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HEV infographic

Diagnosis of Hepatitis E Virus Infection: Current Capabilities and Shortcomings

Hepatitis E virus (HEV) is a major cause of acute viral hepatitis worldwide. It was responsible for an estimated 20 million infections, 3 million symptomatic cases of hepatitis, and 70,000 fatalities each year.[1] As a result of a still-evolving landscape of diagnostic tools, inadequate physician awareness, and incomplete implementation of clinical testing guidelines, the global burden of HEV infection is likely an underestimate. For similar reasons, individuals presenting with hepatitis may be misdiagnosed.

This review will provide an overview of HEV virology and epidemiology, the available approaches for diagnosis of HEV infection, and areas where improvement of diagnostic tools is needed.

MC--13006

Summary

- HEV infection is difficult to diagnose based on clinical manifestations and liver function abnormalities alone.
- Accurate diagnosis relies on HEV-specific diagnostic testing, including tests for anti-HEV antibodies, viral RNA, and viral antigens.
- There are three important applications of tests for HEV:
  - Diagnosis of individual patients
  - Screening of blood donations
  - Seroprevalence studies
- Anti-HEV antibody tests are the mainstay of HEV diagnosis, but the performance of currently available assays is variable.
- Variations in sensitivity can lead to different conclusions when testing specimens for anti-HEV antibodies using multiple assays, while the use of assays with suboptimal sensitivity could lead to misdiagnosis.

Content Overview

HEV Virology

HEV belongs to the *Hepeviridae* family of viruses (subfamily: *Orthohepevirinae*, genus: *Paslahepevirus*).[2] HEV particles are small, between 27 and 34nm in size, and icosahedral in shape. **Eight distinct genotypes of HEV have been identified, four of which (genotypes 1 to 4) are responsible for the vast majority of human infections** (details in the *Epidemiology* section). Isolated infection with HEV genotype 7 has been reported.[3] Each genotype can be further subclassified into a variety of subtypes based on phylogenetic analysis.[4,5] The four genotypes of HEV that commonly infect humans belong to the same serotype.

The HEV genome is a single molecule of capped, positive-sense RNA, 6.4 to 7.2 kb in length. The genome of all genotypes of HEV has three open reading frames (ORF) which are translated from genomic or subgenomic forms of viral mRNA. ORF1 encodes seven non-structural proteins needed for genome replication, while ORF2 encodes the structural capsid protein, and ORF3 encodes a single phosphoprotein. In HEV genotype 1, a fourth ORF has been reported.[6]

Detailed understanding of HEV replication is lacking, partly because a robust *in vitro* viral growth system is not available. Nonetheless, it is known that **infection is initiated in intestinal epithelial cells following ingestion of contaminated food or water, followed by dissemination of the virus in blood to hepatocytes in the liver.**

Hepeviridae infect liver cells via clathrin-mediated endocytosis, followed by translation of the genomic RNA to produce the ORF1 non-structural proteins needed for RNA replication in the infected cell cytoplasm. Following synthesis of a negative-sense RNA intermediate, new positive-sense genomic and subgenomic mRNAs are transcribed. Capsid proteins made from ORF2 in the subgenomic mRNA assemble into new virions, which package nascent copies of genomic RNA and are released via multivesicular bodies. Nascent virus particles released into the blood have an exosomal membrane surrounding the capsid structure (quasi-enveloped particles). The envelope is lost following passage through the bile duct, resulting in uncoated viral particles entering the gut and being excreted in the bile and feces. Loss of the exosomal membrane is associated with an increase in infectivity.[7] For more details regarding HEV replication, see Himmelsbach et al. [8]

Epidemiology

HEV genotype is strongly associated with the primary mode of transmission, geographic distribution, and degree of endemicity of infections.

HEV-1 and HEV-2 only infect humans and predominantly in low- and middle-income countries in Africa and Asia (HEV-1 and 2) and in Mexico (HEV-2). They are transmitted via the fecal-to-oral route, predominantly in resource-limited settings with poor sanitation; person-to-person (including mother-to-child) transmission is also possible. HEV-1 and 2 cause seasonal outbreaks as well as sporadic infections, which are usually acquired through drinking water contaminated with sewage.

HEV-3 and 4 are found in North and South America (HEV-3), Europe (HEV-3 and 4), and Asia (HEV-3 and 4) (**Figure 1**). They have a broader host range and cause sporadic zoonotic infections in humans. Animal hosts for HEV-3 and 4 include pigs, wild boar, rabbits, deer, mongoose, and domestic dogs and cats.[9,10] Farm workers and animal handlers in close contact with infected animals are at a relatively high risk of acquiring HEV infection in endemic areas.[11] HEV can also be acquired by people consuming undercooked meat (primarily pork, but also boar, rabbit, and deer), milk, or raw shellfish.

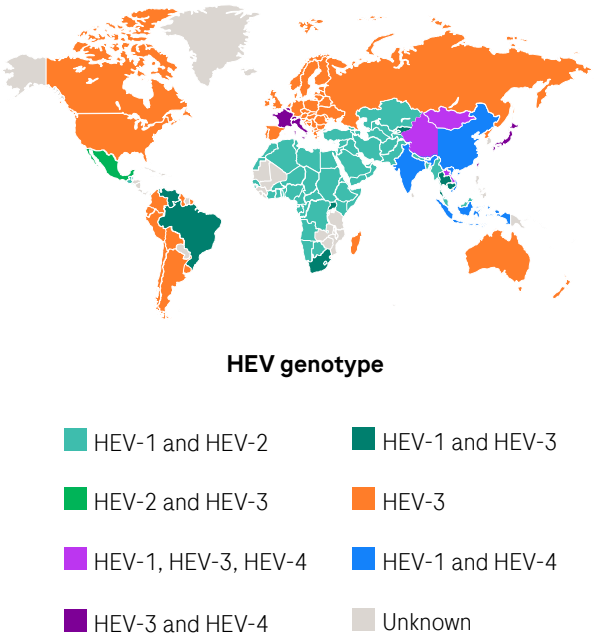
HEV is found globally, but HEV genotypes are region-specific[12,13]*

HEV-1 and HEV-2

Primarily **LMIC** in Asia and Africa and in Mexico in the 1980 outbreak[14]

Disease occurs as **outbreaks** due to contaminated water supplies and can last from several days to months if the source of contamination is not identified[15]

Acquired through **fecal–oral** route (human-to-human), usually through contamination of water supplies



HEV-3 and HEV-4

HEV-3 is **found worldwide**, including in Europe, North America, South America, and Japan.

HEV-4 is **most prevalent** in China but can also be found in Southeast Asia, Japan, and central Europe.

Occasional **sporadic** cases of locally-acquired infection (autochthonous)

Zoonotic transmission (from pigs, wild boar, deer, rabbits, mongoose, domestic dogs, and cats) to humans, possibly through consumption of undercooked meat[9,10]

Figure 1. HEV geographical distribution. Infographic generated based on data from references 12 and 13. Data collected until 2020. HEV, hepatitis E virus; LMIC, low- and middle-income countries.

Less frequently, and mostly in endemic areas, all four genotypes of HEV can also be transmitted parenterally through blood transfusion, organ transplantation, or vertically from infected mothers to their infants.[16-18]

Clinical features of HEV infection

The clinical manifestations of HEV infection are variable in humans, ranging from asymptomatic in the majority of healthy individuals to life-threatening in certain vulnerable populations (Figure 2). The proportion of infections that are symptomatic is dependent on the genotype: HEV-1 and 2 are associated with a higher rate of symptomatic hepatitis than HEV-3 and 4 (about 2%).[19,20] The **majority of symptomatic infections are characterized by self-limiting acute hepatitis**, indistinguishable from other types of viral hepatitis, with fever, anorexia, nausea, myalgia, malaise, and jaundice, accompanied by elevated transaminase and bilirubin levels in serum.[19,20] When they occur, symptoms usually become apparent approximately 2 to 8 weeks after infection and last for between 1 day and 6 weeks.[21,22]

A small fraction (0.5–4%) of HEV-infected individuals develop acute liver failure. Patients with existing chronic liver diseases are at increased risk of liver failure, and mortality can be as high as 67%. Pregnant women are at a high risk of developing symptomatic disease following an HEV-1 infection during the second and third trimesters. Many of these women progress to acute liver failure, hemorrhage, and eclampsia, and the mortality rate can reach 15–25%. HEV-1 infection during pregnancy is also associated with more frequent miscarriages, preterm deliveries, stillbirths, and perinatal mortality.

In immunocompromised or immunosuppressed individuals (including solid organ transplant recipients, people living with HIV/AIDS, and patients receiving cancer chemotherapy), HEV-3 and 4 can also establish a chronic infection.[23,24] Initially, chronically infected individuals are asymptomatic or have mild, nonspecific symptoms and lack clinical signs of hepatitis. Over time, about 10% of chronically infected patients can progress to decompensated cirrhosis resulting in fatal liver failure.

HEV is implicated in a variety of pathologies outside the liver as well, the nature of which may be influenced by the genotype.[25-27] Such extrahepatic manifestations include neurological and renal disease, hematological disorders, pancreatitis, polyarthritis, myocarditis, and thyroiditis. The underlying mechanisms of how HEV infection leads to extrahepatic manifestations, including whether they are a result of viral replication in tissues outside of the liver versus secondary effects of liver pathogenesis, are not well defined.

HEV infection is generally self-limited in healthy immunocompetent individuals.[12,28,29]

Incubation

- The incubation period ranges from 2 to 10 weeks, with an average time of 5 to 6 weeks.
- Most recipients excrete the virus until 3–4 weeks after infection.

Symptomatic phase

- The majority of infections are asymptomatic, but 5–30% of individuals have symptoms indistinguishable from those of other acute forms of hepatitis, lasting from 1 to 6 weeks.
- The most common symptoms are malaise, fever, body aches, nausea, vomiting, jaundice, pale stools, and dark urine.

Convalescent phase

- In immunocompetent patients with acute hepatitis E, the infection usually resolves spontaneously.
- Immunocompromised patients who are infected with HEV-3 or HEV-4 might develop a chronic infection. No chronic cases of HEV-1 or HEV-2 have been reported to date.

- In rare cases, individuals infected with HEV develop acute liver failure, a life-threatening condition.
- The presence of pre-existing chronic liver diseases increases the risk of liver failure, with a mortality of up to 67% in such patients who also have acute HEV infection.[30,31]
- HEV-1 infection in pregnant women, particularly in the third trimester, is associated with high maternal and fetal morbidity and mortality.[32-34]

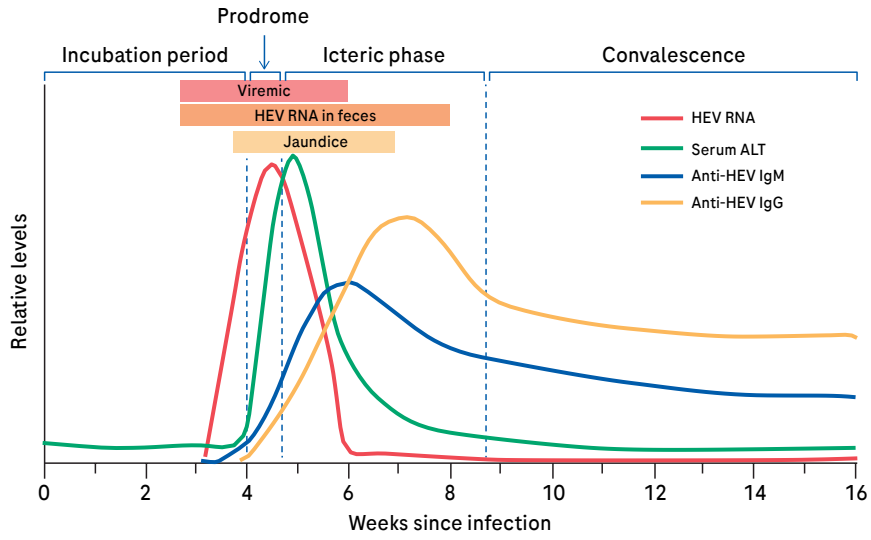
Figure 2. Course of HEV acute infection. HEV, hepatitis E virus.

Immune response

The adaptive immune response to HEV infection in immunocompetent individuals is typically characterized by development of anti-HEV IgM antibodies at around the time of symptom onset; these IgM antibody concentrations then drop to lower levels but can remain detectable for 6 months or longer.[20,35,36] Secretory IgA antibodies can also be measured in serum with kinetics that are similar to those of IgM.[37] Anti-HEV IgG antibodies become predominant a few weeks after IgM levels peak and can be detected for years after the infection has been cleared.[20,35,36] A conceptual diagram illustrating the dynamics of antibody response and serum alanine transaminase (ALT) is shown in (**Figure 3**).

HEV infection also induces a broad cytotoxic T-cell response in immunocompetent hosts. This response is likely important for long-lived immunity and protection from disease.[39]

Typical self-limited HEV infection profile



HEV RNA and capsid antigen become detectable in blood and stool ~2 weeks after viral exposure and persist for ~4 weeks and ~6 weeks in blood and stool, respectively.

Anti-HEV IgM is detectable in blood from the 4th week after viral exposure and lasts a maximum of 6–9 months.

Anti-HEV IgG appears shortly after IgM and persists for several years in blood.

ALT levels, an indicator of liver damage, generally increase 4 weeks after initial viral exposure.

In immunocompromised patients who develop **chronic HEV infection, HEV RNA** persists in blood, stool, and body fluids for **more than 3 months.**

Immunocompromised patients are likely to have low or undetectable levels of anti-HEV antibodies.[40]

Figure 3. A typical self-limited HEV infection profile.[20,35,36] Figure adapted from 20. HEV, hepatitis E virus; IgG, immunoglobulin G; IgM, immunoglobulin M; ALT, alanine transaminase.

Treatment and prevention

In immunocompetent individuals, most HEV infections, whether symptomatic or not, are cleared by the immune system. However, **antiviral therapy for HEV infection may be indicated for some acutely infected patients** (e.g., pregnant women and immunosuppressed or immunocompromised patients) **and in chronically infected patients.**[40] The first intervention recommended in response to confirmed HEV infection in immunosuppressed patients is to reduce the intensity of the immunosuppressive therapy if possible.[40,41] **While no HEV-specific antivirals have been tested in large randomized clinical trials or approved for clinical use, sustained viral response (or viral clearance) has been achieved through the use of ribavirin**, in spite of its important hematological side effects that can limit its tolerability and toxicity, especially in pregnant women.[42-44] **Pegylated interferon-α therapy has been used for treatment of chronic HEV infection,**[45,46] mostly in patients who cannot tolerate ribavirin; however, it cannot be used in transplant recipients and has significant side effects. **Sofosbuvir**, a nucleoside polymerase inhibitor approved for treatment of hepatitis C virus infection, **has anti-HEV activity *in vitro*[47,48] but no proven efficacy in clinical studies.**[49]

An effective vaccine against HEV infection (called HEV 239 or Hecolin®) was approved for use in China in 2010 and is undergoing clinical study for use in Bangladesh and the United States (US).[50-52] The vaccine antigen is a fragment of the HEV-1 capsid (ORF2) protein, produced in bacteria. The recombinant protein self-assembles into virus-like particles. Several other candidate vaccines are in development.[53]

In addition, there are several prevention strategies that can be employed to limit HEV infection. These include ensuring access to clean public water supplies, general food safety measures, and the proper disposal of human excreta. Individuals can also avoid exposure by keeping good personal hygiene.

Diagnostic markers

In general, **clinical manifestations and liver function abnormalities associated with HEV infection are not distinguishable from those caused by other infectious hepatitis viruses, drug-induced liver injury (DILI), or autoimmune disease. Therefore, accurate diagnosis of HEV infection relies heavily on diagnostic testing. Tests for HEV are based on the detection and/or quantitation of host antibody responses, viral RNA, or viral antigen (Figure 4).**

Anti-HEV antibodies

Tests that detect the presence or measure the concentration of circulating anti-HEV antibodies are the **mainstay of HEV diagnosis owing to their relative simplicity and low cost** compared to HEV RNA tests. Most HEV serological tests described to date detect anti-HEV IgG or IgM antibodies in serum or plasma. Anti-HEV tests are commercially available from several different manufacturers, some of which are CE-IVD marked, but none has been approved by the US FDA. Antibody tests can be laboratory-based, including enzyme-linked immunoassays (ELISA), or in lateral-flow rapid test format. The performance characteristics of anti-HEV tests are variable, especially with regard to sensitivity.[54-61] Calibration of anti-HEV IgG assays using the WHO reference reagent for antibodies to HEV[62,63] has improved the situation somewhat.[36]

Viral RNA

Detection of viral RNA in blood is considered to be the **gold standard for evidence of active viral replication.** Most assays for HEV RNA are based on quantitative real-time reverse transcription PCR (qRT-PCR) and are very sensitive. Since qRT-PCR tests are designed to amplify and detect specific sequences in the viral genome, they are at risk of decreased sensitivity or even false negative results in patients infected with viral variants bearing sequence changes that abrogate primer or probe binding. Targeting of highly conserved regions and use of degenerate primers are strategies that can mitigate this risk.

Viral RNA is the **first biomarker to become detectable after the incubation period following infection,** followed by viral antigen. Anti-HEV IgM antibodies then appear in serum, followed by IgG (**Figure 3**). IgM concentrations decrease more rapidly than IgG, usually becoming undetectable 3 to 4 months after they are first detected. Thus, simultaneous testing for both antibody types, as well as viral RNA or antigen, can give an indication of the duration of the infection (**Table 1**). If multiple measurements over time can be obtained, assessment of whether IgM or IgG levels are increasing or decreasing can also help determine the duration of HEV infection. However in immunocompromised individuals, antibody production may be delayed or not occur, making detection of viral RNA necessary to diagnose HEV infection. Also, anti-HEV IgM antibodies may persist for several months in some patients. In contexts where access to RNA testing is limited, a multifactorial model for identification of acute infection that uses anti-HEV IgM, viral antigen, and ALT levels has been proposed.[64]

Viral antigen

The viral capsid (ORF2) protein is the **major component of the virus particle and an important antigen against which host antibodies are directed.** Capsid protein in blood or plasma **may reach detectable concentrations prior to anti-HEV antibodies** and can be measured by ELISA. Since capsid is produced during active replication of HEV in infected hepatocytes, its presence in blood may be a useful marker of acute infection.[65] However, capsid protein levels in blood correlate poorly with RNA concentration.[66] This may be related to the production of capsid in multiple isoforms, only some of which are assembled into virions.[67,68]

Accurate diagnosis of HEV infection heavily relies on diagnostic testing.[69]

Antibody tests[61]

- Current immunoassays that detect antibodies against HEV use recombinant ORF2 and/or ORF3 proteins from HEV-1 and HEV-3 strains as antigens.
- Antibodies in patients infected with other HEV genotypes cross-react with HEV-1 epitopes.
- The presence of anti-HEV IgM in serum is a marker of acute infection, but must be combined with anti-HEV (rising titers) or HEV RNA for diagnosis.
- The presence of anti-HEV IgG alone is a marker of past HEV infection.
- Current anti-HEV tests have lower detection limits of 0.25–2.5 WHO U/mL. [73]
- The diagnostic performance of IgM and IgG assays varies considerably and must be evaluated carefully.
- In immunosuppressed patients with chronic hepatitis E, anti-HEV antibodies are often undetectable.[39]

RNA tests[70,71]

- HEV RNA detection and quantification in blood, feces, or other bodily fluids is the gold standard for detecting active HEV infection (acute or chronic).
- Most RT-PCR assays for the detection of HEV RNA target a conserved region of the HEV genome, usually located in ORF3.[74]

Antigen tests[66,67,72]

- HEV capsid antigen tests are based on a sandwich enzyme immunoassay.
- The presence of HEV antigen in blood, feces, or other bodily fluids may be an indicator of active HEV infection.
- Capsid protein levels in blood correlate poorly with RNA concentration probably because the capsid is produced in multiple isoforms, only some of which are assembled into virions.

Figure 4. Diagnostic tools for HEV. HEV, hepatitis E virus; ORF, open reading frame; WHO, World Health Organization; U, units; IgG, immunoglobulin G; IgM, immunoglobulin M; RT-PCR, reverse transcription polymerase chain reaction.

Use cases for HEV testing

Diagnostic testing strategies for HEV should be chosen based on the goal of testing and the clinical context. At least three **applications of HEV tests are important to consider: testing of individual patients with hepatitis, screening of blood supply to prevent transfusion-associated infection, and population-level surveillance.**

Individual patient diagnosis

For individual patient diagnosis and monitoring, the European Association for the Study of the Liver (EASL) recommends that *all people with hepatitis* be tested for HEV. [29] This includes:

- All people with symptoms consistent with acute hepatitis.
- Travelers with hepatitis returning from areas endemic for HEV genotype 1 or 2.
- Patients with unexplained flares of chronic liver disease.
- Patients with abnormal liver function tests after receiving blood products.
- All immunosuppressed patients with unexplained abnormal liver function tests.
- Patients presenting with suspected DILI. In elderly patients, many of whom are on multiple medications, HEV infection is often misdiagnosed as DILI.[75-77] Before diagnosing hepatitis as DILI, HEV infection should be ruled out.
- Patients with symptoms possibly related to extrahepatic effects of HEV, including neuralgic amyotrophy, Guillain-Barré syndrome, encephalitis/myelitis, and unexplained acute neurological findings.
- Patients treated with ribavirin – test for HEV RNA in serum and stool at the end of a scheduled period of ribavirin therapy (usually 12 weeks).

According to the guidelines published by EASL,[41] European Centre for Disease Prevention and Control (ECDC),[78] and Public Health England,[79] **individual diagnosis of HEV infection in immunocompetent patients should consist of serological tests for anti-HEV antibodies supplemented in some cases by nucleic acid tests (NAT). Anti-HEV antibody development may be delayed or may not be detectable in immunocompromised patients (e.g., transplant recipients), so increased reliance is placed on NAT results.** In immunocompetent patients with elevated liver function test results, an active HEV infection can be diagnosed based only on serology if IgM antibodies are present and the concentrations of IgG are increasing.[79] Patterns of IgG and IgM antibodies may also help distinguish between early (IgM positive, IgG negative) and late (both positive) infections. If HEV RNA is detected over more than a 3-month interval, the patient is diagnosed as having a chronic infection. See (**Table 1**) for a summary of biomarker patterns and association with different stages of infection.

Recommendations based on EASL guidelines[41]

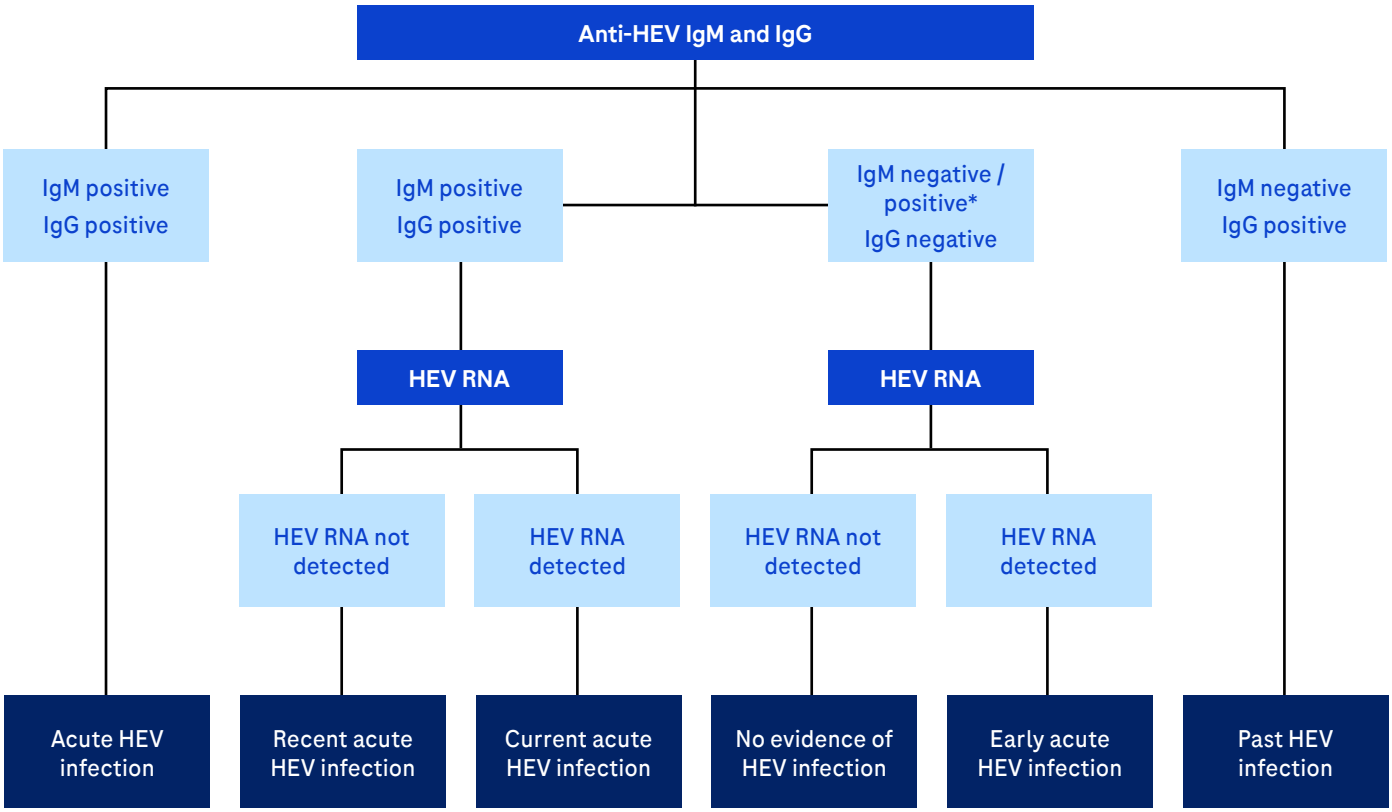
✓ Yes ✗ No

Laboratory test interpretation				
RNA	IgM	IgG	Infection phase	Virus replication
–	–	–	Not infected or incubation period	None or undetected
+	–	–	Acute (early)	✓
+	+	–	Acute (mid)	✓
+	+	+	Acute (late)	✓
–	+	+	Early recovery phase	✗
–	–	+	Late recovery phase	✗
+ (≥3 months)	–/+	–/+	Chronic	✓

Table 1. Patterns of HEV infection biomarkers and association with stages of infection. Table adapted from 41. HEV, hepatitis E virus.

The Public Health England guidelines include an algorithm for interpretation of HEV testing results in support of individual diagnosis of immunocompetent patients[79] (**Figure 5**). Starting with antibody test results, a positive diagnosis can be made if both IgG and IgM are positive even in the absence of NAT, which help discriminate between a previous infection (RNA negative) versus a current acute infection (RNA positive). If antibodies are absent, NAT can enable the detection of an early-stage acute infection or can rule out HEV infection if it is negative.

The presence of anti-HEV IgG but not IgM indicates a past infection. The presence of anti-HEV IgM but not IgG is not diagnostic in the absence of NAT, because IgM positivity on its own is not sufficient to diagnose an HEV infection.



* Detection of anti-HEV IgM alone does not diagnose HEV infection

Figure 5. Interpretation of testing for HEV infection in immunocompetent patients. Adapted from 76. HEV, hepatitis E virus; IgG, immunoglobulin G; IgM, immunoglobulin M; RNA, ribonucleic acid.

Screening of blood and organ donors

Several studies have reported that HEV can be detected in donated blood and that this can lead to **HEV infection of transfusion recipients.**[16,17,54,56,58,80-86] **To reduce the risk of transfusion-associated transmission of HEV, the ECDC recommends that blood donor services screen blood donors for HEV RNA,** informed by local risk assessment and cost-effectiveness studies.[78] RNA testing is preferred because of its greater sensitivity and association with infectivity compared to antibody testing.

Similarly, HEV can be transmitted via transplantation of organs from HEV viremic donors.[16,43] Importantly, because of the use of immunosuppressive therapy in transplant recipients to prevent organ rejection, HEV exposure can lead to chronic infection. **HEV testing of organ donors is recommended in international guidelines.**[40,87]

Seroprevalence studies

Population-level surveillance of the prevalence of HEV infection is an **important aspect of our understanding of the epidemiology and infection prevention strategies for HEV. Seroprevalence surveys are based on the detection of anti-HEV IgG in serum or plasma and provide** important **information about differences in HEV prevalence** according to geography, trends over time, and demographic attributes such as age, sex, residential status (urban vs. rural), occupation, exposure to animal reservoirs, etc. They can also be used to compare assays, given a large enough sample size to control for other variables. There are many examples of HEV seroprevalence studies from countries all around the world that illustrate the utility of this type of data.[1,83,88-104] However, it is important to note that prevalence data from studies that use different methods for measurement of antibody levels should not be compared to each other, as the assay characteristics (i.e., sensitivity and specificity) are likely to be different. Seroprevalence surveys have also been performed in animals in order to characterize the risk associated with occupational exposure to animals with high prevalence.[10,93,94,103,105]

Unmet needs in HEV diagnostic tools

Retrospective assessments of the performance of diagnostic methods employed for the different use cases described above have illuminated **some areas where assay performance has been suboptimal. The most important of these is low and variable assay sensitivity.** Testing of panels of specimens for anti-HEV antibodies using multiple assays frequently demonstrates that variation in sensitivity can lead to different conclusions.[55-61,96,106,107] Assay variability influences estimation of the window period in asymptomatic individuals and comparison to symptomatic patients[37] as well as calculation of seroprevalence.[54,91,96,101,108] The **use of assays with suboptimal sensitivity could lead to misdiagnosis,** including not recognizing cases of HEV infection in individuals with low antibody titers or misclassification based on not detecting anti-HEV IgM, for example. **Comparability of results between different tests is an important consideration,** for example, when monitoring antibody or RNA concentrations over time in a particular patient, especially if the patient changes clinic location or if the laboratory changes assay provider. It is also crucial when comparing quantitative data between studies that use different tests. **Calibration using an accepted standard material,** such as those provided by the World Health Organization or its laboratory partners,[62] is the **best way to minimize the impact of interassay variability.**

Conclusions

HEV infection is difficult to diagnose based on clinical manifestations and liver function abnormalities alone. **Accurate diagnosis relies on HEV-specific diagnostic testing,** including tests for anti-HEV antibodies, viral RNA, and viral antigen.

HEV testing strategies should be chosen based on the goal of testing and the clinical context. There are three important applications of HEV tests: testing of individual patients with hepatitis, screening of the blood supply to prevent transfusion-associated infection, and population-level surveillance.

Diagnosis of individual patients with hepatitis is based on serological tests for anti-HEV antibodies, NAT for HEV RNA, or a combination of both. In immunocompromised individuals, detection of viral RNA is necessary to diagnose HEV infection.

Screening of blood donations by testing for HEV RNA helps reduce the risk of transfusion-associated transmission of HEV. As HEV can also be transmitted via transplantation of organs from HEV viremic donors, **HEV RNA testing of organ donors is also recommended.**

Seroprevalence surveys help gain a better understanding of HEV epidemiology and prevention strategies based on the detection of anti-HEV IgG in serum.

Anti-HEV antibody tests are the mainstay of HEV diagnosis because of their simplicity and low cost, but the performance characteristics of currently available assays are variable. Retrospective assessments of anti-HEV diagnostic methods have shown that **low and variable assay sensitivity is a major issue. Variations in sensitivity can lead to different conclusions when testing panels of specimens for anti-HEV antibodies using multiple assays, while the use of assays with suboptimal sensitivity could lead to misdiagnosis.**

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