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.

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 lipidosis (cats)
    - Diabetes mellitus
    - Gall bladder mucocoele/stones
    - Hyperthyroidism (cats)
    - Neoplasia
    - Inflammatory
        - 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)
    - Adults >6 yo, may have higher ALP values than other breeds when matched for age
- Miscellaneous
    - Neoplasia (benign and mammary tumors in dogs)
    - Post-suckling pups and foals
    - Increased placental ALP in late term pregnancy (cats)

Related Findings

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

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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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