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Molecular Characterization Of HBC and HBS In Hepatitis B Virus Infections: The Role Of Interleukin-6 (Il-6) In Immune Response In Thi-Qar Governorate

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Abstract
Hepatitis B virus (HBV) remains a major global health concern, leading to chronic liver diseases and hepatocellular carcinoma. This study focuses on the molecular characterization of the viral markers Hbc and Hbs and their correlation with the immune marker Interleukin-6 (IL-6) in hepatitis B patients. The study aims to provide insights into the immunological response of patients in Thi-Qar Governorate, Iraq. A total of 120 patients were analyzed, and IL-6 levels were measured using enzyme-linked immunosorbent assay (ELISA). The results showed a significant correlation between elevated levels of Hbc and Hbs and high IL-6 concentrations, suggesting a key role of IL-6 in the immune response to HBV infections.

Keywords: Hepatitis B Virus (HBV), Hbc Antigen, Hbs Antigen, Interleukin-6 (IL-6), Immune Response, Thi-Qar Governorate, Chronic Liver Disease, Cytokine Profiles, Liver Fibrosis, Hepatocellular Carcinoma (HCC)

Introduction

Hepatitis B virus (HBV) is one of the most prevalent infectious diseases worldwide, affecting over 250 million individuals and causing nearly 1 million deaths annually due to complications such as cirrhosis and hepatocellular carcinoma (HCC) (World Health Organization, 2022). HBV is a DNA virus that primarily targets hepatocytes and can lead to both acute and chronic liver infections. Chronic infection often leads to progressive liver damage, resulting in cirrhosis and liver cancer. The immune system's response to HBV infection is mediated through both the innate and adaptive immune responses. One key aspect of this response is the production of cytokines, including pro-inflammatory cytokines like interleukin-6 (IL-6). IL-6 plays a critical role in the acute phase response and is involved in regulating immune responses, inflammation, and hematopoiesis. Elevated levels of IL-6 have been linked to various chronic diseases, including chronic liver disease and HCC (Tanaka et al., 2014).

In patients with chronic hepatitis B, the viral proteins hepatitis B core antigen (Hbc) and hepatitis B surface antigen (Hbs) are key markers of infection and immune activity. Hbc, which is associated with viral replication, and Hbs, which is involved in viral entry and immune recognition, both play important roles in the pathogenesis of HBV. Understanding the relationship between these viral markers and immune responses, such as IL-6 production, is essential for developing targeted therapies and improving patient outcomes.This study aims to explore the relationship between Hbc and Hbs viral markers and IL-6 levels in HBV-infected patients in Thi-Qar Governorate, Iraq. By characterizing these markers and their role in immune responses, the study seeks to provide insights into the mechanisms underlying HBV-related liver inflammation and potential therapeutic targets.

Materials and Methods

Study Design

A cross-sectional study was conducted between January and December 2023 in Thi-Qar Governorate, Iraq. A total of 120 patients diagnosed with hepatitis B infection were enrolled in the study. Patients were categorized into three groups based on the expression levels of Hbc and Hbs antigens.

Sample Collection

Blood samples were collected from all participants, and serum was separated for further analysis. Hbc and Hbs antigen levels were measured using quantitative ELISA kits (Bio-Rad, USA), and IL-6 concentrations were determined using the IL-6 ELISA kit (Thermo Fisher Scientific, USA).

Study Groups

1. Group A: Patients with high levels of Hbc and Hbs.
2. Group B: Patients with moderate levels of Hbc and Hbs.
3. Group C: Patients with low levels of Hbc and Hbs.

Statistical Analysis

Data were analyzed using SPSS version 26. Descriptive statistics were used to summarize demographic and clinical characteristics. One-way ANOVA was used to compare IL-6 levels between the three groups. The correlation between

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Hbc/Hbs levels and IL-6 concentrations was evaluated using Pearson's correlation coefficient. A p-value of less than 0.05 was considered statistically significant.

Results

Table 1: Demographic and Clinical Characteristics of the Study Population

Characteristic	Group A (n=40)	Group B (n=40)	Group C (n=40)
Age (years)	45 ± 12	43 ± 11	42 ± 10
Male (%)	60%	55%	50%
Female (%)	40%	45%	50%
ALT (IU/L)	120 ± 30	95 ± 25	70 ± 20
AST (IU/L)	105 ± 28	90 ± 22	65 ± 18

Table 2: Comparison of Hbc, Hbs, and IL-6 Levels in Study Groups

Marker	Group A (High)	Group B (Moderate)	Group C (Low)
Hbc (ng/mL)	75 ± 10	50 ± 8	25 ± 5
Hbs (ng/mL)	65 ± 9	40 ± 6	20 ± 4
IL-6 (pg/mL)	110 ± 20	60 ± 15	25 ± 10

Table 3: Statistical Analysis of IL-6 Levels Between Groups

Group Comparison	Mean Difference (IL-6)	p-value
Group A vs Group B	50 ± 10	< 0.01
Group A vs Group C	85 ± 15	< 0.001
Group B vs Group C	35 ± 8	< 0.05

Discussion

The results of this study demonstrate a significant correlation between high levels of Hbc and Hbs antigens and elevated IL-6 concentrations in patients with hepatitis B infection. Group A, which exhibited the highest levels of Hbc and Hbs, also had the highest IL-6 levels, suggesting that patients with increased viral load or viral activity experience heightened immune activation. Elevated IL-6 levels in these patients may contribute to the inflammatory response observed in chronic hepatitis B, which could lead to liver damage over time.

These findings are consistent with previous studies, such as Wang et al. (2020), who reported that IL-6 is a key cytokine in chronic HBV infection and is associated with liver fibrosis and cirrhosis. Additionally, elevated IL-6 levels have been linked to an increased risk of hepatocellular carcinoma, as demonstrated by Yu et al. (2021).

The results also highlight the potential of IL-6 as a therapeutic target for managing chronic HBV infection. By modulating IL-6 activity, it may be possible to reduce the inflammatory response and prevent long-term liver damage.

Conclusion

This study provides evidence of a strong association between Hbc and Hbs antigen levels and IL-6 concentrations in hepatitis B patients. Elevated IL-6 levels are indicative of a heightened immune response, which may contribute to liver inflammation and disease progression. Targeting IL-6 could offer a promising therapeutic strategy for managing chronic HBV infections and mitigating liver damage.

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