Hepatitis B - virology

- DNA virus
- class *Hepadnaviridae*

Transmission
- Sexual contact
- Injecting drug use or other percutaneous exposure i.e. tattoos
- Perinatal transmission

There are two possible outcomes following hepatitis B infection
- 1) clearance of the hepatitis B virus
- 2) Chronic hepatitis B infection
Hepatitis B – clinical features

• Incubation period 45-180 days (mean 60-90 days)
• Clinical illness associated with acute infection is age-dependent:
  • Jaundice occurs in <10% of children less than 5 years of age
  • Jaundice occurs in 30%-50% of older children and adults.
• Most acute HBV infections in adults result in complete recovery with clearance of HBsAg from the blood, production of anti-HBs, and immunity from future infection.
• ~30%-90% of young children and 2%-10% of adults develop chronic infection (“carrier state”)
• Persons with chronic HBV infection are often asymptomatic:
  • high risk for developing cirrhosis or liver cancer.
Hepatitis B serological markers

- **Hepatitis B surface antigen (HBsAg)**
  - This is a protein on the surface of the hepatitis B virus (HBV); it can be detected in the serum during acute or chronic HBV infection.
  - The presence of HBsAg indicates that the person has hepatitis B infection.
  - HBsAg is the antigen used to make hepatitis B vaccine.

- **Total hepatitis B core antibody (anti-HBc)**
  - Appears at the onset of symptoms in acute hepatitis B infection and persists for life.
  - The presence of anti-HBc indicates previous or ongoing infection with HBV.

- **IgM antibody to hepatitis B core antigen (IgM anti-HBc)**
  - Its presence usually indicates acute (<6 months) as opposed to chronic hepatitis B infection.
  - Can also be found during viral reactivations

- **Hepatitis B e antigen (HBeAg)**
  - A product of the nucleocapsid (envelope) gene of the hepatitis B virus that is found in serum during acute and chronic hepatitis B infection.
  - Its presence indicates that the virus is replicating and the infected person has high levels of HBV. However patients that are HBeAg negative may also have high levels of HBV.

- **Hepatitis B e antibody (HBeAb or anti-HBe)**
  - Spontaneous conversion from e antigen to e antibody (a change known as “e” seroconversion) is a predictor of long-term clearance of HBV in patients undergoing antiviral therapy and indicates lower levels of HBV.
  - Spontaneous “e” seroconversion also occurs in natural infection

- **Hepatitis B surface antibody (anti-HBs)**
  - The presence of anti-HBs is generally interpreted as indicating recovery and immunity from HBV infection.
  - Anti-HBs also develops in a person who has been successfully vaccinated against hepatitis B.
Acute Hepatitis B Virus Infection with Recovery
Typical Serologic Course

Symptoms
HBeAg anti-HBe

Titer
Total anti-HBc
HBsAg IgM anti-HBc anti-HBs

Weeks after Exposure
0 4 8 12 16 20 24 28 32 36 52 100

CDC
Progression to Chronic Hepatitis B Virus Infection
Typical Serologic Course

- Acute (6 months)
- Chronic (Years)

- HBeAg
- anti-HBe
- HBsAg
- Total anti-HBc
- IgM anti-HBc

Titer vs. Weeks after Exposure vs. Years

CDC
Centers for Disease Control and Prevention
Interpretation of serology results

<table>
<thead>
<tr>
<th>HBsAg</th>
<th>anti-HBc</th>
<th>anti-HBs</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>negative</td>
<td>negative</td>
<td>negative</td>
<td>Susceptible</td>
</tr>
<tr>
<td>HBsAg</td>
<td>negative</td>
<td>positive</td>
<td>Immune due to natural infection</td>
</tr>
<tr>
<td>anti-HBc</td>
<td>negative</td>
<td>positive</td>
<td>Immune due to hepatitis B vaccination</td>
</tr>
<tr>
<td>anti-HBs</td>
<td>negative</td>
<td>positive</td>
<td>Acutely infected</td>
</tr>
<tr>
<td>HBsAg</td>
<td>positive</td>
<td>positive</td>
<td>Chronically infected</td>
</tr>
<tr>
<td>anti-HBc</td>
<td>positive</td>
<td>negative</td>
<td>Interpretation unclear; two possibilities:</td>
</tr>
<tr>
<td>IgM anti-HBc</td>
<td>positive</td>
<td>negative</td>
<td>1. Resolved infection (most common)</td>
</tr>
<tr>
<td>anti-HBs</td>
<td>negative</td>
<td></td>
<td>2. False-positive anti-HBc, thus susceptible</td>
</tr>
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