

Alkaline Phosphatase Elevation in Cats & Dogs

One of my tasks as a board-certified veterinary internal medicine specialist is interpreting a wide variety of diagnostic tests. One of the most common laboratory abnormalities for which patients are referred to me is elevation of an enzyme called alkaline phosphatase, often abbreviated as SAP, SALP, and ALP. There are numerous potential reasons for the enzyme to be elevated, so this week I'm sharing information about ALP in hopes of bringing some clarity to an often mysterious biochemical abnormality. I hope you enjoy the post. Happy reading!



What is alkaline phosphatase?

Alkaline phosphatase is a group of enzymes in the body that cause the breakdown of organic compounds in the body called phosphate esters. This enzyme is produced by two specific genes or isoenzymes:

- Intestinal ALP gene/isoenzyme
- Tissue non-specific ALP gene/isoenzyme

Each isoenzyme has a different amino acid sequence but has similar enzymatic activity. Each isoenzyme produces different forms - these are called isoforms. Some of these isoforms can be measured, including:

- Intestinal ALP isoenzyme - intestinal ALP isoform, corticosteroid ALP isoform (dog only)
- Tissue non-specific ALP isoenzyme - liver ALP isoform, bone ALP isoform, placental ALP isoform, leukocyte (white blood cell) ALP isoform

The naming of these genes/isoenzymes can be confusing. For example, the intestinal ALP gene/isoenzyme is NOT made by intestinal tissue; rather it is made by liver and biliary cells.

The proportion of isoforms varies with age. For example, the bone ALP isoform is most prevalent in dogs less than one year of age because of bone growth. In contrast, the liver ALP isoform predominates in dogs older than one year. The corticosteroid ALP isoform accounts for 10-30% of total alkaline phosphatase in normal dogs. Based on published studies, the proportion of the bone ALP isoform decreases and the proportion of C-ALP increases as dogs age.



What causes ALP to increase?

As you can imagine, there are many potential causes of alkaline phosphatase elevation in cats and dogs given the different isoforms of the enzyme. With that being said, most causes of alkaline phosphatase are due to the liver, bone, and/or corticosteroid isoforms. Some common causes are:

LIVER ISOFORM

1. Liver, gall bladder, and pancreatic diseases - gall bladder mucocele, copper storage disease, chronic active hepatitis, common bile duct obstruction, acute & chronic pancreatitis, hepatic lipidosis, cancers, vacuolar hepatopathy, nodular hyperplasia, portosystemic vascular anomalies (shunting disorders)
2. Hormone disorders - hyperadrenocorticism (Cushing's disease), hypothyroidism, diabetes mellitus
3. Acute or chronic stress
4. Drugs - phenobarbital, corticosteroids (e.g.: prednisone, dexamethasone)
5. Inflammatory bowel disease
6. Sepsis
7. Specific breeds - Miniature schnauzers

BONE ISOFORM

1. Young growing animals
2. Specific breeds - Siberian huskies
3. Cancers - mammary gland tumors, osteosarcoma
4. Hormone disorders - hyperparathyroidism, hyperthyroidism
5. Healing fractures
6. Nutritional bone diseases

CORTICOSTEROID ISOFORM

1. Specific breeds - Scottish terriers
2. Hormone disorders - hyperadrenocorticism (Cushing's disease), diabetes mellitus, liver & gall bladder diseases
3. Drugs - corticosteroids (e.g.: prednisone, dexamethasone), progesterone
4. Acute or chronic stress

As you can see, some diseases cause multiple isoforms to elevate. Nevertheless, the point is this: alkaline phosphatase is elevated, and a thorough diagnostic investigation is required to determine the definitive cause(s).



How do you diagnose the cause of ALP elevation?

The first steps veterinarians will take to try to determine the definitive cause(s) of alkaline phosphatase elevation are reviewing a patient's thorough medical history and performing a complete physical examination. Particular attention is paid to a patient's age, current medications & supplements, diet, and known diseases. Subsequently, blood, urine, and/or diagnostic imaging may be indicated, including:

- Complete blood count
- Biochemical profile
- Urinalysis
- Thyroid profile
- Adrenal function testing
- Isoform differentiation
- Liver function testing (e.g.: serum bile acids, plasma ammonia level)
- Liver sampling (e.g.: cytology, biopsy)
- Screening for pancreatic inflammation & dysfunction
- Radiographs +/- ultrasonography (i.e.: chest, abdomen, limbs)

Pet owners may find it helpful to partner with a board-certified veterinary internal medicine specialist to develop a logical and cost effective diagnostic plan.

How is ALP elevation treated?

Specific treatment(s) are determined based on an accurate definitive diagnosis. For that reason, I can't underscore enough the importance of making a proper diagnosis. Understandably, alkaline phosphatase elevation caused by bone cancer is very different than that for diabetes mellitus. Unquestionably, making a solid diagnosis requires an appropriately thorough diagnostic investigation. Furthermore, veterinarians can provide families with meaningful information about prognosis when they've been able to make a definitive diagnosis.

The take-away message about alkaline phosphatase elevation in cats and dogs...

Alkaline phosphatase elevation is one of the most common biochemical abnormalities documented in cats and dogs. There are multiple potential causes, necessitating a logical and thorough diagnostic investigation. A pet's treatment(s) and prognosis are based on an accurate and timely diagnosis.

To find a board-certified veterinary internal medicine specialist, please visit the American College of Veterinary Internal Medicine.

Wishing you wet-nosed kisses,

CriticalCareDVM