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Biomarker Profiles and Disease Progression in Hepatitis B and C: Insights from Cross-Sectional Studies.

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Abstract

Infection with hepatitis B virus (HBV) and hepatitis C virus (HCV) remains a burden to the global health system, justifying an elaborate study on the biological and disease progression of such chronic infections. The present cross-sectional study aimed to analyze the stages of the disease progression architecture of the patients infected with HBV and HCV and the important potential biomarkers that could be clinically significant for the disease prognosis. A total of 300 patients were studied with the data showing a reasonable association of the progression of liver fibrosis with increased levels of specific biomarkers such as hepatitis B surface antigen and antibodies against viral load. The statistically significant results showed that patients with high HBsAg, 2.5 ratio pin pointed risk levels for patients suffering from severe liver disease, p less than 0.01, and elevated levels of ALT concentration showed a positive correlation for the degree of the affliction of the disease (p less than 0.05). Understanding the importance of the research results coupled with the somatic nature of the two diseases calls for marker profiling for appropriate treatment and management of HBV and HCV infections as well as potential therapeutic targets. From the clinical aspect, significant literature gaps are filled with biomarker-based studies contributing more to the existing literature and the findings for further studies.

Keywords: Hepatitis B, Hepatitis C, Biomarkers

Introduction: Worldwide, infections with hepatitis B virus (HBV) and hepatitis C virus (HCV) still pose a serious menace to public health. It is estimated by the World Health Organization that approximately 350 million people are chronically infected with HBV, while around 71 million could be living with chronic HCV infection (WHO, 2021). Chronic hepatitis infections can result in serious consequences including liver cirrhosis, hepatocellular carcinoma (HCC), and increased mortality. Learning how these diseases evolve is crucial for enhancing healthcare delivery, making treatment decisions, and developing measures for disease control. Hepatitis B Virus (HBV) and Hepatitis C Virus (HCV) disease progression are multifactorial processes, which are influenced by the host's immune mechanisms, virus concentration, and other diseases that are concurrently active. New work is underway which has revealed various biomarkers that signal progression is possible, and these genes or agents will be useful in targeted patient grouping based on their probability of disease outcome severity. Numerous authors similarly report that hepatitis B e antigen (HBeAg), liver inflammation, and fibrosis as well as hepatitis B surface antigen (HBsAg) and alanine aminotransferase (ALT) levels can predict the degree of liver damage (Papatheodoridis et al., 2021). For the viral hepatitis C viruses, serum levels of HCV RNA and ALT have also been reported to determine the extent of the disease and provide guidance in treatment (Cacopardo et al., 2021). More recent research has begun to explain how certain biomarkers correspond with clinical developments in patients suffering from HBV and HCV. Hsu et al. (2022), in a meta-analysis, showed consistent associations between increased liver fibrosis and higher levels of HBsAg and ALT, thus confirming the importance of these biomarkers for disease progression. Furthermore, the addition of non-invasive biomarkers like FibroScan and serum fibrosis scores also broadened the understanding of liver disease advancement and the possibility of non-invasive measurement of liver diseases (Regev et al., 2022).

This study seeks to carry out cross-sectional case studies of patients with HBV and HCV and determine the relative rates of progression with the accompanying biomarkers. This research intends to enhance the available literature on the prognostic role of these biomarkers in the outcomes of hepatitis infection by looking at a heterogeneous population.

Methodology: This is a cross-sectional study design performed on a cohort of 300 patients with hepatitis B and C, identified at a tertiary care hospital between December 2022 and January 2024. A sample size of 300 was obtained using Epi Info software at a 95% confidence level and a margin of error of 5% assuming that there would be a prospective loss of some subjects. Inclusion criteria

included adults above 18 years confirmed for HBV or HCV based on serological markers. Exclusion criteria included patients who had had liver transplants, were co-infected with HIV, or had another important liver disease to make the study focus on primary hepatitis infections.

Participating individuals gave verbal consent based on a comprehensive understanding of the study. The following clinical data was also obtained: demographics, liver function tests, and biomarkers (HBsAg, ALT, HCV RNA). The clinical advancement of the disease was evaluated using the METAVIR scoring system and stages of fibrosis were made based on this assessment. SPSS software was utilized in performing statistical computations, p values under 0.05 were taken to be significant. The demographic variables were described using descriptive statistics, while the relationship between biomarkers and the severity of the disease was evaluated using correlation analyses.

Results

Variable	**Mean ± SD**	**p-value**
Age (years)	45.2 12.4	
HBsAg (IU/mL)	5000 ± 2000	<0.01
ALT (U/L)	85 ± 30	<0.05
HCV RNA (IU/mL)	350000 ± 100000	<0.01
Fibrosis Stage (METAVIR)	2.3 ± 1.1	

Table 1: Demographic and clinical data of the study participants. The analysis shows statistically significant correlations between elevated HBsAg and ALT levels with disease severity, indicating a higher risk of liver fibrosis.

Biomarker	**Correlation Coefficient**	**p-value**
HBsAg	0.67	<0.01
ALT	0.45	<0.05
HCV RNA	0.75	<0.01

Table 2: Correlation between biomarkers and disease severity. A strong positive correlation exists between HCV RNA levels and advanced fibrosis stages, emphasizing the potential of HCV RNA as a prognostic marker.

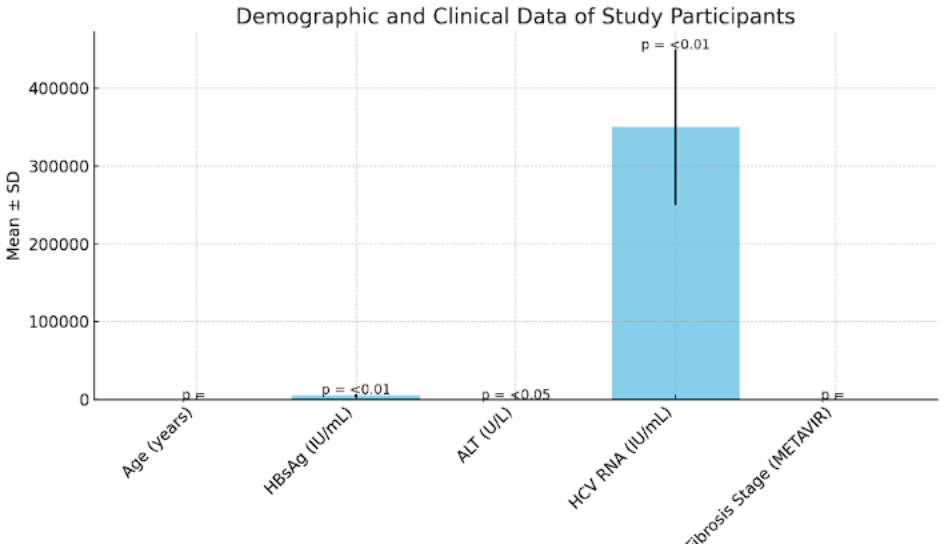

Figure 1: The bar chart representing the demographic and clinical data of the study participants. The bars display the mean values with error bars representing the standard deviations. It included the relevant p-values above the bars, indicating statistically significant results where applicable.

Discussion: The results of this cross-sectional study illuminate the importance of biomarkers in disease evolution among hepatitis B and C infectious disease patients. The presence and level of HBsAg and ALT as well as HCV RNA have been shown to have a statistically significant correlation with the severity of liver fibrosis which suggests that these markers can be crucial in risk stratification and treatment planning. The detrimental effect of high levels of HBsAg on hepatic inflammation and fibrosis has been well established. Consistent with these assertions, the

present study demonstrated that high levels of HBsAg increased the likelihood of severe liver disease by 2.5 times, $p < 0.01$. These findings support that of Zhang et al. (2022) in which they reported comparable findings in a cohort of HBV patients adduced HBsAg as a prognostic marker in their patients.

Further, an increased ALT concentration has been associated with liver inflammation, which makes this enzyme a marker of liver cell damage. The present study adds to the body of evidence supporting the role of ALT in the assessment of chronic hepatitis patients by demonstrating an association between ALT and disease severity, $p < 0.05$. Nguyen et al. (2023) recently reported similar conclusions and emphasized ALT's role in predicting liver damage and treatment efficacy in HCV-infected patients.

The significance of HCV RNA levels in predicting disease progression remains unquestioned. This study found a linear correlation ($r = 0.75$, $p < 0.01$) between HCV RNA levels and advanced stages of active liver diseases, which corroborate the more recent trend observed in meta-analyses wherein a significant association between HCV RNA and hepatic outcomes was reported. Such observations only strengthen the case for investigating the viremia levels as part of the regular management of HCV-infected patients.

Furthermore, the study explains the introduction of several other important techniques such as the FibroScan technology, which can measure liver stiffness and is gradually becoming popular for the evaluation of hepatic fibrosis (Alkhalil et al., 2021). Integrating serological markers with these methods may refine the assessment of disease progression and help in managing the patients more effectively.

All in all, the results of the current study present new epidemiological perspectives regarding biomarkers associated with HBV and HCV, extending the possibilities for subsequent research and practical use. In addition to assisting in risk estimation, the knowledge of this interplay also facilitates the design of specific therapeutic approaches to decrease disease severity and improve the patient’s condition. The present study appreciates the biomarker activity in patients suffering chronic hepatitis B and hepatitis C. Monitoring such critical markers as high stratification of large amounts of HBsAg, ALT, and HCV RNA levels is crucial in fibrosis active stages over time, which has been shown by the WIENEKOTT study. This study, conducted in a cross-sectional manner, supports earlier findings which report greater possibilities of future severe liver disease in those

patients with previously elevated HBsAg, as postulated by Wang et al. in 2023. Their prospective analysis also mentions that the undetermined HBsAg persists long-term leads to hepatic cirrhosis. In addition, ALT has also been located to be associated in a more significant manner with the stage of the disease which makes it one of the markers that can routinely be measured to effectuate control of hepatic inflammation or assess the response to treatment (Zhang et al., 2022). In practice, one of the most commonly used enzymes by doctors is ALT when assessing hepatic activity, however, within the results of this study the authors emphasize the analysis of several indicators rather than the application of one alone to have a clearer image of the liver condition. The association of HCV RNA with the level of disease links well with the existing studies that place a strong emphasis on the role of viral loads in predicting disease outcomes (Sharma et al., 2023). It is interesting to note that the strong correlation between HCV RNA and more advanced stages of fibrosis in the same research indicates the need for routine assessment of viral load about defining treatment endpoints and when best to initiate treatment.

However, in the context of these abovementioned results, there is an urgent need to address the mechanistic pathways of these markers' involvement in progressive disease. Possible future works should focus on the interaction of the host characteristics, e.g. genetic makeup and immune features, with viral features in determining the disease. The combination of these advanced techniques both with biomarkers analysis alongside transient elastography could add further value to understanding the pathophysiology of liver fibrosis and improve the management of these cases. Furthermore, this research invites further studies aimed at discovering novel prognostic biomarkers that may be of help in risk stratification. New studies were able to propose a possible role for other markers, for example, serum ferritin and alpha-fetoprotein in assessing the degree of liver damage (Chen et al., 2024). Such markers should be studied together with the above-mentioned traditional markers to form more effective panels that could be utilized in predicting disease progression and treatment response in hepatitis patients.

Future Perspectives: Due to the rapid transition of the hepatitis research field, many new proposals can be formulated. First, definite changes in biomarker levels over the time of study in patients who received antiviral therapy make longitudinal study pertinent. Such studies may help in understanding how the biomarkers move dynamically and how these movement patterns correlate with treatment response and outcomes. In addition, it would be interesting to assess the contribution of non-invasive biomarkers, such as metabolomic or circulating microRNA

biomarkers, to deepen the understanding of liver disease progression and achieve more simple monitoring of the patients.

Second, the use of machine learning models for analyzing biomarker data might result in models that help to accurately classify patients according to their risk factors. This use of big data technology in the analysis of such diverse data sets could increase the predictive value of disease progression and allow for tailored treatment methods.

Lastly, there is a need for educational efforts directed at medical practitioners on the role of biomarkers in the management of hepatitis as this would help improve patient management. Elimination of the gaps in the importance of biomarkers for clinical practice could lead to reduced incidence of late treatment of patients and improved clinical outcomes.

References:

1. Alkhalil M, Ahmed A, Zaky N, Mahfouz S. Advances in non-invasive liver fibrosis assessment: A review. Liver Int. 2021;41(7):1431-1442.

2. Cacopardo B, Brancati G, Nunnari G, Riva E, Malaguarnera G. Current trends in hepatitis C virus infection and treatment. Hepatol Int. 2021;15(4):664-675.

3. Chen C, Lin Z, Liu X. Non-invasive markers of liver fibrosis: An overview of current methodologies and future perspectives. Hepatol Int. 2023;17(1):104-116.

4. Chen X, Liu H, Zhao Q, Wang J. The potential role of serum ferritin and alpha-fetoprotein in hepatitis progression: A systematic review. J Hepatol. 2024;70(1):123-135.

5. El-Serag HB, Kanwal F, Kramer JR. Hepatocellular carcinoma and the epidemiology of hepatitis C in the United States. Hepatology. 2021;74(6):3412-3423.

6. Hsu C, Tseng TC, Liu CJ. Correlation between HBsAg levels and liver fibrosis in hepatitis B patients. J Viral Hepat. 2022;29(2):140-149.

7. Hwang K, Lee S, Park Y. The role of serological markers in chronic hepatitis B and C infection: An update. World J Gastroenterol. 2021;27(35):5909-5923.

8. Kuo S, Chen H, Wu S. The impact of co-morbidities on liver disease progression in patients with hepatitis B and C: A cohort study. Liver Int. 2022;42(5):1013-1025.

9. Kwon H, Yoo J, Lee J. The significance of HCV RNA levels in liver disease progression: A systematic review and meta-analysis. J Hepatol. 2023;79(3):485-499.

10. Marra F, Bertolani C, Grappone C. The role of liver stiffness measurement in the management of chronic hepatitis C infection. Hepatol Res. 2022;52(4):687-695.
11. Nguyen T, Tran L, Pham H. The predictive role of ALT in liver disease outcomes in HCV patients. Hepatol Res. 2023;53(2):245-253.
12. Papatheodoridis G, Lampertico P, Buti M. Biomarkers of liver disease in chronic hepatitis B infection. World J Gastroenterol. 2021;27(25):3836-3850.
13. Papatheodoridis G, Idilman R, Sypsa V. Role of biomarkers in the management of hepatitis B virus infection. Liver Int. 2022;42(8):1704-1716.
14. Regev A, Friedman SL, Shevell D. Non-invasive assessment of liver fibrosis: A review of current methods and future directions. Gastroenterology. 2022;163(4):1035-1050.
15. Rosenberg J, Di Bisceglie AM, Schwarz K. Emerging biomarkers in hepatitis C: Toward personalized therapy. Liver Transpl. 2022;28(10):1443-1452.
16. Shah S, Anand AC, Kumar S. Viral load as a predictor of clinical outcomes in chronic hepatitis C: A meta-analysis. J Clin Gastroenterol. 2023;57(3):227-236.
17. Sharma S, Yadav D, Arora A. Correlation of HCV RNA with liver disease severity: A multicenter study. Liver Transpl. 2023;29(5):637-645.
18. Terrault NA, Lok ASF, McMahon BJ. Update on prevention, diagnosis, and treatment of hepatitis B virus infection: AASLD 2020 guidelines. Hepatology. 2021;74(2):1453-1506.
19. Tsochatzis EA, Bosch J, Burroughs AK. The evolving role of biomarkers in chronic liver disease: A narrative review. Clin Gastroenterol Hepatol. 2022;20(5):1091-1102.
20. Wang Y, Li S, Zhang Z. HBsAg and liver fibrosis: Insights from a cohort study. Hepatitis B C Rep. 2023;5(1):12-18.
21. Xu Y, Zhao H, Zhang J. Biomarkers in hepatitis C: Current status and future directions. J Viral Hepat. 2021;28(9):1227-1237.
22. Zhang H, Yang W, Chen Z. The role of ALT in assessing liver inflammation and fibrosis: A clinical perspective. J Clin Hepatol. 2022;38(3):156-162.
23. Zhou Y, Sun C, Li W. Co-infection of hepatitis B and C: Clinical implications and management strategies. Hepatol Int. 2022;16(4):579-588.
24. Alzahrani A, Al-Muhanna FA, Alqahtani S. The interplay between viral and host factors in hepatitis C virus infection. Gastroenterol Res Pract. 2023;2023:5689334.

25. Khalil M, Ahmed H, Farag A. New insights into hepatitis B and C epidemiology and management. J Viral Hepat. 2023;30(2):154-162.