

## Study of C-reactive Protein in COVID-19 Patients in Tertiary Care Hospital, Jharkhand

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### Abstract

**Aims:** This study was aimed to measure and evaluate the C-reactive protein in diagnosed cases of COVID-19 Patients.

**Study design:** An observational study.

**Place and Duration of Study:** Department of Biochemistry, Sheikh Bikhari Medical College and Hospital, Hazaribag, Jharkhand, between 28<sup>th</sup> March 2021 and 27<sup>th</sup> April 2021.

**Methodology:** We included 238 patients (140 men, 98 women; age range 18-99 years) with documented COVID-19 were reviewed. The subjects were divided into two group severe and non-severe COVID-19. The details were recorded on a pre-structured performa. Between group, differences were tested using the Mann-Whitney's U-test. The receiver operating characteristic curve was plotted for C-reactive protein with severity. A binary logistic regression was used to identify variables independently associated with severity. The data was analyzed using Statistical Package for the Social Sciences (SPSS).

**Results:** Out of 238 patients, 136 patients were included in non-severe group and 102 patients in severe group. Patients with increased CRP levels were significantly higher ( $p < 0.05$ ) in severe cases [median 78.7 mg/L, interquartile range (IQR) 65.5-92.0] than in non-severe patients [median 25.5 mg/L, interquartile range (IQR) 12.4-38.8]. Binary logistic regression showed ferritin to be an independent predictor of all-cause mortality supplemented with an AUC of 0.67 on ROC analysis.

**Conclusions:** CRP levels are an indicator of disease severity and prognosis of disease. Those patients who have higher CRP level have poor prognosis so CRP level must be monitored during course of disease.

**Keywords:** [covid-19, C-reactive protein, severe, prognosis]

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### I. Introduction

The novel coronavirus disease 2019 (COVID-19) that emerged in December 2019 in Wuhan (Hubei, China), has surprisingly occupied the entire globe overwhelmingly, with many countries experiencing the second wave [1]. By March 30, 2021, 127,349,248 confirmed cases of COVID-19, including 2,787,593 deaths, were reported to the World Health Organization (WHO) [2]. Even though the rapidly evolving clinical course and presentation continue to amaze the medical fraternity, cases infected with this severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), often present with severe pneumonia and organ targeted injuries involving the liver, heart, and kidneys [3]. With the surging devastating effects of the pandemic, the focus of scientific efforts was on developing optimal therapeutic regimens to combat the virus. Meanwhile, there was also a dire need for early risk stratification systems and biomarkers to predict disease progression, to identify high-risk patients at an early stage of the infection [4-6]. Recently, some studies have reported that C-reactive protein (CRP) levels can be used in the early diagnosis of pneumonia and that higher CRP levels were associated with severe pneumonia [6]. Hence, the current study aims to measure and evaluate the CRP levels to provide a reference for the clinical management of COVID-19 patients.

### II. Material And Methods

#### 2.1 Study Population

The observational study was carried out at Department of Biochemistry, Sheikh Bikhari Medical College and Hospital, Hazaribag, Jharkhand, from 28<sup>th</sup> March 2021 to 27<sup>th</sup> April 2021. A total of 238 COVID-19 patients enrolled from COVID ward of Sheikh Bikhari Medical college and Hospital, Hazaribag, Jharkhand in this study and divided into non-severe and severe groups. Non-sever group included 136 patients and severe group included 102 patients. All patients with COVID-19 who enrolled in the recent study were diagnosed according to the WHO interim guidance for COVID-19 (6th edition) [7]. In other words, all patients with the physician- and laboratory confirmed (positive nasopharyngeal/throat swab specimens by reverse transcription-polymerase chain

reaction (RT-PCR)) COVID-19 infection were included, while suspected cases with similar clinical symptoms were excluded. One of the following criteria was used to determine severe COVID-19 illness: respiratory rate >30 bpm, oxygen saturation <93% on room air, arterial oxygen partial pressure (PaO<sub>2</sub>)/ oxygen concentration (FiO<sub>2</sub>) ≤300 mm Hg, and intensive care unit (ICU) admission.

### 2.2 Analysis of serum CRP

Serum analysis for CRP was determined on fully automated autoanalyser (AU 480, BECKMAN COULTER), which works on absorptive spectrophotometry using Immunoturbidimetric method. The blood sample was collected, as per the standard protocol. The concentrations of CRP were expressed in mg/L.

### 2.3. Statistical Analysis.

Statistical data were analyzed using SPSS version 20.0. As the data that was skewed; median values were reported along with interquartile ranges (IQR) for continuous variables. Between group, median differences were tested using the Mann–Whitney’s U-test and categorical variable were compared by chi-square test. The predictive value of the CRP was evaluated by measuring the area under the receiver operating characteristic curve (AUC). A “p value” below 0.05 was considered statistically significant and p < 0.001 considered statistically highly significant.

## III. Results

A total of 238 inpatients were declared COVID-19 positive during the study duration. Out of these, 138 patients were included in the severe group, while 102 patients were included in the non-severe group. Median age of severe group was 57 (IQR: 50–68) years and median age of non-severe group was 52.4 (IQR: 35–62) years. The average age was higher in the severe group than in the non-severe group (p = 0.08) as shown in Table 1. Out of 238 patients 140 patients were male and 98 patients were female. Out of 98 female 33 female were included in severe group and 65 female in non-severe group. Out of 140 male, 83 male were included in severe group and 57 male were included in non-severe group as mentioned in table 2 and figure 1. The severity ratio for males was higher than for females, but this difference was not significant (p = 0.56). Median CRP being 78.7 (IQR: 65.5–92.0) and 25.5 (IQR: 12.4–38.8) mg/L was found to be significantly higher in the severe group compared to the non-severe cases group respectively (p value = 0.002) as shown in table 1.

**Table 1**  
Age and CRP levels in severe Vs Non-severe

Groups	Age (median, IQR) (years)	CRP median (IQR) (mg/L)
Severe case (n=102)	57.4 (50-68)	78.7(65.5-92.0)
Non-severe case (n=136)	52.4 (35-62)	25.5(12.4-38.8)
p value	0.08	0.002

p < 0.05 statistically significant and p < 0.001 highly significant

IQR-Interquartile range

CRP- C-reactive protein

**Table 2**  
Gender distribution in Groups

Groups	Male	Female
Severe	83	33
Non-severe	57	65

p value= 0.56

p < 0.05 statistically significant and p < 0.001 highly significant

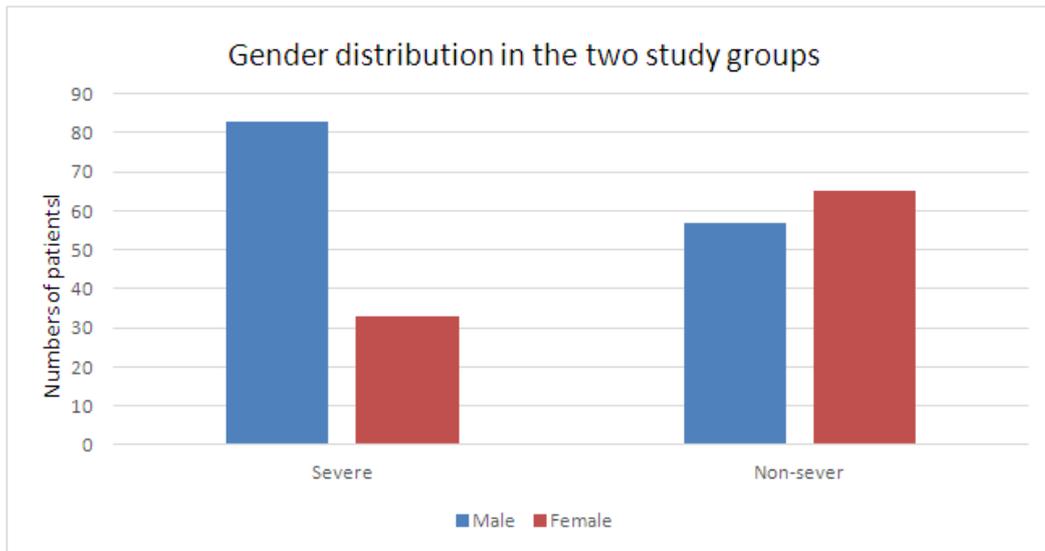
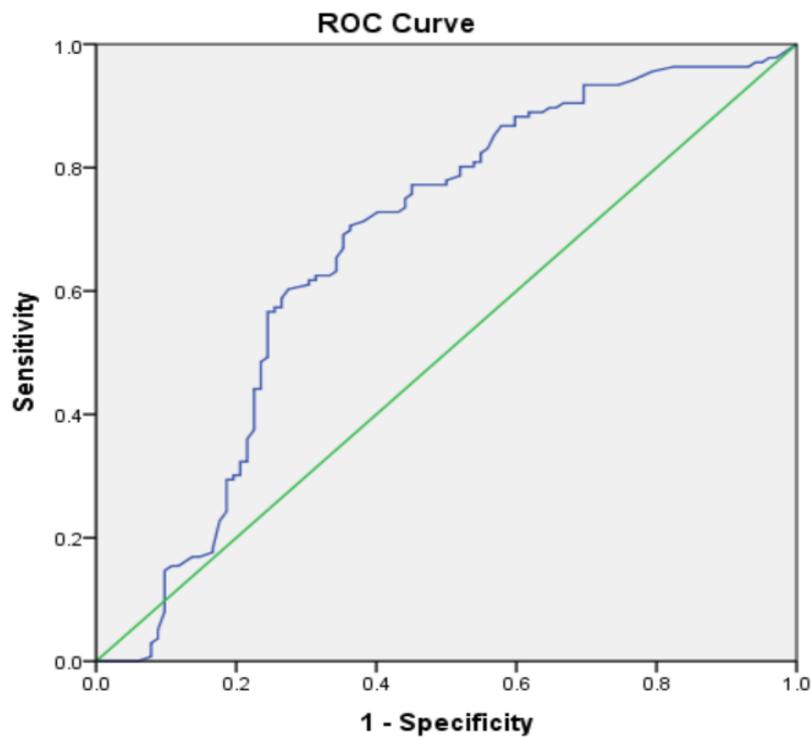
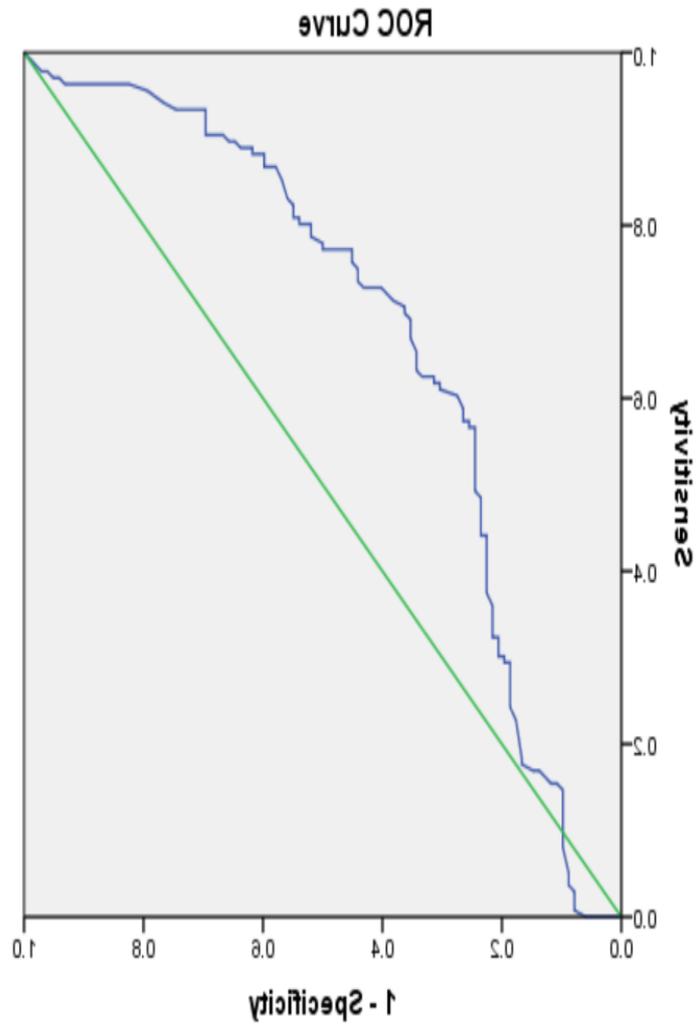


Figure 1. Gender distribution in two study group

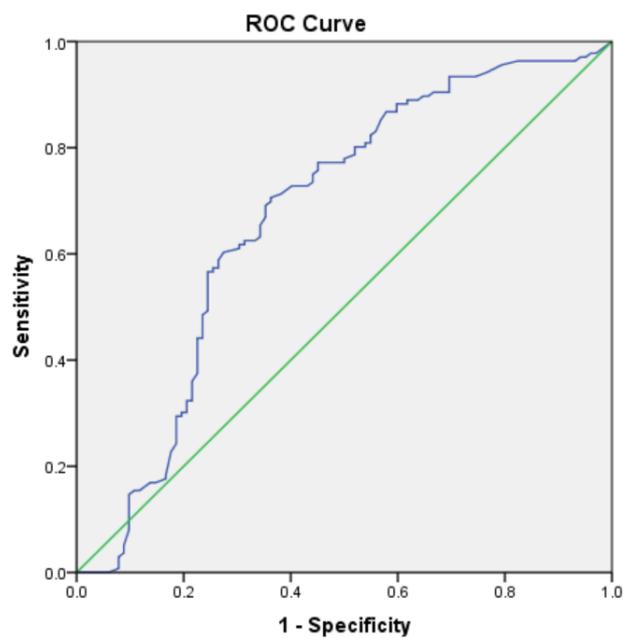
ROC curve analysis was used to compare the performance of CRP as a predictor of severity with an AUC of 0.67 (95% CI: 0.57–0.74) as illustrated in Fig.2. The optimal cut-off for the prediction of severity was 38.62 mg/l with a sensitivity of 78% at a compromised specificity i.e. 52%.





AUC-0.67

**Figure 2:** Receiver operating characteristic (ROC) curves of C-reactive protein for predicting the disease severity in COVID-19 patients



#### IV. Discussion

In developing countries like India, the role of CRP more important in risk stratification and prognostic indication as it is an inexpensive test widely available. Since, it is cheaper, it is also easier to follow up in patients of COVID-19. The current study showed significantly higher CRP levels in severe cases than in non-severe patients suggesting that the CRP level may be a biomarker of disease severity and progression in patients with COVID-19. Liu et al. reported that more severe cases infected with COVID-19 expressed significantly higher CRP levels than non-severe patients [8]. Qin et al. observed higher CRP levels in severe COVID-19 patients than in non-severe cases, suggesting that this biomarker can be monitored to evaluate disease progression [9]. Sahu et al. performed a meta-analysis to assess CRP levels as a potential biomarker of the COVID-19 prognosis. Their results indicated that CRP concentrations remain high in expired patients and could be a promising biomarker for assessing mortality [10]. A significant increase of CRP was found with levels on average 20 to 50 mg/L in patients with COVID-19[11,12,13]. Elevated levels of CRP were observed up to 86% in severe COVID-19 patients[10,14,13]. Patients with severe disease courses had a far elevated level of CRP than mild or non-severe patients. For example, a study reported that patients with more severe symptoms had on average CRP concentration of 39.4 mg/L and patients with mild symptoms, CRP concentration of 18.8 mg/L[12]. CRP was found at increased levels in the severe group at the initial stage than those in the mild group[15]. In another study, the mean concentration of CRP was significantly higher in severe patients (46 mg/L) than non-severe patients (23 mg/L)[15].

The patients who died from COVID-19 had about 10 fold higher levels of CRP than the recovered patients (median 100 vs 9.6 mg/L)[16]. The current study evaluated the association between CRP and COVID-19 infection, and the findings indicated that a patient with a CRP level >38.62 mg/L was more likely to develop the severe form of the disease. In the current study, AUC is 0.67 In other words, ROC analysis confirmed CRP as a valuable predictor of COVID-19 progression and severity. Mahmoud et al. have also reported AUC of 0.70 for severity in prediction in patients with COVID-19[17].

#### V. Conclusion

CRP levels are an indicator of disease severity and prognosis of disease. Those patients who have higher CRP level have poor prognosis, so CRP level must be monitored during course of disease.

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#### COMPETING INTERESTS

None.

#### AUTHORS' CONTRIBUTIONS

“ ‘Hemanti designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. ‘Rajiv kumar Mahli’ managed the analyses of the study and managed the literature searches. All authors read and approved the final manuscript.”

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