

Creatine Kinase (CK)

Interpretive Summary

Description: Creatine kinase (CK) is a muscle enzyme. Increased CK suggests leakage of the enzyme from muscle cells, often as a result of muscle inflammation or trauma. CK may also be referred to as creatine phosphokinase (CPK).

Decreased CK

Common Causes

- Not clinically significant

Increased CK

Common Causes

- Muscle trauma
 - Restraint
 - Difficult venipuncture
 - Hit by car/other trauma
 - Prolonged recumbency
 - Surgical procedures
 - Muscle biopsy
 - Intramuscular injections
- Muscle inflammation
 - Ischemia
 - Post-infarct ischemia
 - Aortic thromboembolism
 - Disseminated intravascular coagulation [DIC]
 - Necrosis
 - Snake/spider envenomation
 - Heatstroke
 - Infectious
 - *Toxoplasma* sp.
 - *Neospora* sp.
 - Pyogenic bacterial infections
 - Endocarditis
 - Systemic infections (septicemia)
 - Parasitic
 - Inflammatory non-infectious myositis
 - Immune-mediated polymyositis
 - Eosinophilic myositis
- Exertional disorders
 - Exertional rhabdomyolysis
 - Seizures
 - Azoturia/tying up syndrome (horses)

Uncommon Causes

- Congenital/inherited degenerative myopathies
 - Muscular dystrophy (different forms in dogs, cats, and horses)
 - Myotonia
 - Hyperkalemic periodic paralysis
- Nutritional myopathies

- Vitamin E/selenium deficiency (horses)
- Hypokalemia (cats)
- Taurine deficiency (cats)
- Toxic
 - Ionophores (e.g. monensin)
 - Castor bean (ricin)
 - Gossypol (cotton seed meal)
- Neoplastic
- Artifact
 - Hemolysis interferes with some CK assays
- Miscellaneous disorders
 - Hypothyroidism (dogs)
 - Inconsistent CK results
 - Urinary obstruction
 - Vomiting
 - Shivering/trembling
 - Malignant hyperthermia
 - Hypothermia

Related Findings

- Increased AST
 - Especially with muscle necrosis
 - Increased AST suggests more severe injury
- Increased ALT
 - Usually relatively minor compared to CK increases
- Increased LDH
 - Especially with muscle necrosis
- Myoglobinuria
 - Indicates severe muscle injury
- Infection
 - Positive antibody titers or PCR for *Toxoplasma gondii* or *Neospora caninum* infection
 - Endocarditis
 - Supportive echocardiogram findings
 - Increased Cardiopet® proBNP levels
- Immune-mediated polymyositis
 - Positive anti-nuclear antibody (ANA) titers may be present
- Histopathology consistent with muscle inflammation or necrosis

Additional Information

Physiology

- CK is located in the cytoplasm of muscle and catalyzes a reversible reaction involving the transfer of phosphate (PO_4) from creatine-phosphate to ADP thus forming ATP. Creatine-phosphate is produced in resting muscle and the opposite reaction provides energy during periods of muscle activity.
- Skeletal muscle is the main source of CK in the blood. CK is also present in relatively large amounts in myocardium but the contribution of myocardial CK to serum concentrations is minor. Significant elevations in CK are usually the result of skeletal muscle damage.
- Other tissue sources contributing to serum CK (low concentrations) include the smooth muscle of the gastrointestinal tract, uterus, kidney, and urinary bladder and the thyroid gland
- The serum half-life of CK is very short (2 to 4 hours). After muscle injury, serum CK activity increases rapidly, peaks in 6 to 12 hours, and can return to normal (reference intervals) within 24 to 48 hours after a single minor injury. Several days may be required to return to reference intervals after a more severe injury.

- Serial determination of CK differentiates active versus resolving muscle injury

References

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