



## Frequently-Asked Questions: Thyroid Function in Cats

### How do I diagnose hyperthyroidism in a cat?

In a cat with appropriate clinical signs of hyperthyroidism, a first step would be to perform a feline thyroid profile. Remember signalment is important in considering a diagnosis of hyperthyroidism. So far, hyperthyroidism has not been diagnosed in cats less than 6-7 years of age.

Most hyperthyroid cats have high serum concentrations of thyroid hormones. However, there are a small proportion of hyperthyroid cats which have normal or only slightly elevated thyroid hormone concentrations. This phenomenon is termed "occult hyperthyroidism." A number of possible explanations exist for this phenomenon including the presence of thyroid pathology which is not yet sufficiently severe to be easily documented (mild disease); the presence of a concurrent non-thyroidal illness; and day-to-day or week-to-week fluctuations in thyroid hormone concentrations in hyperthyroid cats which sometimes dip into the reference range.

Therefore, the finding of normal thyroid hormones in a cat with appropriate clinical findings does not rule out hyperthyroidism. In most of these cases, however, the thyroid hormone concentration is within the top half, or more often the top quarter, of the reference range. To continue investigating the possibility of hyperthyroidism, consider doing one of the following: 1) repeat the profile after a few weeks, 2) perform a T3 suppression test.

### How do I interpret the T3 suppression test?

The first step in interpreting a T3 suppression test is to compare the pre- and post- pill T3 and FT3 concentrations. We need to document an increase in 2 to 3 hour post pill T3 and FT3 to demonstrate that the medication was adequately administered and absorbed. If there is no change in T3 and FT3, and the baseline T3 and T4 concentrations are not clearly elevated, we cannot make a correct interpretation of the test. In a normal cat without hyperthyroidism, administered T3 will exert a negative feedback on pituitary production of TSH, resulting in suppressed serum T4 and FT4 concentrations. Autonomously functioning thyroid tissue (hyperthyroidism) will not respond to the negative feedback effect of exogenous T3 (either because TSH production is already suppressed by the thyroid *hyper*function or because the adenomatous tissue does not respond to changes in TSH concentration). Therefore, hyperthyroid cats show no (or very little) decrease in T4 and FT4 concentration during the T3 suppression test. The determination between what is adequate suppression to rule out hyperthyroidism and what is inadequate suppression indicating hyperthyroidism is best made using multivariable criteria established in original publications (e.g. Refsal KR, Nachreiner RF, Stein BE et al. Use of the tri-iodothyronine suppression test for diagnosis of hyperthyroidism in ill cats that have serum concentration of iodothyronines within normal range. Journal of the American Veterinary Medical Association 1991; 199: 1594-1601). In practical terms, a suppression of 50% or greater from baseline T4 concentrations rules out hyperthyroidism while 30 to 50% is borderline. Perhaps because this test is commonly applied to equivocal cases, it is not uncommon to see equivocal results which give mixed interpretative messages in the multiparameter interpretation.

### **How do I interpret a low T4 and T3 in a cat?**

Non-thyroidal factors such as illness (euthyroid sick) or glucocorticoid therapy can cause a significant decrease in serum concentrations of thyroid hormones in the cat. In fact, this decrease in thyroid hormone concentration is correlated with prognosis. The lower the T4 concentration; the worse the prognosis regardless of the underlying cause (Peterson ME and Gamble DA. Effect of non-thyroidal illness on serum thyroxine concentration in cats (1988). *Journal of the American Veterinary Medical Association* 1990; **197**: 1203-1208, and Mooney CT, Little CJ and Macrae AM. Effect of illness not associated with the thyroid gland on serum total and free thyroxine concentrations in cats. *Journal of the American Veterinary Medical Association* 1996; **208**: 2004-2008).

Hypothyroidism is rare in cats, and only few cases of naturally-occurring primary hypothyroidism have been documented. However, iatrogenic hypothyroidism following treatment for hyperthyroidism including chronic methimazole, bilateral thyroidectomy or radioactive iodine treatment is a common cause of decreased thyroid hormone concentrations. Recent laboratory data suggest that the canine endogenous TSH assay has sufficient cross-reactivity with feline TSH to be useful in the diagnosis of primary feline hypothyroidism—see submission forms.

### **Is the TSH assay valid in the cat?**

The TSH assay used at MSU is marketed as canine assay. However, there is some cross-reactivity with feline TSH, which allows us to use the test to identify hypothyroid cats. Studies of diagnostic sensitivity and specificity of TSH are difficult to perform because of the rarity of naturally-occurring primary hypothyroidism in cats. However, our experience with iatrogenic hypothyroidism (following treatment for hyperthyroidism) suggests that diagnostic sensitivity and specificity might be similar to that reported for the dog. Causes of false positive elevations in TSH concentration in the cat may be similar to those in the dog, such as following treatment with sulfonamides, or during the recovery phase after a serious illness. Abnormally high levels of T4, as seen in hyperthyroidism, will inhibit TSH secretion and cause low values, however, the analytical sensitivity of the test is not sufficient for it to be a reliable adjunct in the diagnosis of hyperthyroidism.

### **Free T4 by dialysis is elevated, but the other tests are normal or low. Is this cat hyperthyroid?**

When Free T4 by dialysis (FT4D) is clearly very much higher than would be expected from the other test results, it may be that the dialysis membrane was disrupted and the result is invalid. If we have sufficient serum available we can re-run these analyses. In rare cases of feline non-thyroidal illness we might see an above reference range FT4D (Mooney CT, Little CJ and Macrae AM. Effect of illness not associated with the thyroid gland on serum total and free thyroxine concentrations in cats. *Journal of the American Veterinary Medical Association* 1996; **208**: 2004-2008). The Free T4 2 Step (FT4-2S) is also helpful in this regard. Low or normal T3's and TT4 are attributed to an effect of the illness on serum protein binding characteristics. Also increased plasma concentrations of free fatty acids (in some feline hyperlipidemic and negative energy balance states) will displace T4 from binding proteins and increase measured FT4.

### **If you suspect hyperthyroidism in a cat, yet all the thyroid hormone concentrations are within normal limits. Does this rule out hyperthyroidism?**

No. Especially if the T4 or FT4 are on the higher end of the reference range. See second question above.

### **Can cats become hypothyroid after treatment for hyperthyroidism?**

Iatrogenic hypothyroidism following treatment for hyperthyroidism including chronic methimazole, bilateral thyroidectomy or radioactive iodine treatment is a common cause of decreased T4 levels. Recent laboratory data suggest that the canine endogenous TSH assay has sufficient cross-reactivity with feline TSH to be useful in the diagnosis of primary feline hypothyroidism.

### **Why does a sample for a premium thyroid profile need to be shipped on ice? Why does it have to be shipped to arrive in 2 days or faster?**

Time and temperature can both have an effect on Free T4 by equilibrium dialysis (FT4d). Most thyroid hormone exists bound to proteins, and only a small percentage exists as free hormone. Once a sample is drawn, these proteins start to break down, releasing more free thyroid hormone. This process is accelerated with warm temperatures, and over time. This release of free hormone from the binding proteins can result in a 'false' increase in measured FT4 by equilibrium dialysis.