International Journal of Biological and Biomedical Research

A Review about Hepatitis B Virus: Transmission, Pathogenesis, Diagnosis, and Prevention

Omalbaneen Majid Fakher
Department of Nursing, Medical Technical Institute/Baghdad, Middle Technical University, Baghdad, Iraq

* Corresponding Author: **Omalbaneen Majid Fakher ; E-mail:** omalbaneen.majid@mtu.edu.iq

Article Info

E-ISSN: 3107-7137
Volume: 02
Issue: 04
Received: 18-05-2026
Accepted: 24-06-2026
Published: 15-07-2026
Page No: 98-102

Abstract
Hepatitis means inflammation of the liver. One cause is the hepatitis B virus (HBV), an infection that can persist and raise the risk of cirrhosis and liver cancer, making it a serious global health concern. HBV spreads through contaminated blood, sexual contact, or transmission from mother to child during childbirth. Vaccination, early diagnosis, and basic preventive measures can reduce its spread. The World Health Organization aims to eliminate hepatitis B as a public health threat by 2030. The study stresses vaccination, safety protocols, and awareness among healthcare workers, while calling for more research and stronger prevention efforts..

DOI: https://doi.org/10.54660/IJBBR.2026.2.4.98-102

Keywords: Hepatitis B Virus (HBV); Liver Inflammation; Hepatitis B Vaccination; Disease Prevention and Awareness

1. Introduction

Hepatitis means inflammation of the liver, identified by inflammatory cells in liver tissue. Infection is one possible cause, but toxins, drugs, alcohol, and other noninfectious factors can also trigger it. When a virus is responsible, the condition is called viral hepatitis. Most cases are linked to one of five unrelated hepatotropic viruses: hepatitis A, hepatitis B, hepatitis C, hepatitis D, or hepatitis E. Viruses such as herpes simplex, cytomegalovirus (CMV), Epstein-Barr, yellow fever, coxsackie, and adenovirus can also inflame the liver [1]. Hepatitis B, caused by the enveloped deoxygenated ribonucleic acid (DNA) virus known as hepatitis B virus (HBV), can be fatal and remains a serious global health problem. Sometimes the infection becomes chronic, raising the risk of cirrhosis and liver cancer. Symptoms vary widely—from none or mild illness to severe disease and, in rare cases, fulminant hepatitis. [2]. Hepatitis B virus (HBV) infection remains the most common chronic viral infection worldwide. An estimated 2 billion people have been infected, while more than 350 million live with the virus chronically. The Global Burden of Disease study placed HBV among the world's leading health priorities and named it the tenth leading cause of death, linked to 786 000 deaths each year. Those numbers led WHO to include viral hepatitis among its major public health priorities [3]. The World Health Organization has pledged to eliminate HBV [4]. Nurses who contract Hepatitis B after entering hospital face serious health risks, and their infection may also expose patients and other healthcare workers to transmission. The main concern is workplace exposure. Preventive measures are needed to protect nurses and limit transmission in healthcare facilities. This study examines the level of exposure nurses face at work and identifies the factors that raise their risk of infection.

1.1. Background

The World Health Organization estimates that about 240 million people worldwide have hepatitis B virus (HBV), which contributes to roughly 780 thousand deaths each year [5]. Of those infected, 50% may develop chronic liver disease, and 10% may develop liver fibrosis that can progress to liver cancer [6].

In 1967, Krugman and his colleagues showed that hepatitis occurred in at least two forms. One, later named serum hepatitis, was transmitted parenterally. Around the same time, they found an antigen—later called the SH antigen—in blood samples

from patients with transfusion-associated hepatitis during the incubation period. Subsequent research established that the Au and SH antigens were the same: both were forms of the hepatitis B surface antigen (HBsAg.) [7]

In 1970, Dane and his colleagues used electron microscopy to identify the viral particle, later named the Dane particle. Researchers had sequenced its genome by the early 1980s and were testing improved versions of the original vaccine.

The American Food and Drug Administration approved it; because the vaccine helped prevent primary liver cancer caused by HBV, it was also called an anti-cancer vaccine [8]

Lurman (1885) after World War 11, when clinical and epidemiological studies provided the necessary evidence.

Chronic hepatitis B has four recognized phases, but patients may not experience all of them, and the phases do not necessarily occur in a fixed order, as shown in Figure (2-1). The first, called immune tolerance, usually features reactive HBeAg (“e” antigen), High serum HBV DNA, with ALT levels that are normal or only slightly raised and no meaningful histological abnormalities.

Fibrosis and inflammation can appear. During the second phase, known as immune clearance, the body works to remove the virus; if the infection persists, the risk of cirrhosis and hepatocellular carcinoma (HCC) increases [7]

Liver inflammation and raised ALT levels occur as HBV-DNA declines modestly. Over time, HBeAg is lost and seroconversion to anti-HBe occurs. The infection then moves into the inactive-carrier phase, when liver disease generally becomes less active and the prognosis improves; histology usually shows the same trend. becomes undetectable, as shown in Figure (2-2). Reactivation may occur later, either spontaneously or after immunosuppression. Liver damage can then worsen, with ALT and HBV-DNA rising again. Identifying these phases helps estimate the risk of liver injury, but applying the classification in practice remains difficult because the infection changes over time [5]

Once researchers found that HBsAg prompted the body to produce anti-HBs, and that this antibody could protect against HBV infection, work began on prototype hepatitis B vaccines. During the 1980s, several countries expanded vaccine production and licensing. By 1990, a global campaign was underway: routine vaccination for every infant aimed to curb HBV transmission and reduce chronic liver disease and PHC linked to HBV. [8].

1.2. Virus Structure

The virion contains a relaxed, circular, double-stranded DNA genome covalently attached to the viral polymerase. Proteins embedded in the outer envelope mediate viral binding. Most virions are spherical, although polymorphic variants, including filamentous forms, also occur. The non-segmented genome contains long and short strands that meet to create a closed loop; it is only partly double-stranded. The longer strand contains 3020–3320 nucleotides, while the shorter strand contains 700–2800 nucleotides. The viral core is infectious, whereas the outer coat carries the virus’s principal antigenic determinant, HBs Ag [9], as shown in the figure.(1)

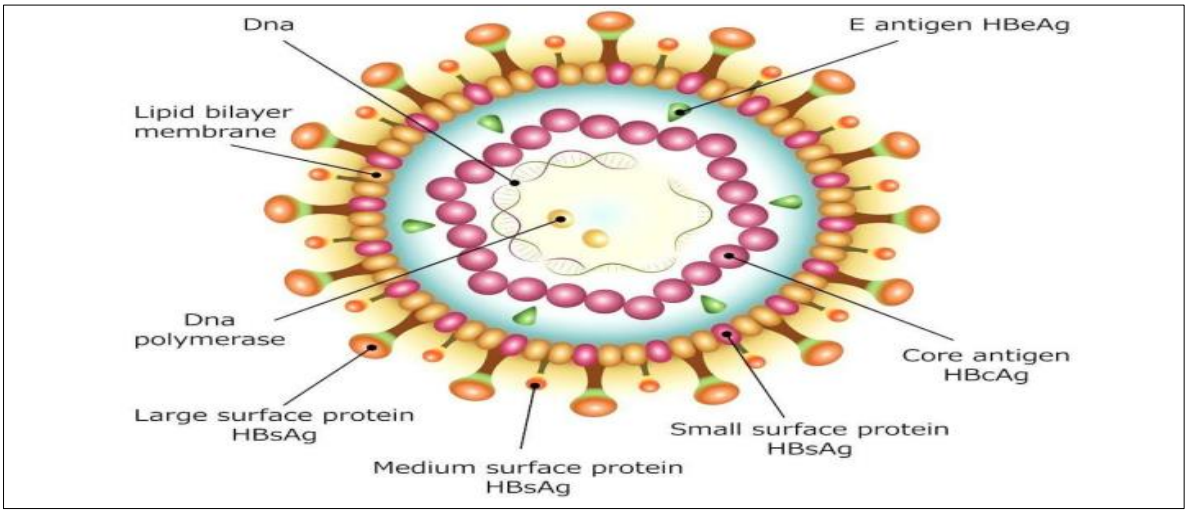

Fig 1: A simplified drawing of the HBV particle andsurface antigen

1.3. Epidemiology

Chronic HBV infection does not occur at the same rate everywhere. Worldwide prevalence is grouped into three levels: high, intermediate, and low endemicity [10]. The age when infection occurs is linked to the region's HBV endemicity [11], as shown in Table 1.

Table 1: Characteristics of endemic patterns of hepatitis B virus infection. Source: adapted from

Characteristic	Endemicity of infection		
	Low (%)	Intermediate (%)	High (%)
Chronic infection prevalence	0.5-2	2-7	≥8
Past infection prevalence	5-7	10-60	70-95
Perinatal infection	Rare	Uncommon	Common
	<10	10-60	>20
Early childhood infection	Rare	Common	Very common
	<10	10-60	>60
Adolescent/adult infection	Very common	Common	Uncommon
	70-90	20-50	10-20

1.4. Hepatitis B Virus Transmission

HBV spreads when someone comes into contact the greatest transmission risk, although semen and saliva have also been implicated. Transmission occurs through three recognized routes: perinatal, sexual, and parenteral or percutaneous exposure. Reliable evidence does not support airborne transmission, and feces are not infectious sources. Contaminated food [12].

1.5. Signs and Symptoms

The clinical course of hepatitis B stems from the interaction between the virus and the host's immune response. That process can injure the liver and, in some patients, eventually lead to cirrhosis or hepatocellular carcinoma. Acute infection may cause clear symptoms, but it can also pass without symptoms.

When jaundice develops, it is often preceded by a prodromal phase that may resemble serum sickness. Patients usually report general symptoms: loss of appetite, nausea, vomiting, low-grade fever, muscle aches, tiredness, and altered taste or smell, sometimes with an aversion to food or cigarettes. Intermittent mild-to-moderate pain may occur in the right upper quadrant or epigastrium [13].

Fulminant or subfulminant hepatitis may lead to hepatic encephalopathy. Sleep disruption can come first, followed by drowsiness and confusion; in severe cases, coma develops. Ascites, gastrointestinal bleeding, and coagulopathy are also possible [7]. Chronic hepatitis B often causes no symptoms, particularly in people who remain immune tolerant or have inactive chronic infection without signs of active disease. During the replicative phase, however, chronic active hepatitis can produce symptoms similar to those of acute hepatitis [12]. HBV transmission becomes more likely when standard precautions are not followed, especially hand hygiene, personal protective equipment (PPE), and safe injection practices.

1.6. Laboratory Diagnosis andManagement

Diagnosis draws on both clinical findings and laboratory results. Many people with Hepatitis B have no symptoms, while others develop complaints that resemble those caused by many other diseases. Laboratory testing is therefore needed for a definitive diagnosis and to identify which type of viral Hepatitis is present.

Testing may combine hepatitis B surface antigen (HBsAg), hepatitis B core antigen (HBcAg), hepatitis B e antigen (HBeAg), and the corresponding antibodies, including anti-HBs/HBsAb, total anti-HBc, anti-HBc IgM, and anti-HBe. The focus is on detecting these antigens and antibodies [14].

The Hepatitis B Foundation (HBF) recommends that all adults undergo hepatitis B screening with a triple serological marker panel: HBsAg, anti-HBs, and total anti-HBc. For patients infected with HBV, the following tests should be performed to determine the infection phase [15]:

a. Test for HBsAg, HBeAg/anti-HBe, and HBV DNA.
b. Liver blood tests, including aspartate aminotransferase (AST) and alanine transaminase (ALT).
c. To check for cirrhosis, use transient elastography (Fibroscan), a noninvasive test, or a needle liver biopsy, which is invasive.

Every patient with HIV infection should undergo screening for HBV. No single screening method has been established as optimal, though clinicians usually test for HBsAg and anti-HBs. When both results are negative, the patient should receive an active hepatitis B vaccine. The vaccine is safe for people with HIV, but it works less reliably: 30% show no primary response, compared with 2.5% of healthy individuals, and protection may fade sooner. Testing only for HBsAg and anti-HBs can miss occult HBV infection, since these patients often test positive only for anti-HBc. [16].

1.7. Treatment

Most adults clear acute hepatitis B on their own, so treatment is generally unnecessary [17]. Fewer than 1% of patients may need early antiviral therapy, mainly those who develop an aggressive infection—fulminant hepatitis—or have compromised immunity.

People with chronic infection and persistently high serum alanine aminotransferase and HBV-DNA levels may qualify for treatment. By 2008, the USA had licensed five antiviral drugs pegylated interferon alpha-2a (Pegasys). None could eliminate the infection, but these treatments could suppress viral replication and reduce liver damage, including cirrhosis and cancer. [18].

An infant born to a mother known to carry hepatitis B can receive hepatitis B immune globulin (HBIg), antibodies against HBV. When HBIg is given within twelve hours of

birth along with the HBV vaccine, the risk of acquiring the infection falls by 95%, and the mother can safely breastfeed her child. [19].

1.8. Prevention andControl

HBV infection can be prevented in two ways: stopping exposure to infected people and inducing immunity in those who have not been exposed. Screening donated blood for HBsAg, together DNA testing to the screening process lowers transfusion-associated disease even further, although the extra cost has limited its adoption.10 Infected people should also receive counselling on prevention [3].

"Booster immunisations may still be needed during late childhood and young adulthood to prevent infection." where they live or whether hepatitis B is endemic there. Yet safe vaccines have been available for years, and their cost has fallen, while apathy and reluctance—rather than financial barriers—continue to limit implementation. In the USA, hepatitis B infection has risen by one-third despite more than a decade of access to safe, effective vaccines; an estimated 300 000 new infections occur each year [20].

In developing countries, especially across Africa, the cost of HBV vaccines and the size of the population may make effective mass immunisation unaffordable at present. The hope is that medical resources will eventually be redistributed and that primary health care will receive greater attention. [20].

2. Conclusion

Several factors can increase the risk of hepatitis B infection. People should be encouraged to receive the hepatitis B vaccine, especially those who work in healthcare centers and hospitals. Basic precautions also matter: wear masks and gloves, avoid direct contact with infected people, and never use contaminated or unsterilized tools. Public education should explain why vaccination and prevention are necessary. Regular hepatitis B screening programs can also identify infections early and allow prompt treatment.

References

1. National Guidelines for Prevention, Care AndTreatment for Viral Hepatitis, Republic Of Ghana.
2. Desalegn Weldebrhan, Hailemariam Berhe, Yohannes Tesfay. Risk Factors for Hepatitis B Virus Infection In North Ethiopia: A Case–Control Study, Hepatic Medicine: Evidence AndResearch. 2023.
3. Prof Christian Trépo Md, Prof Henry L Y Chan Md, Prof Anna Lok Md. (2014). Hepatitis B Virus Infection. The Lancet, Volume 384, Issue 9959, Pages 2053-2063.
4. Katerina Roma *et al*. A Review Of The Systemic Manifestations Of Hepatitis B Virus Infection, Hepatitis D Virus, Hepatocellular Carcinoma, AndEmerging Therapies, Narrative Review, Gastro Hep Advances 3:276–291. 2024.
5. Danyenne Rejane De Assis, Simone De Barros Tenore, João Renato Rebello Pinho, David Salomão Lewi, Paulo Roberto Abrão Ferreira. Characteristics Of An Outpatient Chronic Hepatitis B Virus Infection Cohort, 13(2):189-95. 2015.
6. Muhammad Miftahussuru *et al*. Quality Of Life AndRelated Factors Among Hepatitis B Virus Infected Individuals, A Multifaceted Review Journal In The Field Of Pharmacy, Sys Rev Pharm: 11(3):960-964. 2020.
7. Obeagu EI, Obeagu, G.U. AndNwosu DC. Hepatitis B AndHepatitis C Viral Infection: A Review. International Journal Of Current Research In Chemistry AndPharmaceutical Sciences, Int. J. Curr. Res. Chem. Pharm. Sci. 2016;3(11):10-21.
8. Harold S. Margolis, Miriam J. Alter, AndStephen C. Hadler, Viral Hepatitis, A. S. Evans *et al*. (Eds.), Viral Infections Of Humans © Springer Science-Business Media New York 1997.
9. Saade Abdal Kareem Jasim, Yasameen Hassan Ali, Wurood J. Rajab. Overview Of Hepatitis B Virus, Clinical Features, AndHost Immune Response, Article In Annals Of The Romanian Society for Cell Biology ·. Annals Of R.S.C.B., Issn:1583-6258, Vol. 25, Issue 3, Pages. 1704 – 1714; 2021.
10. Jinlin Hou, Zhihua Liu, AndFan Gu. Epidemiology AndPrevention Of Hepatitis B Virus Infection, International Journal Of Medical Sciences, Ivyspring International Publisher, 2(1):50-57. 2005.
11. Alter M. Epidemiology Of Hepatitis B In Europe AndWorldwide. J Hepatol 39:S 64-S69; 2003.
12. Semen AndSaliva. J Infect. Experimental Transmission Of Hepatitis B Virus, 142:67-71. 1980.
13. Nikolaos T Pyrsopoulos. Hepatitis B, Chief Editor Bs Anand, Md, Medical Director Of Liver Transplantation, Rutgers New Jersey Medical School. 2022.
14. Who. Guidelines On Hepatitis B AndC Testing [Internet]. Geneva (Switzerland): World Health Organization; 2017.
15. Meryem Guvenir AndAyse Arikan. Hepatitis B Virus: From Diagnosis To Treatment, A.Arikan, Near East University, Faculty Of Medicine, Department Of Medical Microbiology AndClinical Microbiology, Nicosia, Turkish Republic Of Northern Cyprus, Meryem Guvenir AndAyse Arikan. 2020.
16. Robert Thimme, Hans Christian Spangenberg, Hubert E. Blum. Hepatitis B Or Hepatitis C AndHuman Immunodeficiency Virus Infection, Journal Of Hepatology 42: S37–S44. 2005.
17. Hollinger, F.B. AndLau DT. "Hepatitis B: The Pathway To Recovery Through Treatment" Journal Of The Gastroenterology Clinics Of North America 35 (4):895-931. 2006.
18. Dienstag JL. Hepatitis B Virus Infection. New English Journal Of Medicine. 2008;359(14):1486-1500.
19. Robson SC, Schoub B, Abdool Karim SS. Viral Hepatitis B - An. Overview, Volume 84 No. 8: P 530; 1994.
20. Muhammad Miftahussurur, *et al*. Quality of Life andRelated Factors Among Hepatitis B Virus Infected Individuals, A multifaceted review journal in the field of pharmacy, Sys Rev Pharm;11(3):960-964. 2020.
21. Ranjan Kumar, Shiv Kumar Mehi, Sudha, Amit Kumar. HEPATITIS B VIRUS ANDHEPATITIS C VIRUS COINFECTION AMONG OUTDOOR PATIENTS

ANDINDOOR PATIENTS OF TERTIARY CARE HOSPITAL, BHAGALPUR, BIHAR, INDIA, Original Research Article, Source of Support: Nil, Conflict of Interest: None declared Int J Acad Med Pharm; 5 (4); 2101-2104. 2023.

How to Cite This Article
Fakher OM. A review about hepatitis b virus: transmission, pathogenesis, diagnosis, andprevention. Int J Biol Biomed Res. 2026;2(4):98-102. doi:10.54660/IJBBR.2026.2.4.98-102.

Creative Commons (CC) License
This is an open access journal, andarticles are distributed under the terms of the Creative Commons Attribution NonCommercial-ShareAlike 4.0 International (CC BY-NCSA 4.0) License, which allows others to remix, tweak, andbuild upon the work non-commercially, as long as appropriate credit is given andthe new creations are licensed under the identical terms.