ANESTHESIA CONCERNS FOR HYPERTHYROID CATS
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**Key points**
- Effects of excessive thyroid hormones
- Management of comorbidities
- Anesthetic protocols

Excessive amounts of thyroid hormones, T4 and T3 are responsible for increased metabolic rate. To review the thyroid gland helps to regulate many metabolic processes – growth, development and energy expenditure. T3 and T4 hormones help control metabolism. Feline hyperthyroidism is the most common disease of the endocrine system in our feline patients.

Signs and symptoms that may be seen with these patients may include:
- Weight loss despite polyphagia
- Polyuria/polydipsia
- Vomiting
- Diarrhea
- Behavioral changes
- Tachycardia
- Poor hair coat
- Muscular weakness
- Systemic hypertension

The key points to remember when dealing with hyperthyroid feline patients is to recognize the physiological changes that have occurred. The increased metabolic rate typically gives us a thin patient with little or no fat reserves.

Behavioral changes tend towards hyperexcitability often making these patients more challenging to being handled. Increasing the patient’s stress level during handling exacerbates any existing tachycardia and systemic hypertension. If at all possible, an experienced technician team should handle these patients during the exam, and perianesthetic period.

This disease is often seen in our senior/geriatric patients that may or will have concurrent renal compromise. Special care must be taken to provide for renal perfusion during the anesthesia to avoid any decompensation. Since hyperthyroidism induces increases in blood pressure and blood supply to the kidneys, treating the disease will result in a drop in the blood supply to the kidneys. In a cat with kidney failure, this can cause a worsening of their kidney function in the few months after treatment for hyperthyroidism with either radioactive iodine or surgical removal of the gland. Medical management of hyperthyroidism using methimazole has been shown to cause an alteration in the glomerular filtration rate of feline patients. It is not uncommon to attempt to make patients euthyroid prior to surgery. Renal function must be monitored prior to surgery as well as followed in the post-operative period.

Cardiovascular alterations seen as a result of the hyperthyroidism may include the development of hypertrophic cardiomyopathy as well as systemic hypertension. Hypertrophic cardiomyopathy is a disease that causes thickening of the heart muscle resulting in poor relaxing
and filling ability. As the left ventricle becomes progressively thicker, less blood can enter the chamber; thus, less blood is ejected out to the body. Care must be taken not to cause any additional increase in heart rate further compromising cardiac output. Tachycardia causes an increase in myocardial oxygen demand putting further stress on the cardiac muscle which is already working overtime. A systolic murmur may be noted as may a gallop sound during auscultation. Arrhythmias seen with these patients are sinus tachycardia with the possibility of ventricular ectopic beats.

The combination of overall muscular weakness and hypertrophic cardiomyopathy may give you a patient that is tachypnic.

Developing your plan – there is no easy cookbook recipe that will obviously cover all hyperthyroid patients. Care must be taken to tailor your agents based on each individual patient needs. There are however some agents that should only be used as rescue agents.

Anticholinergics- Atropine/glycopyrrolate: Will cause an increase in heart rate, contractility, cardiac output and myocardial oxygen consumption. Rescue doses should be at hand but carefully consider the resting heart rate before routine administration.

Alpha 2 agonists- Profound sedation and analgesia. Significant cardiovascular effects include: vasoconstriction, bradycardia, decreased cardiac output. Not optimal for those individuals with cardiac compromise. An extremely low dose, 3mcg/kg, may be used if absolutely demanded by the patient for handling. I would typically combine this with butorphanol at 0.2-0.4 mg/kg for a premedication.

Benzodiazepines - Midazolam and diazepam: Cause little or no myocardial depressant effects. May see increase in heart rate due to excitation with inadequate use of adjunctive agent, i.e. mu opioid Midazolam: Water soluble and is more useful for IM injections. When combined with an opioid, it will provide neuroleptanalgesia. NOT reliable as tranquilizers for dogs and cats!! Patients may lose inhibitions and become excitable. When combined with an opioid as a CRI can be utilized to decrease MAC of inhalant agent. No analgesia provided.

Disassociative agents- Will indirectly stimulate the cardiovascular system by increasing sympathetic tone cause an increase in heart rate, cardiac output, mean arterial pressure, pulmonary arterial pressure and central venous pressure. Increase in rate causes an increase in myocardial work and oxygen demand/consumption. Ketamine does not produce a true anesthetic state – dissociation from the environment with analgesia and sensory loss. Heart rate and arterial pressure increase due to an increase in sympathetic tone (CNS derived). Telazol, tiletamine and zolazepam (benzodiazepine) has clinical effects similar to ketamine.

Propofol is a hypnotic agent and does cause direct myocardial depression as well as decrease in systemic vascular resistance. Decrease in contractility leads to increase in heart rate – will be transient – lasting several minutes.

If at all possible, preoxygenate the patient, propofol induction will allow for rapid capture of the airway and is the lesser of the evils. To avoid the least amount of inhalant, you may consider CRI administration of a pure mu opioid intra-op with or without a benzodiazepine.

Monitoring of these patients is critical to ensure appropriate heart rate, rhythm and systemic blood pressure.