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Correlation between Serum C-reactive protein Level with Severity of Covid19 Disease

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Abstract

Background: New coronavirus pneumonia (COVID-19) is a health emergency due to its high infectiousness and high case fatality in critically ill patients. C-reactive protein is one of the acute phase proteins and nonspecific markers of inflammation and has been found to correlate with disease severity and treatment of many infectious and non-infectious conditions.

Objective: To correlate the serum level of C-reactive protein among COVID-19 Patients with disease severity.

Materials and Methods: this analytical cross-sectional study, was conducted at Aliaa specialized hospital, Omdurman city, Khartoum state, during the period from January to March 2021. Fifty patients diagnosed with covid-19 using RT-PCR, were enrolled in the study and then classified into severe patients and non-severe patients The CRP was measured by Particle enhanced immunoturbidimetric assay in Integra 400 fully automated instruments. The data were analyzed using SPSS version (25).

Results: Out of fifty patients, 42 patients were the non-severe group, and the remaining eight patients were the severe group. The average age was 66.45 years (ranging between 30 and 120 years), and 54% of patients were males and 36% were females. The most common coexisting conditions were Diabetes Mellitus and hypertension; 60% of patients were having a Diabetes Mellitus, and 52% of patients were having hypertension. The study's findings indicated that the mean CRP level of severe group was considerably higher than that of the non-severe group (365.75± 209.378), with a p-value of (0.002) and the results of the correlation analysis revealing a strong positive link between the severity of the disease and CRP (r=0.419**, p=0.002).

Conclusion: serum C-reactive protein has been found to correlate with disease severity.

Keywords: Covid19, C- reactive protein, Coronavirus.

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Introduction:

The 2019 novel coronavirus (2019-CoV) or the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) as it is now called, is spreading rapidly around the world from its origin in Wuhan City in Hubei Province of China [1].

In total, 494,215,930 cases of Coronavirus disease 2019 (COVID-19) were reported worldwide and 2.35 million deaths were reported as of April 6, 2022, in Sudan 29851 cases were reported. In critically ill patients, COVID-19 is a health emergency due to its high infectiousness and high mortality rates. The pathological and physiological processes and diagnostic methods of COVID-19 are challenged specially for new variants of the virus. In order to improve case

fatality, clinical monitoring and appropriate treatment strategies were essential [2].

On February 28, 2020, the World Health Organization raised the global assessment of the risk of COVID-19 spread and impact to very high [3,4].

Reducing the virus's spread and mortality has become a worldwide issue. Because of the rapid increase in the number of COVID-19 patients, hospitals in many regions are facing significant challenges. Severe patients are typically treated in the intensive care unit, while mild patients are admitted to the isolation ward [5]. However, a small percentage of non-severe patients will progress to severe cases. As a result, identifying this group of patients early and actively monitoring and treating them is critical to reducing mortality and improving outcomes in COVID-19 patients [6]. C-reactive protein (CRP) is a non-specific acute phase reactant produced by hepatocytes during infection or inflammation [7]. C-reactive protein (CRP) can be used to help differentiate between viral and bacterial infections. Higher levels indicate more severe infection and have been used as an indicator of COVID-19 disease severity in several studies [8,9]. It can also be used to make an early diagnosis of pneumonia, and patients with severe pneumonia had elevated CRP levels. Because of the high mortality rate of Covid-19 and the lack of effective treatments, it is critical to control covid-19 infections to reduce outcomes and prevent disease aggravation [9,10].

Many studies were conducted to assess the serum level of C - reactive protein and correlate it with disease severity [11, 12]. Elevated levels of serum C-reactive protein (CRP) have been observed in patients with COVID-19 and used to assist with triage, diagnostics, and prognostication [13, 14]. The pathological, physiological, and diagnostic methods of COVID-19 are in the fact-finding stage. Upon examination, the clinical features can be interpreted more clearly through the use of biological markers like CRP. Therefore, investigation of the CRP level might have paramount importance for early diagnosis and appropriate management of COVID-19-related complications [15]. This article aims to explore C - reactive protein in the context of COVID-19 pathogenesis and assess how its level changes with the severity of the disease, and correlate it serum level of C - reactive protein with disease severity.

Materials and Methods

This was cross-sectional study was conducted in Khartoum state at Aliaa specialized hospital during the period from January to March 2021. Fifty subjects were enrolled in the study and then classified into severe patients and non-severe patients according to the clinical criteria, physical examination as po2, CT scan results.

Inclusion and exclusion criteria: patients diagnosed with covid-19 and accepted to participate in the study were included. Patient who refuse to participate in the study, in addition to patient with any type of infection and

inflammation and patient with incomplete data were excluded.

Ethical consideration: The local committee of AL Neelain University, the Faculty of medical laboratory sciences, and the ministry of health ethically approved the study. All participants were informed verbally of the aim of the study whereas subjects who refused to participate were excluded from the study. A detailed history was taken from each individual using a pre-designed questionnaire.

Blood sampling: An expert lab technician under a septic condition collected venous blood sample (3ml) from Covid-19 patients in plain containers, blood samples were left to clot at room temperature then serum was separated by centrifugation at 3000 rpm for 5 min for measuring the CRP. The CRP was measured by Particle enhanced immunoturbidimetric assay in Integra 400 full automated instruments. Reference Range (Expected Values: <0.8 mg/dL).

Statistical analysis: The data were analyzed using SPSS version (25). Independent T-test was used to compare mean value C - reactive protein level between severe and non-severe groups, then person correlation coefficients was used to correlate C - reactive protein level with disease severity. Results were expressed as Mean± SD., with the level of significance set at P-value<0.05.

Results

Among the 50 included patients in the age range of 30 to 120 years, 42 patients belong to non-severe group and eight were severe. The average age was 66.45 years, and 54% of patients were male and 36% were female. 30 patients were have Diabetes Mellitus which represent 60%, and 26 patients have a Hypertension which represent 52% of patient were the most common coexisting conditions (Table 1, Figure 1).The study results showed that, the mean level of CRP was significantly high in severe group (365.75 ± 209.378) than in non-severe group (219.02 ± 95.349) with p value (0.002) (Table 2). The correlation analysis showed significant positive correlation between CRP ($r=0.284^{*}$, p= 0.045) with Disease severity (Figures 3).

Table 1: Demographic Characteristics of Study population

	Severe (8)	Non-severe (42)	P value
Age	72.75 ± 24.341	60.14 ± 13.968	0.04
Diabetes mellitus	8 (16.0%)	22 (44.0%)	
Hypertension	8 (16.0%)	18 (36.0%)	

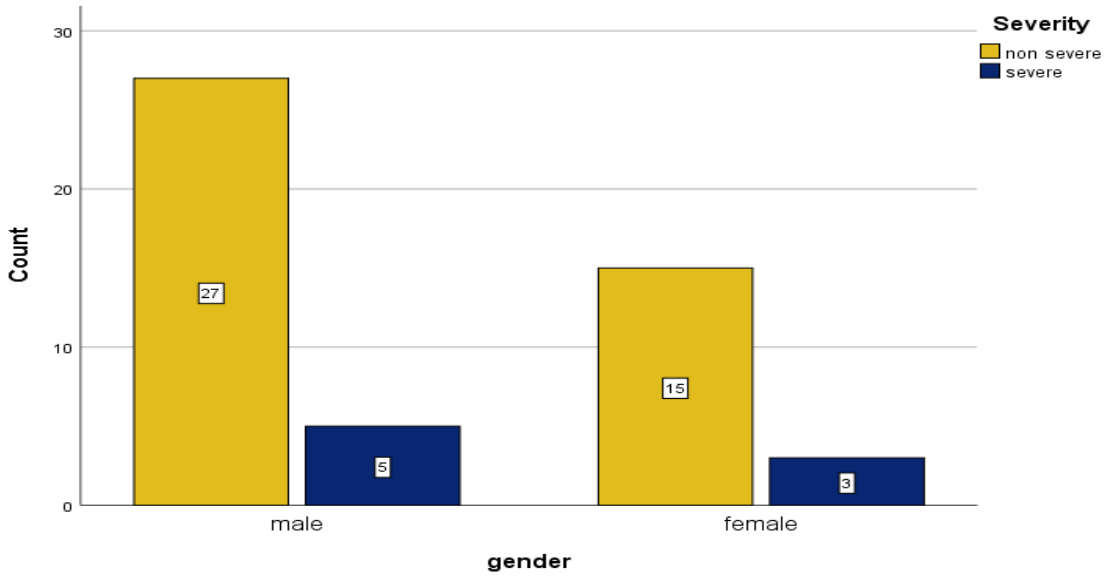

Figure 1: Gender distribution in study population

Table 2: Compares the mean level of CRP in study groups

	Severe (8)	Non-severe (42)	P value
Serum CRP	365.75 ± 209.378	219.02 ± 95.349	0.002

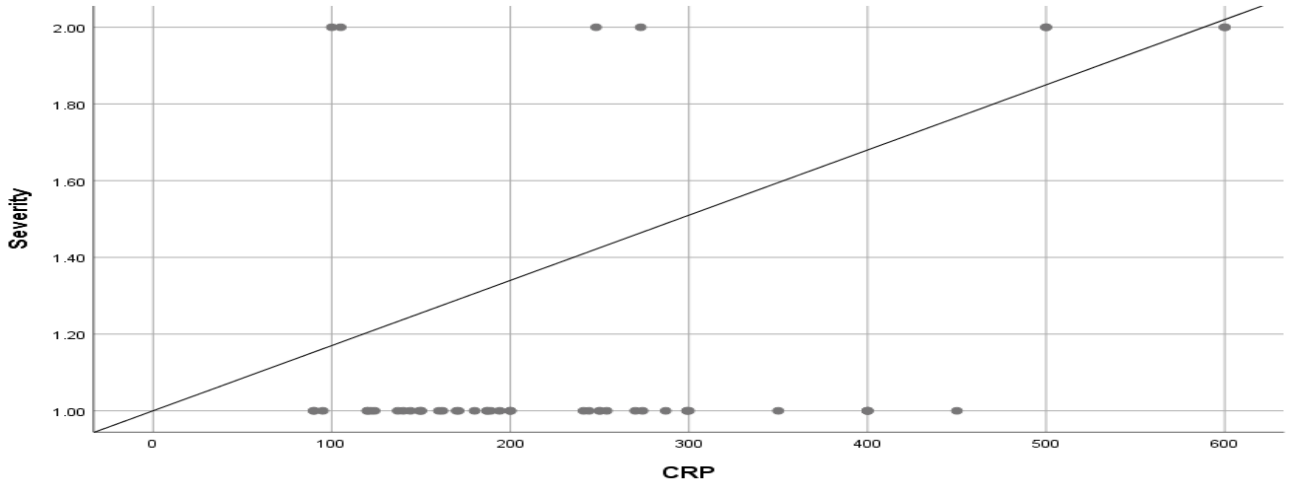

Figure 3: Show correlation of CRP with Disease severity

Discussion

C-reactive protein (CRP) is now considered as a biomarker of infection and can be used as a precise and fast indicator of the chronic inflammation in the human body, because CRP rises dramatically within hours of infection, which activate the complement system via the classical pathway and macrophages via Fc-receptors [16]. In the context of the SARS-CoV-2-induced disease COVID-19 it is remarkable that CRP plasma levels rise to an extent similar to bacterial infections .Further, CRP levels correlate with bad prognosis in COVID-19 and were emphasis to be a reliable marker for a huge

number of deleterious processes [17, 18, 19]. In this study a 50 patients diagnosed with COVID-19 were recruited to correlate the level of CRP with disease severity, and the results showed a significant increase in the level of CRP within the COVID-19 which agrees with the previous study[3,20,21] and a more Elevated levels of CRP were observed up in severe COVID-19 patients than non-severe cases [3,12, 20,22,23,24,25] . This elevation indicates that covid19 disease is progressed and lung lesion of patients is large. The elevated levels of CRP might be linked to the overproduction of inflammatory cytokines (cytokines storm) in severe patients with COVID-19. Cytokines fight against the microbes but when the immune system becomes hyperactive, it can damage lung tissue. Thus, CRP production is induced by inflammatory cytokines and by tissue destruction in patients with COVID-19 [26]. The CRP levels were really interrelated with lung lesion and disease severity. This recommends that in the initial period of COVID-19, CRP levels may give the clinician first thought about severity of disease and size of lung lesions. It is clearly known that an appropriate treatment of infected individuals has a great implication in controlling the infectious diseases. Hence, there is an urge of early indicator biomarker of severity in the era of COVID-19 that may help to initiate timely and effective treatment strategies. Infection with COVID-19 is characterized by exuberant inflammatory reaction, particularly of the severe form of the disease resulting from excessive inflammation contributing to the loss of lives related to COVID-19. CRP is an indicator of systemic inflammation. Therefore, the level of CRP may clearly show not only the progression of mildly infected individuals but also dictate the recovery or adverse outcome of severe patients. CRP preferably binds to phosphocholine expressed highly on the surface of damaged cells. This binding makes active the classical complement pathway of the immune system and modulates the phagocytic activity to clear microbes and damaged cells from the organism. When the inflammation or tissue damage is resolved, CRP concentration falls, making it a useful marker for monitoring disease severity. In addition to being a biomarker of acute inflammation, it has recently been shown to be associated with chronic inflammation, such as cardiovascular diseases and Type II diabetes mellitus which may aggregated the severity of patient if infected with COVID- 19 [26, 27].

This study also showed that the number of male patients more than female in this study population with agree with previous study [28].

Conclusion

Finally, this study was concluded that elevation of CRP level increased in severe patients of covid 19 more than in mild cases, and the patients may be in a worse state of this disease.

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