

Serum Enzyme Tests:

Serum enzyme tests measure the amount of muscle proteins present in the blood. Where muscle tissue is healthy, these proteins remain in muscle and the amount present in blood is relatively low.

Many, but not all, neuromuscular diseases that cause muscle deterioration lead to a significant increase in the muscle protein levels found in the blood. Thus, serum enzyme tests can be important aids in the diagnosis of neuromuscular diseases.

The value of these tests typically is greatest at early stages of the disease. At the earliest disease stage, muscle mass is relatively great, and changes in serum protein levels may occur even before symptoms such as weakness become apparent.

At later stages of some diseases, however, muscle mass may be so reduced that serum protein levels may even appear normal.

Creatine kinase (CK): This protein is confined almost exclusively to muscle. A higher-than-normal CK level in blood indicates a leakage from muscle tissue. Determination of the serum CK level is an important laboratory test in the diagnosis of Duchenne muscular dystrophy and other muscle diseases.

Other enzymes: Increased levels in blood of aldolase, lactic dehydrogenase (LDH), glutamic oxaloacetic transaminase (GOT), pyruvate kinase (PK), and several other enzymes also may indicate the presence of a neuromuscular disease.

Alkaline phosphatase (ALP) :

Alkaline phosphatase (ALP) is present in a number of tissues including liver, bone, intestine, and placenta. Serum ALP is of interest in the diagnosis of 2 main groups of conditions- hepatobiliary disease and bone disease associated with increased osteoblastic activity.

A rise in ALP activity occurs with all forms of cholestasis, particularly with obstructive jaundice. The response of the liver to any form of biliary tree obstruction is to synthesize more ALP. The main site of new enzyme synthesis is the hepatocytes adjacent to the biliary canaliculi.

ALP also is elevated in disorders of the skeletal system that involve osteoblast hyperactivity and bone remodeling, such as Paget's disease, hyperparathyroidism, rickets and osteomalacia, fractures, and malignant tumors. A considerable rise in alkaline phosphatase activity caused by increased osteoblast activity following accelerated bone growth is sometimes seen in children and juveniles.

Interpretation:

The elevation in alkaline phosphatase (ALP) tends to be more marked (more than 3 fold) in extrahepatic biliary obstruction (eg, by stone or by cancer of the head of the pancreas) than in intrahepatic obstruction, and is greater the more complete the obstruction. Serum enzyme activities may reach 10 to 12 times the upper limit of normal, returning to normal on surgical removal of the obstruction.

The ALP response to cholestatic liver disease is similar to the response of gamma-glutamyltransferase (GGT), but more blunted. If both GGT and ALP are elevated, a liver source of the ALP is likely. Among bone diseases, the highest level of ALP activity is encountered in Paget disease as a result of the action of the osteoblastic cells as they try to rebuild bone that is being resorbed by the uncontrolled activity of osteoclasts. Values from 10 to 25 times the upper limit of the reference interval are not unusual. Only moderate rises are observed in osteomalacia, while levels are generally normal in osteoporosis. In rickets, levels 2 to 4 times normal may be observed. Primary and secondary hyperparathyroidism are associated with slight to moderate elevations of ALP; the existence and degree of elevation reflects the presence and extent of skeletal involvement. Very high enzyme levels are present in patients with osteogenic bone cancer. A considerable rise in ALP is seen in children following accelerated bone growth.

In addition, an increase of 2 to 3 times normal may be observed in women in the third trimester of pregnancy, although the interval is very wide and levels may not exceed the upper limit of the reference interval in some cases. The additional enzyme is of placental origin.

Alkaline phosphatase

Alkaline phosphatase (often shortened to alk phos) is an enzyme made in liver cells and bile ducts. The alkaline phosphatase level is a common test that is usually included when liver tests are performed as a group.

Explanation of test results:

A high alk phos level does not reflect liver damage or inflammation. A high alk phos level occurs when there is a blockage of flow in the biliary tract or a buildup of pressure in the liver--often caused by a gallstone or scarring in the bile ducts.

Other things to know:

- Many patients with hepatitis C have normal alk phos levels.
- Hepatitis C treatment usually does not affect alk phos levels.
- Alk phos is produced in other organs besides the liver--it is also found in the bones and the kidneys.
- If your alk phos level is high, your doctor will probably order additional tests to determine why.

AST (SGOT)

AST, or aspartate aminotransferase, is 1 of the 2 "liver enzymes." It is also known as serum glutamic-oxaloacetic transaminase, or SGOT. AST is a protein made by liver cells. When liver cells are damaged, AST leaks out into the bloodstream and the level of AST in the blood becomes higher than normal. AST is different from ALT because AST is found in parts of the body other than the liver--including the heart, kidneys, muscles, and brain. When cells in any of those parts of the body are damaged, AST can be elevated.

Explanation of test results:

A high AST level often means there is some liver damage, but it is not necessarily caused by hepatitis C. A high AST with a normal ALT may mean that the AST is coming from a different part of the body. It is important to realize that the AST level in most patients with hepatitis C goes up and down. The exact AST level does not tell you how much liver damage there is, or whether the liver is getting better or worse, and small changes should be expected.

However, for patients receiving treatment for hepatitis C, it is helpful to see if the AST level goes down.

Other things to know:

- The AST level is not as helpful as the ALT level for checking the liver.
- Many patients with hepatitis C will have a normal AST level.
- Patients can have very severe liver disease or cirrhosis and still have a normal AST level.

ALT (SGPT)

ALT, or alanine aminotransferase, is 1 of the 2 "liver enzymes." It is sometimes known as serum glutamic-pyruvic transaminase, or SGPT. It is a protein made only by liver cells. When liver cells are damaged, ALT leaks out into the bloodstream and the level of ALT in the blood is higher than normal.

Explanation of test results:

A high ALT level often means there is some liver damage, but it may not be related to hepatitis C. It is important to realize the ALT level goes up and down in most patients with hepatitis C. The ALT level does not tell you exactly how much liver damage there is, and small changes should be expected. Changes in the ALT level do not mean the liver is doing any better or any worse. The ALT level does not tell you how much scarring (fibrosis) is in the liver and it do not predict how much liver damage will develop.

Other things to know:

- Many patients with hepatitis C will have a normal ALT level.
- Patients can have very severe liver disease and cirrhosis and still have a normal ALT level.
- When a patient takes treatment for hepatitis C, it is helpful to see if the ALT level goes down.

Bilirubin

Bilirubin is a yellowish substance that is created by the breakdown (destruction) of hemoglobin, a major component of red blood cells.

Explanation of test results:

As red blood cells age, they are broken down naturally in the body. Bilirubin is released from the destroyed red blood cells and passed on to the liver. The liver excretes the bilirubin in fluid called bile. If the liver is not functioning correctly, the bilirubin will not be properly excreted. Therefore, if the bilirubin level is higher than normal, it may mean that the liver is not functioning correctly.

Other things to know:

- Levels of bilirubin in the blood go up and down in patients with hepatitis C.
- When bilirubin levels remain high for prolonged periods, it usually means there is severe liver disease and possibly cirrhosis.
- High levels of bilirubin can cause jaundice (yellowing of the skin and eyes, darker urine, and lighter-colored bowel movements).
- Elevated bilirubin levels can be caused by reasons other than liver disease.
- Total bilirubin is made up of 2 components: direct bilirubin and indirect bilirubin.
- Direct bilirubin + indirect bilirubin = total bilirubin
