



Virology for 2<sup>nd</sup> Year MD Students

# (14) Hepatitis Viruses

University of Jordan

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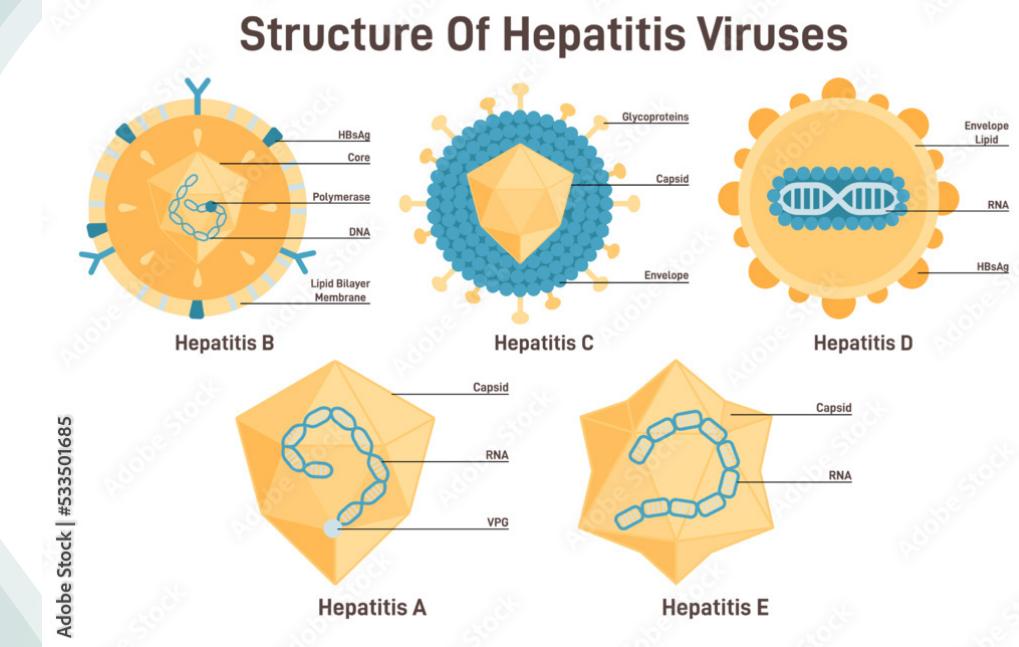
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# Overview of hepatitis viruses

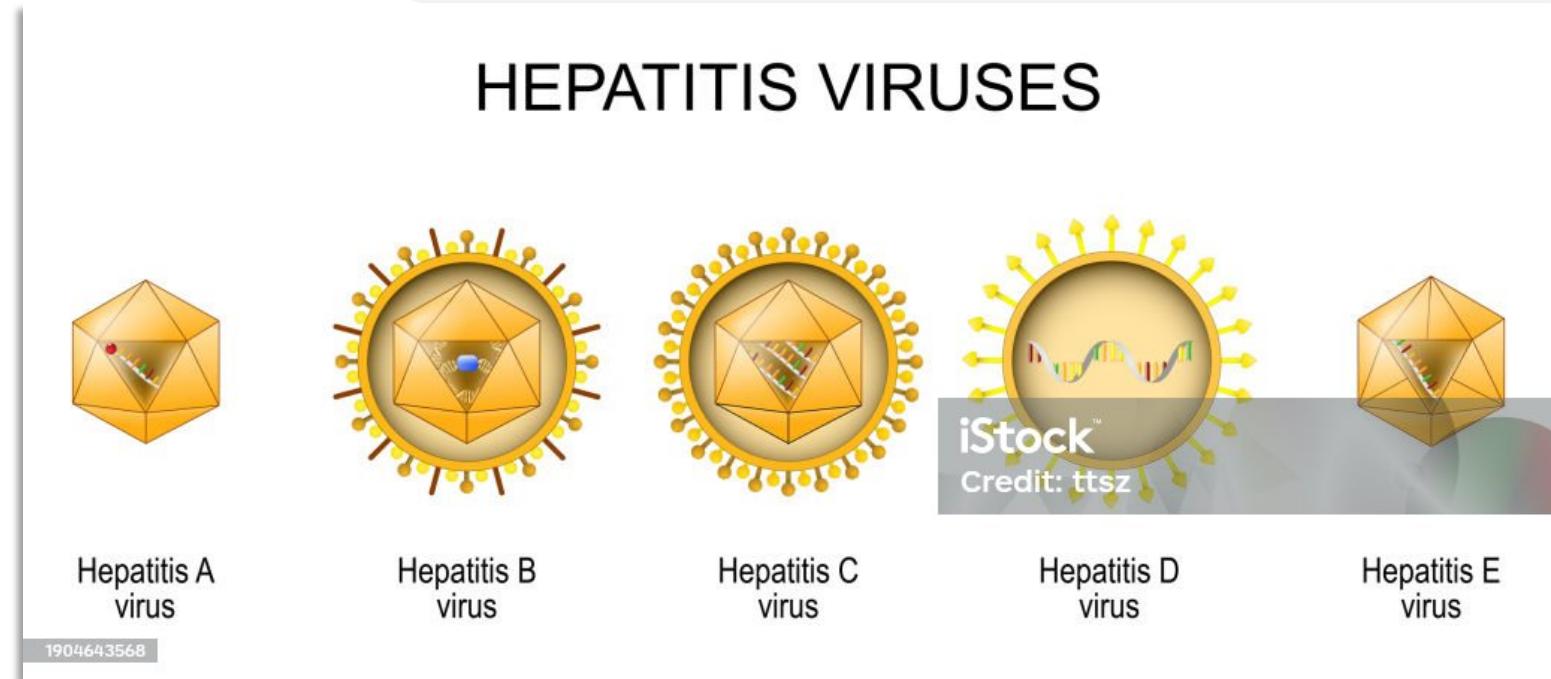
- A. Hepatitis A virus (HAV)
- B. Hepatitis B virus (HBV)
- C. Hepatitis C virus (HCV)
- D. Hepatitis D virus (HDV): Defective virus and can cause infection only if HBV is present. It is also called the delta agent.
- E. Hepatitis E virus (HEV)
  - All these viruses infect the hepatocytes causing liver inflammation (hepatitis).
  - Other viruses that can cause hepatitis (secondary hepatic involvement) such as EBV, CMV, HSV.





# Structure of hepatitis viruses

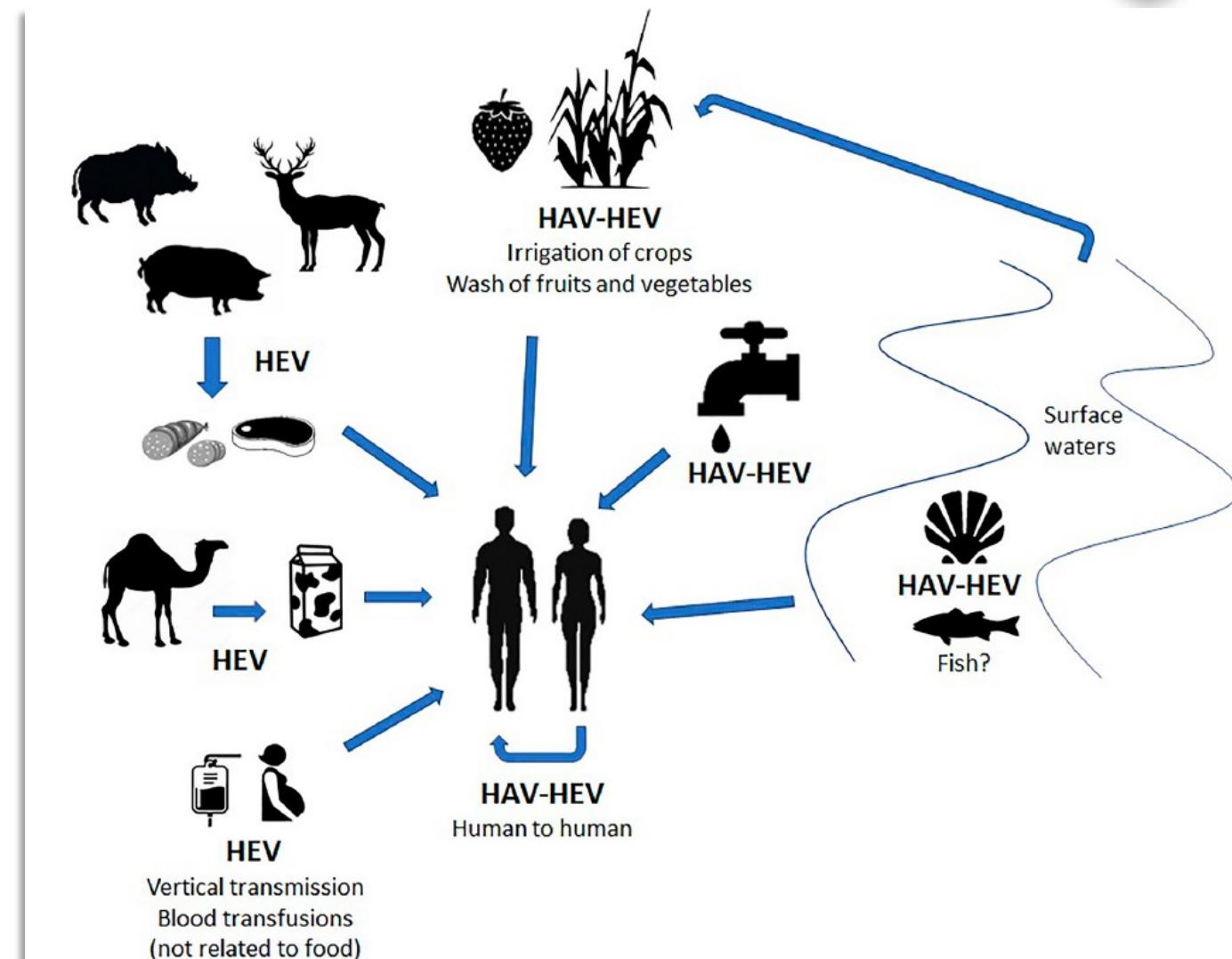
- A. Hepatitis A virus (HAV): positive-sense single stranded RNA non-enveloped
- B. Hepatitis B virus (HBV): double stranded DNA enveloped
- C. Hepatitis C virus (HCV): positive-sense single stranded RNA enveloped
- D. Hepatitis D virus (HDV): negative-sense single stranded RNA enveloped
- E. Hepatitis E virus (HEV): positive-sense single stranded RNA non-enveloped





# Transmission of hepatitis viruses

- HAV: Fecal-oral transmission (e.g., contaminated water, contaminated food, close personal contact (daycare, household)), sexual transmission
- HEV: Fecal-oral transmission (contaminated water), undercooked pork, deer meat, blood transfusion, vertical





# Transmission of hepatitis viruses



## At-risk groups for Hepatitis B virus



## How Hepatitis Delta Can Be Transmitted:



- HBV: Blood exposure (transfusions, injection drug use, needlestick injuries), mother-to-child, sexual, health-care exposure (hemodialysis, organ transplantation).
- HCV: Blood exposure (injection drug use, transfusion, needlestick injuries), hemodialysis, organ transplantation, mother-to-child transmission, sexual.
- HDV: the same as HBV



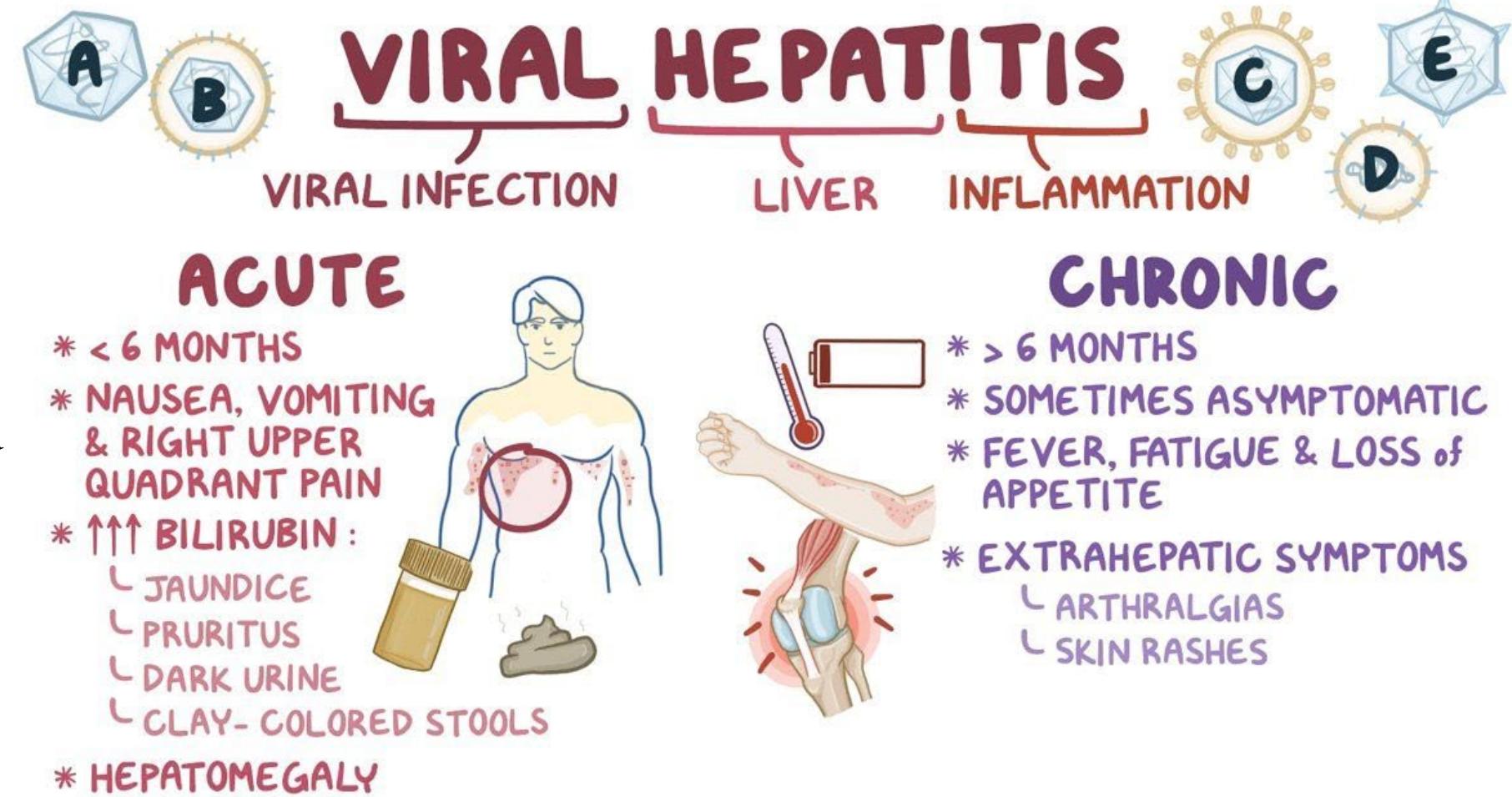
# Clinical features of viral hepatitis

- Short incubation (weeks):
  - HAV: 2-6 weeks (average 4 weeks)
  - HEV: 2-8 weeks (average 5-6 weeks)
- Long incubation (months)
  - HBV: 1-6 months (average 3 months)
  - HCV: 2-6 months (average 6-7 weeks, but often clinically silent)
  - HDV: Similar to HBV



# Clinical features of viral hepatitis

- All five viruses can cause acute viral hepatitis, characterized by jaundice, nausea, vomiting, anorexia, fatigue, fever, marked elevation of ALT and AST (often ALT > AST).
- Asymptomatic acute infection can occur with all five viruses





# Clinical features of viral hepatitis

- All 5 viruses can cause fulminant hepatitis (acute liver failure) in a minority of patients (less than 1% on average). Mortality by acute hepatitis E can reach 20-30% in 3rd trimester. HDV-HBV co-infection or super-infection markedly increases fulminant risk
- HBV, HCV and HDV cause chronic infection (continue to be present in the body for more than 6 months). Chronic infection progress to cirrhosis and subsequently to hepatocellular carcinoma. So, HBV and HCV can be considered as oncoviruses. Age is the main determinant of chronicity.
- Chronic HEV can occur in immunocompromised patients.



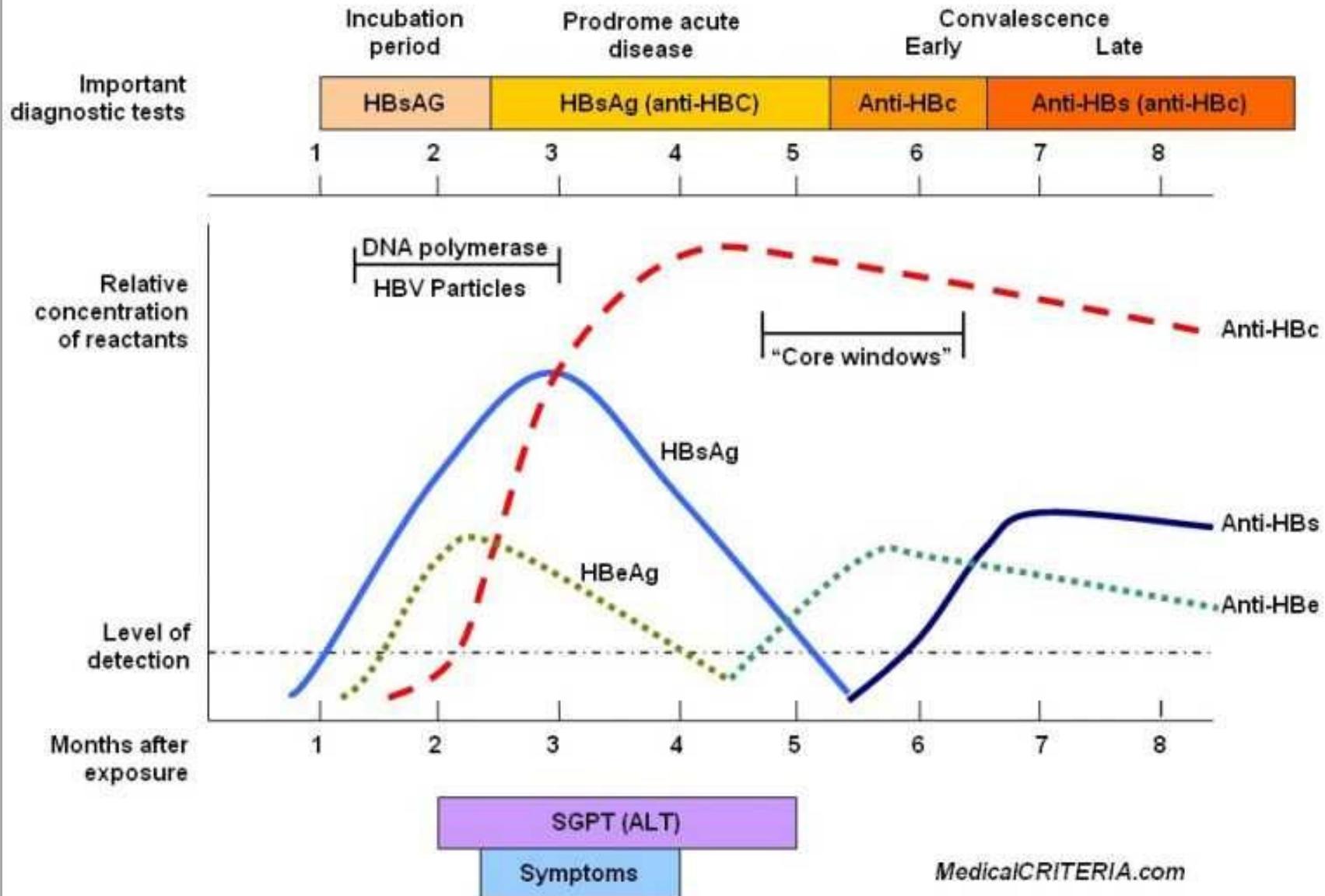
# Diagnosis

- Hepatitis A virus (HAV): Serology. HAV IgM (acute infection). HAV IgG (past infection or vaccination).
- Hepatitis B virus (HBV): Serology, molecular detection.
- Hepatitis C virus (HCV): Serology, molecular detection.
- Hepatitis D virus (HDV): First, HBV must be present. Serology, molecular detection.
- Hepatitis E virus (HEV): Serology. HEV IgM (acute infection).



# Diagnosis – HBV

## HEPATITIS B PROFILE





# Treatment of hepatitis viruses

- Acute infection: Supportive care
- Chronic HBV: Antiviral medications (nucleoside analogs with entecavir or tenofovir as first-line), interferon for life.  
Treatment suppresses HBV replication but does not eradicate the virus (not curative)
- Chronic HCV: Antiviral medications (direct-acting antivirals DAAs). Cure rate (sustained viral response SVR): >95%. Thus, chronic HCV is curable
- Chronic HDV: Interferon. HBV control. Newer drugs are evaluated (Bulevirtide) which is an entry inhibitor (blocks NTCP receptor).





# Prevention

- HAV: Inactivated vaccine (Highly effective (>95%) and induces long-lasting immunity). Two doses
- HBV: Recombinant HBsAg (surface antigen) vaccine. Three doses (0 - 1 - 6 months). 90% effective in immunocompetent adults.
- HBV vaccination prevents HDV infection.
- No vaccine has been approved for hepatitis C prevention.
- The only licensed hepatitis E vaccine worldwide, the Hecolin vaccine is approved for use in some countries. Recombinant protein-subunit vaccine



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Hecolin vaccine: long-term efficacy against HEV for a three-dose regimen

Florence Abravanel, Sébastien Lhomme

Published: February 19, 2024 • DOI: [https://doi.org/10.1016/S0140-6736\(23\)02455-8](https://doi.org/10.1016/S0140-6736(23)02455-8) • [Check for updates](#)





# Epidemiology

- “WHO estimates that 296 million people were living with chronic hepatitis B infection in 2019, with 1.5 million new infections each year.”
- “Globally, an estimated 58 million people have chronic hepatitis C virus infection, with about 1.5 million new infections occurring per year.”
- HDV affects globally nearly 5% (an estimated 12 million) of people who have a chronic infection with HBV.
- Hepatitis A causes mild to severe illness in an estimated 1.4 million people per year, with a further 113 million people being infected but not developing symptoms.
- An estimated 20 million people are infected with hepatitis E every year, leading to 3.3 million symptomatic cases.



Thank You...  
Wishing you all the best!