Alkaline Phosphatase (ALP)

Interpretive Summary

**Description:** Alkaline Phosphatase (ALP) is primarily an indicator of cholestatic liver disease. It also increases with severe bone destruction and due to steroid induction.

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**Decreased ALP**

**Common Causes**

- Not clinically significant
- Artifact
  - Hemolysis
  - Assay performed on EDTA plasma

**Increased ALP**

**Common Causes**

- Cholestasis, either intrahepatic or extrahepatic (dogs > cats or horses)
  - Impaired bile flow due to:
    - Hepatic necrosis
    - Hepatocellular swelling
  - Cushing's disease (dogs)
  - Hepatic lipodosis (cats)
  - Diabetes mellitus
  - Gall bladder mucocoele/stones
  - Hyperthyroidism (cats)
  - Neoplasia
    - Cholangiohepatitis/cholecystitis
    - Pancreatitis
- Induction by drugs or hormones
  - Corticosteroids
  - Phenobarbital
  - Thyroxine
- Increased osteoblastic activity in bone
  - Young animals (increases up to 3-4 times level expected in mature dogs)
  - Osteosarcoma, other bone neoplasia

**Uncommon Causes**

- Drugs (dogs)
  - Phenytoin
  - Primidone
- Toxic
  - Ragwort (horses)
  - Alsike clover (horses)
  - Mycotoxin
- Increased osteoblastic activity in bone (dogs)
  - Fracture repair
  - Rickets
  - Hyperparathyroidism
• Benign familial hyperphosphatasemia (Siberian Huskies)
• Benign hyperphosphatasemia (Scottish Terriers)
  o Adults >6 yo, may have higher ALP values than other breeds when matched for age
• Miscellaneous
  o Neoplasia (benign and mammary tumors in dogs)
  o Post-suckling pups and foals
  o Increased placental ALP in late term pregnancy (cats)

Related Findings

• Cholestasis
  o Increased ALT, AST, GGT, bilirubin
  o Abdominal radiographs may show:
    ▪ Enlarged liver
    ▪ Gall stones or calcification of gall bladder (rare)
  o Abdominal ultrasound may show:
    ▪ Enlarged, hyperechoic liver
    ▪ Abnormal gall bladder
      ▪ Enlarged/obstructed
      ▪ Mucocele
      ▪ Stones in the gall bladder
  o Histopathology/cytology findings consistent with cholestatic liver disease
• Cushing’s disease
  o Decreased urine specific gravity
  o Stress leukogram: increased neutrophils and monocytes, decreased lymphocytes and/or eosinophils
  o Adrenal function tests consistent with Cushing’s disease
• Hepatic lipidosis
  o ALP:GGT ratio increased compared to other liver diseases in cats
• Diabetes mellitus
  o Increased serum glucose and glucosuria
  o Increased fructosamine
• Hyperthyroidism
  o Increased T4, free T4, free T4 by equilibrium dialysis
• Neoplasia
  o Enlarged/irregular liver on radiographs and/or ultrasound
  o Cytology/histopathology findings consistent with neoplasia
• Pancreatitis
  o Increased amylase and lipase
  o Increased Spec cPL® or Spec fPL®
• Osteosarcoma
  o Proliferative bone lesions on radiographs
  o Cytology/histopathology findings consistent with neoplasia

Additional Information

Physiology

• Alkaline phosphatase refers to a group of enzymes that catalyze hydrolysis of phosphate esters in an alkaline environment in vitro.
• Cellular function is poorly described, but these are membrane-bound enzymes present in most tissues.
• High activities are present in liver, bone, intestine, kidney, and placenta.
• Changes in the serum level of ALP are attributed primarily to hepatic (L-ALP) and bone (B-ALP) isoenzymes since intestinal, renal, and placental isoenzymes have extremely short half lives.
Hepatic ALP is found mainly in liver canalicular cell membranes and increases with biliary disease, especially with cholestasis.

In dogs, glucocorticoids (endogenous or exogenous) induce an isoenzyme in the liver (C-ALP) that contributes to serum increases.

In cats, the hepatic isoenzyme has such a short half-life that even minor increases are considered significant.

In horses, serum ALP levels are highly variable, and are of limited diagnostic use.

References


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