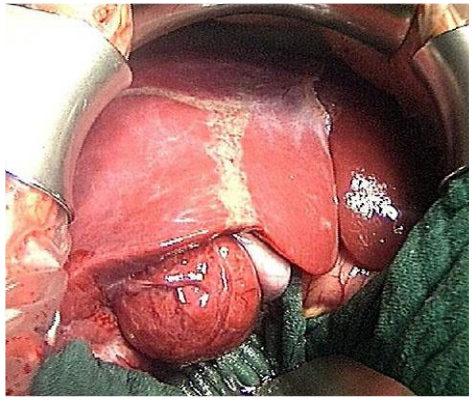
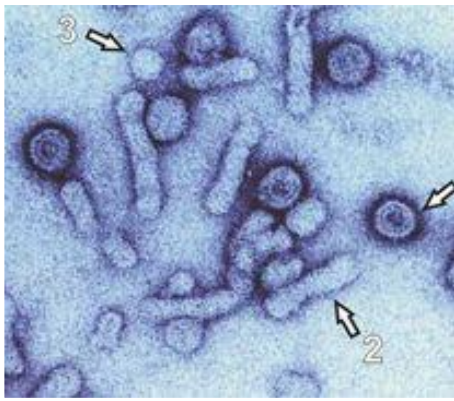



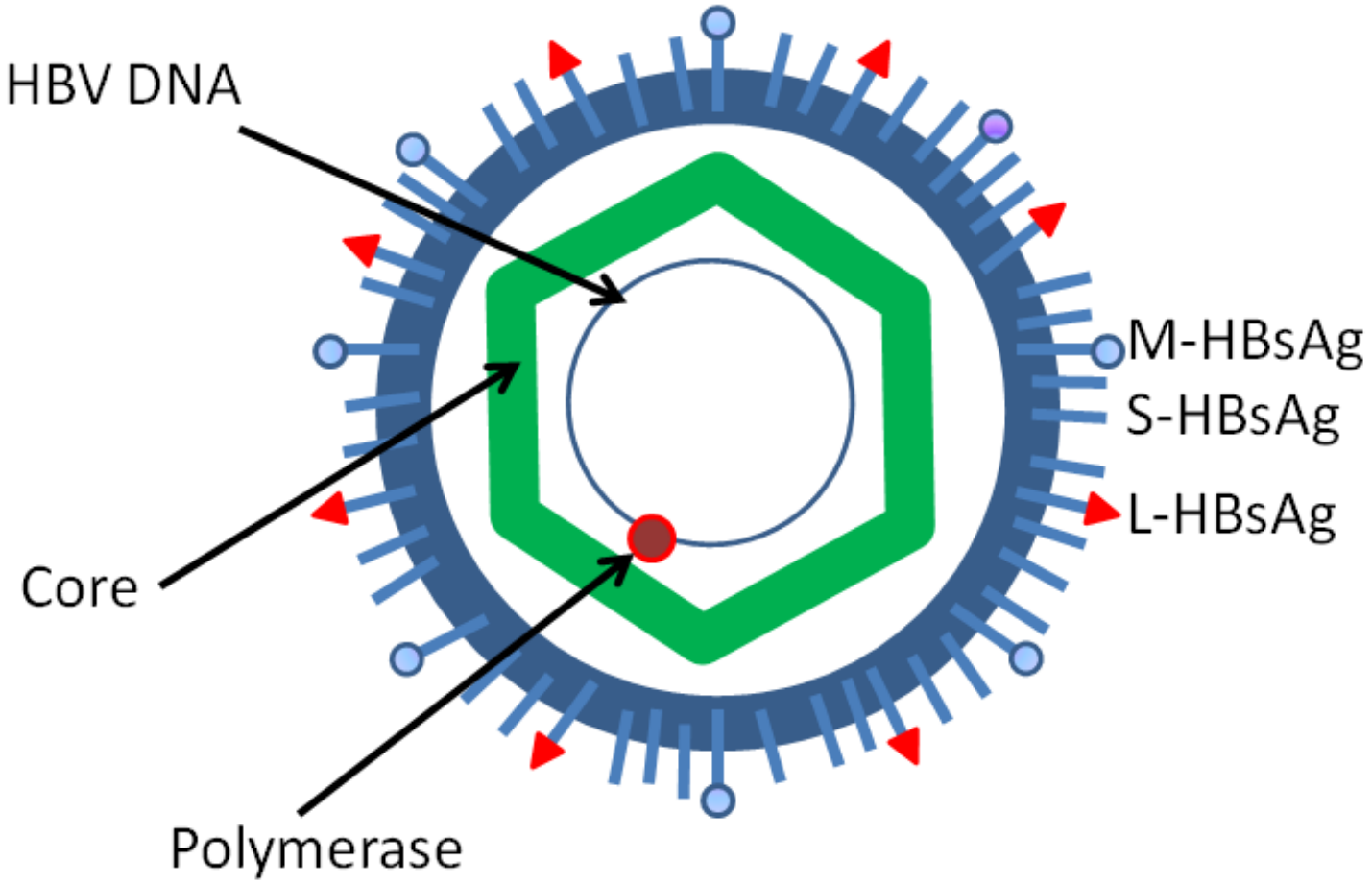
Hepatitis B Virus

Masika M.M.

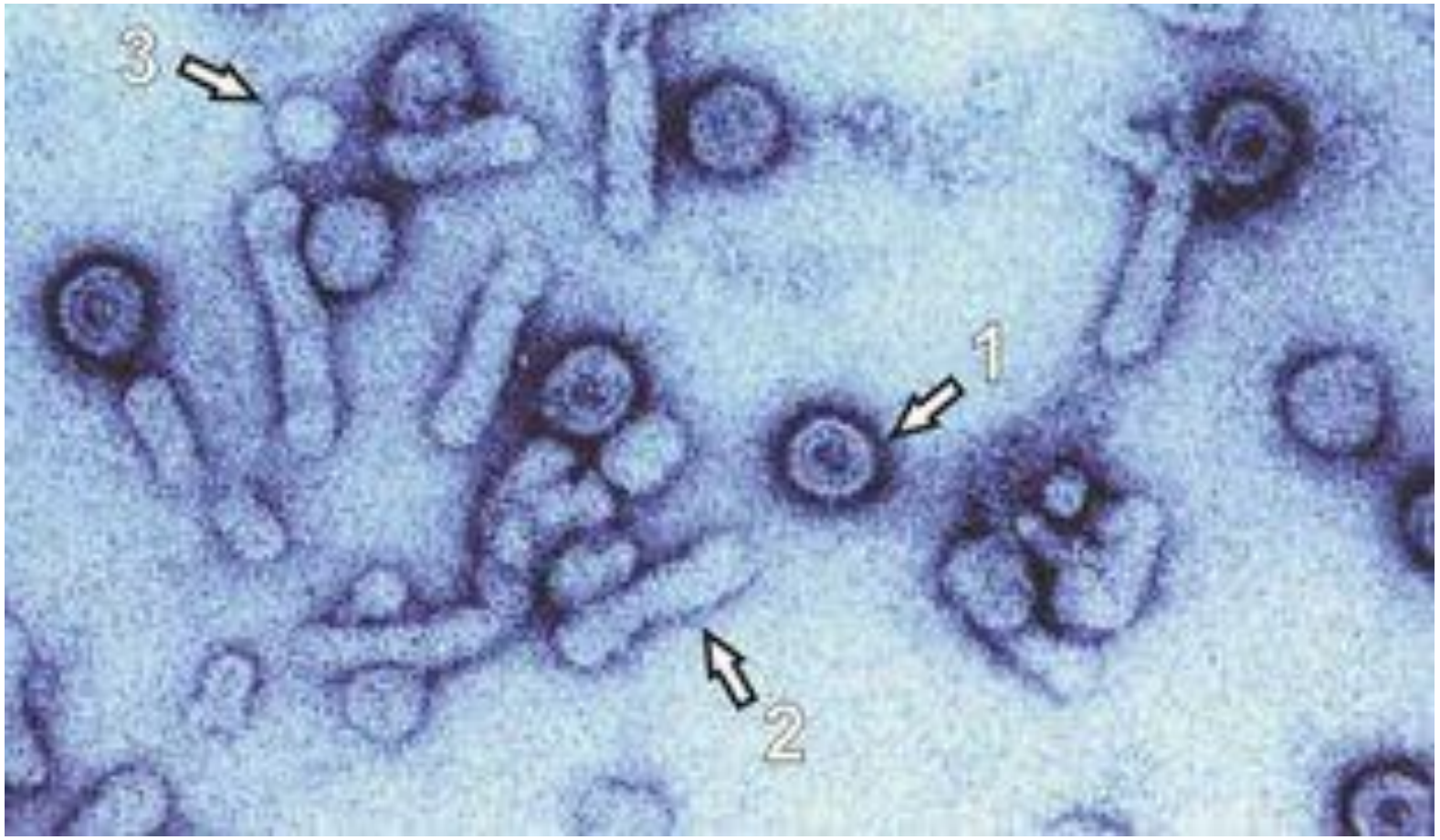
HBV Virology

- **Family**: *Hepadnaviridae*
- **Genus**: *Orthohepadnavirus*
- **Species**: *Hepatitis B virus*
- **8 genotypes**: A - H
- Circular DNA, partially double-stranded
- Enveloped

HBV structure



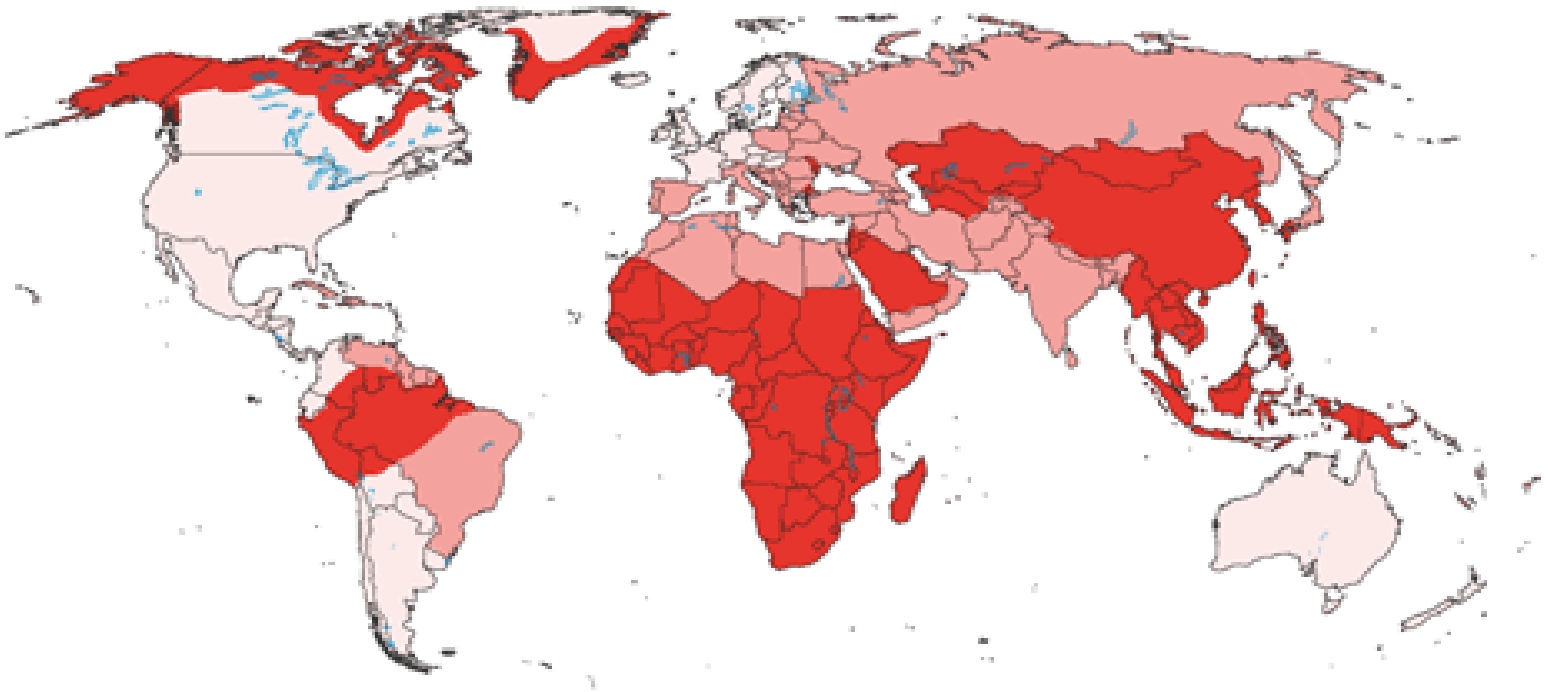
HBV Electron Micrograph



HBV Epidemiology

- A third of global population has been infected
- 5% (400 million) are HBV carriers
- 25% of chronic infections develop serious liver disease – *cirrhosis, Hepatocellular carcinoma (HCC)*
- 1 million deaths p.a. related to HBV
- HBV causes 50% of all cases of HCC

HBV Prevalence



Level of endemicity	% of general population with chronic HBV infection	% of world population
high endemicity	greater than 7%	about 45%
intermediate endemicity	2% to 7%	about 43%
low endemicity	less than 2%	about 12%

HBV Transmission

- **Sexual contact** (Predominant mode among adults)
- **Close contact**
- **Vertical transmission**
  - During delivery, rarely transplacental
  - No evidence of transmission through breastfeeding
- **Blood**
  - Blood transfusions
  - Sharing of needles, razors
  - Tattooing, acupuncture
  - Renal dialysis
  - Organ transplant

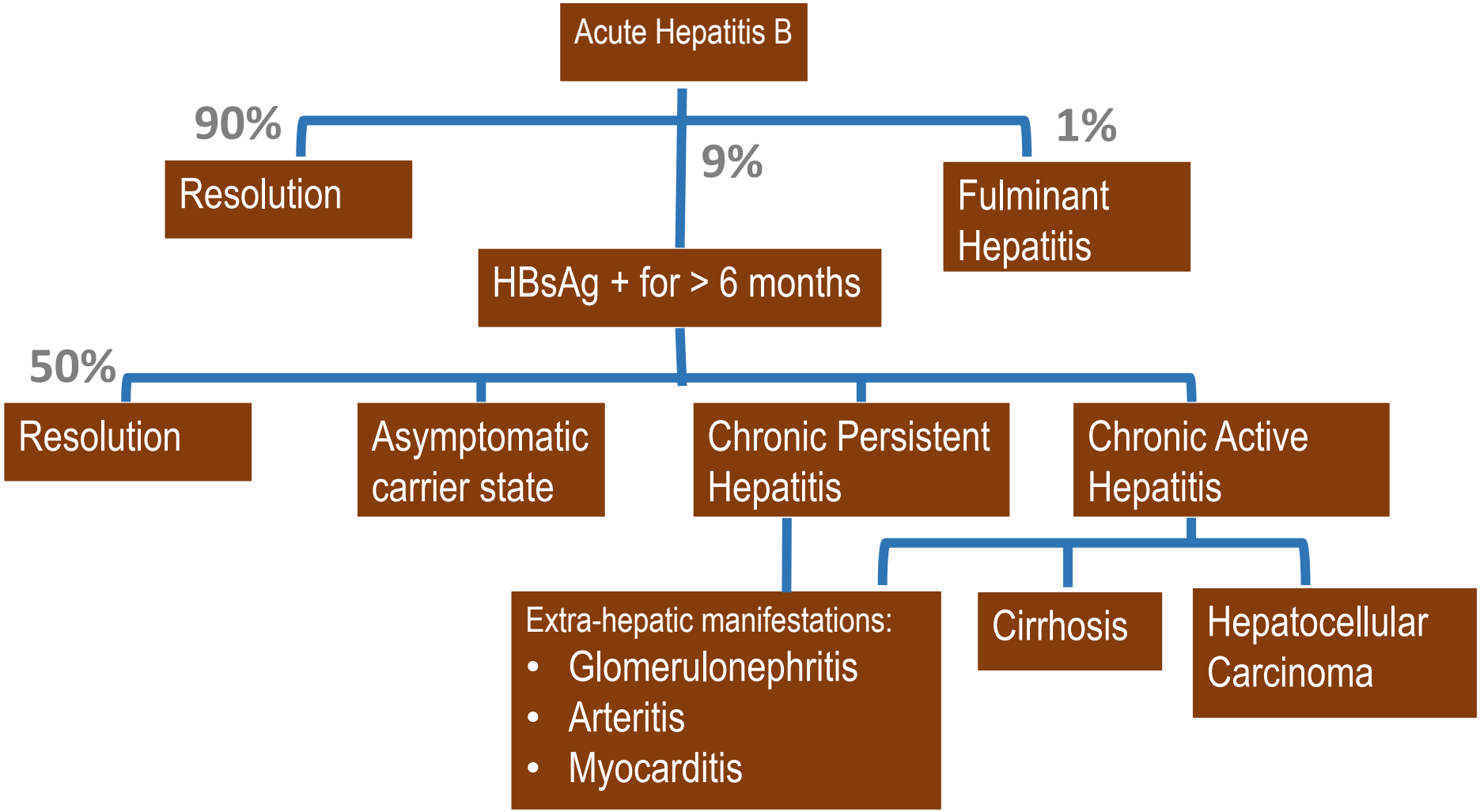
HBV Risk Factors

1. Multiple sexual partners
2. Intravenous Drug Use (PWIDs)
3. MSM
4. Household members of an infected person
5. Crowding/Institutionalization
6. Occupational risk – Health workers

HBV Pathogenesis

- Parenterally transmitted
- Replicates in Hepatocytes
- Virus particles & surface protein released into blood
  - *Viremia is prolonged and blood is highly infectious*
- Host immune response destroys infected hepatocytes
  - ➢ *Level of immune response determines manifestations*
- Chronic infection >> destruction/regeneration >> cirrhosis/cancer

HBV: Clinical outcomes



HBV Infection: Disease Phases

1. Immune tolerance phase
2. Immune active /immune clearance phase
3. Inactive chronic infection
4. Chronic disease
5. Recovery

HBV: Clinical Features

- Long incubation period: 60-90 days (1-6 months)
- Insidious onset of symptoms
- Often asymptomatic, esp. in the very young
- **90%** of infected infants develop chronic infection
- Approx. **5% of adults** develop chronic infection

HBV: Acute Phase

Variable presentation

- Subclinical
- Icteric
- Fulminant hepatitis (1% of HBV infections)

Acute Hepatitis

- Non-specific features:
  - *Fever, Malaise, Myalgia, Nausea/vomiting, etc.*
- Abdominal pain – Right upper quadrant
- Dark urine/ pale stool
- Jaundice

HBV: Fulminant Hepatitis

- CNS:
  - Encephalopathy, confusion, somnolence, coma
- GIT: bleeding, ascites
- Coagulopathy

HBV: Chronic Phase

- **Possible outcomes of Chronic HBV infection:**
  - Asymptomatic Chronic Infection (carrier)
  - Chronic Persistent Hepatitis
  - Chronic Active Hepatitis
  - Cirrhosis
  - Hepatocellular Carcinoma

Chronic Hepatitis

- **Symptoms**
  - Malaise,fatigue, weakness
  - Weight loss
  - Peripheral edema
  - Ascites
- **Extra-hepatic manifestations**
  - Antibody-complex deposition

HBV Infection: Complications

Extra-hepatic manifestations:

- **Resp**: Pleural effusions/ hepatopulmonary syndrome
- **CVS**: arrhythmias, myocarditis, arteritis
- **CNS**: encephalopathy, somnolence, confusion
- **MSS**: arthralgia
- **Renal**: Glomerulonephritis
- **Hematological**: bone marrow aplasia

HBV: Diagnosis

Serology:

- Antigens:

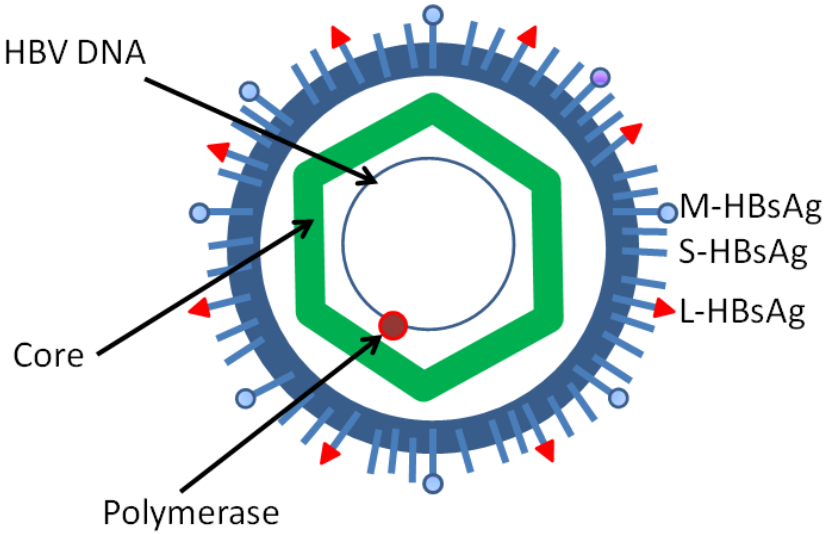
  HBsAg, eAg ,

- Antibodies:

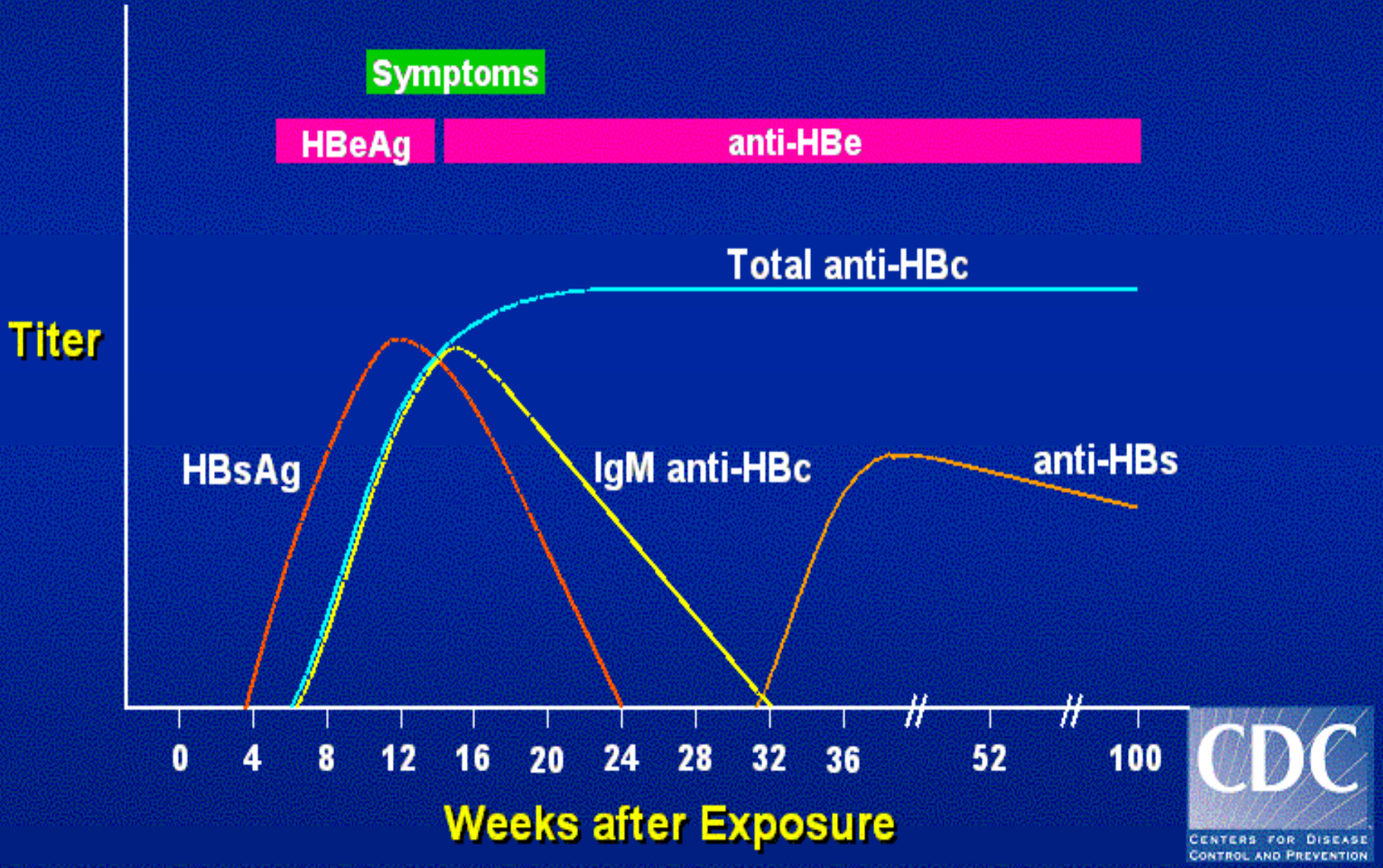
  antiHBs , eAb, core Ab

PCR:

- HBV DNA/ Viral load



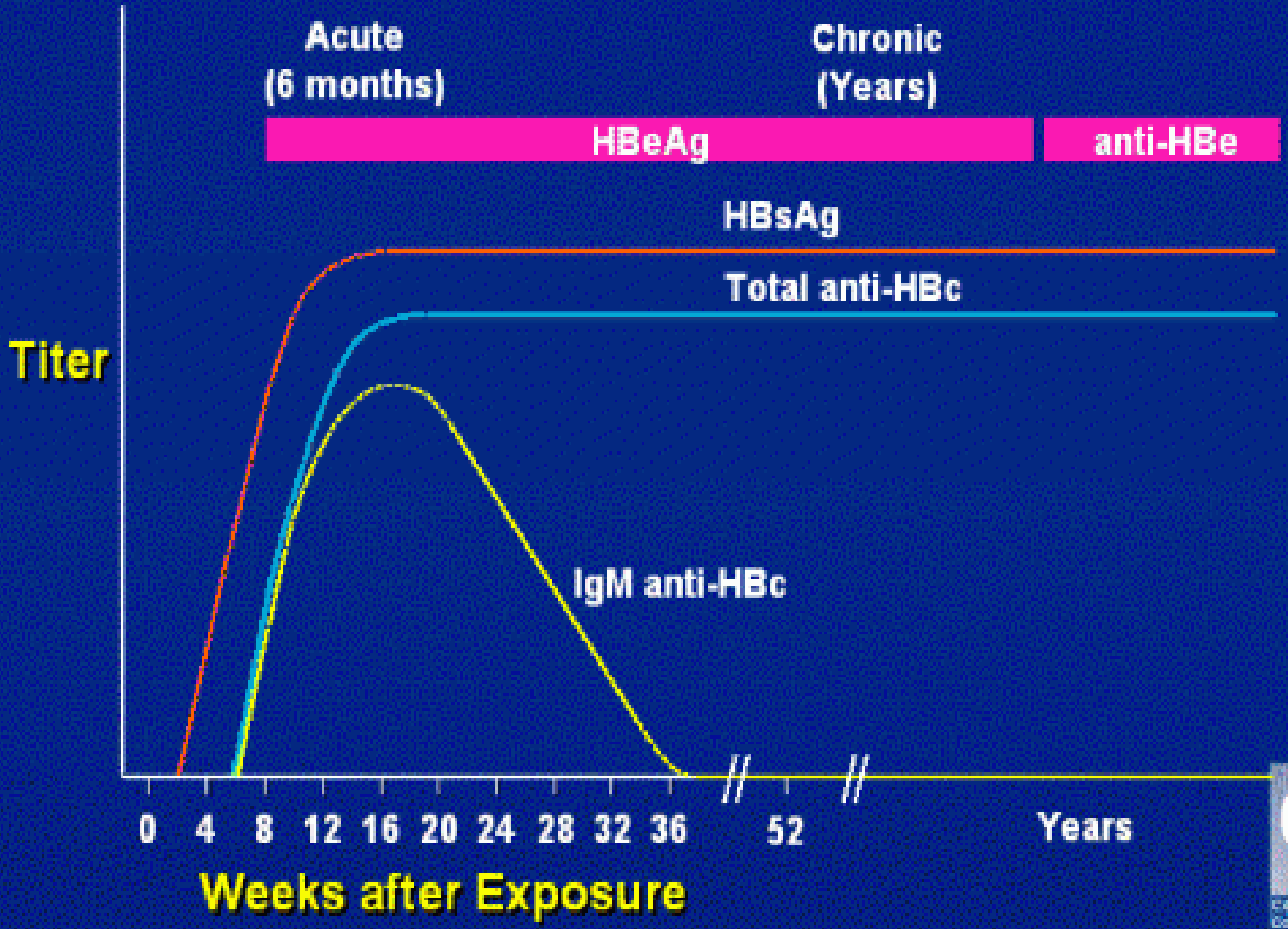
Acute Hepatitis B Virus Infection with Recovery
Typical Serologic Course



CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Progression to Chronic Hepatitis B Virus Infection

Typical Serologic Course



CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

HBV: Viral antigens

Surface Antigen (sAg)

- Surface (envelope) protein
- Secreted in excess into the blood (spheres & tubules)
- Presence in serum indicates **virus replication**

e antigen (eAg)

- Secreted protein, shed in small amounts into blood
- Presence indicates that a **high level of viral replication**
- May be falsely negative in carriers some mutations in eAg gene

Core Antigen (cAg)

- Core protein
- Present in infected liver cells, not found in blood

HBV: Antibody Response

Surface antibody (sAb, antiHBs)

- Detectable late in convalescence after resolution of infection,
- Remains detectable for life
- Not found in chronic carriers
- Indicates immunity

e antibody (eAb, antiHBe)

- Becomes detectable as viral replication falls
- In a carrier, it indicates **low infectivity**

Core IgM

- Rises early in infection
- Indicates recent infection

Core IgG

- Rises early
- Present for life in both carriers & those who clear the infection
- Indicates exposure to HBV

HBV: Viral Load

- HBV viral load measures level of **HBV DNA** in blood
- The most **reliable** marker of infectivity.
- More reliable than eAg which can be negative in some carriers due to mutations in the eAg gene

HBV Serology Interpretation

HBsAg	Anti-HBs	Anti-HBc	Anti-HBc (IgM)	Interpretation
(-)	(-)	(-)		Susceptible
(-)	(+)	(+)		Immune after infection
(-)	(+)	(-)		Immune after vaccine
(+)	(-)	(+)	(+)	Acute Infection
(+)	(-)	(+)	(-)	Chronic Infection
(-)	(-)	(+)		Resolved infection, Low level chronic infection, False positive (Anti-HBc)

HBV: Other Investigations

1. Liver Function Tests: *ALT,AST,ALP,GGT, Bilirubin*
2. Coagulation Profile: *INR (International normalized ratio)*
3. Renal Function Tests
4. Full blood count
5. Radiology: Ultrasound/CT scan/ MRI
6. Liver biopsy & histology

HBV Treatment

1. **Interferons (6 months)**
   - INF-α2a
   - Pegylated INF – α2a

2. **DNA polymerase inhibitors (Lifelong)**
   - Entecavir
   - Tenofovir
   - Lamivudine
   - Adefovir
   - Telbivudine

Prevention

- Health education
- Safe sex practices
- Safe injection practices
- Screening blood/blood products
- Vaccine
- Post-exposure prophylaxis
  - Vaccine & HBIG given within **48hrs**

HBV Vaccine

Four types of vaccines are available

1. **Serum derived** - sHBAg purified from the serum of HBV carriers
2. **Recombinant sAg** - made by genetic engineering in yeast
3. **Combination vaccines** - vaccines against HBV vaccine + other organisms e.g. Hepatitis A+B

Vaccination done at 0,1 and 6 months for adults

- Infants receive three doses: at 6, 10 and 14 weeks
- 3 doses induce immunity in 95% of recipients

Questions??

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