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Creatine kinase

Creatine kinase is most abundant in cells of cardiac and skeletal muscle and in brain, but also occurs in other tissues such as smooth muscle.

CASE STUDY 1

A 45-year-old man was prescribed a statin by his general practitioner because of hypercholesterolaemia. A week after commencement on the drug, he complained of severe muscle aches. The following are the results of the tests requested by his general practitioner:

Plasma

Creatine kinase (CK) 14 200 U/L (< 250)
Bilirubin 12 μmol/L (< 20)
Alanine aminotransferase (ALT) 82 U/L (< 42)
Asparate aminotransferase (AST) 98 U/L (< 45)
Alkaline phosphatase 113 U/L (< 250)
Albumin 40 g/L (35–45)
Urine was positive for myoglobin.

DISCUSSION

The grossly elevated CK activity supports the diagnosis of rhabdomyolysis. This is a rare complication of statin drug usage. It is important also to monitor renal function, as the myoglobin released from muscle is nephrotoxic. Intracellular ions such as potassium are also released from the muscle into the circulation, resulting in hyperkalaemia. Note that the plasma AST and ALT activities are raised, as these can be found in muscle as well as in liver tissue.

Causes of raised plasma creatine kinase activities

_ *Artefactual*: due to in vitro haemolysis, using most methods.

_ *Physiological*:
– neonatal period (slightly raised above the adult URL),
– during and for a few days after parturition,
– plasma CK is generally higher in Africans than in Caucasians.

_ *Marked increase* (may be greater than 5–10 times URL):
– dermatomyositis and polymyositis,
– 'shock' and circulatory failure,
– myocardial infarction,
– muscular dystrophies,
– rhabdomyolysis (the breakdown of skeletal muscle),

– necrotizing fasciitis.

_*Moderate to slight increase* (usually less than five times URL):
– muscle injury,
– infections, for example viral,
– after surgery (for about a week),
– physical exertion – there may be a signifi cant rise in plasma activity after only moderate exercise, muscle cramp or following an epileptic fi t,
– after an intramuscular injection,
– hypothyroidism
– alcoholism (possibly partly due to alcoholic myositis),
– some cases of cerebrovascular accident and head injury,

– malignant hyperpyrexia,
– certain drugs, for example statins, ciclosporin, cocaine,
– glycogen storage diseases,
– carnitine palmityl transferase defi ciency.

Plasma CK activity is raised in all types of muscular dystrophy, but not usually in neurogenic muscle diseases such as poliomyelitis, myasthenia gravis, multiple sclerosis or Parkinson's disease.

Causes of low plasma creatine kinase activity

This is unusual but may include cachetic states associated with reduced muscle mass, for example alcoholism, undernutrition and patients in intensive care.

Why do doctors order this test?

When muscle tissue is damaged, CK leaks into your bloodstream. Doctors usually check these levels to investigate:

- Muscle Injury: To diagnose conditions like rhabdomyolysis or physical trauma.
- Heart Issues: Though other tests like Troponin are now more common for heart attacks, CK-MB (a specific type of CK) can still be used to check for heart muscle damage.
- Neuromuscular Disorders: To help diagnose or monitor diseases like Muscular Dystrophy.

• Statin Monitoring: If you are taking cholesterol medication (statins) and experience unexplained muscle pain

Understanding the elevation

In a standard healthy adult, the "normal" range is typically between **22 and 200 U/L** (Units per Liter).

Mild Elevation (up to 500–1,000 U/L): Very common after a standard workout, a long hike, or even a fall. It usually indicates typical "wear and tear."

Moderate Elevation (1,000–5,000 U/L): Often seen after very intense or "eccentric" exercise (like heavy squats or a marathon). It can also be caused by certain medications like statins.

Severe Elevation (>5,000–10,000+ U/L): This is the "red flag" zone. High levels like this, especially when accompanied by symptoms, may indicate **Rhabdomyolysis** (a serious condition where muscle tissue breaks down rapidly).