

## Viral Hepatitis B Infection

November 2013

Rob Pace

### **SLIDE 1: TITLE**

### **SLIDE 2**

I'm Rob Pace, Viral Hepatitis Prevention Coordinator for North Carolina. Today I will be covering Hepatitis B.

### **SLIDE 3**

At the end of this presentation you should be able to apply knowledge of Hepatitis B serology to determine Hepatitis B case definitions, describe the modes of transmission of Hepatitis B, describe preventative measures for Hepatitis B and locate NC DPH web-based guidance for case investigation and reporting of Hepatitis B.

### **SLIDE 4**

Hepatitis B is a contagious liver disease that results from infection with the Hepatitis B virus. "Hepatitis" means inflammation of the liver. The liver is a vital organ that processes nutrients, filters the blood, and fights infections. When the liver is inflamed or damaged, its function can be affected causing many different symptoms. There are several different viruses that can infect the liver resulting in hepatitis and they have been given letter designations. Hepatitis A, B and C are the most common in the U.S. but the list continues up the alphabet to include D, E, and G. A person infected with Hepatitis B can develop an "acute" infection, which ranges in severity from a very mild illness with few or no symptoms, sometimes not even noticed, to fulminant hepatitis, a rare form with severe, rapidly progressive loss of hepatic function resulting in coagulopathy, encephalopathy and frequently death.

### **SLIDE 5**

The Hepatitis B virus is heat- and pH-resistant, stable in many organic solvents, and tolerant of desiccation, making the virus is extremely hearty. It can survive a week on objects outside the body. Its survivability combined with the high numbers of virus often present in an infected individuals blood give Hepatitis B an unusually high level of infectivity. It is up to 100 times more infective than the HIV virus. The B virus is made of layers which surround a core containing DNA. The outside layer contains a protein called Hepatitis B Surface Antigen or HBsAg for short. Inside the virus surrounding the DNA is a layer containing a protein called the Hepatitis B Core Antigen. Using a unique method of replication that includes the copying back

NC Communicable Disease Manual/CD Course/Viral Hepatitis B

Nov. 2013

Page 1 of 7

of RNA to DNA, Hepatitis B virus must enter a host cell to reproduce. The virus binds to a receptor found on the surface of hepatocytes or liver cells. Once inside a liver cell, the virus hijacks the cells reproductive process to reproduce new viruses. During reproduction, extra parts of virus or antigens are released into serum where they can be detected and the body reacts to them by producing antibodies. The presence of DNA, antigens and antibodies is the basis for Hepatitis B testing.

#### **SLIDE 6**

The most frequent test for Hepatitis B is the Hepatitis B Surface Antigen or HBsAg for short. This antigen is the protein that is contained in the outer shell or envelope of the virus. It's presence in the blood indicates an active infection. This test is usually reported as positive or reactive.

#### **SLIDE 7**

Hepatitis e Antigen, often stated "little e" antigen is often used during treatment of Hepatitis B to determine effectiveness of treatment. It is not offered through the state laboratory of public health. A positive e antigen does indicate an active infection.

#### **SLIDE 8**

Hepatitis B DNA is neither an antigen nor an antibody. It's presence in serum however does indicate an active infection. Quantitative counts or "viral loads" are used as an indicator of infectiveness and success in treatment. Interestingly, Hepatitis B DNA can be incorporated into host hepatic cells where it is not detectable by serum testing and can remain there for the person's lifetime.

#### **SLIDE 9**

Hepatitis B core IgM antibody is the first measurable reaction of the body's immune response to the Hepatitis B virus. This antibody is created in response to the core antigen, a protein in the inner layer of the virus surrounding the DNA.

#### **SLIDE 10**

Hepatitis B core antibody total is the measurement of IgM and IgG antibodies to the core antigen. If IgM is positive, the core total will be positive. If the core total is positive and IgM is negative, it indicates IgM has waned but IgG remains. This is useful for determining if someone had Hepatitis B in the past.

## **SLIDE 11**

Hepatitis B surface antibody indicates the body's final immune response to the Hepatitis B virus. This antibody is detectable in persons who have resolved a natural infection or have been successfully vaccinated against Hepatitis B.

## **SLIDE 12**

During the course of an infection, the various antigens and antibodies will occur in a specific order. The first detectable is the HBsAg, represented by the red line on this graph, which is detectable about 3 weeks after infection. Shortly after the HBsAg becomes detectable, HB DNA represented by the dark red bar and HBeAg represented by the light green bar will become detectable. The body will respond to the infection with IgM antibodies to HB core Ag depicted by the yellow line around week 6. All of this will occur before the person shows any symptoms which occur 60 to 120 days after exposure with an average incubation time of 90 days. The time for symptoms is indicated by the green bar at the top of the graph. As the infection progresses, the IgM antibodies will wane, core total antibodies depicted by the blue line will remain positive due to IgG antibodies and antibodies to HBsAg indicated by the red line will develop. Individuals who develop antibodies to HBsAg will resolve the infection and have natural immunity from re-infection.

## **SLIDE 13**

Although the acute course of the disease is the same for all individuals, in some persons, antibodies to HBsAg never develop and they remain chronically infected with detectable HBsAg and antiHBe Total for the rest of their lives. The likelihood of developing a chronic infection is inversely proportional to the age at time of infection. Approximately 90% of infants infected will go on to chronic infection while only 5% of adults infected will become chronic. HBsAg will remain detectable in these individuals throughout their life.

## **SLIDE 14**

Hepatitis B surveillance is reported under 3 case definitions, Acute, Chronic, and Perinatal. These definitions help us monitor how and where the disease is being transmitted. The clinical diagnosis of providers may not always match with our surveillance case definitions so it is important that health departments collect case information and apply the case definition independently of the clinical diagnosis. The current case definitions can be found in the N.C.

Communicable Disease Manual on line. From time to time the CDC and Council of State and Territorial Epidemiologist (CSTE) will update these case definitions, always be sure you are using the current definition.

#### SLIDE 15

Acute Hepatitis B refers to the first 6 months after someone is exposed to the Hepatitis B virus. Some people are able to fight the infection and their immune system clears the virus from the body. These people are left with antibodies which indicate they had a natural case of the disease and protects them from re-infection except in some very rare circumstances. The surveillance case definition for Acute Hepatitis B requires a discrete onset of symptoms. The date the symptoms began may not be discernible, but the patient can identify a period when they changed from their normal state to an ill state. The symptoms of infection can be very general e.g., fever, headache, malaise, anorexia, nausea, vomiting, diarrhea, and abdominal pain, so they must be considered with other indicators. The definition uses either jaundice or alanine aminotransferase (ALT) levels >100 IU/L as an indicator, one or both must be present to meet the acute case definition. Although we normally think of jaundice as a symptom, in this case it must be present in addition to other constitutional symptoms. Although there are other labs that indicate liver dysfunction the case definition is restrictive to ALT. ALT greater than 100 must be present if jaundice is not. Finally, to meet the acute case definition, a person must have a positive or reactive HBsAg. A HB DNA or HBe antigen will not suffice to meet the acute case definition. IgM anti-HB core is not required but must be positive if it was done.

#### SLIDE 16

Chronic Hepatitis B refers to the illness that occurs when the Hepatitis B virus is not cleared by the immune system and remains in a person's body. Over time, the infection can cause serious health problems due to destruction of hepatocytes as a result of the immune response to the virus. Individuals who are HBsAg positive are at a much higher risk of hepatocellular carcinoma during their lifetime. The chronic condition can be indicated through positive surface antigen, e antigen or DNA. With any one of these tests positive, a person will be a probable case. If a person has 2 of these tests positive more than 6 months apart, they will meet the confirmed classification. **If a person has one of these tests and an IgM antiHBc negative at the same time indicating they are not acute, they are confirmed as a chronic case.** There is a comment attached to the chronic case definition which addresses discordant results. To paraphrase the comment, if more than one of these tests was performed and only one was positive, you go with the positive. Negative HBeAg results and HBV DNA levels below positive cutoff level do not confirm the absence of HBV infection.

## **SLIDE 17**

The younger a person is when infected with Hepatitis B virus, the greater his or her chance of developing chronic Hepatitis B. Approximately 90% of infected infants will develop chronic infection. The risk goes down as a child gets older. Approximately 25%–50% of children infected between the ages of 1 and 5 years will develop chronic hepatitis. The risk drops to 6%–10% when a person is infected over 5 years of age. Worldwide, most people with chronic Hepatitis B were infected at birth or during early childhood. When infected early in life, a person is more likely to experience liver damage. A case definition and program for monitoring and preventing vertical transmission to infants was created and funded by the CDC. Here in N.C., the perinatal Hepatitis B case management program has been established in the Immunization Branch of the N.C. Division of Public Health. They track every pregnancy in Hepatitis B infected women in the state with the goal of preventing transmission from mother to child. Their program and programs like it in other states, have been hugely successful in reducing vertical transmission to almost non-existent levels. The N.C. Electronic Disease Surveillance System (NC EDSS) has been structured to assist in identifying pregnancies in women with Hepatitis B so that they may be tracked.

## **SLIDE 18**

Since acute, chronic and perinatal cases cannot be differentiated solely by lab results, the North Carolina Electronic Disease Surveillance System (NC EDSS) contains a place holding event called a Hepatitis B Lab/Condition Report to be used until information is available to classify an event. CD nurses must investigate and gather case information, make a determination as to the type of case and change the case to acute, chronic, perinatal or keep the Lab/Condition Report based on their findings. Using a Hepatitis B Lab/Condition Report event allows persons who have been previously reported to be updated with a new address, additional laboratory testing or other information without altering the original case report. It also allows for the tracking of multiple pregnancies during a woman's life through the subsequent report package. Lab/Condition Reports for persons previously reported should be returned to the state with the subsequent report package completed. Local Health Department users should never deduplicate Hepatitis B events.

## **SLIDE 19**

Algorithms, business rules and other information to assist with the reporting of Hepatitis B events are contained in the NC Communicable Disease Manual and supplemental Hepatitis B manual on line. The algorithms step a user through the reporting process but if you still need assistance with Hepatitis B reporting, please contact myself or the TATP nurse consultant for your county. The NC EDSS helpdesk cannot merge hepatitis B events. The first step in reporting

hepatitis B is always determining if the person has been previously reported. Nurses who work hepatitis B cases should have a special user ID that allows them to search statewide for hepatitis B cases. The Hepatitis B Statewide Viewer ID can be requested by having the NC Lead for your county contact the NC EDSS Help Desk.

#### **SLIDE 20**

Hepatitis B is transmitted in body fluids. Blood by far and away has the highest concentration of virus however it is also found in semen, vaginal secretions and other fluids. It is not found in breast milk or sweat. Most infections have resulted from vertical, sexual or needle sharing exposures however infections in household contacts without obvious blood exposure and infection via fomites has been documented.

#### **SLIDE 21**

Anyone who is exposed to the blood or body fluids of an infected person is at risk for Hepatitis B. The persons at greatest risk are infants born to infected mothers who are not treated at birth, persons with multiple sexual partners or sexually transmitted diseases. Persons who share drug equipment are also at risk. Health care workers are also subject to exposure, but should be vaccinated to prevent infection.

#### **SLIDE 22**

This graph shows risk behaviors identified in 2011 reported cases. You can see that multiple sexual partners and drug use were the most prevalent identified risks. Living with an infected person is associated with transmission although the risk is less than other types of exposures.

#### **SLIDE 23**

The Centers for Disease Control and Prevention has a Comprehensive Immunization Strategy to Eliminate Transmission of Hepatitis B Virus in the United States. The keystone to this plan is the current vaccine that has been around since the 1986. Besides the vaccination plan, reducing exposures through mandated control measures and occupational exposure control are part of preventing the further spread of the disease.

#### **SLIDE 24**

The CDC's immunization plan is truly comprehensive. It includes vaccination of all infants at birth, identification of Hepatitis B infected women during pregnancy, childhood vaccinations and vaccination of adults with risk factors. In the period from 1990 to 2005, after the

NC Communicable Disease Manual/CD Course/Viral Hepatitis B

Nov. 2013

Page 6 of 7

implementation of the immunization plan, the incidence of acute hepatitis B declined 78%. The reduction in cases should continue as the childhood vaccinated cohort moves up in age. This slide lists the groups this vaccine is recommended for, which, with the last bullet could include almost everyone. This does not represent who the state will provide vaccine for at no cost. Health departments should check the latest North Carolina Immunization Program guidance to determine who may receive state supplied vaccine at no cost. Hepatitis B vaccine contains hepatitis b surface antigen that is produced by genetically altered yeast cells. The vaccine does not contain any virus or DNA and cannot infect anyone. The vaccine HBsAg is detectable when serum HBsAg testing is done and therefore testing should be delayed until 21 days after vaccination.

#### **SLIDE 25**

The North Carolina Administrative Code requires persons infected with Hepatitis B Virus to follow certain control measures. Failure to follow these control measures is a misdemeanor and could potentially be prosecuted. Some of the control measures are listed here. They include measures to prevent exposure by sexual contact, drug use and from donated blood or organs. Some control measures also require specific actions on the part of the local health director. Measure 4 requires persons newly diagnosed to identify sexual and needle sharing contacts to the health director. Measure number 6, requires infected persons to report all household contacts to the health director. When reporting a new case of Hepatitis B, health departments should include documentation of contacts, whether sexual, needle sharing or household, were identified, tested and vaccinated in the event report. Lastly, measure 7 requires an individual to be tested 6 months after diagnosis to determine whether they are a chronic carrier. Health departments should be contacting individuals 6 months after they are diagnosed if their carrier status is unknown. These individuals can be tested at state expense if they do not have funds or a provider to carry out the testing.

#### **SLIDE 26**

Any workers who have reasonably anticipated contact with blood or OPIM during performance of their jobs are considered to have occupational exposure and to be at risk of being infected. An employer must develop an exposure control plan and implement use of universal precautions and control measures, such as engineering controls, work practice controls, and personal protective equipment to protect all workers with occupational exposure. In addition, employers must make hepatitis B vaccination available to these workers.

#### **SLIDE 27**

#### References