Viral hepatitis

- The word “hepatitis” means inflammation of the liver.
- There are five main types of viral hepatitis: A, B, C, D, E.
  - Hepatitis A and E are typically caused by ingestion of contaminated food or water.
  - Hepatitis B, C and D are typically caused by contact with contaminated blood or body fluids.
- In particular, viral hepatitis types B and C lead to chronic disease in hundreds of millions of people and, together, are the most common cause of liver cirrhosis and cancer.
Hepatitis B
Virus
Hepatitis B Virus (HBV)

- Hepatitis B causes acute hepatitis (short term and/or severe) and chronic infection (lingering—may not be severe) leading to chronic liver disease.

- The acute illness causes liver inflammation, jaundice (yellowing of the skin, eyes, etc), and (rarely) death.

- HBV is transmitted in blood, by sexual intercourse and from mother to child.
classification

- **family**: hepadnaviridae contains two genera:
  - 1- **Genus**: Orthohepadnavirus.
  - 2- **Genus**: Avihepadnavirus.
**Structure and genome**

Spherical, enveloped virion, 42 nm, enclosing inner icosahedral 27 nm nucleocapsid (core) composed of 180 capsomeres

Hepadnaviruses code for three major antigens, designated surface (HBsAg), core (HBcAg), and e (HBeAg).

Envelope contains the glycoprotein, hepatitis B surface protein (HBsAg) of three different size species with common C-termini, L-, M-, and S-HBsAg

Core contains the phosphoprotein, hepatitis B core protein HBcAg, plus polymerase with three enzyme activities: reverse transcriptase, DNA polymerase, and RNase H

Virions and subviral particles of hepatitis B virus. (A) Negative contrast electron microscopy of purified intact (B) Negative contrast electron microscopy of subviral particles—hepatitis B surface protein (HBsAg) (C) Model of an intact virion and subviral particles showing constituents.
Laboratory diagnosis

1- Liver Chemistry tests:
   • AST, ALT, ALP, and total Bilirubin (rise in acute phase)

2- Serology: 1-BY using ELISA
   • detect viral antigens or antibodies
   • 1) HBsAg: It is the first marker to appear in blood after infection.
   • 2) Anti-HBs (HBsAb): Disappearance of HBsAg and the appearance of anti-HBs signals recovery from HBV infection, non-infectivity.
   • 3) Anti-HBc: IgM anti-HBc appears shortly after HBsAg is detect (HBcAg alone dose not appear in serum)
   • IgM-HBc may also or can persist for 3-6 months or longer.
   • IgG-HBc also appear during acute hepatitis B but persist indefinitely.
   • 4) HBeAg:
   • HBeAg appear in blood concurrently with HBsAg, or soon afterwards.
   • HBeAg indicate viral replication and infectivity.
• 2- by using Radio-immunoassay

• This technique uses an immune reaction [Antigen – Antibody reaction] to estimate a ligand Ag + Ag* + Ab

• AgAb + Ag*Ab + Ag + Ab*  

• A mixture is prepared of radioactive antigen and antibodies against that antigen.

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• At increasing concentrations of unlabeled antigen, an increasing amount of radioactive antigen is displaced from the antibody molecules. The antibody-bound antigen is separated from the free antigen in the supernatant fluid, and the radioactivity of each is measured by Gamma Counter
Radioactive antigen

"First" antibody

Add unlabeled antigen (∙)

Radioactive antigen (∙) displaced by unlabeled antigen (∙)

Precipitate ag-ab complexes with anti-immunoglobulin ("second" antibody)

Radioactivity of supernatant = free antigen

Radioactivity of precipitate = bound antigen

"Second" antibody
3- PCR : to measure the amount of HBV DNA

4-Liver Biopsy:
to determine grade (Inflammation) and stage (Fibrosis) in chronic Hepatitis

5- Isolation : HBV replication in primary cultures of human hepatocytes, but virus culture impracticable for routine diagnostic use.
Prevention

• vaccination:
  • highly effective recombinant vaccines.
• Hepatitis B immunoglobulin (HBig | ):
  • exposed within 48 hours of the incident/neonates whose mothers are HBsAg and HBeAg positive.
• Other measures:
  • screening of blood donors, blood and body fluid precautions.
Treatment

- Acute hepatitis B infection does not usually require treatment because most adults clear the infection spontaneously.
- On the other hand, treatment of chronic infection may be necessary to reduce the risk of cirrhosis and liver cancer.
- Although none of the available drugs can clear the infection, they can stop the virus from replicating, thus minimizing liver damage.
- **Antiviral drugs**
  - lamivudine (Epivir),
  - adefovir (Hepsera),
  - tenofovir (Viread),
  - interferon alpha-2a