

## Diagnosis and Management of Feline Hyperthyroidism Complicated with Chronic Kidney Disease

Min-Hee Kang and Hee-Myung Park<sup>1</sup>

BK21 Basic & Diagnostic Veterinary Specialist Program for Animal Diseases and Department of Veterinary Internal Medicine, College of Veterinary Medicine, Konkuk University, Seoul 143-701, Korea

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**Abstract :** A 14-year-old spayed, mixed breed, female cat was admitted for evaluation of a polyphagia, hyperactivity and chronic weight loss. Physical examination revealed a tachycardia and mild elevated systemic blood pressure. This cat had azotemia and mild increased total thyroxine (TT4) and free thyroxine concentration. However triiodothyronine (T3) level was normal, the T3 suppression test for definite diagnosis were made. No changes of TT4 serum concentration before and after the exogenous T3 administration in this cat showed hyperthyroidism. This cat was diagnosed as mild hyperthyroidism concurrent with chronic kidney disease (CKD) and antithyroid drug, methimazole, was used for medical management. This is first case report describing clinical and laboratory characteristic features of feline hyperthyroidism complicated with CKD and its clinical outcome using medical management in our country.

**Key words :** Cat, Chronic kidney disease, Hyperthyroidism, Methimazole.

### Introduction

Hyperthyroidism and chronic kidney disease (CKD) is the most common disorder in geriatric cats (2,3,6,7). Hyperthyroidism cause excessive production and secretion of triiodothyronine (T3) and thyroxine (T4) by the thyroid glands which result in multisystemic disorder (2). Diagnosis is usually required clinical history for polyphagia with weight loss and confirmed by measurement of increased serum total T4 (TT4) and T3 concentrations (9,12). Treatments include surgical removal of thyroid gland, medical management with antithyroid drugs, and radioactive iodine therapy (3,9,12).

This is the first case report of definite diagnosis and medical management of feline hyperthyroidism concurrent with CKD in our country.

### Case History

A 14-year-old spayed, mixed breed, female cat was admitted for evaluation of a chronic weight loss, hyperactivity and intermittent vomiting over last six-month period. Physical examination revealed a tachycardia (over 240 beats per minute), poor body condition, excessive shed and poor hair coat. No oral and dental abnormalities were found. Systolic blood pressure was mild elevated (142 mmHg, Cardell Model 9401, Sharn Veterinary Inc., Tampa, FL USA). A complete blood count revealed mild leukocytosis ( $21.96 \times 10^3/\mu\text{l}$ ; reference range,  $5.5\text{-}19.5 \times$

$10^3/\mu\text{l}$ ) with stress leukogram. Serum chemistry profiles showed mild hyperglycemia (152 mg/dl; reference range, 73-134 mg/dl), elevated blood urea nitrogen (BUN) (37 mg/dl; reference range, 8-26 mg/dl) and elevated creatinine (2.1 mg/dl; reference range, 1.0-1.6 mg/dl). Urinalysis revealed inadequate urine concentration (urine specific gravity 1.022) without proteinuria (urine protein : creatinine ratio 0.19). Thoracic radiographs revealed cardiomegaly. On electrocardiography, sinus tachycardia was identified. Ultrasonography of the kidney revealed irregular kidney margin and elevated parenchymal echogenicity of both kidney, and pyelectasis on left kidney. The cat was initially diagnosed as chronic kidney disease (CKD), stage 2. To rule out hyperthyroidism and cardiac disease, further tests, such as thyroid hormone profiles and echocardiography were evaluated. Echocardiography identified no ventricular thickening. Serum TT4 level was mildly elevated (4.9  $\mu\text{g}/\text{dl}$ ; reference range, 0.8-4.0  $\mu\text{g}/\text{dl}$ ) and free T<sub>4</sub> by equilibrium dialysis (FT<sub>4</sub>ED) test was also increased (78 pmol/L; reference range, 10-50 pmol/L). However, serum T<sub>3</sub> was within normal range (60 ng/dl; reference range, 40-150 ng/dl). To confirm hyperthyroidism, T3 suppression test was operated. Exogenous T<sub>3</sub> (liothyronine; Dalim biotech, Seoul, Korea) was administered (25  $\mu\text{g}/\text{cat}$ , PO, q 8 h) for 2 days (6 doses) and on the morning of the 3<sup>rd</sup> day, final dose of T<sub>3</sub> was administered. Blood sample was collected before the test and 4 hours later the last medication for serum TT4 evaluation. Before and after the test, there was no change of serum TT4 level, 3.9  $\mu\text{g}/\text{dl}$  respectively. The cat was diagnosed as hyperthyroidism concurrent with CKD.

Treatment was initiated with oral medication, methimazole (1.25 mg/cat, PO, q 12 h; Bu Kwang Pharm, Seoul, Korea). The

<sup>1</sup>Corresponding author.  
E-mail : parkhee@konkuk.ac.kr

**Table 1.** Laboratory findings in a hyperthyroid cat with a chronic kidney disease

Parameters	Interval after first examination						Reference Range
	0	D7 <sup>a</sup>	D10 <sup>b</sup>	D17 <sup>c</sup>	D31	D45	
BUN(mg/dl)	37	ND*	33	29	34	34	18-33
CRSC(mg/dl)	2.1	ND	2.1	2.1	2.4	2.4	1.0-1.6
ALT(U/L)	62	ND	40	50	35	39	28-106
AST(U/L)	35	ND	ND	ND	35	24	12-71
ALP(U/L)	35	ND	32	33	23	25	14-71
GLU(mg/dl)	152.4	ND	ND	ND	ND	120	73-134
TP(g/dl)	8.1	ND	7.8	7.4	7	7.7	6.6-8.4
ALB(g/dl)	3.4	ND	2.9	2.7	2.8	2.8	1.9-3.9
T4(mcg/dl)	4.9	3.9	3.9	ND	1.4	ND	0.8-4.0
ft4(pmol/L)	78	ND	ND	ND	ND	ND	10-50
T3	60	ND	77	ND	ND	ND	40-150

\*ND : not done, D : days

<sup>a</sup>;the T3 suppression test starting day

<sup>b</sup>;the T3 suppression test finishing day

<sup>c</sup>;a starting day of medical management with methimazole

clinical signs of the cat were improved over the next 2 weeks and serum TT4 level decreased to 1.4 µg/dl. The serum BUN and creatinine concentration had increased slightly after the methimazole administration, however the cat remained clinically healthy 2 months after admission.

## Discussion

Cats with hyperthyroidism have increased glomerular filtration rates (GFR) and decreased creatinine concentration, because excess thyroid hormone decrease peripheral vascular resistance while increasing cardiac output (1,2,10,14). Thus, few reports described hyperthyroid cats with CKD, because high GFR in hyperthyroid cats mask concurrent kidney problem (1,10,13). Similar results such as increased renal blood flow and GFR were revealed in hyperthyroidism human (11). Due to the medical or surgical treatment normalized GFR, treating hyperthyroidism developed azotemia in some cats (1,4, 10,13,14). There is no validate methods to predict renal function before and after treatment for hyperthyroidism (10,14), definite diagnosis before treatment and closer monitoring of renal function during treatment is important. Usually clinical history, laboratory examination including elevated TT4 and T3 are used for diagnosis of hyperthyroidism (3). However, mild hyperthyroid cat have normal or mildly increased serum TT4 and T3 concentration. In this situation, the T3 suppression test appears to be valuable methods to differentiate hyperthyroid cat from normal one (8).

In the present case, the cat was diagnosed as CKD based on the history and laboratory examination. Hyperthyroidism was also suspected due to the increased serum TT4, FT<sub>4</sub>ED and nor-

mal T3 concentration. Up to 25% of all affected patients, serum T3 values are within the reference range (8). For definite diagnosis of hyperthyroidism, T3 suppression test were operated. After administration of exogenous T3, serum TT4 concentrations were not changed in this cat, which usually significantly decreased in normal thyroid functional cat. The final diagnosis of this cat was mild hyperthyroidism concurrent with CKD.

Treatment of hyperthyroidism have three options; surgical removing of thyroid gland, antithyroid medication, and radioactive iodine (9,12). This cat had only mild hyperthyroidism and kidney problem, antithyroid drug was initiated. Methimazole is an effective and safe antithyroid drug and can administer by oral and transdermal (5,9). Transdermal methimazole treatment is better compliance by the owner and less side effects compare to oral medication, however it is not available at this time.

The combined measurement of TT4, FT<sub>4</sub>ED, T3 and T3 suppression tests may have diagnostic value for definite diagnosis of hyperthyroidism in cats with concurrent CKD. Management with methimazole may be worsening the azotemia in the CKD cats, however this is relatively safe method to control the hyperthyroidism in cats with CKD.

In the present case report, we described a case of hyperthyroidism in a cat complicated with CKD. In conclusion, this case demonstrates that the T3 suppression test is valuable methods in mild hyperthyroid cat and methimazole is relatively safe and effective treatment option.

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## Reference

1. Adams WH, Daniel GB, Legendre AM. Investigation of the effects of hyperthyroidism on renal function in the cat. *Can J Vet Res* 1997; 61: 53-56.
2. Becker TJ, Graves TK, Kruger JM, Braselton WE, Nachreiner RF. Effects of methimazole on renal function in cats with hyperthyroidism. *J Am Anim Hosp Assoc* 2000; 36: 215-223.
3. Feldman EC, Nelson RW. Feline hyperthyroidism. In: *Canine and Feline Endocrinology and Reproduction* 2nd ed. Philadelphia: WB Saunders, 1996; 118-165.
4. Graves TK, Olivier NB, Nachreiner RF, Kruger JM, Walshaw R, Stickle RL. Changes in renal function associated with treatment of hyperthyroidism in cats. *Am J Vet Res* 1994; 55: 1745-1749.
5. Hoffmann G, Marks SL, Taboada J, Hosgood GL, Wolfsheimer KJ. Transdermal methimazole treatment in cats with hyperthyroidism. *J Feline Med Surg* 2003; 5: 77-82.
6. Maddison J, Syme H. Chronic kidney disease in dogs and cats: pathophysiology and diagnosis. *Ir Vet J* 2009; 63: 44-50.
7. May SN, Langston CE. Managing chronic renal failure. *Compend Contin Educ Pract Vet* 2006; 853-863.
8. Peterson ME, Graves TK, Gamble DA. Triiodothyronine (T3) suppression test - an aid in the diagnosis of mild hyperthyroidism in cats. *J Vet Intern Med* 1990; 4: 233-238.
9. Peterson ME, Kintzer PP, Hurvitz AI. Methimazole treatment of 262 cats with hyperthyroidism. *J Vet Intern Med* 1988; 2: 150-157.
10. Riensche MR, Graves TK, Schaeffer DJ. An investigation of predictors of renal insufficiency following treatment of hyperthyroidism in cats. *J Feline Med Surg* 2008; 10: 160-166.
11. Shirota T, Shinoda T, Yamada T, Aizawa T. Alteration of renal function in hyperthyroidism: increased tubular secretion of creatinine and decreased distal tubule delivery of chloride. *Metabolism* 1992; 41: 402-405.
12. Trepanier LA. Medical management of hyperthyroidism. *Clinic Tech Small Anim Pract* 2006; 21: 22-28.
13. Wakeling J, Moore K, Elliott J, Syme H. Diagnosis of hyperthyroidism in cats with mild chronic kidney disease. *J Small Anim Pract* 2008; 49: 287-294.
14. Williams TL, Peak KJ, Brodbelt D, Elliott J, Syme HM. Survival and the development of azotemia after treatment of hyperthyroid cats. *J Vet Intern Med* 2010; 24: 863-869.

## 고양이에서 만성 신부전에 병발한 갑상선 기능 항진증의 진단과 치료

강민희 · 박희명<sup>1</sup>

건국대학교 수의과대학 내과학교실

**요 약** : 14년령의 갑종 암컷 고양이가 다식증, 과잉행동 및 체중감소를 주증으로 내원 하였다. 신체검사서 빈백과 고혈압이 확인되었으며, 실험실 검사를 통하여 요소 질소 증 및 갑상선 호르몬 (TT4, fT4)의 상승이 확인 되었다. 환자는 확진을 위하여 T3 억압 시험이 시행 되었으며, 검사 결과 외부에서 T3가 공급된 전후의 갑상선 호르몬 수치에 변화가 없는 것이 확인 되었다. 따라서, 환축은 만성 신부전에 병발한 갑상선 기능 항진증으로 진단되었으며, 메티마졸을 이용한 약물 관리가 실시 되었다. 결론적으로 본 증례의 경우 고양이에서 발생한 만성 신부전에 병발한 갑상선 기능 항진증의 임상증상과 진단, 그리고 치료 반응에 대한 국내 첫 증례보고이다.

**주요어** : 고양이, 만성 신부전, 갑상선기능 항진증, 메티마졸