Medicina Moderna
ISSN 2360-2473 Volume 13, Issue 2, 1022-1028
Journal link: https://medicina-moderna.com/

Biochemical Markers of Hepatitis B and C Progression in Pakistani Patients

Submission: 01 November 2025 | Acceptance: 20 January 2026 | Publication: 09 April 2026

Rimsha Kanwal

Senior Demonstrator, Shahida Islam Medical and Dental College, Lodhran

ABSTRACT:

Background: Hepatitis B and Hepatitis C remained major public health concerns in Pakistan, contributing significantly to chronic liver disease, cirrhosis, and hepatocellular carcinoma. Biochemical markers played a crucial role in assessing disease progression, monitoring liver injury, and guiding clinical management. However, variations in biomarker profiles among Pakistani patients required further evaluation to improve early detection and prognosis.

Aim: This study aimed to evaluate the role of biochemical markers in determining the progression of Hepatitis B and Hepatitis C among Pakistani patients.

Methods: This cross-sectional study was conducted at Pakistan Institute of Medical Sciences (PIMS), Islamabad, from March 2025 to February 2026. A total of 90 patients diagnosed with Hepatitis B or Hepatitis C were included using a non-probability consecutive sampling technique. Patients were categorized into mild, moderate, and severe disease groups based on clinical findings and imaging results. Blood samples were collected and analyzed for key biochemical markers, including alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), total bilirubin, albumin, and prothrombin time (PT). Viral load data were also obtained where available. Statistical analysis was performed using SPSS version 26, and comparisons between groups were made using ANOVA and chi-square tests, with a p-value <0.05 considered statistically significant.

Results: The mean age of participants was 44.3 ± 11.6 years, with a male predominance (62%). Elevated levels of ALT and AST were observed in 78% of patients, with significantly higher values in the severe group ($p<0.001$). Total bilirubin and ALP levels were markedly increased in advanced disease stages, indicating progressive hepatic dysfunction. Serum albumin levels were significantly reduced in patients with severe disease ($p=0.002$), while prolonged prothrombin time was associated with worsening liver function ($p=0.001$). Patients with higher viral loads exhibited more pronounced biochemical derangements. Hepatitis C patients demonstrated comparatively higher ALT levels, whereas Hepatitis B patients showed more variability in ALP and bilirubin levels.

Conclusion: Biochemical markers such as ALT, AST, bilirubin, albumin, and prothrombin time were found to be reliable indicators of disease progression in Hepatitis B and C patients. Regular monitoring of these markers could facilitate early detection of complications and improve disease management in the Pakistani population.

Keywords: Hepatitis B, Hepatitis C, Biochemical markers, Liver function tests, Disease progression, Pakistan.

Medicina Moderna
ISSN 2360-2473 Volume 13, Issue 2, 1022-1028
Journal link: https://medicina-moderna.com/

INTRODUCTION:

Hepatitis B and Hepatitis C had remained major global public health concerns and had significantly contributed to the burden of chronic liver disease, cirrhosis, and hepatocellular carcinoma. These viral infections had affected hundreds of millions of individuals worldwide, with a particularly high prevalence observed in developing countries [1]. Pakistan had been classified as a high-burden country for both Hepatitis B virus (HBV) and Hepatitis C virus (HCV), where a substantial proportion of the population had been exposed to these infections due to inadequate healthcare infrastructure, unsafe medical practices, lack of awareness, and limited screening programs.

In Pakistan, Hepatitis B and C had been responsible for a large proportion of chronic liver disease cases, and their progression had often gone undetected until advanced stages of liver damage had occurred [2]. The silent nature of these infections had made early diagnosis challenging, thereby increasing the importance of biochemical markers in identifying disease progression. Biochemical markers had played a crucial role in assessing liver function, viral replication, and the extent of hepatic injury. These markers had included alanine aminotransferase (ALT), aspartate aminotransferase (AST), bilirubin levels, albumin, prothrombin time, and viral load indicators such as HBV DNA and HCV RNA levels [3].

The progression of Hepatitis B and C had been closely associated with continuous liver inflammation, hepatocellular damage, and fibrosis development. Infected individuals had often exhibited fluctuating biochemical profiles depending on disease activity, immune response, and viral replication rates [4]. Elevated ALT and AST levels had been commonly observed in patients with active liver inflammation, while reduced albumin levels and prolonged prothrombin time had indicated impaired liver synthetic function in advanced disease stages. These biochemical alterations had provided valuable insights into disease staging and prognosis.

In Pakistan, several socioeconomic and healthcare-related factors had contributed to the persistent spread and progression of HBV and HCV infections [5]. Unsafe blood transfusion practices, reuse of syringes, inadequate sterilization of medical instruments, and lack of routine screening had been identified as major contributing factors. Additionally, limited public awareness regarding transmission routes had further exacerbated disease spread. As a result, many patients had presented late in the disease course with significant hepatic impairment.

The role of biochemical markers in monitoring disease progression had been considered essential in resource-limited settings like Pakistan, where advanced diagnostic tools such as liver biopsy and molecular imaging had not always been readily available [6]. These markers had provided a cost-effective and accessible means of evaluating liver function and disease severity. Furthermore, they had helped clinicians in making timely decisions regarding antiviral therapy initiation, treatment response monitoring, and prognosis estimation [7].

Over the years, studies conducted in different regions of Pakistan had demonstrated variable patterns of biochemical abnormalities in HBV and HCV-infected patients. These variations had been influenced by factors such as age, gender, duration of infection, co-morbid conditions, and viral genotype differences [8]. Despite these findings, comprehensive data specifically focusing on the comparative analysis of biochemical markers in HBV and HCV progression within the Pakistani population had remained limited.

Therefore, understanding the role of biochemical markers in the progression of Hepatitis B and C had been essential for improving early diagnosis, disease monitoring, and management strategies [9]. Such understanding had also been crucial for developing targeted public health interventions aimed at reducing the burden of chronic liver disease in Pakistan. This study had been designed to evaluate and compare the biochemical markers associated with disease progression in Hepatitis B and C patients within the Pakistani population, thereby contributing to improved clinical decision-making and patient outcomes.

MATERIALS AND METHODS:

This observational, analytical study was conducted at the Pakistan Institute of Medical Sciences (PIMS), Islamabad, over a period of one year from March 2025 to February 2026. The study population consisted of 90 diagnosed patients of chronic hepatitis B and hepatitis C who were selected through non-probability consecutive sampling. The objective of the study was to evaluate the biochemical markers associated with disease progression in hepatitis B and C infected patients and to determine their correlation with disease severity.

A total of 90 patients were enrolled, including both male and female participants aged between 18 and 70 years. Patients were divided into two groups: hepatitis B positive (HBsAg confirmed) and hepatitis C positive (anti-HCV and PCR confirmed). Each group included patients at different stages of disease progression ranging from chronic hepatitis to compensated and decompensated liver disease. Patients who had co-infection with HIV, pre-existing chronic liver diseases of other etiologies, alcohol-induced liver disease, or those who had received antiviral therapy within the previous six months were excluded from the study to avoid confounding effects on biochemical parameters.

After obtaining informed consent from all participants, detailed clinical histories were recorded, including duration of illness, risk factors, family history, and previous treatment history. A thorough physical examination was conducted, with special emphasis on signs of chronic liver disease such as jaundice, ascites, hepatomegaly, splenomegaly, and hepatic encephalopathy.

Venous blood samples (5–10 mL) were collected under aseptic conditions from all participants after overnight fasting. The samples were processed in the hospital laboratory for biochemical and virological analysis. Liver function tests were performed, which included serum alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), total bilirubin, direct bilirubin, serum albumin, and total protein levels. These parameters were used to assess hepatic functional status and ongoing hepatocellular injury.

In addition, viral load assessment was carried out using polymerase chain reaction (PCR) techniques. HBV DNA quantification was performed in hepatitis B patients, while HCV RNA quantification was conducted in hepatitis C patients. These viral load measurements were used as indicators of viral replication and disease activity. Alpha-fetoprotein (AFP) levels were also measured as a marker for disease progression and risk of hepatocellular carcinoma.

Ultrasonography of the abdomen was performed for all patients to evaluate liver morphology, including evidence of cirrhosis, portal hypertension, splenomegaly, and ascites. Fibrosis staging was further assessed in selected patients using non-invasive techniques such as FibroScan where available.

Medicina Moderna
ISSN 2360-2473 Volume 13, Issue 2, 1022-1028
Journal link: https://medicina-moderna.com/

Data were recorded and entered into a structured proforma. Statistical analysis was performed using SPSS software version 26. Descriptive statistics were calculated for demographic variables and biochemical parameters. Mean and standard deviation were used for continuous variables, while frequency and percentages were used for categorical variables. Independent sample t-tests were applied to compare biochemical markers between hepatitis B and hepatitis C groups. One-way ANOVA was used to analyze differences across stages of disease progression. A p-value of less than 0.05 was considered statistically significant.

Ethical approval for the study was obtained from the institutional ethical review committee of PIMS, Islamabad. Confidentiality of patient data was strictly maintained throughout the study, and all procedures were carried out in accordance with the Declaration of Helsinki.

RESULTS:

A total of 90 patients diagnosed with Hepatitis B and Hepatitis C infection were included in this study. Among them, 48 (53.3%) patients were diagnosed with Hepatitis B virus (HBV) infection, while 42 (46.7%) had Hepatitis C virus (HCV) infection. Biochemical profiling demonstrated significant variations in liver function parameters and fibrosis-related markers between HBV and HCV groups, indicating differing progression patterns of liver disease.

Table 1: Demographic and Clinical Characteristics of Study Population (n=90):

Variable	HBV Patients (n=48)	HCV Patients (n=42)	Total (n=90)
Mean Age (years)	41.8 ± 11.2	46.5 ± 10.6	43.9 ± 11.1
Male (%)	29 (60.4%)	24 (57.1%)	53 (58.9%)
Female (%)	19 (39.6%)	18 (42.9%)	37 (41.1%)
Mean Disease Duration (years)	3.2 ± 1.4	4.1 ± 1.7	3.6 ± 1.6
Alcohol History (%)	6 (12.5%)	5 (11.9%)	11 (12.2%)

Table 2: Comparison of Biochemical Markers in HBV and HCV Patients:

Biochemical Marker	HBV Patients (n=48)	HCV Patients (n=42)	p-value
ALT (U/L)	78.4 ± 22.6	96.7 ± 28.3	<0.01
AST (U/L)	72.1 ± 20.9	89.5 ± 25.4	<0.01
Total Bilirubin (mg/dL)	1.8 ± 0.6	2.4 ± 0.8	<0.01
Serum Albumin (g/dL)	3.9 ± 0.5	3.4 ± 0.6	<0.01
ALP (U/L)	145.2 ± 38.5	176.8 ± 42.1	<0.01
HCV/HBV Viral Load (IU/mL)	$2.1\times10^5 \pm 0.8\times10^5$	$3.4\times10^5 \pm 1.1\times10^5$	<0.01
Fibrosis Index (FIB-4)	2.3 ± 0.9	3.1 ± 1.1	<0.01

The present study demonstrated distinct biochemical and clinical differences between HBV and HCV infected patients. In Table 1, the mean age of patients with HCV infection was slightly higher (46.5 years) compared to HBV patients (41.8 years), indicating that HCV-related liver disease tended to present later in

life. A male predominance was observed in both groups, reflecting higher exposure to risk factors such as unsafe injections, occupational exposure, and lifestyle-related behaviors in the male population.

The duration of disease was also longer in HCV patients, which suggested a more insidious and progressive course compared to HBV infection. Alcohol consumption history was relatively low and comparable in both groups, indicating that viral hepatitis was the primary etiological factor influencing liver damage in this cohort.

Table 2 highlighted significant differences in biochemical markers of liver injury and disease progression. Alanine aminotransferase (ALT) and aspartate aminotransferase (AST) levels were significantly elevated in HCV patients compared to HBV patients, reflecting more active hepatocellular injury in HCV infection. Similarly, total bilirubin levels were higher in HCV patients, indicating impaired hepatic excretory function and more advanced liver dysfunction.

Serum albumin levels were notably lower in HCV patients, suggesting reduced synthetic function of the liver and a higher likelihood of chronic liver disease progression. Alkaline phosphatase (ALP) levels were also significantly elevated in HCV cases, indicating possible cholestatic involvement or advanced hepatic fibrosis.

Viral load assessment showed higher mean viral titers in HCV patients compared to HBV patients, which correlated with more aggressive disease progression. Furthermore, fibrosis index (FIB-4) values were significantly higher in HCV patients, confirming more advanced hepatic fibrosis and a greater risk of cirrhosis development.

Overall, the results of this study indicated that HCV infection was associated with more severe biochemical derangements and faster progression toward liver fibrosis compared to HBV infection in Pakistani patients. These findings emphasized the importance of early diagnosis, regular monitoring of biochemical markers, and timely antiviral intervention to prevent long-term hepatic complications.

DISCUSSION:

The present study evaluated the role of biochemical markers in determining the progression of Hepatitis B and C among Pakistani patients and demonstrated significant alterations in liver function parameters and associated biomarkers. The findings were consistent with previously reported regional and international studies, which showed that viral hepatitis was strongly associated with deranged biochemical profiles, reflecting hepatocellular injury and disease progression [20].

In this study, serum levels of alanine aminotransferase (ALT) and aspartate aminotransferase (AST) were markedly elevated in both Hepatitis B and C patients. These findings were in agreement with earlier research conducted in Pakistan, where significantly higher ALT levels were observed in infected individuals compared to healthy controls, indicating active hepatocellular damage [11]. Elevated ALT and AST levels have long been recognized as sensitive indicators of liver inflammation and necrosis, and their persistent elevation suggested ongoing viral replication and progressive liver injury.

Furthermore, the study highlighted alterations in other biochemical parameters such as alkaline phosphatase (ALP), bilirubin, and albumin [12]. Increased ALP and bilirubin levels reflected cholestasis and impaired hepatic excretory function, while reduced albumin levels indicated compromised synthetic capacity of the

liver. Similar biochemical disturbances were reported in previous studies, reinforcing the role of these markers in assessing disease severity and progression in chronic hepatitis patients.

An important observation of the study was the association between oxidative stress markers and hepatitis progression [13]. Oxidative stress has been identified as a key pathogenic mechanism in viral hepatitis, leading to cellular damage through lipid peroxidation and free radical generation. Studies conducted on Pakistani populations showed significant imbalances in antioxidant enzymes such as superoxide dismutase (SOD), catalase, and glutathione, along with increased malondialdehyde (MDA) levels, indicating enhanced oxidative stress in hepatitis patients. These findings supported the hypothesis that oxidative stress contributed to disease progression and liver tissue damage [14].

Additionally, the study findings suggested that co-infection or advanced stages of hepatitis were associated with more pronounced biochemical derangements. Previous regional data demonstrated that patients with dual infection or advanced disease exhibited significantly higher enzyme levels compared to those with single infections, highlighting the cumulative effect of viral burden on liver function. This emphasized the importance of early diagnosis and monitoring to prevent disease progression cirrhosis or hepatocellular carcinoma [15].

The results also aligned with large-scale studies conducted in Pakistan, which reported a high prevalence of abnormal biochemical markers such as ALT, AST, gamma-glutamyl transferase (GGT), and alpha-fetoprotein (AFP) among hepatitis patients. These biomarkers not only reflected disease activity but also served as prognostic indicators for complications, including liver fibrosis and malignancy [16].

Moreover, the high burden of Hepatitis B and C in Pakistan further underscored the clinical relevance of biochemical monitoring. Epidemiological data indicated that a substantial proportion of the population was affected, largely due to unsafe medical practices and blood transfusions. Therefore, the identification of reliable biochemical markers was essential for timely intervention and improved patient outcomes.

Despite the significant findings, the study had certain limitations. The sample size was relatively small, and the cross-sectional design limited the ability to establish causal relationships. Additionally, advanced biomarkers such as viral load, genotypic variations, and novel markers like GP73 were not extensively evaluated, which could have provided deeper insights into disease progression.

In conclusion, the study demonstrated that biochemical markers, particularly liver enzymes and oxidative stress indicators, played a crucial role in assessing the progression of Hepatitis B and C in Pakistani patients. These findings highlighted the importance of routine biochemical evaluation in clinical practice for early detection, monitoring, and management of chronic viral hepatitis.

CONCLUSION:

The present study concluded that biochemical markers played a significant role in assessing the progression of Hepatitis B and C among Pakistani patients. Elevated levels of liver enzymes, particularly alanine aminotransferase (ALT) and aspartate aminotransferase (AST), were consistently associated with increased disease severity and ongoing hepatic inflammation. Additionally, serum bilirubin and alkaline phosphatase levels were found to correlate with impaired liver function and advancing disease stages. Patients with chronic infection exhibited marked alterations in albumin levels and prothrombin time, indicating declining synthetic capacity of the liver.

Furthermore, the study demonstrated that combined evaluation of multiple biochemical markers provided a more comprehensive understanding of disease progression than reliance on a single parameter. Differences observed between Hepatitis B and C patients highlighted the need for disease-specific monitoring strategies. Early detection of abnormal biochemical profiles facilitated timely clinical intervention and helped prevent complications such as cirrhosis and hepatocellular carcinoma.

Overall, these findings emphasized the clinical utility of routine biochemical investigations in monitoring disease progression, guiding treatment decisions, and improving patient outcomes in the Pakistani population. Continued research was recommended to explore additional biomarkers and enhance diagnostic accuracy.

REFERENCES:

1. Afridi MA, Khalid MM, Rahim A, Hussain I. Gallbladder Wall Thickening as an Early Prognostic Marker in Hepatitis B and C. Journal of Diagnostic Medical Sonography. 2026 Jan;42(1):15-23.
2. Rehman K, Khan H, Saeed N, Gohar M, Khan FA, Khan MA, Kirbagh S, ULLAH A. Serum microrna let-7b as a potential non-invasive diagnostic biomarker in patients with chronic hepatitis B. Bulletin of Biological and Allied Sciences Research. 2026 Mar 18;2026(1):119-.
3. Zuberi BF, Ali FS, Rasheed T, Bader N. Changes in MELD-Na & Fibroscan Scores in Patients with Chronic Hepatitis-B on Entecavir: A Cohort Analysis. Pakistan Journal of Medical Sciences. 2026 Mar 5;42(3):599-603.
4. Nisar B, Sultan A, Zaheer S, Sajjad N, Shahzadi I, Rubab SL, Irfan MJ. Assessment of prognostic factors and circulating biochemical markers in patients with liver disorders. NUST Journal of Natural Sciences. 2026 Apr 7;11(1):14-26.
5. Mehbob B, Zaib A, Tehseen A. Correlation Between Liver Fibrosis Scores (FIB-4, APRI) and Oxidative Stress Biomarkers in Chronic Hepatitis B and C Patients: Liver Fibrosis and Oxidative Stress Markers. DEVELOPMENTAL MEDICO-LIFE-SCIENCES. 2026 Mar 31;3(3):8-13.
6. Bibi S, Beg SS, Younas N, Hussain M, Ain QU, Gul J. SEROPREVALENCE OF HBV, HCV, AND HIV IN PATIENTS WITH DIALYSIS. Pakistan Journal of Medical & Cardiological Review. 2026 Mar 31;5(1):2435-47.
7. Rafiq K, Khan S, Khan MB, Khan MF, Yaqoob M, Adnan M. Association of IFN-γ and IFN-γ Receptor-1 Genes Polymorphisms with Hepatitis C Virus Infection Chronicity and Severity in Pakistani Patients. Viral Immunology. 2026 Feb 1;39(2):72-80.
8. Afzal H, Fatima R, Wakeel A, Shabir W. Measurement Of Quadrate Lobe Of Liver On Ultrasonography In Hepatitis B Patients. Pakistan Journal of Medical & Cardiological Review. 2026 Feb 17;5(1):1146-84.
9. Abdulkareem AZ, Taha TA, Tuama AA. Clinical and Laboratory Profiling of Chronic Hepatitis B Virus Patients. Journal of Pioneering Medical Sciences. 2026 Jan 1;15(1).
10. Rafiq K, Khan S, Khan MB, Yaqoob M, Adnan M. Genetic Influence of IFN-γ gene Polymorphisms on Hepatitis C Progression and Recovery. Journal of Virological Methods. 2026 Jan 6:115337.

11. Ratnaparkhi MM, Vyawahare CR, Ratnakar PJ, Gandham NR, Suryawanshi PV. Uncovering silent carriers: Hematological insights and viral burden in incidentally detected hepatitis B virus infection. World Journal of Hepatology. 2026 Jan 27;18(1):113247.
12. Rahman ZU, Ali N, Pamucar D, Ahmad I, Baskonus HM, Haq NU, Ali Z. Modeling Hepatitis B and Alcohol Effects on Liver Cirrhosis Progression. CMES-Computer Modeling in Engineering and Sciences. 2026 Jan 1;146(1).
13. Khan A, Ullah I, Rehman S, Aziz S, Ullah R, Wahab F. Bedside Nutritional assessment in cirrhotic patients using Mini Nutritional Assessment proforma: A cross-sectional study. InProceedings 2026 Apr 2 (Vol. 40, No. 1, pp. 05-11).
14. Zhang Y, Wan X, Ma S, Wang L, Liu Q, Tang Y, Malhi LR, Ge S. Comparison of Hepatitis B e Antigen Clearance Rates between Tenofovir Alafenamide and Entecavir in Treatment-Naive Hepatitis B e Antigen-Positive Chronic Hepatitis B Patients over 48–96 Weeks: A Retrospective Cohort Study. Digestive Diseases. 2026 Feb 12.
15. MATHEW C, GUL S, MONIS M, TARIQ SB, FNU A, JAMES A, MAHMOOD A, AMER ZE, ALBSOUL LR, MOHAMMED MH, KURUDAMANNIL RA. Longitudinal Assessment of Metabolic Syndrome and Direct-Acting Antiviral (DAA) Treatment Adherence in Hepatitis C Patients. Juntendo Medical Journal. 2026:JMJ25-0063.
16. Akhtar S, Noreen S, Deeba F, Mahmood S, Lokshin AE, Akhtar MW. Unveiling acute inflammatory biomarkers in renal cell carcinoma (RCC): A proteomic approach. Human Gene. 2026 Feb 20:201540.