

Imtiaz Alam, M.D.
Mandy Mishra, CNS
Austin Hepatitis Center
12201, Renfert Way
Suite 235
Austin, TX 78758

Phone: [512] 719-4370
Fax: [512] 719-4371

LIVER FUNCTION TESTS

The diagnosis of liver diseases depends upon a combination of history, physical examination, laboratory testing and sometimes radiological studies and biopsy. Only a physician who knows all of these aspects of a specific case can reliably make a diagnosis. Many individuals with liver diseases nonetheless have questions about their laboratory test results and seek information about their significance.

The term "liver function tests" and its abbreviated form "LFTs" is a commonly used term that is applied to a variety of blood tests that assess the general state of the liver and biliary system. Routine blood tests can be divided into those tests that are true LFTs, such as serum albumin or prothrombin time, and those tests that are simply markers of liver or biliary tract disease, such as the various liver enzymes. In addition to the usual liver tests obtained on routine automated chemistry panels, physicians may order more specific liver tests such as viral serologic tests or autoimmune tests that, if positive, can determine the specific cause of a liver disease.

Alanine aminotransferase (ALT)

ALT is an enzyme produced in hepatocytes, the major cell type in the liver. ALT is often inaccurately referred to as a liver function test, however, its level in the blood tells little about the function of the liver. The level of ALT in the blood (actually enzyme activity is measured in the clinical laboratory) is increased in conditions in which hepatocytes are damaged or die. As cells are damaged, ALT leaks out into the bloodstream. All types of hepatitis (viral, alcoholic, drug-induced, etc.) cause hepatocyte damage that can lead to elevations in the serum ALT activity. The ALT level is also increased in cases of liver cell death resulting from other causes, such as shock or drug toxicity. The level of ALT may correlate roughly with the degree of cell death or inflammation, however, this is not always the case. An accurate estimate of inflammatory activity or the amount cell death can only be made by liver biopsy. (See also aspartate aminotransferase below.)

Aspartate aminotransferase (AST)

AST is an enzyme similar to ALT (see above) but less specific for liver disease as it is also produced in muscle and can be elevated in other conditions (for example, early in the course of a heart attack). AST is also inaccurately referred to as a liver function test by many physicians. In many cases of liver inflammation, the ALT and AST activities are elevated roughly in a 1:1 ratio. In some conditions, such as

alcoholic hepatitis or shock liver, the elevation in the serum AST level may higher than the elevation in the serum ALT level.

Alkaline phosphatase

Alkaline phosphatase is an enzyme, or more precisely a family of related enzymes, produced in the bile ducts, intestine, kidney, placenta and bone. An elevation in the level of serum alkaline phosphatase (actually enzyme activity is measured in the clinical laboratory), especially in the setting of normal or only modestly elevated ALT and AST activities, suggests disease of the bile ducts. Serum alkaline phosphatase activity can be markedly elevated in bile duct obstruction or in bile duct diseases such as primary biliary cirrhosis or primary sclerosing cholangitis. Alkaline phosphatase is also produced in bone and blood activity can also be increased in some bone disorders.

Gamma-glutamyltranspeptidase (GGT)

An enzyme produced in the bile ducts that, like alkaline phosphatase, may be elevated in the serum of patients with bile duct diseases. Elevations in serum GGT, especially along with elevations in alkaline phosphatase, suggest bile duct disease. Measurement of GGT is an extremely sensitive test, however, and it may be elevated in virtually any liver disease and even sometimes in normal individuals. GGT is also induced by many drugs, including alcohol, and its serum activity may be increased in heavy drinkers even in the absence of liver damage or inflammation.

Bilirubin

Bilirubin is the major breakdown product that results from the destruction of old red blood cells (as well as some other sources). It is removed from the blood by the liver, chemically modified by a process call conjugation, secreted into the bile, passed into the intestine and to some extent reabsorbed from the intestine. Bilirubin concentrations are elevated in the blood either by increased production, decreased uptake by the liver, decreased conjugation, decreased secretion from the liver or blockage of the bile ducts. In cases of increased production, decreased liver uptake or decreased conjugation, the unconjugated or so-called indirect bilirubin will be primarily elevated. In cases of decreased secretion from the liver or bile duct obstruction, the conjugated or so-called direct bilirubin will be primarily elevated. Many different liver diseases, as well as conditions other than liver diseases (e. g. increased production by enhanced red blood cell destruction), can cause the serum bilirubin concentration to be elevated. Most adult acquired liver diseases cause impairment in bilirubin secretion from liver cells that cause the direct bilirubin to be elevated in the blood. In chronic, acquired liver diseases, the serum bilirubin concentration is usually normal until a significant amount of liver damage has occurred and cirrhosis is present. In acute liver disease, the bilirubin is usually increased relative to the severity of the acute process. In bile

duct obstruction, or diseases of the bile ducts such as primary biliary cirrhosis or sclerosing cholangitis, the alkaline phosphatase and GGT activities are often elevated along with the direct bilirubin concentration.

Albumin

Albumin is the major protein that circulates in the bloodstream. Albumin is synthesized by the liver and secreted into the blood. Low serum albumin concentrations indicate poor liver function. The serum albumin concentration is usually normal in chronic liver diseases until cirrhosis and significant liver damage is present. Albumin levels can be low in conditions other than liver diseases including malnutrition, some kidney diseases and other rarer conditions.

Prothrombin time (PT)

Many factors necessary for blood clotting are made in the liver. When liver function is severely abnormal, their synthesis and secretion into the blood is decreased. The prothrombin time is a type of blood clotting test performed in the laboratory and it is prolonged when the blood concentrations of some of the clotting factors made by the liver are low. In chronic liver diseases, the prothrombin time is usually not elevated until cirrhosis is present and the liver damage is fairly significant. In acute liver diseases, the prothrombin time can be prolonged with severe liver damage and return to normal as the patient recovers. Prothrombin time can also be prolonged in cases of vitamin K deficiency, by drugs (warfarin, used therapeutically as an anti-coagulant, prolongs the prothrombin time) and in non-liver disorders.

Platelet count

Platelets are the smallest of the blood cells (actually fragments of larger cells known as megakaryocytes) that are involved in clotting. In some individuals with liver disease, the spleen becomes enlarged as blood flow through the liver is impeded. This can lead to platelets being sequestered in the enlarged spleen. In chronic liver diseases, the platelet count usually falls only after cirrhosis has developed. The platelet count can be abnormal in many conditions other than liver diseases.

Serum protein electrophoresis

In this test, the major proteins in the serum are separated in an electric field and their concentrations determined. The four major types of serum proteins whose concentrations are measured in this test are albumin, alpha-globulins, beta-globulins and gamma-globulins. Serum protein electrophoresis is a useful test in patients with liver diseases as it can provide clues to several diagnostic possibilities. In cirrhosis, the albumin may be decreased (see above) and the gamma-globulin elevated. Gamma-globulin can be significantly elevated in some

types of autoimmune hepatitis. The alpha-globulins can be low in alpha-1-antitrypsin deficiency.