

a series of fact sheets written
by experts in the field of liver
disease

HBV:

How to Interpret Hepatitis B Antibody & Viral Tests

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To find out if you are infected with hepatitis B, or the status of your infection, a healthcare worker will take a blood sample from you and a laboratory will analyze it for several hepatitis B viral components that provide a roadmap to your hepatitis B infection.

These viral components include antigens or proteins that make up different parts of the hepatitis B virus (called HBV), and antibodies, which your immune system generates to combat each antigen.

A viral test is different than a “liver function” test, which also requires a blood sample. Liver function tests look for liver enzymes, such as alanine aminotransferase or ALT, and other substances that indicate if liver cells are healthy or damaged.

To overcome a hepatitis B infection, the immune system must produce antibodies against these HBV antigens.

- **Surface antigen:** The outer coating of the virus is made up of the surface antigen or HBsAg. It surrounds the core of the virus.
- **Core antigen:** The inner shell contains the core antigen (HBcAg).
- **E antigen:** Another antigen found in the core's interior is the “e” antigen (HBeAg).
- Also, within the core of the virus are the viral DNA genetic material and the DNA polymerase enzyme, which contains the key genetic replication instructions.

Doctors look for the surface antigens and antibodies, the “e” antigens and antibodies, and core antibodies in a viral test. They should also look at the levels of virus in the blood (the hepatitis B DNA or HBV DNA) to track how actively viruses are replicating in your liver.

Hepatitis B Surface Antigen (HBsAg): The presence of surface antigen in your lab report indicates you have a hepatitis B infection. It can be an acute (short-term) or a chronic (potentially life-long) infection. Simply put, if *you* have surface antigen, you have hepatitis B and are capable of infecting others.

When HBV replicates in the liver, it produces more surface antigen than is needed to generate new viruses. The excess surface proteins clump together in the bloodstream and are easily identified in lab tests.

Laboratory tests can usually identify surface antigen about four weeks after infection, but it can take up to 12 weeks after infection for a test to reveal the presence of surface antigen.

In an acute infection, the immune system is able to combat the “foreign” surface antigen and create surface antibodies (HBsAb or anti-HBsAg) to vanquish the infection within four months of when symptoms first appear. However, in a chronic infection, the immune system cannot mount a successful campaign to rid the body of the surface antigen and create enough surface antibodies to keep the infection away. Chronic

hepatitis B is diagnosed when surface antigen is present in the bloodstream for more than six months.

When surface antigens disappear and surface antibodies appear in a lab report, then the person is considered to have cleared the infection. Bottom line: the surface antibody is what everyone wants to achieve. It means they have cleared the infection and can no longer infect others.

Hepatitis B Core Antigen (HBcAg) and Antibodies (anti-HBc or HBcAb): The hepatitis B core antigen forms the inner core of the virus and is produced when the virus replicates in liver cells. The core antigen is found only in HBV-infected liver cells, not in the bloodstream. But hepatitis B core antibodies are found in the bloodstream and can be identified by viral tests.

Core antibodies are the first detectable HBV antibodies to appear, usually around eight weeks after infection. They are present in anyone who has had either an acute or a chronic HBV infection.

People who have been vaccinated against hepatitis B have been injected with only the surface antigen portion of the virus, to cause their immune systems to produce surface antibodies to forever protect them against infection. A viral test on their blood would only reveal the surface antibody. However, anyone who has been actually infected with HBV would show both core antibodies as well as surface antibodies in their lab test.

Hepatitis B “e” Antigen (HBeAg) and “e” Antibodies (anti-HBe or HBeAb): The “e” antigen is a protein secreted into the bloodstream by viruses that are actively replicating in liver cells. When a lab test finds “e” antigen, it means the virus is actively replicating and that the person usually has a large quantity of HBV-DNA in their bloodstream. They are usually more infectious to anyone who may come into contact with their blood or body fluids, than someone who has developed the “e” antibody.

People with the “e” antigen are considered at greater risk of progressing to liver disease than those who have developed an “e” antibody because it indicates ongoing viral replication in the liver. Children with chronic hepatitis B

often test positive for the “e” antigen because their immune systems have not yet “noticed” the virus, or attempted to stop the virus from replicating in the liver.

Some people who have had hepatitis B for many years lose the “e” antigen, develop “e” antibodies, but continue to have moderately high viral load and elevated ALT levels, which indicates liver damage. This HBeAg-negative hepatitis is believed to be caused by HBV that have certain mutations (a precore mutation), which allow the virus to replicate even when the “e” antigen is absent.

In acute cases of hepatitis B, when the body’s immune system quickly responds and eradicates the viral infection, the “e” antigen appears only briefly. It disappears as viral replication declines in the liver as the immune system launches “e” antibodies to combat this antigen.

Hepatitis B “e” antibodies usually persist for one or more years after resolution of an acute infection. Seroconversion, or production of “e” antibodies, is the goal of most medical treatments for hepatitis B today. Once the “e” antibody is produced, there are usually fewer viruses infecting and damaging the liver.

Hepatitis B Virus DNA (HBV-DNA): HBV DNA is the genetic material that carries the blueprint of the virus. It is found in the bloodstream and is the best indication of how rapidly the virus is replicating in the liver. High levels of HBV-DNA, up to several billion viral particles per milliliter, indicate rapid viral replication in the liver. Low or undetectable rates indicate an “inactive” infection, with low viral replication in the liver.

Increasingly, more and more doctors are testing patients’ HBV DNA levels. Patients must be assertive and proactive in asking for this test, which is also very useful if someone is HBeAg-negative, because it will indicate viral replication despite the absence of the “e” antigen.

The American Association for the Study of Liver Disease (AASLD) recommends:

- HBeAg-positive patients whose HBV DNA levels exceed 20,000 IU/mL after a three- to six-month period of moderately elevated ALT levels, or who remain HBeAg-

positive with HBV DNA levels greater than 20,000 IU/mL and are age 40 or older should be considered for a liver biopsy and treatment if the biopsy shows moderate to severe inflammation or significant fibrosis.

- HBeAg-positive patients with HBV DNA levels greater than 20,000 IU/mL after a three- to six-month period of elevated ALT levels, which are twice normal, should be considered for treatment.
- HBeAg-negative patients with HBV DNA greater than 2,000 IU/mL should be tested for ALT every three months during the first year to verify that they are truly in the “inactive carrier state” and then every six to 12 months. Tests for HBV DNA and more frequent monitoring should be performed if ALT or AST increases above the normal limit.

Except for HBV-DNA, all antigen and antibody test results are reported as either positive or negative. Either the antigens or antibodies are discernable at a certain level, or they are undetectable. Only the HBV-DNA test result is reported numerically.

Recently, doctors have begun to examine what impact HBV genotypes or viral strains have on a patient’s infection progression and response to treatment. More and more doctors are performing HBV genotype tests to determine what treatment should be recommended, though currently this is not recommended by the AASLD hepatitis B treatment guidelines. One study of those treated with pegylated interferon found that genotype A had higher rates of HBeAg seroconversion than other genotypes. Currently, there has been no documented differences in responses to antiviral treatment between HBV genotypes.

Reference:

AASLD Guidelines on Chronic Hepatitis B

<https://www.aasld.org/eweb/docs/practiceguidelines/chronichepBcorrection.pdf>

Note: *This page begins with an update/correction, followed by the guidelines.*

For more information about the hepatitis B immunization, visit the following websites.

- Centers for Disease Control and Prevention website on hepatitis B immunization:
<http://www.cdc.gov/ncidod/diseases/hepatitis/b/factvax.htm>
- Immunization Action Coalition provides extensive information on all childhood immunizations, including hepatitis B.
<http://www.immunize.org>
- National Network for Immunization Safety provides up-to-date, science-based information about immunization.
<http://www.immunizationinfo.org>
- American Academy of Pediatrics, an organization of 57,000 pediatricians, issues recommendations to ensure childhood health and safety.
<http://www.aap.org>

For more information about the hepatitis B, visit the following websites.

- Hepatitis B Foundation:
<http://www.hepb.org>
- HIVandHepatitis.com
<http://hivandhepatitis.com>

For more information about hepatitis C, hepatitis B and HCV coinfections, please visit www.hcvadvocate.org.

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