Hepatitis B Fact Sheet
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HBV Fact Series

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How to Interpret Hepatitis B
Antibody & Viral Tests

To determine if someone is infected with the hepatitis B virus (HBV), or to find out the status of an infection, a clinician will take a blood sample and send it to a laboratory. Technicians will analyze it for several hepatitis B viral components, which provide a roadmap to an infection.

These viral components include antigens or proteins that make up different parts of the virus and antibodies, which the 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 at liver enzymes, such as alanine aminotransferase or ALT, and other substances that may indicate if the liver is healthy or damaged.

Up to 70 percent of people infected with HBV, especially children, experience no symptoms. The most common symptoms are jaundice (yellowing of the skin or the whites of the eyes), fatigue, stomach discomfort and abdominal pain, fever, loss of appetite, nausea and joint pain.

To resolve or clear the HBV infection, the immune system must produce antibodies against the HBV antigens – certain proteins of the hepatitis B virus.

Hepatitis B Antigens include:

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 of a virus contains the core antigen (HBcAg). This antigen is only found in infected liver cells.

E antigen: Another antigen found in the core's interior is the "e" antigen (HBeAg).

HBV Genotype:

There are different strains or genotypes of HBV. Each genotype originated in different regions of the world and is designated by letters A-H. Doctors don't routinely conduct genotype tests, which require a blood sample. However, if pegylated interferon treatment is being considered, a doctor may order a genotype test because genotypes A and B appear to respond better to interferon than genotypes C and D.

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Antibody & Viral Tests

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.

In order to diagnose hepatitis B, certain markers such as surface antigens and antibodies, the "e" antigens and antibodies, and core antibodies are measured in a viral test. Also, the levels of virus in the blood (hepatitis B DNA or HBV DNA) are measured to track how actively viruses are replicating.

Hepatitis B surface antigen (HBsAg): The presence of surface antigen in a lab report indicates a hepatitis B infection. It can be an acute (short-term) or a chronic (potentially life-long) infection. Simply put, if the surface antigen is present, a person has HBV and is capable of infecting others.

When HBV replicates in the liver, it produces more surface antigen than is needed to generate new viruses. These excess surface antigens clump together in the bloodstream and are easily identified by lab tests. Laboratory tests can usually identify surface antigen about four weeks after infection, but it can take as long as nine weeks.

In an acute infection, the immune system is able to combat the "foreign" surface antigen by creating enough surface antibodies (abbreviated HBsAb or anti-HBsAg) to destroy this antigen within a few weeks of when symptoms first appear. However, in a chronic infection, the immune system cannot effectively rid the body of the antigen and create enough antibodies to fight off the infection. 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 a person has cleared the infection. ***Bottom line:*** *the surface antibody is what everyone wants to develop. 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 core antibodies are found in the bloodstream and are identified by viral tests.

Core antibodies are the first detectable HBV antibodies to appear, usually within a few weeks after infection. They are present in anyone who has had either acute or 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 protect them against future infection. A viral test on their blood would only reveal the surface antibody. However, anyone who has been actually infected with HBV would have 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 by hepatitis B viruses that are actively replicating in liver cells. When a lab test identifies the "e" antigen, it means the virus is actively replicating and the person usually has a large quantity of HBV-DNA in their bloodstream. Their blood and body fluids are usually more infectious, because of the high volume of virus, than someone who has developed the "e" antibody.

People with the "e" antigen may be at greater risk of progressing to liver disease than those who have developed the "e" antibody, especially after many years of infection, because it indicates rapid viral replication. Children with chronic hepatitis B often test positive for the "e" antigen because their immune systems have not yet "noticed" the virus or attacked the infected liver cells.

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 without producing the "e" antigen.

In acute hepatitis B, when the body's immune system quickly responds and eradicates the antigens and infected liver cells, the "e" antigen appears only briefly. It disappears as viral replication declines in the liver and the immune system produces "e" antibodies to destroy 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 one of the goals of most medical treatments for hepatitis B. Once "e" antibodies are produced, there are usually fewer HBV 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, which can reach up to millions or billions of international units per milliliter (abbreviated copies/mL), indicate rapid viral replication in the liver and a higher risk of liver damage. Low or undetectable rates indicate low viral replication 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.

Because viral load can be very high, viral load can be reported in "logs" that represent multiplying the number by 10, so 10^1 equals 10, 10^2 equals 100, and 10^3 equals 1,000 etc. A viral load that appears as 10^4 copies/mL equals 10,000 copies/mL.

Doctors should always test a patient's viral load because it plays an important role in deciding if someone needs treatment, or if treatment is working to lower viral load. For example, current guidelines suggest that people who test positive for HBeAg, have elevated ALT levels that indicate liver damage, and who have a viral load above 20,000 IU/mL may be considered for treatment. People who are HBeAg-negative with elevated ALTs, and who have viral load exceeding 2,000 IU/mL may also be considered for treatment.

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The information in this fact sheet is designed to help you understand and manage HBV and is not intended as medical advice. All persons with HBV should consult a medical practitioner for diagnosis and treatment of HBV.

For more information about hepatitis B, visit the following websites.
Hepatitis B Foundation: www.hepb.org • HIVandHepatitis.com

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