Adult-Onset Hypothyroidism in a Lynx (Lynx canadensis)
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ADULT-ONSET HYPOTHYROIDISM IN A LYNX
(LYNX CANADENSIS)


Abstract: A 19-yr-old female lynx (Lynx canadensis) presented for an acute onset of anorexia and reluctance to move. Physical examination, radiography, hematology, and serum biochemistry revealed evidence of renal failure, presumptive uremic gastritis, chronic intervertebral disk disease at T13–L1, and markedly low serum levels of total thyroxine (1.54 nmol/L) and total triiodothyronine (0.55 nmol/L). Twenty-five hours after its original presentation, the lynx exhibited horizontal nystagmus, which has been suggested as a clinical sign associated with hypothyroidism in domestic dogs. The lynx was euthanatized because of poor prognosis, and medical management concerns related to its chronic renal failure. Necropsy examination substantiated that the lynx had true hypothyroidism with 60–90% of the thyroid gland replaced with adipose tissue. Although feline adult-onset hypothyroidism may have low incidence, it should still be considered as a cause of nonspecific signs of disease in cats, as well as signs suggestive of hypothyroidism. Routine monitoring of baseline exotic feline thyroid levels throughout life would help to identify normal values and diagnose a potential disease that has obscure clinical signs.

Key words: Lynx, Lynx canadensis, hypothyroidism, nystagmus, feline, endocrine.

INTRODUCTION

Hypothyroidism is a complex disease, and clinical signs are frequently nonspecific because of thyroid hormone’s effects on multiple body systems.16 Feline hypothyroidism is typically congenital or iatrogenic but may rarely be of adult onset.20 Low feline serum total thyroxine (TT4) concentrations are frequently attributed to the suppressive effects of nonthyroidal illness, termed euthyroid sick syndrome, and not to true hypothyroidism.4 Clinical signs of feline congenital and iatrogenic hypothyroidism are disproportionate dwarfism and gradually decreasing activity accompanied by weight gain, respectively.4 There is little clinical or pathologic information available regarding adult-onset hypothyroidism in cats.

CASE REPORT

A 19-yr-old reproductively intact female lynx (Lynx canadensis) housed at the Knoxville Zoological Gardens since she was 5 mo old was examined after acute onset of anorexia and reluctance to move. The lynx had been housed alone for the last 6 yr and had a previously unremarkable clinical history.

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The lynx was immobilized with ketamine (Ketafo®, Abbott Laboratories, North Chicago, Illinois 60064, USA; 6.8 mg/kg, i.m.) and xylazine (Phoebix Pharmaceutical, Inc., St. Joseph, Missouri 64506-0457, USA; 0.4 mg/kg, i.m.) administered by remote injection (Telinject® USA, Inc., Saugas, California 91350, USA). Eleven minutes after darting, the lynx vomited a moderate amount of fresh blood in foamy material. Kidneys were palpably small, and hind limb musculature was moderately atrophied. Ocular examination was normal. Radiographs of the thorax revealed normal, older feldfocal pneumonic infiltrates and chronic intervertebral disk herniation between the 13th thoracic and first lumbar vertebrae, with end plate erosions. Abdominal radiographs showed small kidneys with normal shape and contour. The lynx was treated with Normasol-R (Abbott Laboratories; 300 ml, i.v. and 300 ml, s.c.) and ampicillin (Polyflex®, Fort Dodge, Iowa 50501, USA; 21 mg/kg, i.m.). Blood and urine samples were collected and submitted to the laboratory for analysis. After the administration of yohimbine (Antagonil®, Wildlife Pharmaceuticals, Fort Collins, Colorado 80522-2120, USA; 0.1 mg/kg, s.c.), recovery from anesthesia was uneventful.

Abnormal laboratory findings were a degenerative left shift (white blood corpuscles = 8.90 × 10⁹/L, neutrophils = 3.74 × 10⁹/L, and bands = 4.00 × 10⁹/L) and evidence of renal failure with blood urea nitrogen of 23.21 mmol/L (x = 10.71 ± 3.57 mmol/L), creatinine of 360 μmol/L (x = 185.60 ± 53.04 μmol/L), and a urine specific gravity of 1.025.8 Urine culture was not performed because urine sediment was unremarkable. Amylase, lipase,
and bile acid levels were unremarkable. Serologic tests for antibodies to feline infectious peritonitis, feline immunodeficiency viruses, *Histoplasma capsulatum* and * Blastomyces dermatitidis*, and for antigen to feline leukemia virus were negative. Serum TT4 and total triiodothyronine (TT3) were low at 1.54 nmol/L and 0.55 nmol/L, respectively (domestic feline normal values TT4 = 12.87–51.48 nmol/L; TT3 = 0.77–2.30 nmol/L); Endocrinology Laboratory, School of Veterinary Medicine, University of Tennessee, Knoxville, Tennessee 37901, USA). Serum TT4 reference range = 16.73 ± 5.15 nmol/L in four adult *Lynx canadensis*. Free thyroxine (T4) level by equilibrium dialysis in this lynx was 13 pmol/L (reference interval for domestic feline 10–50 pmol/L; Animal Health Diagnostic Laboratory, College of Veterinary Medicine, Michigan State University, East Lansing, Michigan 48909, USA). This lynx had multiple problems, and it was tentatively diagnosed with chronic renal failure, uremic gastritis, chronic intervertebral disk disease at T13–L1, and euthyroid sick syndrome. Twenty-five hours after the initial presentation, the lynx showed reluctance to move, anorexia, and had pronounced horizontal nystagmus with the fast phase directed toward the right. The lynx was reimmobilized for further diagnostic tests; however, euthanasia was elected due to medical management concerns. Cerebral spinal fluid collected immediately antemortem was within normal limits. Gross necropsy and histopathology found marked glomerulonephritis, moderate erosive gastritis, and marked parathyroid chief cell hyperplasia consistent with chronic renal failure and secondary renal hyperparathyroidism. Lung cultures grew >100 colonies of *Escherichia coli* and >500 colonies of *Streptococcus zooepidemicus*, which were considered to be postmortem contaminants. There were incidental findings of a left, parathyroid chief cell adenoma and multifocal cortical hyperplasia of the adrenal glands. There were no gross or histologic lesions in the cerebral cortices, eyes, or auditory bullae. There were no gross lesions of the spinal cord, and it was not examined histopathologically. The thyroid gland was moderately to markedly, chronically, and diffusely atrophied. Eighty to 90% of the left gland and 60–70% of the right thyroid gland consisted of very small follicles containing little to no colloid and lined by cuboidal epithelium with vacuolated cytoplasm containing brown pigment (lipofuscin). The gland margins were infiltrated by adipose tissue (Fig. 1a, b). Neither extrathyroidal tissue nor a thyroid microadenoma was found. Stored serum samples in the past 3 yr showed serum TT4, TT3, and free T4 levels of 8.49 nmol/L, 0.71 nmol/L, and 17 pmol/L, respectively. The only clinical signs reported at the date when those samples were drawn were lethargy and inappetence for 7 days, and no abnormalities were found on physical examination, complete blood count, serum biochemistries, or radiographs of chest and abdomen.

**DISCUSSION**

Primary adult-onset hypothyroidism has been well documented in domestic dogs but not in domestic cats. In the dog, the most common type of hypothyroidism (>95%) is a progressive loss of functional thyroid tissue due to primary dysfunction of the gland itself. This loss of functional thyroid tissue is caused by either lymphocytic thyroiditis, which is thought to be immune-mediated, or by idiopathic atrophy of the gland, where the gland is replaced by adipose tissue. Less than 5% of canine hypothyroidism is due to nonfunctional thyroid tumors or is secondary to pituitary tumors. There have been no reports of tertiary hypothyroidism due to deficient thyrotropin-releasing hormone (TRH) in dogs or cats. Clinical adult-onset hypothyroidism is not well recognized in cats. One cat with adult-onset hypothyroidism confirmed with a thyroid-stimulating hormone test had clinical signs similar to those of dogs with hypothyroidism, including lethargy, obesity, cold intolerance, and dermatologic abnormalities. A thyroid biopsy identified lymphocytic thyroiditis, with lesions similar to those found in dogs with the same condition. Adult-onset feline hypothyroidism has been experimentally studied in two adult cats using thyroid ablation radiation to create thyroid atrophy. Hypothyroidism was confirmed by measuring sera TT3 and TT4 before and after a TSH-stimulation test. These cats were followed for 163 wk and were found to have minimal clinical abnormalities. The only abnormality the cats developed was marked lethargy by week-17 postthyroid ablation, but they adapted and seemed to return to normal activity by week 40. No changes in body weight or cholesterol were noted, and the only change in hair coat was decreased grooming that resulted in hair mats and seborrhea.

The lynx studied in the present article had thyroid atrophy and replacement of the thyroid gland with adipose tissue. This lynx had clinical signs that most closely resembled the signs observed in the feline thyroid ablation study (decreased activity). Clinical manifestations of canine hypothyroidism
Figure 1. Photomicrographs of the left thyroid gland from a Canadian lynx with clinical signs suggestive of hypothyroidism, showing small thyroid follicles and containing little colloid. H&E. A. ×66. Bar = 100 μm. B. ×132. Bar = 50 μm.
have been well documented. The most common clinical findings are lethargy, weight gain, and dermatologic conditions such as alopecia, pyoderma, and seborrhea.16 Neuromuscular abnormalities, female infertility, myxedema, ocular disorders, and cretinism are less common but well documented.16 Vestibular disease and lower motor neuron deficits are uncommon neurologic manifestations of primary hypothyroidism.4,10,16 The lynx had acute vestibular disease and evidence of hind limb atrophy, signs that occur in hypothyroid dogs.4,10,16 There was no pathologic evidence of disease other than hypothyroidism to explain the lynx’s vestibular disease. Neurologic deficits may be the only clinical signs in some hypothyroid dogs.10,11,16 The lynx’s decreased activity could also have been due to the hind limb atrophy, renal failure, and chronic intervertebral disk disease.

There are only a few reports on the prevalence of histologic disease of feline thyroid glands. One study evaluated 75 consecutive cat necropsies.13 Although none of the cats were suspected to have had thyroid disease, 95% of them had thyroid gland abnormalities, including cystic follicles or adenomas. Lymphocytic thyroiditis and idiopathic thyroid gland atrophy were not identified. Two male cats had thyroid gland amyloidosis with only a few follicles retaining colloid material. This suggests that both had significant loss of functional thyroid gland. Neither cat had amyloid elsewhere in the body, and they showed no clinical signs of hypothyroidism. Both had been euthanized for a facial sinus infection and nephritis. Serum thyroid hormone levels had not been reported in either cat.

The first part of a two-part clinicopathologic study found that 65% of 54 retrospective feline cases and 49% of 86 prospective feline cases had histologic thyroid abnormalities.1 The second part of the same study confirmed that only 16% of the 77 cats with any histologic thyroid lesions had clinical signs relating to thyroid disease.14 Histologic evidence of feline hypothyroidism was found in five of the 140 cases examined (0.03%), and none of these cats had shown signs of hypothyroidism. Thyroid disease is often unrecognized, apparently. The type of hypothyroid changes in two of these five cats may have been due to carcinomatous effects. In three of the cats, amyloidosis caused thickening of the interstitium and severe amyloid formation that almost obliterated the acini.

Deficient circulating thyroid hormone level affects almost the entire metabolic function;4 hence, clinical signs can be variable and their onset subtle, gradual, and mistaken for signs of old age. Many people with adult-onset hypothyroidism also have nonspecific clinical signs that may be attributed to aging and remain undiagnosed for years. Although indices for scoring clinical symptoms were developed in the 1960s, clinical symptoms are being used less as criteria for treatment because of concern about the effects of untreated subclinical hypothyroidism.3,15

Diagnostic tests for hypothyroidism can yield confusing results. Numerous factors, such as concurrent illness, drugs, and random fluctuations of hormone concentration, can falsely lower baseline thyroid hormone concentrations.15,17 Breed, species, and age can introduce variability as well.9 Hypothyroidism can only be diagnosed definitively by histologic examination of the thyroid gland, and this complex and invasive procedure is rarely performed antemortem.4,5

Hypothyroidism in cats was historically diagnosed using history, clinical signs, and blood tests. Nonregenerative anemia (in cats with iatrogenic and congenital hypothyroidism), hypercholesterolemia, low baseline serum TT4 concentration, and a lack of response to TSH stimulation or TRH stimulation testing were suggestive.4 However, bovine-TSH (b-TSH) is not currently available to perform function testing.22 Intravenous use of TRH, a hypothalamic peptide that stimulates pituitary TSH release for diagnosing feline hypothyroidism, is of questionable value because the test has only been evaluated for diagnosing feline hyperthyroidism and salivation, vomiting, tachypnea, and uncontrolled defecation can follow such administration.22

A combination of serologic tests is used to diagnose human and canine hypothyroidism. High TSH, low TT4, and low free T4 (by dialysis) levels suggest hypothyroidism in dogs, particularly in the cases of suspected nonthyroidal illness.2,18 Assays for TSH are species specific, and there are no TSH assays developed from materials of feline origin.6 No assays have been validated for cats or exotic species. The commercially available immunoradiometric assay for canine TSH may, however, detect feline TSH.6 Although it appears to distinguish normal from elevated TSH concentrations in feline sera, it is not able to differentiate normal from pathologically suppressed values and is therefore an unreliable indicator of hyperthyroidism in cats.

There was not enough banked serum to measure our lynx’s TSH levels. Although direct equilibrium dialysis measurement of free T4 has been validated in cats, 17.2% of cats with nonthyroidal illness have false low levels and 6.3% have false elevations.19 And although the lynx’s free T4 concentrations were within the domestic feline reference in-
interval, the previous free T4 value of 17 pmol/L in this lynx decreased during 3 yr to 13 pmol/L at the time of its clinical presentation. These free T4 values cannot be fully interpreted until lynx reference intervals are established.

CONCLUSIONS

Although clinical descriptions of adult-onset hypothyroidism in domestic cats are scarce, histopathology studies support its occurrence. Although not prevalent, it should be considered as a possible diagnosis in older cats with nonspecific signs of disease. Serum TT4 and free T4 levels should be measured and thyroid biopsy considered in suspected cases. Serologic TSH testing in felids may become more valuable as more data are acquired. Once nonthyroid illness has been ruled out, therapeutic trials can be performed. Routine life-long monitoring of TT4, free T4, and (potentially) TSH concentrations in exotic cat species would help to better establish normal value ranges and to diagnose hypothyroidism.

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LITERATURE CITED


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