

Hypercalcemia

A PowerPage Presented By



Hypercalcemia is most commonly identified on routine biochemical screening tests either as part of the workup of related clinical signs or just by chance. There are many potential causes of hypercalcemia and making a correct etiologic diagnosis is critical to patient management. Several of the important individual causes of hypercalcemia have a dedicated PowerPage including hypoadrenocorticism, renal insufficiency, and lymphoma. Instead of a detailed discussion of each potential cause of hypercalcemia, this PowerPage presents the differential diagnoses and a logical approach to the evaluation and diagnosis of a dog or cat patient with hypercalcemia.

Definitions

- Hypercalcemia
 - Serum total calcium >12 mg/dl
 - Serum ionized calcium >1.4 mmol/l

Relevant Pathophysiology

Calcium is regulated in the body by parathyroid hormone (PTH), vitamin D (calcitriol), and calcitonin

- PTH- Causes increased Ca and P mobilization from bone and promotes phosphate excretion and calcium retention by the kidneys (overall should cause increased Ca and decreased P)
- Calcitriol- Increases Ca absorption from intestines and results in increased P as well
- Calcitonin- Reduces calcium levels by inhibition of osteoclastic bone resorption

Clinical Signs of Hypercalcemia

Clinical signs of hypercalcemia are generally seen when levels are >15 mg/dl. Animals with levels >18 mg/dl may be much debilitated. Clinical signs may include:

- **Polydipsia, polyuria**
- Anorexia
- Depression, weakness
- Vomiting
- Constipation
- Arrhythmias
- Seizures, **muscle tremors**

Differential Diagnoses for Hypercalcemia

This is a fairly complete list of differential diagnoses for hypercalcemia:

- Many mnemonics/variations are used to remember these; one of the more complete ones is GOSH DARN IT
- G-Granulomatous disease, growing young dogs

- O-Osteolytic disease (osteomyelitis, neoplasia)
- S- Spurious (lipemic or post-prandial blood samples, lab error, hemolysis)
- H-Hyperparathyroidism (primary)
- D- Drugs (thiazides, calcium containing phosphate binders)
- A- Addison's disease (hypoadrenocorticism)
- R- Renal failure (acute or chronic)
- N- Nutritional (Hypervitaminosis D- from drugs, cholecalciferol rodenticide, or poisonous plants, hypervitaminosis A, or excess Ca)
- I- Idiopathic (mainly cats)
- T- Tumors
 - Humoral hypercalcemia of malignancy
 - Most commonly lymphoma, apocrine gland anal sac adenocarcinoma
 - Bone osteolysis
 - Most commonly multiple myeloma. Also lymphoma or bony neoplasia
- Of these differentials, most are easily diagnosed by history, PE, and minimum database tests, and repeating a fasting serum calcium measurement except for hypoadrenocorticism, hyperparathyroidism, neoplasia, and idiopathic

Workup and Diagnosis

- Thorough history and physical exam
 - Including rectal exam, lymph node and mammary chain palpation
 - Orthopedic exam
- CBC, biochemical profile, and urinalysis
 - Assess BUN/Creatinine for renal function
 - Assess electrolytes (Na: K ratio <27:1 suggestive of Addison's)
 - Hyperglobulinemia- suggestive of myeloma or lymphoma
- Diagnostic imaging
 - Thoracic radiographs to assess for hilar lymphadenopathy, granulomatous pulmonary disease, lytic bone lesions
- Additional tests depend on degree of suspicion for hypoadrenocorticism, hyperparathyroidism, neoplasia, and idiopathic and may include:
 - Can perform ACTH stimulation test to rule out hypoadrenocorticism if suspected
 - Cervical ultrasound or cross sectional imaging (CT/MRI) to assess parathyroid glands
 - PTH-rP levels to assess for humoral hypercalcemia of malignancy

Treatment of Hypercalcemia

- The best treatment is to identify and address the underlying etiology
- Options for treating the symptoms of hypercalcemia itself include:
 - IV fluid diuresis (0.9% NaCl is fluid of choice)
 - Furosemide promotes calciuresis but should only be given to hydrated patients (avoid thiazides)
 - Prednisone or dexamethasone are glucocorticoids that promote calciuresis and decrease bone resorption and intestinal absorption of calcium
 - Administration to a possible lymphoma candidate can hamper diagnosis and decrease effectiveness of eventual treatment
 - Avoid if diagnosis is unknown



- Bisphosphonates- Inhibit osteoclast activity
- Calcitonin- Mainly used for hypervitaminosis D (largely replaced by bisphosphonates)
- Sodium bicarbonate- Decreases ionized calcium which is responsible for most signs
 - Usually only given as an emergency treatment

