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ORIGINAL ARTICLE

CRP as a Prognostic Indicator in Hospitalized Patients with Covid-19

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ABSTRACT

Objective: The aim of this study is to determine the CRP as a prognostic indicator in hospitalized patients with COVID-19.

Study Design: Retrospective observational study

Place and Duration: Sahiwal Medical College, Sahiwal. Jan 2021-Nov 2021

Methods: There were ninety patients had coronavirus disease of both genders were presented in this study. Patients were aged between 20-75 years were admitted in hospital. Informed written consent was taken from all the patients for detailed demographics age, sex, body mass index, education status and residency. Symptoms and comorbidities were calculated among all patients. Outcomes were CRP level was indicated among severe, non-severe and died patients with pandemic disease. Hospital stay was also calculated. Chi square and test was used for categorical variables. SPSS 22.0 version was used to analyze complete data.

Results: Mean age of the patients was 50.12±3.45 years with mean BMI 27.88±6.34 kg/m^2. Majority of the patients 55 (61.1%) were males and 35 (38.9%) were females. 52 (57.8%) cases were from urban areas and 38 (42.2%) were from rural areas. 49 (54.4%) patients were literate. Fever, dry cough and fatigue were the most common symptoms in patients. Hypertension and diabetes mellitus were the most common comorbidity. Among 90 cases, rate of mortality was 19 (21.1%). We found that mean CRP level among died patients were significantly higher 184.11±89.67 mg/L as compared to severe patients 134.13±111.14 mg/L and non-severe patients 89.34±64.43 mg/L. Mean hospital stay was 6.09±6.34 days.

Conclusion: According to our findings, CRP levels rise rapidly in COVID-19 patients, and these data suggest that CRP could be used clinically to predict COVID-19 prognosis and severity before disease progression and the manifestation of clinical symptoms. CRP is an acute-phase, non-specific serological biomarker of inflammation and infection and is linked to disease severity and outcomes.

Keywords: Coronavirus, C-reaction protein (CRP), Outcomes, Mortality

INTRODUCTION

The severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) pandemic has taxed worldwide critical care capacity since indications of the resultant coronavirus disease 2019 (COVID-19) may include abrupt respiratory failure needing mechanical ventilation. Beyond isolated pulmonary disease, COVID-19 has been associated with substantial inflammation leading to neurologic, cardiovascular, coagulation, and other end-organ symptoms. Identifying indications of illness severity may potentially help to identify individuals at risk of extended critical care or death.

Several retrospective assessments have evaluated the clinical features and outcomes of hospitalised patients with COVID-19 [1,2]. Derangements in laboratory markers of inflammatory response, particularly C-reactive protein (CRP), have been found as predictors of clinical severity and consequences [3,4]. CRP is an acute-phase, nonspecific measure of inflammation or infection and has been demonstrated to broadly correlate with disease severity and treatment response across a number of infectious and noninfectious disorders [5]. Elevated CRP levels have been previously documented in severe acute respiratory syndrome, Middle East respiratory syndrome, H1N1 influenza [9–11]. Recent investigations have indicated that CRP levels are increased in individuals with COVID-19 and may correlate with severity of disease and disease progression [6]. As such, CRP has promise as a possible predictive biomarker.

Current outbreak of SARS-CoV-2 virus resulted in catastrophic global public health crisis. The United States emerged as the epicentre of this pandemic with global numbers continuously on the increase. Despite substantial progress in management of COVID-19 patients, there are no good diagnostic and prognostic indications of disease severity to guide therapy. The involvement of systemic inflammatory response has been increasingly recognized in pathophysiology of COVID-19 infection. Studies have revealed that uncontrolled inflammation is a primary contribution to the illness severity as greater levels of inflammatory markers, particularly C reactive protein (CRP), are connected with disease severity in patients with SARS-CoV-2 [7].On the other hand, patient's nutritional state effects the host immune system and poor nutrition is connected with altered immunocompetence and higher risks of infections [8]. Albumin has long been employed as a nutritional status indicator, and a link between hypoalbuminemia and severe COVID-19 disease [9] has just been discovered. Inflammation and nutritional status can be reflected in the CRP/Albumin (CRP/Alb) ratio, which represents the ratio of a positive acute phase inflammatory reactant to a negative one. Prognostic biomarkers in various inflammatory states and illnesses have recently been identified using this biomarker.

Patients with COVID-19 may have no symptoms or just minor symptoms. Only a small percentage of patients experienced a life-threatening sickness, and many of those individuals died as a result of their condition. COVID-19 can be considered to have cytokine storm, multiorgan illness, and a wide range of physiological pathways disrupted by fibrinolysis and hemostasis.[10]

It is possible to identify COVID-19 severity early and to monitor bad outcomes, mortality and prognosis of patients with COVID-19 using biomarkers that show abnormalities in inflammatory, haematological, and biochemical biomarkers.[11] COVID-19 patients with abnormal laboratory parameters have recently become apparent, and published studies have recommended that specific clinical laboratory parameters may help in risk stratification and prognosis of these patients, ultimately leading to earlier interventions and the achievement of desired clinical outcomes.[12,13]

A retrospective observational study of the temporal course of CRP and its connection to all-cause mortality in hospitals was therefore carried out. It was determined that LOS, hospitalization, and the rate at which the patient was intubated were secondary outcomes that were evaluated. More attention was paid to the association between C-reactive protein (CRP) levels and disease severity in severe COVID-19 patients, since CRP levels were shown to be elevated in patients with severe COVID-19.

MATERIAL AND METHODS

This retrospective observational study was conducted at Sahiwal Medical College, Sahiwal and comprised of ninety patients. genders were presented in this study. Patients were aged between 20-75 years were admitted in hospital. Informed written consent was taken from all the patients for detailed demographics age, sex, body mass index, education status and residency. Patients <20 years and those did no give any written consent were excluded from this study.

Patients were aged between 20-75 years were admitted in hospital. Mild people have general symptoms such as fever and cough but no respiratory symptoms or abnormal chest findings. Those with a SpO2 of 94 percent or more are considered moderate patients. SpO2 94%, respiratory rate greater than 30 breaths/minute (bpm), PaO2/FiO2 300 mm Hg, lung infiltrates greater than 50%, nasal cannula and high flow oxygen required in severe patients Patients in dire need of a life-saving intensive care unit include those with acute respiratory distress syndrome, septic shock, cytokine storm, and multi-organ failure. COVID-19 individuals with serious illness show abnormalities in hematological, biochemical, and inflammatory biomarkers, which support the use of these biomarkers in risk classification models. COVID-19 individuals in epidemic areas with inadequate health resources can benefit from these biomarkers, which can detect patients who are at risk of developing severe disease even before they exhibit clinical signs. The severity of COVID-19 can be assessed using the following tests: C-reactive protein, albumin, lactate dehydrogenase, neutrophil to lymphocyte ratio, lymphocyte count, procalcitonin, albumin, thrombocytes, and ferritin. In COVID-19 patients, a decrease in lymphocytes, thrombocytes, albumin, and an increase in CRP, NLR, procalcitonin, D-Dimer, and ferritin have all been seen.

Outcomes were CRP level was indicated among severe, non-severe and died patients with pandemic disease. Hospital stay was also calculated. Chi square and test was used for categorical variables. SPSS 22.0 version was used to analyze complete data.

RESULTS

Mean age of the patients was 50.12±3.45 years with mean BMI 27.88±6.34 kg/m^2. Majority of the patients 55 (61.1%) were males and 35 (38.9%) were females. 52 (57.8%) cases were from urban areas and 38 (42.2%) were from rural areas. 49 (54.4%) patients were literate. Fever, dry cough and fatigue were the most common symptoms in patients. Hypertension and diabetes mellitus were the most common comorbidity.(table 1)

Table 1: Baseline details of enrolled cases

Variables	Frequency	Percentage
Mean age (years)	50.12±3.45	
Mean BMI (kg/m^2)	27.88±6.34	
Gender		
Male	55	61.1
Female	35	38.9
Residency		
Urban	52	57.8
Rural	38	42.2
Literacy		
Yes	49	54.4
No	41	45.6
Symptoms		
Fever	45	50
Dry cough	20	22.2
Fatigue	15	16.7
Anorexia	10	11.1
Co-morbidities		
Hypertension	47	52.2
Diabetes mellitus	23	25.5
Cardiovascular disease	12	13.3
Chronic kidney disease	8	8.9
Vaccinated		
Yes	50	55.5
No	40	44.5

Among 90 cases, rate of mortality was 19 (21.1%), 40 (44.4%) cases were severe and 31 (33.3%) patients were non-severe. Mean hospitalization of patients was 6.09±6.34 days.(table 2)

Table 2: Association of severity and mortality rate among cases

Variables	Frequency	Percentage
Mean Hospital Stay (days)	6.09±6.34	
Severe	40	44.4
Non-severe	31	34.4
Mortality	19	21.1
Total	90	

Table 3: Association of CRP level among enrolled cases

Variables	Frequency	P Value
CRP Level mg/mL		
Died	184.11±89.67	0.03
Severe	134.13±111.14	0.01
Non-severe	89.34±64.43	0.04

We found that mean CRP level among died patients were significantly higher 184.11±89.67 mg/L as compared to severe patients 134.13±111.14 mg/L and non-severe patients 89.34±64.43 mg/L.(table 3)

DISCUSSION

According to our findings, CRP levels are a reliable predictor of mortality regardless of a person's age, body mass index (BMI), or other medical conditions. The greater the risk of death for a patient, the higher the CRP level was. Both CRP levels and the period of hospitalisation from admission to discharge were linked. However, there was no correlation between CRP levels and outcomes. Despite the fact that age was an important predictor of patient mortality, the association between CRP levels and death cannot be discounted. Additionally, the CRP level was not the only parameter that was statistically significant when evaluating LoS, and more research is needed to identify which parameter, if any, is the most important in prolonging LoS.

In this retrospective observational study 90 patients of both genders had coronavirus were included. Mean age of the patients was 50.12±3.45 years with mean BMI 27.88±6.34 kg/m^2. Majority of the patients 55 (61.1%) were males and 35 (38.9%) were females. 52 (57.8%) cases were from urban areas and 38 (42.2%) were from rural areas. Findings of our research were comparable to the studies conducted in past.[14,15] 49 (54.4%) patients were literate. Fever, dry cough and fatigue were the most common symptoms in patients. Hypertension and diabetes mellitus were the most common comorbidity. A study of 191 COVID-19 patients found that 75% had bilateral lung infiltration, 71% had ground glass opacity, and 67% had a lactate dehydrogenase level >245 U/L [16]. C-reactive protein (CRP) is an inflammatory marker, and the findings of this study reveal that higher levels of C-reactive protein in patients indicate a more severe disease and worse outcomes for patients. If CRP levels are elevated, future studies may examine the effects of corticosteroids and/or other anti-inflammatory medicines on patient outcomes [17]. CRP was the primary focus of this study as a predictor of COVID-19 results, not infection therapy. A statistically significant sample of patients who got dexamethasone was not included in the raw data.

Among 90 cases, rate of mortality was 19 (21.1%), 40 (44.4%) cases were severe and 31 (33.3%) patients were non-severe. Mean hospitalization of patients was 6.09±6.34 days. It is possible to predict disease severity, unfavourable events, prognosis, and mortality in COVID-19 patients based on CRP levels alone. Because severe patients are more likely to have high CRP levels than non-severe patients, high CRP levels in COVID-19 patients at the time of hospital admission suggest that CRP can be used as an independent biomarker for earlier detection of disease severity [18,19], and because severe patients are more likely to have high CRP levels than non-severe patients, high CRP levels in COVID-19 patients at the time of hospital admission indicate that the disease has progressed [20]. In COVID-19 patients, elevated CRP levels are highly associated with the prognosis of the disease [21]. Therefore, high CRP levels should be used in clinical practise to guide COVID-19 disease severity. As above mentioned our study is comparable. We found that mean CRP level among died patients were significantly higher 184.11±89.67 mg/L as compared to severe patients 134.13±111.14 mg/L and non-severe patients 89.34±64.43 mg/L.

In COVID-19 patients, high CRP levels due to elevated IL-6 release strongly predict the requirement for mechanical ventilation, which implies the like-hood of utilising CRP to guide treatment in COVID-19 patients who might need mechanical ventilation in the future due to hyperinflammatory syndromes. That's why COVID-19 sufferers need to keep their CRP levels in check. In terms of disease severity and mortality, a biomarker called C-reactive protein (CRP) is a practical, affordable, and simple to get option. COVID-19 patients can be monitored and treated with the help of this tool in conjunction with other clinical indicators of prognosis and diagnosis. We can enhance the prognosis and lower fatality rates by doing so. To better stratify and allocate health resources in areas with limited resources, we can conclude that COVID-19 patients' complete laboratory score should be taken into account to predict severity and prognosis regardless of their clinical status for risk stratification and optimal health resource allocation, especially in areas with limited health resources.

CONCLUSION

According to our findings, CRP levels rise rapidly in COVID-19 patients, and these data suggest that CRP could be used clinically to predict COVID-19 prognosis and severity before disease progression and the manifestation of clinical symptoms. CRP is an acute-phase, non-specific serological biomarker of inflammation and infection and is linked to disease severity and outcomes.

REFERENCES

1. Wu Z, McGoogan JM. Characteristics of and Important Lessons From the Coronavirus Disease 2019 (COVID-19) Outbreak in China [Internet]. JAMA. 2020;323(13):1239 Available from: 10.1001/jama.2020.2648
2. Roxby AC, Greninger AL, Hatfield KM, et al. Outbreak Investigation of COVID-19 Among Residents and Staff of an Independent and Assisted Living Community for Older Adults in Seattle, Washington. JAMA Intern Med [Internet] 2020; Available from: 10.1001/jamainternmed.2020.2233
3. Zhang L, Yan X, Fan Q, et al. D-dimer levels on admission to predict in-hospital mortality in patients with Covid-19. J Thromb Haemost 2020;18(6):1324–9. 10.1111/jth.14859 [
4. Velavan TP, Meyer CG. Mild versus severe COVID-19: Laboratory markers [Internet]. International Journal of Infectious Diseases. 2020;95:304–7. Available from: 10.1016/j.ijid.2020.04.061
5. Clyne B, Olshaker JS. The C-reactive protein. J Emerg Med 1999;17(6):1019–25. 10.1016/s0736-4679(99)00135-3
6. Ko J-H, Park GE, Lee JY, et al. Predictive factors for pneumonia development and progression to respiratory failure in MERS-CoV infected patients. J Infect 2016;73(5):468–75.
7. Vasileva D, Badawi A. C-reactive protein as a biomarker of severe H1N1 influenza. Inflamm Res 2019;68(1):39–46.
8. Herold T, Jurinovic V, Arnreich C, et al. Elevated levels of IL-6 and CRP predict the need for mechanical ventilation in COVID-19. J Allergy Clin Immunol [Internet] 2020;Available from: 10.1016/j.jaci.2020.05.008

9. Ponti G, Maccaferri M, Ruini C, Tomasi A, Ozben T (2020) Biomarkers associated with COVID-19 disease progression. Crit Rev Clin Lab Sci 57: 389-399
10. Aziz M, Fatima R, Lee-Smith W, Assaly R (2020) The association of low serum albumin level with severe COVID-19: a systematic review and meta-analysis. Crit Care 24: 255
11. Oh TK, Song IA, Lee JH (2018) Clinical usefulness of C-reactive protein to albumin ratio in predicting 30-day mortality in critically ill patients: A retrospective analysis. Sci Rep 8: 14977
12. Thachil J, Srivastava A. SARS-2 coronavirus-associated hemostatic lung abnormality in COVID-19: is it pulmonary thrombosis or pulmonary embolism? Semin Thromb Hemost. 2020;46:777-780.
13. Lippi G, Plebani M. Laboratory abnormalities in patients with COVID-2019 infection. Clin Chem Lab Med. 2020;58:1131-1134.
14 Sharifpour M, Rangaraju S, Liu M, et al. C-Reactive protein as a prognostic indicator in hospitalized patients with COVID-19. PLoS One. 2020;15(11):e0242400. Published 2020 Nov 20. doi:10.1371/journal.pone.0242400
15 Sharifpour M, Rangaraju S, Liu M, Alabyad D, Nahab FB, Creel-Bulos CM, et al. (2020) C-Reactive protein as a prognostic indicator in hospitalized patients with COVID-19. PLoS ONE 15(11): e0242400
16 Zhou, F, Yu, T, Du, R, Fan, G, Liu, Y, Liu, Z, et al.. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. Lancet 2020;395:1054–62.
17 Horby, P, Lim, WS, Emberson, JR, Mafham, M, Bell, JL, Linsell, L, et al.. RECOVERY Collaborative Group. Dexamethasone in hospitalized patients with Covid-19. N Engl J Med 2021;384:693–704.
18 Chen W, Zheng KI, Liu S, Yan Z, Xu C, Qiao Z. Plasma CRP level is positively associated with the severity of COVID-19. Ann Clin Microbiol Antimicrob. 2020;19:18 Chen W, Zheng KI, Liu S, Yan Z, Xu C, Qiao Z. Plasma CRP level is positively associated with the severity of COVID-19. Ann Clin Microbiol Antimicrob. 2020;19:18
19 Ahnach M, Zbiri S, Nejjari S, Ousti F, Elkettani C. C-reactive protein as an early predictor of COVID-19 severity. J Med Biochem. 2020;39:500-507.
20 Sadeghi-Haddad-Zavareh M, Bayani M, Shokri M, Ebrahimpour S, Babazadeh A, Mehraeen RMehraeen R, et al. C-reactive protein as a prognostic indicator in COVID-19 patients. Interdiscip Perspect Infect Dis. 2021;2021
21 Poggiali E, Zaino D, Immovilli P, Rovero L, Losi G, Dacrema ADacrema A, et al. Lactate dehydrogenase and C-reactive protein as predictors of respiratory failure in CoVID-19 patients. Clin Chim Acta. 2020;509:135-138.
22 Laguna-Goya R, Utrero-Rico A, Talayero P, Lasa-Lazaro M, Ramirez-Fernandez A, Naranjo LNaranjo L, et al. IL-6-based mortality risk model for hospitalized patients with COVID-19. J Allergy Clin Immunol. 2020;146:799-807.e9
23 Wang L. C-reactive protein in the early stages of COVID-19. Med Mal infect. 2020;50:332-334