

## Feline Hyperthyroidism - An Overview

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### Abstract

Thyrotoxicosis is a clinical condition resulting from excessive production and secretion of thyroxine and triiodothyronine. Feline hyperthyroidism is always the result of primary autonomous condition with benign tumor appears to be much more common than carcinomas. Most hyperthyroid cats have variety of clinical signs that reflect multiple organ dysfunction. Most frequent sign includes polyphagia, weight loss, heat intolerance, apathy, diarrhea and also associated with enlargement of one or both thyroid lobes. Hyperthyroidism can be diagnosed based on clinical signs, palpable thyroid nodules, laboratory findings and hormonal assay. Laboratory findings include increase serum enzymes ALT and AST levels. Measurement of random basal serum total T<sub>4</sub> concentration has been extremely reliable in identifying the cats with hyperthyroidism. Serum tT<sub>4</sub> concentration is more reliable than basal serum T<sub>3</sub> levels. If serum hormones fail to confirm thyrotoxicosis then radionuclide thyroid scan should be considered. I<sup>131</sup> and 99mTc (Per technate) provide excellent thyroid images. Thiouracil, Propyl thiouracil (PTU) and Methimazole are drugs used for treatment of thyrotoxicosis. Surgery must be approached as elective procedure and last resort.

**Keywords:** Hyperthyroidism; thyrotoxicosis; total thyroxine; triiodothyronine, tT<sub>4</sub>

### Introduction

Thyroid disorders are very common in pet animals like dogs and cats. Among these disorders hypothyroidism is very common in dogs, while hyperthyroidism is uncommon. In cats hyperthyroidism (thyrotoxicosis) is common and hypothyroidism is very rare condition. Veterinary clinicians were not aware of feline hyperthyroidism until two clinical reports were published by Peterson *et al.* (1979) and Holtzworth *et al.* (1980). Incidence of thyrotoxicosis is steadily increasing. The status of this condition is due to increased awareness amongst owners and diagnostic acuity of Veterinarians. There is no systematic survey on prevalence of thyrotoxicosis in cats has been carried out in India. Hyperthyroidism is caused by the autonomous growth of the follicular cells. There are two types of hyperthyroidism: Exophthalmic goiter (Grave's disease) and toxic adenomatous goiter. In Grave's disease hyperthyroidism appears to be associated with diffuse hyperplasia of thyroid gland. Toxic adenomatous goiter is associated with single or multiple nodules and variable histologic patterns. It is most similar to disorder seen in human beings.

Hyperthyroidism is probably most common endocrinopathy affecting cats older than eight years with an average of thirteen years. There has been no gender or breed predisposition.

Hyperthyroidism in cats is a condition that always arise as a primary autonomous condition of thyroid gland and is rarely due to pituitary and hypothalamus disorders (Bruker, 1999). Benign tumors are common and carcinomas are rare involving one or both thyroid lobes are occurring usually in old cats. Approximately 70-75 percent have benign adenomatous condition involving both lobes. Lesions are histologically similar to nodular hyperplasia or adenomatous goitre in humans (Wakeling *et al.*, 2007).

Although most commercial cat food contains relatively large amount of iodine, studies have failed to demonstrate correlation between dietary iodine and feline hyperthyroidism. Commercial cat food and environment contain variety of other goitrogens, which include Phthalates, Resorcinol, Polyphenol and Polychlorinated biphenyl. Most of them are metabolized via glucuronidation by liver, a process that is usually slow in cats. There is two to threefold increase in risk of developing hyperthyroidism among cats fed on canned cat food. Cats that preferred fish flavoured or liver flavoured canned

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## Feline hyperthyroidism



Fig. 1: Thyrotoxic cat



Fig. 3: Palpable thyroid nodule

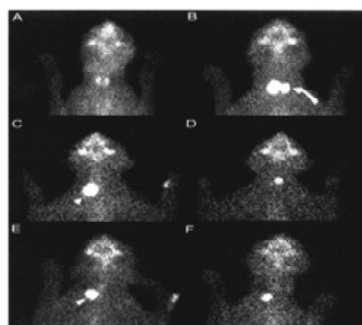


Fig. 2: Thyroid scan

cat food had increased risk of hyperthyroidism (Martin *et al.*, 2000). Thyroid gland contains more selenium per gram than any other tissue. Selenium exerts biological activity through expression of selenoproteins to prevent oxidative damage. Because selenium is also a growth factor, may play role in development of toxic goitre. High selenium concentration may affect feline health (Foster *et al.*, 2001). Further research in this regard is anticipated.

Hyperthyroidism can be diagnosed in most cats based on:

1. Clinical signs
2. Physical examination/ palpable thyroid nodule
3. Laboratory findings
4. Abnormal increase in  $tT_4$  concentration

### Clinical Signs

Hyperthyroid cats have variety of clinical signs that reflect multiple organ dysfunction, weight loss, thinness, atrial fibrillation, anxiousness, muscle weakness and tremors. Mild to moderate increased blood pressure has been documented. Most frequent sign includes heat intolerance, apathy and

diarrhea. Signs are generally gradual and progressive which often delays owner's recognition of the problem. About 92 percent cats showed weight loss, 61 percent polyphagia and 47 percent having polyuria and polydipsia. Weight loss and polyphagia are extremely common signs. The cats were previously thought to be finicky eaters but they can develops excellent appetite. Cat is described as "Always Hungry Cat". Clinical signs are affected by duration of hyperthyroid state and presence and absence of non-thyroidal illness. Nervousness of hyperthyroid cat is characterised by restlessness, irritability and aggressive behaviour (Fig. 1). Most common signs referable to GIT are polyphagia, stool may be soft, bulky and foul smelling. Vomiting is more common than steatorrhea. Although ocular lesions are uncommon in hyperthyroid cats, it must be considered a differential diagnosis in cats brought to the treatment of acute blindness, retinal edema and hemorrhage or detachment. Thyrotoxicosis is one of the common causes of systemic hypertension in cats.

### Physical Examination

In normal healthy cat thyroid lobes are located just below the cricoid cartilage and extended ventrally over the first few tracheal rings. Thyroid lobes are not palpable in normal cats. Hyperthyroidism is invariably associated with enlargement of one or both lobes (more than 91 percent of cases). Increased weight of the lobes associated with adenomatous hyperplasia of thyroid tumor causes migration of these lobes ventrally in the neck. Typical signs of ventroflexion of neck due to weakness of neck muscles. Thiamine and Potassium deficiency must have caused ventroflexion of neck.

### Laboratory Diagnosis

Routine laboratory investigation provides valuable indications of thyrotoxicosis and helps to detect concurrent problems. Hematology shows increased PCV, leucocytosis and lymphopenia. Serum chemistry indicates that more than 90 percent of hyperthyroid cats exhibits abnormalities in serum ALT, AST, increased BUN, Creatinine and Hyperphosphatemia. Serum cholesterol concentration is usually normal in hyperthyroid cats, Lipolysis results in increased FFAs concentration. Specific gravity of the urine will be more than 1.035.

### Hormone Assay

Thyrotoxicosis results in excessive production and secretion of  $T_3$  and  $T_4$ . Measurement of serum total  $T_4$  and  $T_3$  concentrations are commonly used to assess thyroid gland function in veterinary medicine. Measurement of random basal serum total  $T_4$  concentration has been extremely reliable in identifying cats with hyperthyroidism (Nelson and Feldman, 2004). Serum total  $T_4$  concentration is more reliable than basal serum  $T_3$  levels. Commercial veterinary laboratories have now included serum  $T_4$  concentration as a component for feline chemistry profile. In most recent studies serum  $tT_4$  concentration were above normal range in 91 percent of hyperthyroid cats. If cat has serum  $tT_4$  concentration within reference range, it is recommended to repeat the test and second to assay the serum  $fT_4$ . Any abnormally increased serum  $tT_4$  strongly support the diagnosis of thyrotoxicosis especially when appropriate clinical signs are present. The feline reference range is 0.8-2.0  $\mu\text{g}/\text{dl}$ . Hyperthyroid cat may have serum  $tT_4$  value between 2.0-5.0  $\mu\text{g}/\text{dl}$ .

Many studies demonstrated that non thyroidal illness can lower  $T_4$  concentration and decrease their value in cats with hyperthyroidism.  $T_3$  is biologically active hormone, however, primary hormone secreted from canine and feline thyroid gland is  $T_4$ . Total thyroxine can be used for assessment of thyroid gland function in cats suspected of hyperthyroidism. The primary hormone secreted by canine and feline thyroid gland is  $T_4$ , which is metabolized to  $T_3$  at cellular level. The assessment of thyroid gland function in cats suspected of hyperthyroidism has been more reliable with measurement of randomly obtained serum  $tT_4$ . The advantage of assessing serum  $fT_4$  is that it is

more sensitive than serum  $tT_4$  in hyperthyroid cats. But disadvantage is that it is less specific.

Clinician should gain a suspicion of thyrotoxicosis based on careful review of history and physical examination. Careful palpation of cat neck at the area of thoracic inlet is important. Most cats with thyrotoxicosis have a palpable thyroid mass. If thyroid mass is not palpable then clinician should consider that thyroid tissue might be in mediastinum. Diagnosis of thyrotoxicosis can be usually confirmed by evaluation of single random serum total  $T_4$  ( $tT_4$ ). If a cat that appears to be hyperthyroid does not have a diagnostic baseline serum  $tT_4$ , the test can be repeated days to week later along with serum  $fT_3$  concentration. Failure to observe abnormally increased serum  $tT_4$  does not rule out the diagnosis of hyperthyroidism, if clinical signs are consistent. If serum hormones fail to confirm thyrotoxicosis then radionuclide thyroid scan should be considered (Fig. 2). Finally, a possible response to Methimazole therapy would also support the diagnosis. However, trial therapy should be considered as last resort. Surgical exploration of the neck to identify thyroid mass in unconfirmed case is not recommended.

$^{131}\text{I}$  and  $^{99\text{m}}\text{Tc}$  (Pertechnate) provide excellent thyroid images.  $^{99\text{m}}\text{Tc}$  is commonly used and best radionuclide for routine imaging of thyroid gland in human and cats.  $^{99\text{m}}\text{Tc}$  concentrates primarily in three tissues, the thyroid lobe, salivary gland and gastric mucosa. The normal size of the thyroid gland is 1:1 ratio to salivary gland.

### Treatment

Thiouracil, Propylthiouracil (PTU) and Methimazole are drugs used for the treatment of thyrotoxicosis. PTU and Methimazole block synthesis of thyroid hormones by inhibiting organification of iodide. Carbimazole is metabolized to methimazole. Methimazole plasma half-life is 4-14 hrs in human. Methimazole is indicated in treatment of thyrotoxicosis. It is relatively inexpensive, readily available, relatively safe and considered drug of choice for management of feline thyrotoxicosis. Methimazole carries no risk of permanent hypothyroidism. Initial dose of Methimazole 2.5 mg twice a day for two weeks. Most cats require 3 to 7.5 mg/day of Methimazole for control of hyperthyroidism (Nelson and Feldman, 2004).

### Surgical Treatment

As thyroid is easily accessible in hyperthyroidism thus surgical treatment, can correct thyrotoxicosis. It is relatively inexpensive procedure and sophisticated equipments are not required. Surgical removal of thyroid results in permanent cure. But major disadvantage of the surgery is that it increases risk of anesthesia in elderly and fragile cats. It may result in Iatrogenic hypothyroidism and hypoparathyroidism, recurrent laryngeal nerve damage or failure to remove all abnormal thyroidal tissue. An attempt to minimize presurgical and post-surgical complications in hyperthyroid cat should be thoroughly evaluated for co-existing illness prior to surgery like CHF, renal failure, cachexia etc. Reduce surgical and anesthetic complications by controlling thyrotoxicosis prior to surgery. Surgery must be approached as an elective procedure and as last resort, not one that must be performed hastily. Most serious complication associated with bilateral thyroidectomy is postsurgical hypocalcemia. In most cats that retain parathyroid gland activity hypocalcemia is mild and transient (Nelson and Feldman, 2004).

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### J&K admin signs MoU to transform sheep farming sector

Jammu and Kashmir Lieutenant Governor Manoj Sinha on 10<sup>th</sup> Feb, 2022 signed MoU with New Zealand G2G, a public sector company for transforming sheep farming sector in Union Territory with an overarching objective to improve farmer's remuneration, transfer of technology in research, development as well as marketing.