

Calcium

Interpretive Summary

Description: Calcium is an ion that is required by the body for numerous intracellular and extracellular functions. Calcium also is a major component in the structure of bone.

Decreased Calcium

Common Causes

- Chronic kidney disease (dog, cat)
- Acute pancreatitis (dog, cat)
- Decreased serum albumin
- Hypoparathyroidism
- Ethylene glycol toxicity (dog, cat)
- Puerperal tetany/eclampsia (dog, horse)
- Artifact (EDTA contamination)

Uncommon Causes

- Acute tumor lysis syndrome
- Exocrine pancreatic insufficiency
- Intestinal malabsorption
- Cushing's disease (dog)
- Hypercalcitonism
- Hypovitaminosis D (dog)
- Nutritional secondary hyperparathyroidism
- Tetracycline or anticoagulant administration
- Blister beetle poisoning (horse)
- Myopathies (exertional rhabdomyolysis or malignant hyperthermia of horses)

Related Findings

- Chronic kidney disease
 - Increased BUN and creatinine, normal to increased phosphorus
 - Decreased urine specific gravity
- Acute pancreatitis
 - Increased amylase and lipase
 - Increased Spec cPL® or Spec fPL®
- Hypoparathyroidism
 - High normal to increased phosphorus
 - Decreased PTH and ionized calcium
- Ethylene glycol toxicity
 - Decreased bicarbonate, urine specific gravity
 - Increased anion gap, BUN, creatinine, phosphorus and glucose
 - Serum and urine ethylene glycol concentrations may be increased or normal
- EDTA Contamination
 - Increased potassium and decreased alkaline phosphatase

Increased Calcium

Common Causes

- Hypercalcemia of malignancy
 - Lymphoma
 - Multiple myeloma
 - Anal gland adenocarcinoma
 - Thymoma
 - Other neoplasms
- Idiopathic hypercalcemia (cats)
- Primary hyperparathyroidism
- Kidney disease (common in horses; uncommon in dog, cat)
- Addison's disease
- Granulomatous inflammation (e.g. fungal infection)
- Toxins
 - Vitamin D (cholecalciferol rodenticides)
 - Jasmine
 - *Cestrum* spp.
 - *Solanum* spp.
 - Calcipotriol or tacalcitol

Uncommon Causes

- Bone disorders
 - Osteolytic bone lesions
 - Hypertrophic osteodystrophy
- Hemoconcentration (increased serum albumin)
- Canine schistosomiasis
- Pulmonary angiostrongylosis (Europe/Newfoundland – expanding range)
- Young animals, especially large breed dogs
- Artifact
 - Lipemia
 - Postprandial

Related Findings

- Hypercalcemia of Malignancy
 - Increased ionized calcium and decreased parathyroid hormone (PTH)
 - Increased parathyroid hormone-related protein (PTHrp)
 - If associated with increased PTHrp, often have decreased or low normal phosphorus
 - Not all hypercalcemia of malignancy cases will have an increased PTHrp
 - Cytology and/or histopathology consistent with neoplasia
- Hyperparathyroidism
 - High normal to increased PTH and increased ionized calcium
 - Often have decreased or low normal phosphorus
- Kidney Disease
 - Increased BUN, creatinine, phosphorus
 - Decreased urine specific gravity
 - Decreased/normal ionized calcium and increased PTH
- Addison's disease
 - Often have increased potassium and decreased sodium
 - Lack of a stress leukogram (normal or increased lymphocytes and/or eosinophils)
 - Failure to stimulate on an ACTH stimulation test
- Fungal disease
 - Often have increased monocytes and neutrophils
 - Positive serology for antifungal antibodies or antigen
 - Positive PCR or urine antigen tests

- Cytology and/or histopathology consistent with fungal disease
 - Vitamin D Toxicity
 - Increased ionized calcium and decreased PTH
 - Normal to increased vitamin D concentration
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Additional Information

Physiology

- Calcium is controlled by PTH and Vitamin D, and their interactions with bone, kidneys, intestines, and parathyroid glands.
- Total calcium concentration is measured in chemistry panels, and is comprised of three fractions: 50% ionized, 40% protein bound, and 10% complexed to nonprotein anions.
- Ionized calcium is the active form that is hormonally regulated and is available to tissues. The protein bound form is not available to tissues.
- Ionized and complexed forms are filtered by the kidneys; protein bound calcium is not filtered by the kidneys.
- When albumin decreases, there is a proportional decrease in total calcium, but ionized (active form) calcium is unchanged.

References

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