Laboratory Tests and Hepatitis

If you have hepatitis C, your doctor will use laboratory tests to learn more about your individual hepatitis C virus infection, your liver and your health overall. This handout will help you understand what the major tests are and what the results mean.

**Note:** Normal values for laboratory tests can vary from one lab to another. Check with your doctor about the normal range for your lab tests.

### Lab tests to evaluate the liver

Here we explain the names and terms for common liver blood tests.

- Liver panel
- Liver enzymes
- Liver function tests (LFTs)
- ALT
- AST
- Bilirubin
- Albumin
- Prothrombin time
- INR
- Alkaline phosphatase
- Platelets
- Total protein

### Liver panel

A “liver panel” usually refers to several lab tests performed as a group. Depending on the physician or the laboratory, a liver panel usually includes tests for AST, ALT, bilirubin and alkaline phosphatase. It may also include a platelet count, albumin, PT or INR.

### Liver enzymes

The term “liver enzymes” refers to the AST and ALT.

### Liver function tests (LFTs)

The phrase “liver function tests” is commonly used by patients and physicians. Many people use the term to describe the AST and ALT. However, this is not correct – the AST and ALT do not measure the function of the liver, but this terminology is still commonly used.

### ALT (SGPT)

ALT, or alanine aminotransferase, is one of the two “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 does not indicate how much liver damage will develop.

Other things to know:

- Many patients with hepatitis C 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.

AST (SGOT)

AST, or aspartate aminotransferase, is one 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 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 the amount of liver damage, or whether the liver is getting better or worse. 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.

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.

**Albumin**

Albumin is a protein made by the liver. Albumin prevents fluid from leaking out of blood vessels into tissues.

Explanation of test results:

A low albumin level in patients with hepatitis C can be a sign of cirrhosis (advanced liver disease). Albumin levels can go up and down slightly. Very low albumin levels can cause symptoms of edema, or fluid accumulation, in the abdomen (called ascites) or in the leg.

Other things to know:

- A low albumin level can also come from kidney disease, malnutrition, or acute illness.
- A low albumin level causing fluid overload is often treated with diuretic medications, or “water pills.”

**Prothrombin time**

Prothrombin is a protein made by the liver. Prothrombin helps blood to make normal clots. The “prothrombin time” (PT) is one way of measuring how long it takes blood to form a clot, and it is measured in seconds (such as 13.2 seconds). A normal PT indicates that a normal amount of blood-clotting protein is available. More often, a doctor may order an “INR” instead of “PT” because PT and INR are measuring the same factors.

Explanation of test results:

When the PT is high, it takes longer for the blood to clot (17 seconds, for example). This usually happens because the liver is not making the right amount of blood-clotting proteins, so the clotting process takes longer. A high PT usually means that there is serious liver damage or cirrhosis.

Other things to know:

Some patients take a drug called Coumadin (warfarin), which elevates the PT for the purpose of “thinning” the blood. This is not related to having liver disease because it is the Coumadin causing the PT to be high.
The test called INR measures the same factors as PT and is used instead of PT by many doctors. See “INR” (described below).

**INR (international normalized ratio)**

International normalized ratio (INR) is a blood-clotting used to measure how quickly your blood forms a clot, compared with normal clotting time. The INR measures the same factors as Prothrombin Time (PT) described above. Often, the INR is used instead of the PT.

**Explanation of test results:**

A normal INR is 1.0. Each increase of 0.1 means the blood is slightly thinner (it takes longer to clot). If there is serious liver disease and cirrhosis, the liver may not produce the normal amount of proteins and then the blood is not able to clot normally. When your doctor is evaluating the function of your liver, a high INR usually means that the liver is not working as well as it could because it is not making the blood clot normally.

**Other things to know:**

Some patients take a drug called Coumadin (warfarin), which elevates the INR, for the purpose of “thinning” the blood.

- The INR is another way of measuring the blood-clotting time and it is easier to determine than the PT (described above).

**Alkaline phosphatase**

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

**Explanation of test results:**

Alk phos can be abnormal for many different reasons. If it is due to a liver issue, then a high alk phos level usually 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. It is not usually elevated due to inflammation in the liver cells. However, a high alk phos level can be caused by many other reasons, including reasons which have nothing to do with the liver.

**Other things to know:**

Many patients with hepatitis C have completely normal alk phos levels. Since an elevated alk phos can indicate a biliary tract obstruction, it may prompt your doctor to order an ultrasound of the liver.

Hepatitis C treatment usually does not always 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. There are many different explanations for elevated alk phos levels.

**Platelets**

Platelets are cells that help the blood to form clots. The platelet number or “platelet count” in the blood is measured as part of the complete blood count (CBC).
Explanation of test results:

Platelet counts in patients who have cirrhosis are often low. But low platelet counts can also come from other causes, including certain medications. Interferon treatment can reduce platelet counts. When the platelet count is extremely reduced, this condition is known as “thrombocytopenia.” If a platelet count is too low, the patient cannot make normal clots and may bruise more easily.

Other things to know:

If the platelet count drops too low (below 50,000, for example) when a patient is receiving interferon, doctors may recommend that the interferon dosage be reduced.

Total protein

Total protein level is a measure of a number of different proteins in the blood. Total protein can be divided into the albumin and globulin fractions.

Explanation of test results:

Low levels of total protein in the blood can occur because of impaired function of the liver.

Laboratory tests to evaluate the hepatitis C virus

If you have hepatitis C virus (HCV), your doctor is likely to recommend a few different hepatitis C blood tests, not just one. It is helpful to understand what each of these blood tests means. Here, we explain the common blood tests of hepatitis C and the meaning of test results.

- Hepatitis C antibody
- Hepatitis C RNA
- Hepatitis C RIBA
- Hepatitis C genotype

Hepatitis C antibody (HCV Ab, anti-HCV)

This is the first test for determining whether you have been infected with hepatitis C. The results will come back as either positive or negative.

Explanation of test results:

If this test result is positive, it means your body was exposed to the hepatitis C virus and made antibodies (for more information, see the “Antibody” section under Associated Lab Tests). However, it does not tell you whether you are still infected with hepatitis C, and the antibody test does not make the diagnosis of “hepatitis C infection,” it is only the first test that is done. If the antibody test result is positive, you should be tested for hepatitis C RNA (see “Hepatitis C RNA”) to determine whether you are chronically infected. The lab might perform this RNA test automatically if your hepatitis C antibody test is positive or your doctor might need to order the hepatitis C RNA test separately. It is unusual but not impossible for an antibody test to give a positive result even though someone is not infected with the virus. If your doctor suspects your antibody test could have a false-positive result, then you will likely be recommended to have additional tests.
If the antibody test result is negative, it means you have not been infected with HCV, and further testing for hepatitis C usually is not needed. It is unusual but not impossible for a hepatitis C antibody test result to be negative even though someone is infected. If your doctor suspects your antibody test could give a false-negative result, then you will likely be recommended to have additional tests.

**Other things to know:**

After a successful course of treatment for hepatitis C, the hepatitis C antibody remains detectable, but the hepatitis C RNA will be undetectable.

Any patient with a positive test result for the hepatitis C antibody should have additional tests to determine whether the virus is still active.

If the antibody test result is negative, it means you have not been infected with HCV, and further testing for hepatitis C usually is not needed. It is unusual but not impossible for a hepatitis C antibody test result to be negative even though someone is infected. If your doctor suspects your antibody test could give a false negative result, then you will likely be recommended to have additional tests.

**Hepatitis C RNA testing**

The HCV RNA test determines whether the virus itself is present in the bloodstream. Detecting the HCV RNA in the blood is how the diagnosis of “hepatitis C infection” is made.

**How the HCV RNA test is used:**

- Making diagnosis of chronic hepatitis C virus infection
- Detection of an acute HCV infection (less than 6 months from exposure)
- Assessing the level of the virus prior to starting treatment course
- Monitoring the response of the virus to treatment
- Monitoring the virus for any relapse after completion of treatment
- Determining if a patient achieves an SVR from treatment

**Use of the HCV RNA test for HCV treatment:**

The HCV RNA is used to determine the presence of the virus before treatment, and then to monitor the response to HCV treatment. For some treatments, the HCV RNA may also be used to determine the duration of medication that will be needed.

**Terminology of HCV RNA results**

HCV RNA test results can be very confusing. Additionally, different laboratories use different RNA test techniques (assays) and so different labs will report the RNA tests in different ways. The FDA has approved 4 ways of reporting results from HCV RNA tests:
1. An exact number - termed international units of the virus, expressed as IU/mL. Also known as the “viral load.”

2. “> upper limit”. No exact number is reported because it is too high to be accurately measured.

3. “Detected”. This means the virus is present and detected, but at such a low level that it cannot be determined how many copies are present - it is too low to be accurately measured.

4. “Undetected” or “< lower limit” No exact number is reported because no virus is detected at all.

Example: In one lab, the HCV RNA test has a possible result range from 43 IU/mL to 69,000,000 IU/mL

Results could be reported in the following ways:

<table>
<thead>
<tr>
<th>Result</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undetected</td>
<td>HCV RNA was not detected in the specimen.</td>
</tr>
<tr>
<td>Detected</td>
<td>Cannot accurately measure HCV RNA because it is present but at such a low level it is below the lower limit of quantification. This is not the same as undetectable.</td>
</tr>
<tr>
<td>&lt;43 IU/mL</td>
<td>HCV RNA cannot be detected in the sample. This can be considered equivalent to undetectable.</td>
</tr>
<tr>
<td>Quantified result</td>
<td>A result expressed in IU/mL indicates the degree of viral replication.</td>
</tr>
<tr>
<td>&gt;69,000,000 IU/mL</td>
<td>Cannot accurately measure HCV RNA because it is present but at such a high level it is above the upper limit of quantification.</td>
</tr>
</tbody>
</table>

Other things to know:

The viral load does not tell us anything about the severity of a patient’s liver disease or the degree of fibrosis (scarring). For that information, the patient would need a liver biopsy. It is not necessary to check the viral load repeatedly unless a patient is on treatment, is considering treatment, or is being followed up after completing treatment.
Hepatitis C genotype

The hepatitis C genotype is a type of hepatitis C virus. There are 6 genotypes of hepatitis C around the world. The genotypes are numbered 1-6. In the United States, genotype 1 is most common, followed by genotype 2 and 3.

These genotypes also have subtypes, such as:

- Genotype 1a or 1b
- Genotype 2a or 2b
- Genotype 3a or 3b

The genotype of hepatitis C does not change over time. It needs to be tested only once. If you are treated for hepatitis C, your genotype will determine your treatment plan, such as which medications are prescribed and how long the treatment will be needed.

White blood cells (WBCs)

This test measures the total number of white blood cells (WBCs). There are 5 main types of WBCs: neutrophils, eosinophils, basophils, monocytes, and lymphocytes. Each type does a slightly different job. All of them help fight infection.

Explanation of test results:

WBCs are produced in the bone marrow, an area in the middle of many bones. Low WBC “counts” may develop as a side effect of interferon treatment. A low WBC count may be caused by cirrhosis, alcohol use, medications, or other medical conditions.

Neutrophils

Neutrophils play a key role in inflammation, formation of pus, and destruction of bacteria. Your doctor will check your ANC regularly if you are taking interferon treatment. If the ANC falls too low, your doctor may reduce the dosage of interferon you take. Additionally, if the ANC falls too low, your doctor may prescribe additional medication to try to boost the ANC back up.

Other things to know:

The ANC is more important than the total WBC count in terms of determining interferon dosages.

Even if the ANC falls during interferon treatment, it will return to its normal level once treatment is stopped.

Your total WBC count includes neutrophils plus the 4 other types of WBCs (eosinophils, basophils, monocytes, and lymphocytes).

Hemoglobin

Hemoglobin is a protein within red blood cells. Hemoglobin allows red blood cells to carry oxygen to the rest of the body.
Explanation of test results:
Measuring hemoglobin levels helps to estimate the number of red blood cells in the body. A low hemoglobin level is referred to as “anemia.” If hemoglobin levels are very low, patients may feel tired easily.

Other things to know:
The hemoglobin level is related to the hematocrit (see next screen: “Hematocrit”). Low hemoglobin levels can develop during treatment with ribavirin. If needed, lowering the dosage of ribavirin will help bring the hemoglobin level back up.

Hematocrit
The hematocrit is sometimes known as “red blood cell count.” The hematocrit is the percentage of red blood cells in the total contents of your blood.

Explanation of test results:
A low hematocrit is referred to as “anemia.” If the hematocrit is very low, patients may feel tired easily.

Other things to know:
The hematocrit is directly related to the hemoglobin level (see previous screen: “Hemoglobin”). A low hematocrit can develop during treatment with ribavirin. If needed, lowering the dosage of ribavirin will help bring the hematocrit back up.

Creatinine
The level of creatinine in your body is an indication of kidney function. Creatinine comes from the breakdown of creatine, a muscle protein. Properly functioning kidneys remove creatinine from the blood.

Explanation of test results:
High levels of creatinine mean that the kidneys are not functioning normally. When creatinine levels rise gradually, there are usually no symptoms, and the higher levels can be detected only with blood tests.

Other things to know:
Certain medications can cause high levels of creatinine. A high creatinine level is sometimes referred to as “renal insufficiency” or a low “GFR”. If your creatinine level is too high (your GFR is too low), you may not be able to take some hepatitis C medications.

TSH (thyroid-stimulating hormone)
TSH is a hormone produced by the pituitary gland in the brain. TSH causes the thyroid gland (located in the neck) to produce thyroid (T4 and T3).
Explanation of test results:

Having a high TSH level means you are “hypothyroid.” Symptoms can include fatigue, constipation, and weight gain. When there are low levels of thyroid hormone (hypothyroidism), the TSH becomes elevated as the body tries to increase thyroid production.

Having a low TSH level means you are “hyperthyroid.” Symptoms can include weight loss and nervousness. When there are high levels of thyroid hormone (hyperthyroidism), the TSH falls as the body tries to slow thyroid production.

Other things to know:

Thyroid problems are common and occur without hepatitis C. But, Hepatitis C itself can cause thyroid changes.

Glucose

Glucose is also called “blood sugar.” It comes from the breakdown of foods and from production of glucose by the liver.

Explanation of test results:

When the glucose (or blood sugar) level is higher than normal, this is known as “hyperglycemia.” Patients whose fasting glucose levels are higher than 126 mg/dL are considered to have diabetes mellitus. Patients who have both hepatitis C and diabetes mellitus may have a more difficult time controlling their glucose while receiving interferon treatment.

Other things to know:

Most people who have a family history of diabetes, are overweight, or are older than 50 should have a fasting glucose level checked by their doctor.

If you develop diabetes, it is not necessarily related to your hepatitis C.

If you already have diabetes, it is very important to work to get your glucose levels well controlled. Poorly controlled diabetes can lead to “fatty liver” in addition to the hepatitis C infection of the liver.

Fatty liver and hepatitis C together can make liver disease much worse.

HBsAg (hepatitis B surface antigen)

A positive test result means you are infected with hepatitis B.

HBsAb (hepatitis B surface antibody)

A positive test result means you have antibodies to hepatitis B. If you also test positive for HBCab, then you were exposed to or infected with hepatitis B virus in the past, cleared the virus, and are now “immune” (protected) against another infection with hepatitis B. If you test positive for HBsAb but negative for HBCab, then you were vaccinated against hepatitis B and are protected by the vaccination.

HBCab (hepatitis B core antibody)

A positive test result means you once were infected with hepatitis B.
HBV DNA (hepatitis B DNA)
A positive test result means you have the hepatitis B virus in the bloodstream, and this is called “chronic hepatitis B.” You may be a good candidate for hepatitis B drug treatments. A negative result means you do not have hepatitis B replicating or circulating in the bloodstream and you do not need hepatitis B drug treatments.

HBeAg (hepatitis B e antigen)
A positive test result means you have the hepatitis B virus in the bloodstream. If you are HBV DNA positive but this HBeAg test result is negative, then you still have the hepatitis B virus in your bloodstream.

Hepatitis A antibody total
A positive test result means you have been infected with hepatitis A in the past or were vaccinated against hepatitis A in the past but are now immune (protected) against being infected with hepatitis A virus in the future.

AFP (alfa-fetoprotein)
AFP is a protein that is present in patients with liver disease. AFP is also a “tumor marker” and may be used to see whether a patient has liver cancer. (Liver cancer is also called hepatocellular carcinoma).

Explanation of test results:
A high level of AFP might mean that a patient has liver cancer. However, sometimes the AFP is high when there is active liver disease but no cancer. Usually, the AFP test needs to be interpreted by a doctor in combination with pictures of the liver taken with ultrasound or CT scan.

Other things to know:
An elevated AFP level needs to be interpreted by your doctor. A high AFP level may just mean that you have scarring or inflammation in your liver but not liver cancer. AFP can be elevated in other types of cancers and during a normal pregnancy.

Antibody
Antibodies are part of the immune system’s response to infection. Once an infection has taken place, the body makes antibodies, which become detectable in the bloodstream. Different antibodies fight different infections.

Explanation of test results:
If you have a positive test result for a specific antibody, it means your body has had an immune response to that specific infection. It does not necessarily mean you are still infected—it does mean that you were infected at some point in the past. The hepatitis C antibody test is explained under Hepatitis C tests.

Hepatitis A antibody total
Explanation of test results:
A positive test result means you have been infected with hepatitis A in the past or were vaccinated against hepatitis A in the past but are now immune (protected) against being infected with hepatitis A virus in the future.
Who can I contact for more information?

For more information on viral hepatitis visit VA Viral Hepatitis website at:
http://www.hepatitis.va.gov/

Centers for Disease Control and Prevention (CDC) website:
http://www.cdc.gov/hepatitis/index.htm

This material is not copyrighted and may be reproduced.

Patient Care Services Veterans Health Administration
Department of Veterans Affairs, 810 Vermont Avenue, NW Washington, DC 20420

IB 10-645 February 2016