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Association between C-reactive protein levels and viral infection severity

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ABSTRACT

Background: C-reactive protein (CRP) is a vital immune response protein produced by the liver in response to inflammation, increased CRP values signify the intensity of the inflammatory response in several viral infections. *Aim:* This study investigates the link between C-reactive protein (CRP) levels and the severity of several viral infections, including hepatitis A virus (HAV), hepatitis B virus (HBV), hepatitis C virus (HCV), herpes simples 2 virus (HSV-2), and varicella-zoster virus (VZV). *Methodology*: A cross-sectional study was undertaken from the first of October 2024 to the end of November 2024. A total of fifty patients were diagnosed with a viral infection within the last four weeks. Patients were asked to complete a questionnaire and submit blood samples for investigation of CRP, viral load, and WBC counts. Results: The results revealed that CRP levels differed across patients, with HCV and VZV having higher mean values. There were substantial positive connections between CRP levels and white blood cell count, viral load, and hospitalization rates, indicating that CRP is an important index for inflammation and illness severity. *Conclusion*: The study emphasizes the clinical significance of CRP in determining illness state and directing treatment methods for viral infections.

KEYWORDS

CRP, HAV, HBV, HCV, VZV

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1. INTRODUCTION

C-reactive protein (CRP) is an acute-phase protein synthesized by the liver in reaction to inflammation, infection, and tissue injury, predominantly stimulated by interleukin-6 [1]. CRP interacts with necrotic cells and pathogens, facilitating their elimination by phagocytosis, and functions as a crucial biomarker for acute inflammation [2]. Increased CRP levels correlate with several clinical problems, such as infections, autoimmune illnesses, and chronic inflammatory disorders. Although CRP levels are elevated in bacterial infections, viral infections can also increase CRP levels, indi-

cating the body's inflammatory response [1]. Viral infections, including influenza, COVID-19, HIV/AIDS, and hepatitis, affect several organ systems and pose considerable health challenges [3]. The severity of viral infections is contingent upon factors such as the kind of virus, the individual's immune response, age, and pre-existing illnesses [4]. CRP levels increase markedly in reaction to both acute and chronic inflammation, rendering it useful for identifying infections and inflammatory illnesses, however it cannot identify the precise cause [5].

2. METHODOLOGY

2.1. Study design

A cross-sectional study performed in hospital outpatient clinics in Baghdad Medical City, Iraq, from October 1, 2024, to November 30, 2024, fifty patients were evaluated the correlation between the severity of viral infections and CRP levels through questionnaires and clinical assessments.

2.2. Inclusion/exclusion criteria

- Inclusion: adults diagnosed with a viral infection in the preceding four weeks.
- Exclusion: patients with bacterial or fungal co-infections, chronic inflammatory conditions influencing CRP levels, or individuals who denied participation or offered insufficient replies.

2.3. Data collection methods

Data Acquisition: patients were recruited via outpatient clinics, hospital records, and internet platforms. Participants filled out a validated questionnaire that included demographic information, medical history, and lifestyle variables.

Collection of blood samples: venous blood samples were obtained from subjects and analyzed for CRP levels, viral load, and white blood cell counts.

2.4. Ethical approval

This study was approved by the Scientific and Ethics Committee of the Department of Microbiology and the Council Committee of the College of Medicine, at Ibn Sina University for Medical and Pharmaceutical Sciences.

2.5. Statistical analysis

Data analysis was conducted with SPSS version 25.0. Chi-square tests, ANOVA, and Pearson's correlation coefficients were employed to analyses associations across CRP categories, severity levels, WBC counts, and viral load.

3. RESULTS

In this study, age ranged from 19 – 54 years with a mean of 39.32 ± 8.4 years. We noticed that 54.1% of patients were males; 59% were living in rural area; 57.4% were current smokers; and 42.6% were diabetics. The most common viral infection was HCV (52.5%); 19.7% diagnosed with HBV, both of HAV and HSV-2 were seen in 11.5%, and 4.9% had VZV.

This study showed that 59% of patients needed hospitalization and 44.3% of them were diagnosed with viral infection for a period between 1 – 2 weeks. No significant difference detected in the mean CRP level between different types of viral infections.

Table 1 shows that CRP level had a significant strong positive correlation with viral load (r=0.76, p=<0.001), a significant strong positive correlation with WBC count (r=0.828, p=<0.001), and a significant moderate positive correlation with hospitalization duration (r= 0.543, p=0.005).

Table 1. Correlation between CRP levels and certain parameters.

Parameters	CRP level (mg/L)	
	Correlation (r)	p-value
Viral load (copies/ml)	0.76	<0.001
WBC count (10^9/L)	0.828	<0.001
Hospitalization duration (Days)	0.543	0.005

4. DISCUSSION

C-reactive protein (CRP) serves as a critical marker of inflammation and immunological response, increasing following tissue injury, inflammation, and infection [1]. This study highlights the clinical significance of CRP in assessing the severity and development of viral infections. The research underscores the frequency of viral infections among individuals aged 31 to 50 years, indi-

cating a greater occurrence in men, possibly attributable to variables such as injectable medication usage and hormonal variations. Additionally, it indicates that 59.01% of participants are from rural regions, where elevated rates of HCV, HBV, and VZV are noted [6]. Comprehending CRP variations in viral infections offers significant insights into illness pathophysiology and clinical management, becoming CRP an essential instrument for monitoring and controlling these infections [7].

Smoking elevates the risk of infectious illnesses by compromising the body's immune defenses, rendering smokers more vulnerable. The World Health Organization projects that tobacco consumption will represent around 9% of worldwide fatalities from 2000 to 2025. Smoking affects nearly every organ and is an established risk factor for respiratory and many infectious illnesses. Chronic conditions such as diabetes and cardiovascular disorders heighten vulnerability to viral infections, including HBV [4].

Diabetes and other ailments impair immunity, rendering these persons more susceptible to infections. The most elevated CRP levels were noted in VZV infections, succeeded by HCV and HBV, while the lowest values were recorded in HSV-2 and HAV infections [5]. Research indicates substantial relationships between CRP levels and illness severity, including associations with WBC count and viral load [8]. Elevated CRP levels are associated with severe infections and consequences, frequently necessitating hospitalization [9]. Nonetheless, CRP levels may not reliably forecast the influence of infections on everyday activities owing to many reasons. CRP serves as a significant biomarker for the surveillance and management of viral infections, indicating the intensity of the inflammatory response and informing therapeutic choices [10].

5. CONCLUSION

This study highlights the essential function of CRP as a biomarker for evaluating the severity of viral infections. Substantial relationships were identified between CRP levels and markers of illness severity, including viral load, leukocyte count, and hospitalization rates. The correlation between CRP levels and daily activity impairment was modest and insignificant, indicating that additional variables may affect functional results. The results underscore the therapeutic significance of CRP in assessing inflammatory responses and directing prompt management and treatment of viral infections, hence improving patient care.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

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