain drugs (e.g., sulphonamides, antiepileptics) may suppress T4 concentrations in early hyperthyroidism by affecting thyroid hormone metabolism or altering T4 binding proteins (Hillet al., 2018).

Classification of Cats Based on Thyroid Status and T4 Measurements

Group 1 - uncomplicated Hyperthyroidism with Elevated TT4. Cats present with one or more clinical signs specific for hyperthyroidism. TT4 is clearly elevated. No concurrent diseases are

identified (Trepanier, 2015).
Management: initiate treatment for hyperthyroidism according to standard protocols (e.g., antithyroid medications, radioactive iodine, surgery). Monitor response to therapy and reassess TT4 and clinical signs as needed (Carney et al., 2016).
Group 2 - possible Hyperthyroidism with Probable Nonthyroidal Disease (Normal TT4). Cats show clinical signs suggestive of hyperthyroidism but have normal TT4 values. Occult hyperthyroidism is suspected; the presence of a concurrent nonthyroidal disease is likely. Additional testing: TT4 in 2-4 weeks. Measure fT4 (free T4) at the same time (Volckaert et al., 2016).
If TT4 is in the upper half of the normal range and fT4 is elevated, hyperthyroidism is very likely. If TT4 and fT4 remain within normal limits, investigate nonthyroidal diseases (e.g., diabetes mellitus, maldigestion/malabsorption, intestinal neoplasia such as lymphoma) (Carney et al., 2016).
If no concurrent disease is found, but hyperthyroidism is still suspected, perform additional tests (T3 suppression test, TSH measurement alongside T4 and fT4, thyroid ultrasound, scintigraphy) (Peterson and Broome, 2015).
Approximately 20-30% of hyperthyroid cats with normal TT4 have an associated nonthyroidal disease, whereas 70-80% have incipient hyperthyroidism that is not yet consistently detectable (Vaske et al., 2016).
Group 3 - palpable thyroid enlargement, normal TT4, no clinical signs. Cats present with an obvious thyroid enlargement on palpation (thyroid "slip"). TT4 is within reference limits. No clinical signs of hyperthyroidism are evident.
Management: continue monitoring for the development of clinical signs. Retest TT4 after 6 months to check for changes indicating progression to overt hyperthyroidism.
Group 4 - elevated TT4, minimal or ambiguous signs of hyperthyroidism**.** TT4 is elevated, but physical examination and history reveal only a few signs that could be attributed to hyperthyroidism.
Management: T4 measurement in 2-4 weeks to confirm persistently elevated levels. If T4 remains high, initiate treatment for hyperthyroidism. If T4 normalizes at retest, monitor the patient again in 6 months (complete physical exam and T4 measurement) while also investigating possible nonthyroidal conditions.
Group 5 - clinical Hyperthyroidism (Elevated TT4) with confirmed nonthyroidal disease. Cats present with clinical signs of hyperthyroidism and an elevated TT4.One or more nonthyroidal diseases are definitively identified (e.g., thyrotoxic heart disease, hypertension, retinopathy, chronic renal disease, maldigestion/malabsorption, cobalamin deficiency, insulin-resistant diabetes) (Williams et al., 2018). Management: since hyperthyroidism can rapidly worsen a cat's overall condition, treat both the hyperthyroidism and any comorbidities concurrently. Monitor both conditions closely to ensure appropriate response to therapy (Trepanier, 2015).
Group 6 - no clinical signs of hyperthyroidism, no palpable thyroid nodules, but elevated TT4**,** cats show no overt clinical signs. Thyroid lobes are not enlarged on palpation.TT4 is elevated (potentially a false-positive result) (Mclean et al., 2017).
Management: T4 measurement, ideally using enzyme chemiluminescence methods or radioimmunoassay, to confirm the initial result.
If T4 is normal on retesting, monitor the cat's general condition and repeat T4 measurement every 6 months (or more frequently) to check for any trend toward hyperthyroidism.

MATERIALS AND METHODS

The study included 14 adult and geriatric cats, presented to the practice with suspected hyperthyroidism.
Data collected included approximate age and medical history, clinical signs (weakness, tachycardia, neurologic signs, thyroid size on palpation), thyroid palpation (thyroid lobe size assessment) and eventually TT4 (total T4) values measured by standard laboratory methods.
Interpretation criteria
Increased TT4 and clinical signs → confirmed hyperthyroidism.
Normal TT4 with enlarged thyroid gland → possible incipient/occult hyperthyroidism.
Increased TT4 without clinical signs → subclinical hyperthyroidism or measurement errors (possible interferences excluded).

RESULTS AND DISCUSSIONS

Group A included 9 cats diagnosed with hyperthyroidism with clinical signs, age mostly over 10 years (geriatric category).
The clinical signs registered were progressive weakness (n=9), tachycardia (n=9), neurological signs (agitation, tremor, excessive vocalization (n=7), or postural modifications n=3). TT4 median values 6.7 µg/dL.
Group B included 3 cats with enlarged thyroid, age adult (7 and 8 years).
Clinical signs: mild or absent, only thyroid palpation shows moderate enlargement.
The specific determination of TT4 registered a within normal limits (but in the upper half on retest in some individuals).
Possible interpretation: incipient or "occult" hyperthyroidism and requires further monitoring (TT4 retest, fT4 and/or T3 suppression test, TSH).

Figure 1. Cat with weight loss, degraded general state, mydriasis

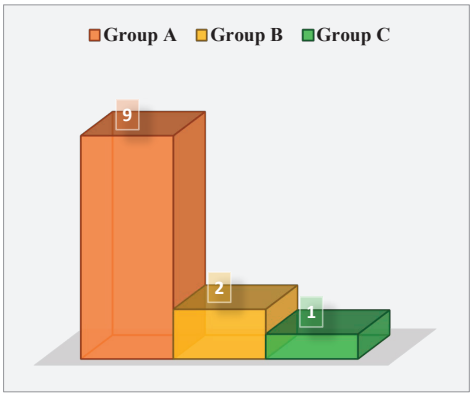

Figure 2. Graphic representation of group cats diagnosed with hyperthyroidism

Group C was represented by 1 cat with increased TT4, the age 9 years old, and the absence of clinical signs with good general condition, no weight loss or behavioural changes and TT4 above reference limits with 5.5 µg/dL value.

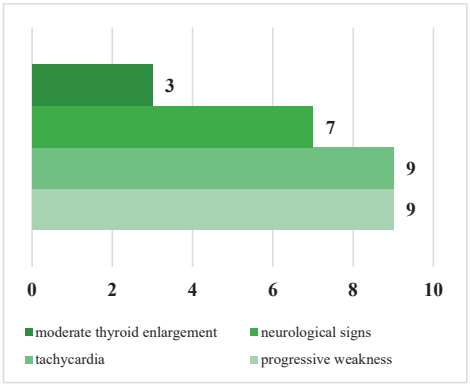

Figure 3. Graphic representation of clinical signs registered in cats with hyperthyroidism

Figure 4. Cat with weight loss, comatous state, mydriasis

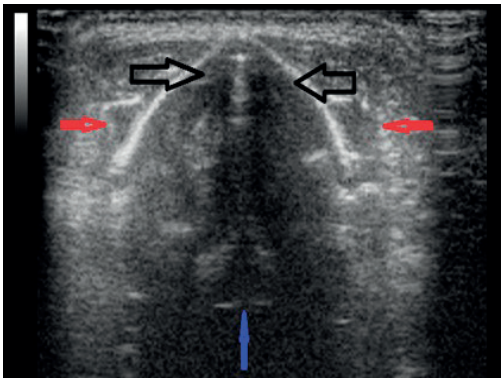

Figure 5. Cat larynx-cross-section of the larynx and thyroid cartilage (black arrow) in expiration (left) and inspiration (right).

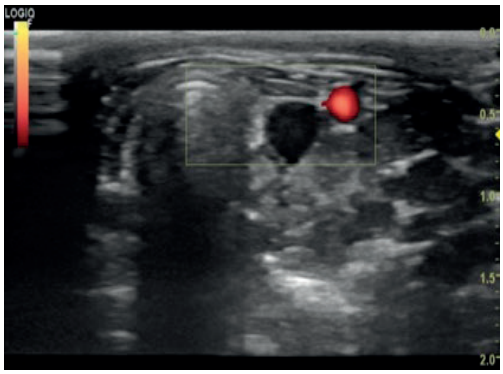

Figure 6. Left thyroid cyst in a cat with hyperthyroidism- The presence of an ovoid structure with a thin capsule and hypoechoic homogenous contents on the left lateral side with a size approximately 2x larger than the ipsilateral common carotid artery. Pulsed and color Doppler examination certifies absence of vascularization

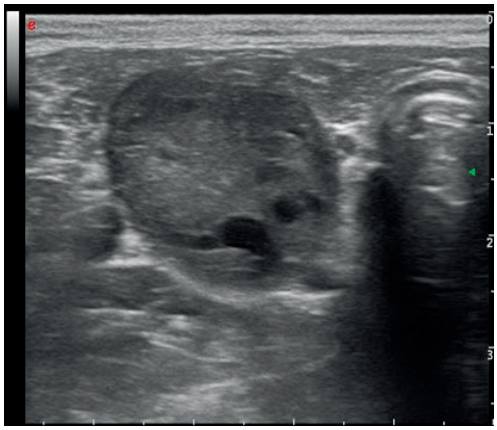

Figure 7. Thyroid carcinomas with well-demarcated outline, with a hypoechoic thyroid parenchyma of inhomogeneous character and sometimes multiple cysts.

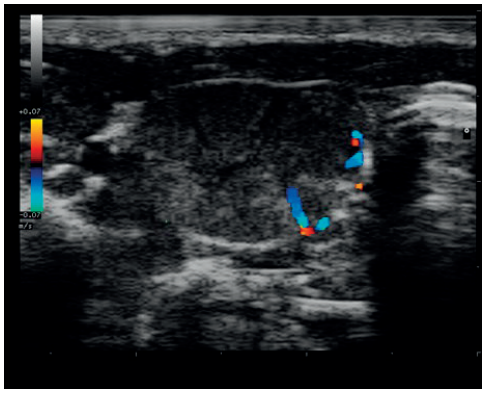

Figure 8. Thyroid carcinomas with well-demarcated outline, with a hypoechoic thyroid parenchyma of inhomogeneous character and sometimes multiple cysts.

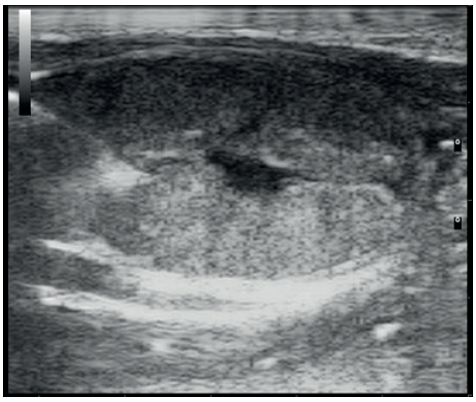

Figure 9. Thyroid carcinomas with well-demarcated outline, with a hypoechoic thyroid parenchyma of inhomogeneous character and sometimes multiple cysts.

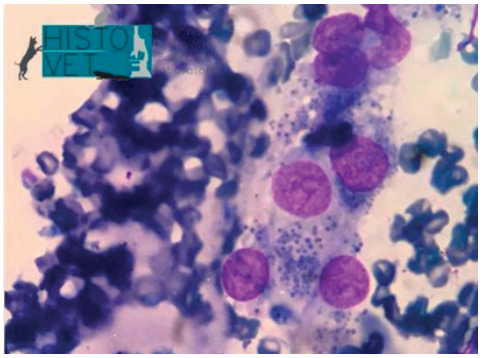

Figure 10. Cytologic - aspiration - thyroid - nuclear pleomorphism, mitoses, chaotic arrangement of epithelial cells with follicular origin.

CONCLUSIONS

In group A, hyperthyroidism predominantly affected geriatric cats (> 10 years), and every cat exhibited the classic systemic manifestations of the disease. The universal presence of progressive weakness and tachycardia, coupled with a high incidence of neurologic signs and a markedly elevated median TT4 of 6.7 µg/dL, confirms both the diagnosis and the substantial physiologic impact of hyperthyroidism in aged felines. These findings highlight the importance of proactive thyroid screening in senior cats and prompt therapeutic intervention to mitigate cardiovascular and neurologic complications.

Group B appears to represent an early or subclinical stage of feline hyperthyroidism. Although all three middle-aged cats (7-8 years) showed only moderate, palpable thyroid enlargement and minimal to no outward clinical

signs, TT4 concentrations repeatedly clustered in the upper reference range. This pattern - structural thyroid change without overt hormone excess - strongly suggests “occult” or incipient hyperthyroidism. Ongoing surveillance (serial TT4, free T4, TSH, or a T_3-suppression test) is warranted to detect progression, so that definitive therapy can be initiated before more pronounced systemic and cardiovascular effects develop.

Group C illustrates a rare “silent” presentation of feline hyperthyroidism. This discordance between biochemical hyperthyroidism and the absence of clinical signs indicates either an incipient phase of the disease or an atypically well-compensated patient. Repeat TT4 (or free T4) measurement, a T_3-suppression test, and close clinical follow-up are advisable, because overt manifestations - and their cardiovascular and metabolic consequences - may emerge suddenly as thyroid hormone excess continues.

This paper highlights the diversity of clinical and laboratory presentations of feline hyperthyroidism, emphasizing the need for continuous monitoring and further investigations in atypical cases.

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