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HEPATOTROPIC VIRUSES (B, D, C): VIROLOGICAL DIAGNOSIS AND PREVENTION

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Annotation
This article provides a scientific overview of the structure, pathogenesis, virological diagnostic methods, and prevention measures for hepatotropic viruses—Hepatitis B (HBV), Hepatitis D (HDV), and Hepatitis C (HCV). The study analyzes modern laboratory methods (ELISA, PCR, serological markers) and prevention strategies in the context of Uzbekistan, based on international and national guidelines.
Keywords: Viral hepatitis, Hepatitis B, Hepatitis D, Hepatitis C, virological diagnosis, prevention, vaccination.

Introduction

Viral hepatitis represents a major global public health problem among liver diseases. These are polyetiological anthroponotic infectious diseases characterized by viral liver damage and transmitted through various routes. According to the World Health Organization (WHO), over 300 million people are affected by chronic hepatitis annually. Hepatotropic viruses—HBV, HCV, and HDV—selectively infect human hepatocytes, causing inflammatory, necrotic, and fibrotic processes. Worldwide, 1 billion people are infected with Hepatitis A each year, and the number of Hepatitis B virus carriers exceeds 1 billion. In Uzbekistan, Hepatitis B and C infections are widespread among the population and can lead to chronic hepatitis and liver cirrhosis. HDV occurs only in conjunction with HBV and follows a severe clinical course. Therefore, the rapid identification, diagnosis, and prevention of these viruses are of paramount importance.

Main Body

Hepatitis B Virus (HBV)

HBV is a 42 nm spherical DNA virus belonging to the Hepadnaviridae family. It contains a partially double-stranded circular DNA, and its replication involves reverse transcriptase. The virion contains the following antigens:

HBsAg - surface antigen of the outer envelope.

HBcAg - nucleocapsid (core) antigen.

HBeAg - a marker of active viral replication.

After entering hepatocytes, HBV is transported to the nucleus and persists as covalently closed circular DNA (cccDNA). This form is a key factor responsible for the chronic nature of the infection. Because cccDNA can persist for years, it can lead to chronic hepatitis, fibrosis, liver cirrhosis, and hepatocellular carcinoma (HCC).

HBV Diagnosis:

In molecular diagnostics, real-time PCR is the "gold standard" for virological monitoring and quantifies the viral load in IU/mL.

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Hepatitis C Virus (HCV)

HCV is an RNA virus from the Flaviviridae family. It is a small, spherical virus (35-50 nm) with a supercapsid envelope, characterized by a high mutation rate. Its ability to form quasispecies allows it to evade the immune system, leading to chronic disease.

Key viral proteins include:

Core Protein - strongly stimulates the immune response.

Glycoproteins E1/E2 - facilitate receptor binding.

NS3, NS5A, NS5B - are active in the replication process.

HCV causes chronic inflammation in hepatocytes, significantly increasing the risk of portal fibrosis, liver cirrhosis, lymphoma, and HCC.

HCV Diagnosis:

Anti-HCV by ELISA - initial screening test.

HCV RNA (RT-PCR) - confirms an active infection.

Genotyping (genotypes 1–6) - determines the treatment strategy.

The frequently asymptomatic nature of HCV infection underscores the importance of diagnostics. PCR monitoring plays a crucial role in treatment with Direct-Acting Antivirals (DAAs).

Hepatitis D Virus (HDV)

HDV is a defective RNA virus incapable of independent replication, classified in the Togaviridae family. It is a spherical virion, 35-37 nm in size, that replicates only in the presence of HBV. HDV infection occurs in two forms:

Coinfection (simultaneous infection with HBV and HDV).

Superinfection (HDV infection in an existing HBV carrier).

The pathogenicity of HDV is significantly more severe than that of HBV alone, leading to:

Strong cytotoxic effects on hepatocytes.

Fulminant hepatitis.

Rapidly progressive cirrhosis.

HDV Diagnosis:

Anti-HDV IgM/IgG - serological detection.

HDV RNA (PCR) - assessment of viral replication.

Due to the high pathogenicity of HDV, patients with coinfection (HDV + HBV) can experience an extremely severe clinical course.

Prevention

Specific Prevention (Vaccination):

Recombinant HBV vaccines (Engerix-B, Euvax-B) are highly effective and used globally.

In Uzbekistan, since 2008, children have been vaccinated in three stages according to the 0-1-6 month schedule.

Vaccine Efficacy:

Reduces the likelihood of HBsAg positivity by 95–98%.

Completely suppresses the spread of HDV infection.

Post-Exposure Prophylaxis:

Hepatitis B Immune Globulin (HBIG).

Administration of the first vaccine dose within 12 hours of exposure.

This is mandatory for healthcare workers.

Conclusion

Hepatitis B, C, and D viruses are among the infections with significant microbiological and hygienic importance. ELISA and PCR methods play a vital role in their early detection. The introduction of the HBV vaccine has significantly reduced the incidence of not only HBV but also HDV. The absence of a vaccine for HCV indicates that epidemiological control of this infection

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relies solely on hygiene practices and safe medical procedures. Regular screening of at-risk groups, early identification of carriers, and epidemiological surveillance are crucial for limiting the spread of these viruses.

In summary, diseases associated with hepatotropic viruses remain a pressing issue in the fields of microbiology, clinical virology, hygiene, and epidemiology. The key conditions for effective control of these infections are: vaccine prophylaxis, improvement of laboratory diagnostics, strict adherence to infection safety rules, enhancement of public health literacy, and strengthened epidemiological monitoring. Their comprehensive application will help reduce the burden of liver disease, strengthen public health, and protect future generations from the risk of viral hepatitis.

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