Study of Serological Markers of Parenterally Transmitted Viral Infections (Hepatitis B and C) in Acute Suspected Hepatitis

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Article Info

ISSN (online): 2582-8940
Volume: 07
Issue: 03
Received: 13-05-2026
Accepted: 11-06-2026
Published: 09-07-2026
Page No: 66-70

Abstract
Background: Hepatitis B virus (HBV) and hepatitis C virus (HCV) are major parenterally transmitted hepatotropic viruses that frequently present as acute hepatitis, clinically indistinguishable from enterically transmitted hepatitis A and E without laboratory confirmation. Serological markers – hepatitis B surface antigen (HBsAg), IgM antibody to hepatitis B core antigen (IgM anti-HBc), and antibody to hepatitis C virus (anti-HCV) – remain the cornerstone of initial diagnostic evaluation of acute suspected hepatitis.
Objective: To review the diagnostic serological marker profile and reported prevalence of HBV and HCV among patients with acute suspected hepatitis.
Methods: A narrative literature review of peer-reviewed Indian and international studies, surveillance reports, and diagnostic guidelines.
Results: Hospital-based studies report HBsAg positivity ranging from 2.8% to 16.10% and anti-HCV positivity from 1.8% to 11.98% among acute hepatitis cohorts, considerably higher than community-level estimates. IgM anti-HBc is essential to confirm acute HBV infection, while anti-HCV has reduced sensitivity during the acute window period.
Conclusion: A structured serological panel combining HBsAg, IgM anti-HBc, and anti-HCV, interpreted within a defined diagnostic algorithm, remains essential for accurate evaluation of acute suspected hepatitis and supports broader viral hepatitis elimination efforts.

DOI: https://doi.org/10.54660/IJMBHR.2026.7.3.66-70

Keywords: Hepatitis B, Hepatitis C, HBsAg, Anti-HCV, Serological markers, Acute hepatitis

1. Introduction

Viral hepatitis remains one of the leading causes of morbidity and mortality from infectious disease worldwide, accounting for an estimated 1.3 million deaths annually – a toll comparable to tuberculosis [1]. According to the World Health Organization (WHO) Global Hepatitis Report 2026, approximately 240 million people are living with chronic hepatitis B virus (HBV) infection and 47 million with hepatitis C virus (HCV) infection globally, with hepatitis B and hepatitis C together accounting for more than 95% of viral-hepatitis-related deaths [2]. India contributes substantially to this global burden, with tens of millions of chronic HBV carriers [13].

Acute viral hepatitis is a clinical syndrome characterised by jaundice, malaise, anorexia, and right-upper-quadrant discomfort, and may be caused by hepatitis A, B, C, D, or E viruses, which differ markedly in their transmission routes, natural history, and

public health implications [12]. Hepatitis A virus (HAV) and hepatitis E virus (HEV) are transmitted via the faecal-oral route and are typically self-limiting, whereas HBV and HCV are transmitted parenterally – through unsafe therapeutic injections, transfusion of blood and blood products, needle-stick injuries, use of unsterilised medical or dental instruments, and, in the case of HBV, vertical (mother-to-child) transmission [8,9]. Because the clinical presentation of acute hepatitis is largely non-specific and overlaps across aetiologies, serological testing is indispensable for establishing the correct diagnosis [12].

For HBV, the relevant serological cascade includes HBsAg, IgM anti-HBc, total anti-HBc, hepatitis B e antigen (HBeAg), and antibody to hepatitis B surface antigen (anti-HBs); each marker carries distinct diagnostic significance, and together they allow differentiation between acute infection, the diagnostically challenging "core window period", resolved infection, and chronic carriage [3,4]. For HCV, anti-HCV is the principal screening marker, although its sensitivity is limited during the early weeks of acute infection [9].

Given the overlapping clinical picture of acute hepatitis due to enterically and parenterally transmitted viruses, and the major long-term consequences of unrecognised HBV or HCV infection – chronic hepatitis, cirrhosis, and hepatocellular carcinoma [8,10] – an accurate understanding of the serological marker profile in patients presenting with acute suspected hepatitis is of considerable clinical and public health importance. This review aims to synthesise available literature on the interpretation and reported prevalence of HBV and HCV serological markers among patients evaluated for acute suspected hepatitis, with particular reference to data from India.

2. Methodology

This is a narrative literature review. A structured search was conducted across PubMed, Google Scholar, ScienceDirect, and Indian biomedical journal databases for articles published in English, with emphasis on studies published between 2000 and 2026. Search terms included combinations of "acute viral hepatitis", "hepatitis B", "hepatitis C", "HBsAg", "anti-HCV", "IgM anti-HBc", "serological markers", and "India".

Studies were considered for inclusion if they reported the seroprevalence of HBV and/or HCV markers among patients with clinically suspected acute hepatitis, or provided guideline-based descriptions of the interpretation of HBV and HCV serological markers. International and national surveillance reports from the World Health Organization and the Centers for Disease Control and Prevention were included for burden-of-disease estimates [1,2,3]. Studies focusing exclusively on chronic liver disease populations without reference to acute presentation, and non-English-language publications, were excluded.

Extracted data were synthesised narratively and organised into tabular (marker interpretation and comparative seroprevalence) and diagrammatic (diagnostic algorithm and comparative bar chart) formats to present a structured overview of the topic.

3. Results

Table 1 summarises the interpretation of the principal HBV and HCV serological markers relevant to acute suspected hepatitis [3,4,11,15]. HBsAg is typically the first detectable marker, appearing one to nine weeks after exposure, and its presence indicates active infection, either acute or chronic [3]. IgM anti-HBc appears at the onset of symptoms and is the key marker confirming acute or recent HBV infection, persisting for six to nine months [4]. Anti-HCV indicates past or present exposure to HCV but is detectable in only an estimated 40–70% of patients during the acute phase of infection, necessitating molecular confirmation (HCV RNA) when acute HCV is strongly suspected despite a negative antibody result [9].

Table 1: Interpretation of Key HBV and HCV Serological Markers in Acute Suspected Hepatitis

Serological Marker	Diagnostic Significance	Typical Pattern in Acute Hepatitis
HBsAg	Surface antigen; earliest marker of HBV infection	Positive within 1–9 weeks of exposure; indicates active infection (acute or chronic)
IgM anti-HBc	Core antibody, IgM class	Positive at symptom onset; persists 6–9 months; confirms acute/recent HBV infection
Total anti-HBc	Core antibody (IgM + IgG)	Positive from acute phase onward; persists indefinitely as marker of past or present infection
HBeAg	Marker of viral replication and infectivity	Often positive during early acute infection alongside HBsAg
Anti-HBs	Surface antibody; marker of immunity	Negative during acute phase; appears during recovery/seroconversion
Anti-HCV	HCV antibody; principal screening marker	Detectable in only ~40–70% of acute HCV cases; may be negative in early window period
HCV RNA	Molecular marker of active HCV replication	Detectable within 1–2 weeks of exposure, before antibody seroconversion

Table 2 compares the reported seroprevalence of HBsAg and anti-HCV across global estimates and selected Indian studies. Global estimates place chronic HBsAg carriage at approximately 2.9% and HCV infection at approximately 0.6% of the population [2]. In a community-based survey from Uttarakhand, India, HBsAg seropositivity was 2.8% and anti-HCV seropositivity was 1.8% [7]. In contrast, a hospital-based study of patients presenting with acute viral hepatitis in North India reported markedly higher figures – HBsAg positivity of 16.10% and anti-HCV positivity of 11.98% [5] – reflecting an enrichment of parenterally transmitted infection among symptomatic acute hepatitis cohorts compared with the general population. This pattern is broadly consistent with hospital-based data from central India, where HBV was reported as the second most common cause of acute viral hepatitis after HEV [6].

Table 2: Comparative Seroprevalence of HBsAg and Anti-HCV: Global Estimates vs. Selected Indian Studies

Source / Study	Population / Setting	Sample Size	HBsAg Positive (%)	Anti-HCV Positive (%)
WHO Global Hepatitis Report, 2026 [2]	General population (global estimate)	—	2.9	0.6
Mittal *et al*., 2013 [7]	Community-based survey, Uttarakhand, India	495	2.8	1.8
Irshad *et al*., 2013 [5]	Hospital-based acute viral hepatitis cohort, North India	267	16.10	11.98

Table 3 presents the serological marker patterns that differentiate the major clinical stages of HBV infection – acute infection, the core window period, resolved/immune status, vaccine-induced immunity, and chronic infection – based on combinations of HBsAg, IgM anti-HBc, total anti-HBc, and anti-HBs [3,4,11,15].

Table 3: Serological Marker Patterns Differentiating Clinical Stages of HBV Infection

Clinical Status	HBsAg	IgM anti-HBc	Total anti-HBc	Anti-HBs	Interpretation
Acute HBV infection	+	+	+	–	Recent infection; high infectivity
Core "window period"	–	+	+	–	HBsAg cleared, anti-HBs not yet developed; anti-HBc only positive marker
Resolved infection (natural immunity)	–	–	+	+	Past infection with subsequent recovery and immunity
Vaccine-induced immunity	–	–	–	+	Immunity from vaccination; no evidence of past natural infection
Chronic HBV infection	+ (>6 mo)	– / low	+	–	Persistent infection; further evaluate with HBeAg, anti-HBe, HBV DNA

Figure 1 illustrates a stepwise diagnostic algorithm for the serological evaluation of a patient presenting with acute suspected hepatitis, incorporating HBsAg, IgM anti-HBc, and anti-HCV testing. Figure 2 graphically depicts the comparative seroprevalence data presented in Table 2.

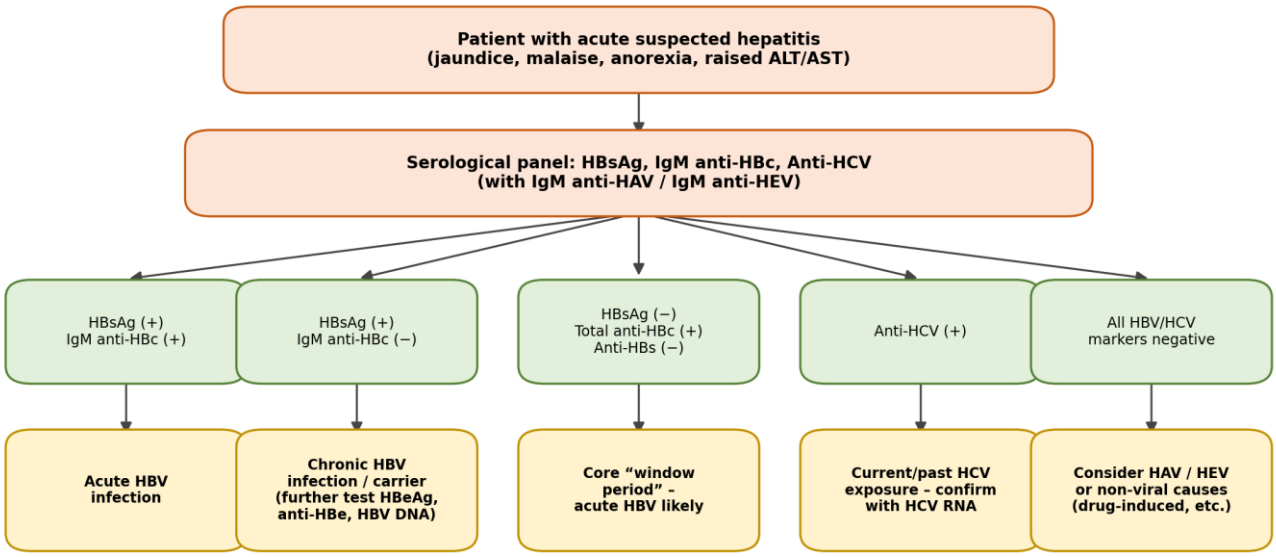

Fig 1: Diagnostic Algorithm for Serological Evaluation of Acute Suspected Hepatitis

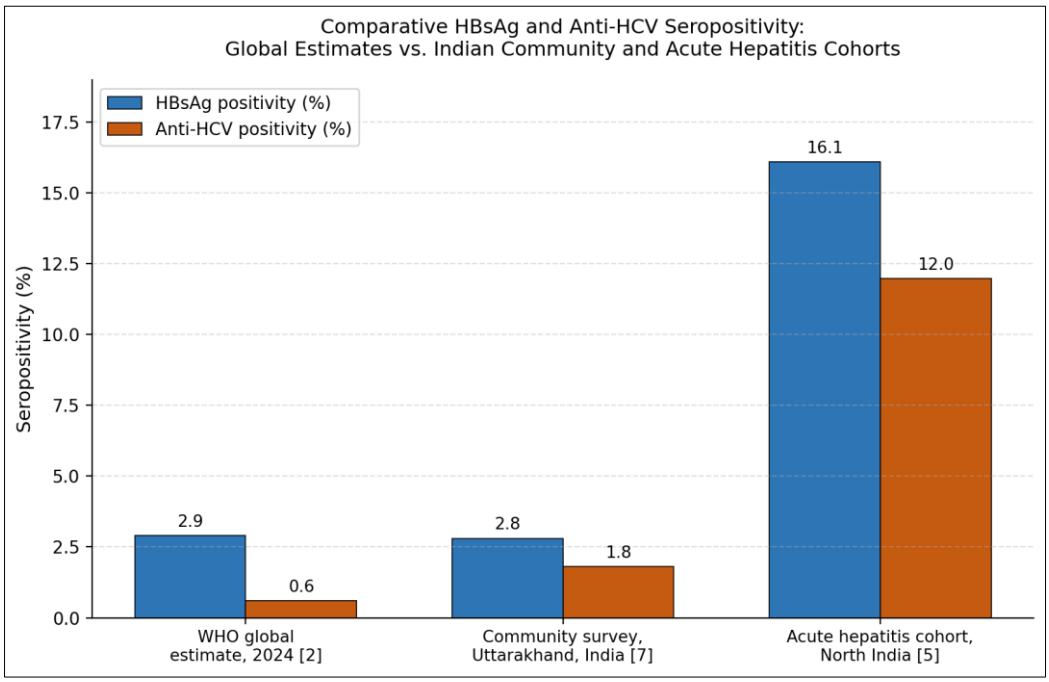

Fig 2: Comparative HBsAg and Anti-HCV Seropositivity Across Global Estimates and Indian Studies

4. Discussion

The findings of this review indicate that, although hepatitis A and E remain the predominant causes of acute viral hepatitis in India [6,12], hepatitis B and C continue to account for a clinically and epidemiologically important minority of acute presentations, and their parenteral mode of transmission carries distinct implications for prevention and control compared with the enterically transmitted viruses [8,9].

The marked difference between community-level HBsAg and anti-HCV seroprevalence (around 2–3% and under 2%, respectively) and the considerably higher rates reported among patients specifically presenting with acute hepatitis (up to 16.10% and 11.98%) [5,7] suggests that individuals with symptomatic acute liver injury represent a population enriched for parenterally acquired infection, likely reflecting risk factors such as unsafe therapeutic injections, blood transfusion, invasive medical or dental procedures, and, in some settings, injection drug use [8,9]. This finding underscores the value of including HBV and HCV markers as a routine part of the acute hepatitis work-up rather than restricting testing to the enteric viruses alone.

A central diagnostic challenge identified in this review is the interpretation of HBsAg in isolation. Because HBsAg is positive in both acute and chronic HBV infection, IgM anti-HBc is essential to confirm a recent or acute infection [3,4]. Equally important is recognition of the core window period, during which HBsAg has become undetectable but anti-HBs has not yet appeared, leaving IgM anti-HBc and total anti-HBc as the only positive markers [4,15]. Failure to test for anti-HBc in this scenario could lead to a patient with acute or recently resolved HBV infection being incorrectly classified as hepatitis B-negative.

For HCV, the relatively low sensitivity of anti-HCV antibody testing in the first weeks of acute infection [9] means that a negative anti-HCV result does not exclude acute HCV infection in a patient with a compatible exposure history and biochemical picture; HCV RNA or core antigen testing, where available, should be considered in such cases.

From a public health perspective, these findings reinforce the rationale behind the WHO's 2030 viral hepatitis elimination targets, which emphasise expanded testing coverage, universal infant hepatitis B vaccination including a timely birth dose, blood and injection safety, and harm-reduction services [2,14]. Current global diagnosis and treatment coverage for both HBV and HCV remain far below these targets [2], and strengthening laboratory capacity for accurate serological – and, where needed, molecular – testing of patients presenting with acute hepatitis represents an achievable step toward improved case detection and linkage to care.

This review has limitations inherent to a narrative synthesis: the included studies vary considerably in study population (community surveys versus hospital-based acute hepatitis cohorts), diagnostic assay (enzyme-linked immunosorbent assay versus rapid immunochromatographic tests), and geographic setting, which limits the direct comparability of the prevalence estimates presented and highlights the need for standardised, prospective, multicentre studies.

5. Conclusion

Serological testing for HBsAg, IgM anti-HBc, and anti-HCV remains the practical first-line approach for the diagnostic evaluation of patients presenting with acute suspected hepatitis. While hepatitis A and E remain the leading causes of acute hepatitis in India, hepatitis B and C account for a substantial proportion of cases and carry disproportionate long-term consequences owing to their potential for chronicity, cirrhosis, and hepatocellular carcinoma. A structured serological algorithm – incorporating awareness of the core window period and the limitations of anti-HCV antibody testing in early infection – combined with confirmatory molecular testing where feasible, can improve diagnostic accuracy in this setting. Continued emphasis on hepatitis B vaccination, blood and injection safety, and laboratory-based surveillance remains essential for progress toward the WHO 2030 viral hepatitis elimination goals [2,14].

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How to Cite This Article

Tiwari S, Rajani M, Sengupta C. Study of serological markers of parenterally transmitted viral infections (hepatitis B and C) in acute suspected hepatitis. Int J Med All Body Health Res. 2026;7(3):66-70.
doi:10.54660/IJMBHR.2026.7.3.66-70.