

## CRP LEVEL AND THE SEVERITY OF COVID-19 PATIENTS AT GOTONG ROYONG HOSPITAL SURABAYA

Christopher<sup>1)</sup>, Mulya Dinata<sup>2)</sup>, Yudita Wulandari<sup>3)</sup>

Correspondent Email: [christopherspt@gmail.com](mailto:christopherspt@gmail.com)

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### ABSTRACT

**Introduction:** Coronavirus Disease 2019 (COVID-19) is an infectious disease caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). C-Reactive Protein (CRP) is an inflammatory protein synthesized in the liver and produced in response to inflammation. Several studies have shown a relationship between CRP levels and the severity of COVID-19.

**Purpose:** This study aims to analyze the relationship between CRP levels and the severity of COVID-19 at Gotong Royong Hospital Surabaya.

**Method:** This study used a cross-sectional design. Data was collected through medical records from COVID-19 patients who were hospitalized at Gotong Royong Hospital Surabaya from July to December 2021.

**Results:** There are 82 samples were collected in this study. Based on the statistical analysis test, there is a significant relationship between CRP level and severity of COVID-19 with  $p = 0.000$ . The value of the correlation coefficient is 0.660, which indicates a positive correlation with a strong relationship between CRP levels and the severity of COVID-19. A high CRP level indicates a wider inflammation in the body, which is related to the severity of COVID-19.

**Conclusion:** There is a significant relationship between CRP levels and the severity of COVID-19.

**Keyword:** COVID-19, CRP, COVID-19 Severity

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<sup>1)</sup> Faculty of Medicine, Widya Mandala Catholic University, Surabaya Email: [christopherspt@gmail.com](mailto:christopherspt@gmail.com)

<sup>2)</sup> Department of Clinical Pathology, Faculty of Medicine, Widya Mandala Catholic University, Surabaya

<sup>3)</sup> Department of Internal Medicine, Faculty of Medicine, Widya Mandala Catholic University, Surabaya

## INTRODUCTION

*Coronavirus Disease 2019* (COVID-19) is a disease caused by *Severe Acute Respiratory Syndrome Coronavirus 2* (SARS-CoV-2). The virus was first discovered in December 2019 in Wuhan, China. SARS-CoV-2 is transmitted through infectious droplets from the mouth or nose when breathing, coughing, sneezing, or talking<sup>1</sup>. Someone infected with COVID-19 will have a positive result from the *Reverse-Transcription Polymerase Chain Reaction* (RT-PCR) examination. COVID-19 gives various symptoms, and most will experience mild to severe symptoms. Some COVID-19 patients are also suffering from critical symptoms. COVID-19 patients who have critical symptoms are related to cytokine storm<sup>2</sup>.

*C-Reactive Protein* (CRP) is an inflammatory protein synthesized in the liver and produced in response to inflammation. The elevation of CRP levels is related to the presence of infection<sup>3</sup>. There is an increase in CRP levels in COVID-19 patients with severe symptoms that are thought to be related to excess production of cytokines<sup>4</sup>. Several studies have also shown a relationship between CRP levels and the severity of COVID-19 patients. Nurshad A. (2020) reported that increased CRP levels were found in 86% of COVID-19 patients with severe symptoms compared to COVID-19 patients with mild symptoms. COVID-19 patients who died also experienced an increase in CRP levels up to 10 times compared to COVID-19 patients who had recovered<sup>4,5</sup>. A study conducted by Milad S. (2020) states that CRP has the potential to be a predictor of severe symptoms of death for COVID-19 patients<sup>6</sup>. This research was conducted to analyze the relationship between CRP levels and the severity of COVID-19 patients at the Gotong Royong Hospital Surabaya.

## METHOD

This study is analytic observational research using a cross-sectional design. Data collected were secondary data from medical records which are results of CRP levels and the severity of COVID-19 inpatients hospitalized at Gotong Royong Hospital Surabaya in July-December 2021. The number of samples was determined using a sample size formula for the coefficient correlation, and the minimum number of samples needed was 46 subjects. The research was conducted by analyzing secondary data from medical records of COVID-19 patients. The data that has been collected were then analyzed using the Spearman correlation test in *Statistical Package for the Social Sciences* (SPSS) application.

## RESULTS

**Table 1: Distribution of Research Sample Characteristics Based on Age**

Ages (Years)	Number of Samples (n)	Percentage (%)
20-30	9	11.0%
31-40	19	23.2%
41-50	22	26.8%
51-60	32	39.0%

In this study, 82 samples were obtained. Based on the data in Table 1, the number of samples aged 20-30 years was nine people (11.0%), aged 31-40 years were 19 people (23.2%), aged 41-50 years were 22 people (26.8%), aged 51-60 years, as many as 32 people (39.0%).

**Table 2: Distribution of Research Sample Characteristics Based on Gender**

Gender	Number of Samples (n)	Percentage (%)
Male	52	63.4%
Female	30	36.6%

Table 2 shows the number of samples for males was 52 subjects (63.4%), and 30 subjects were female (36.6%).

**Table 3: Distribution of Research Samples Based on Severity**

Severity	Number of Samples (n)	Percentage (%)
Mild	14	17.1%
Moderate	38	46.3%
Severe-Critical	30	36.6%

Table 3 shows the distribution of research samples based on the severity of COVID-19. There were 14 subjects (17.1%) had confirmed COVID-19 with a mild degree, as many as 38 subjects (46.3%) had confirmed COVID-19 with a moderate degree, and 30 subjects (36.6%) had confirmed COVID-19 with a critical-severe degree.

**Table 4: Distribution of Average CRP Levels to Degree of Severity**

Severity	Mean CRP Level $\pm$ SD (mg/L)
Mild	24 $\pm$ 31
Moderate	55 $\pm$ 45
Severe-Critical	128 $\pm$ 60

CRP levels were examined for each COVID-19 patient using an Epithod616. The tool uses the ELISA principle, which has quantitative values. The normal value of CRP levels refers to the results of laboratory tests, which are  $<2.5$  mg/L. Table 4 shows that the average CRP levels in patients with mild degrees were  $24 \pm 31$  mg/L, in moderate degrees was  $55 \pm 45$  mg/L, and in severe-critical degrees was  $128 \pm 60$  mg/L.

**Table 5: Correlation Test Between CRP Levels and Severity**

Variable	Test Analysis	Sig. (Coef. Correlation)
CRP Levels and COVID-19 Severity	Spearman Correlation Test	0.000 (0.660)

The relationship between CRP levels and the severity of COVID-19 was analyzed using a Spearman correlation test to find out whether there is a relationship between the two variables. Table 5 shows that the results of the Spearman correlation test, which a value of  $p=0.000$ , was obtained. It shows a significant relationship between CRP levels and the severity of COVID-19. The correlation coefficient value obtained is 0.660, indicating a correlation in a positive direction.

## DISCUSSION

The results of the average CRP levels for the severity of COVID-19 found that patients with mild severity tend to have lower average CRP levels, which is 24 mg/L, compared to those with moderate and severe degrees. In the group of patients with moderate degrees, the average CRP level was 55 mg/L which was higher than those with mild degrees. The severe-critical degree had the highest average CRP levels, 128 mg/L.

Similar results were found in the research by Rosdiana M. (2020). The research found that the increase of CRP levels was found more in COVID-19 patients with severe-critical degrees than mild and moderate degree<sup>7</sup>. Tjahyadi (2020) also reported that COVID-19 patients with severe degrees had higher CRP levels than those with mild-moderate degrees<sup>8</sup>.

The variation of COVID-19 severity depends on the inflammatory response of the host, and if it occurs in excess, there will be a condition called a cytokine storm. Cytokine storms will damage the body's tissues, especially the lungs, leading to

varying degrees of severity. Proinflammatory cytokine levels, including IL-1, TNF- $\alpha$ , and especially IL-6, which have increased accompanied by tissue damage in patients with COVID-19, induce CRP production<sup>5,9</sup>. This event will synergistically increase CRP levels in patients with severe-critical degrees compared to those with mild and moderate degrees. The presence of comorbidities can also influence increased CRP levels. A study by Apriani (2022) showed that comorbidities, including hypertension, diabetes mellitus, coronary heart disease, chronic kidney disease, autoimmune disease, and chronic obstructive pulmonary disease, also increase CRP levels above normal<sup>10</sup>.

Based on the Spearman correlation test between CRP levels and COVID-19 severity, there is a significance value of 0.000 ( $p < 0.05$ ). It shows a significant relationship between CRP levels and the severity of COVID-19. The value of the correlation coefficient is 0.660, which shows a correlation in a positive direction. A positive correlation indicates a direct relationship between the dependent and independent variables, so the higher the CRP levels, the more severe symptoms the patient will experience. The correlation coefficient value close to +1 indicates that the correlation relationship is getting stronger. The results of the analysis show that there is a significant relationship between a strong positive correlation between CRP levels and the severity of COVID-19. Higher CRP levels show that the more extensive inflammation that occurs in the body is related to the degree of severity in COVID-19 patients<sup>11,12,13,14</sup>

## CONCLUSION

Based on the results of this research, it can be concluded that there is a relationship between CRP levels and the severity of COVID-19 patients at the Gotong Royong Hospital Surabaya.

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