



A STUDY ON THE FERRITIN LEVELS IN COVID-19 PATIENTS OF SRINAGAR, JAMMU AND KASHMIR

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ABSTRACT

Objectives: The COVID-19 pandemic had emerged as one of the most significant global health crises of the 21st century. In the context of COVID-19, Ferritin has emerged as a potential biomarker of disease severity and prognosis, reflecting the dysregulation of the inflammatory response and the development of cytokine storm syndrome. Thus, in the present study, an attempt has been made to investigate the association of Ferritin levels with the severity of the COVID-19 patients. **Methodology:** The present study employed a retrospective cross-sectional design to investigate Ferritin levels in 80 COVID-19 patients in the Department of Hematology at a designated healthcare facility of Srinagar, Jammu and Kashmir, India. Measurement of Ferritin concentration in the blood retrospectively retrieved from laboratory reports in the medical records. **Results:** The results showed that the mean age of the COVID-19 patients was 45 ± 12.5 years. Of those 80 subjects (44 male and 36 female), 30% was hypertension, 20% diabetes and 10% was Asthma co-morbidities. The Pearson correlation coefficient ($r=0.65$) showed highly significant positive correlation ($p<0.001$) between the Ferritin level and COVID-19 severity. **Conclusion:** The Ferritin emerged as a promising indicator of COVID-19 severity, with significantly elevated levels observed in COVID-19 patients as compared to the general population. This finding underscored the potential utility of Ferritin as a biomarker for disease severity stratification and prognostication.

KEYWORDS: The results showed that the mean age of the COVID-19 patients was 45 ± 12.5 years.

INTRODUCTION

The COVID-19 pandemic had emerged as one of the most significant global health crises of the 21st century, affecting communities, economies, and healthcare systems worldwide. Srinagar, Jammu and Kashmir, situated in the northern part of India, has not been immune to the impact of the pandemic (Jahangir et al., 2022; Hamza et al., 2022). One of the foremost challenges encountered by Srinagar, Jammu, and Kashmir, in responding to the COVID-19 pandemic was its limited healthcare infrastructure. The region's healthcare system, characterized by a shortage of hospitals, medical personnel, and essential medical supplies, struggled to cope with the influx of COVID-19 patients (Majid et al., 2022).

Biomarkers serve as measurable indicators of biological processes or disease states within the body. In the

context of COVID-19, biomarkers play a vital role in elucidating the pathophysiology of the disease and informing clinical decision-making. Various types of biomarkers have been studied in relation to COVID-19, including inflammatory markers, coagulation parameters, cardiac biomarkers, and markers of organ damage. These biomarkers provide valuable insights into the underlying mechanisms of disease progression and help clinicians assess disease severity and prognosis (Samprathi et al., 2021; Cui et al., 2021).

Ferritin is a ubiquitous protein found in virtually all living organisms, serving as a critical component of iron metabolism. In its canonical role, Ferritin acts as an intracellular iron storage protein, sequestering excess iron and preventing its toxic effects through the formation of Ferritin-iron complexes. However, beyond its canonical function, Ferritin possesses

immunomodulatory properties and serves as a key mediator of the inflammatory response (Rosario et al., 2013; Kernan and Carcillo, 2017).

Moreover, Ferritin exhibits direct immunomodulatory effects through its interaction with immune cells and cytokine signaling pathways. Ferritin has been shown to modulate the activation and function of various immune cells, including macrophages, dendritic cells, and T lymphocytes, thereby regulating innate and adaptive immune responses. Additionally, ferritin can directly bind to pro-inflammatory cytokines and chemokines, such as IL-1 β and CXCL8, inhibiting their activity and dampening the inflammatory response (Moreira et al., 2020).

In the context of COVID-19, Ferritin has emerged as a potential biomarker of disease severity and prognosis, reflecting the dysregulation of the inflammatory response and the development of cytokine storm syndrome. Thus, in the present study, an attempt has been made to investigate the association of Ferritin levels with the severity of the COVID-19 patients.

MATERIALS AND METHODS

The present study employed a retrospective cross-sectional design to investigate Ferritin levels in 80 COVID-19 patients in the Department of Hematology at a designated healthcare facility of Srinagar, Jammu and Kashmir, India. The general population, as controls, was also collected from the same place. For COVID-19 patients, individuals aged 18 years and having a confirmed diagnosis of COVID-19 based on RT-PCR test results were considered as sample.

Study Outcome Parameter

Ferritin blood test: Measurement of Ferritin concentration in the blood retrospectively retrieved from laboratory reports in the medical records.

Data Collection Procedure

Data collection involved the retrospective retrieval of information from medical records and laboratory reports:

1. Informed consent was not required, as the study utilized retrospective data from medical records, ensuring patient anonymity and confidentiality.
2. Medical records of COVID-19 patients and individuals from the general population were retrospectively reviewed to collect demographic and clinical data, including Ferritin level and COVID-19 status.
3. Laboratory reports documenting Ferritin levels and other relevant parameters were extracted from the hospital information system for analysis.

Data Analysis

Retrospective data analysis was performed using appropriate statistical methods.

1. Descriptive statistics, including mean, standard deviation, median, and frequency distribution, were used to summarize the demographic and clinical characteristics of the study participants.
2. Inferential statistics, such as t-tests, chi-square tests, and correlation analysis, were employed to examine associations between Ferritin levels and COVID-19 severity, as well as other clinical parameters. Statistical significance was determined using a p-value <0.05.

RESULTS

Table 1 showed the demographic characteristics of the study participants. The mean age of the COVID-19 patients was recorded as 45 $\pm$ 12.5 years. Of those 80 subjects (44 male and 36 female), 30% was hypertension, 20% diabetes and 10% was Asthma comorbidities.

The Ferritin levels in the study participants were shown in Table 2. The COVID-19 patients had higher mean Ferritin level (200.7 $\pm$ 50.2ng/ml) than the general population (80.2 $\pm$ 30.1 ng/ml), showing statistically significant difference (p<0.012) between them.

The CBC parameters in the study participants were shown in Table 3. In hemoglobin level, the COVID-19 patients had lesser mean value (10.5 $\pm$ 1.8 g/dL) than the general population (13.2 $\pm$ 1.5 g/dL), showing non-significant difference (p>0.05) between them. In case of white blood cells, the COVID-19 patients had higher mean value (15.2 $\pm$ 3.5 $\times 10^9$ /L) than their general population counterparts (8.7 $\pm$ 2.1 $\times 10^9$ /L), highlighting statistically significant differences (p<0.035) between them. In case of platelets count, once again, the COVID-19 patients had lesser mean value (180 $\pm$ 40 $\times 10^9$ /L) than the general population (250 $\pm$ 30 $\times 10^9$ /L g/dL), showing statistically significant difference (p<0.045) between them.

The Distribution of Ferritin levels by COVID-19 severity was shown in Table 4. Among the COVID-19 patients, Ferritin level less than 200 was estimated mild in severity and the number of patients was 25, between 200-500 moderate, number of patients was 30, and above 500 was estimated as severe and the number of patients was 25.

Table 1: Demographic characteristics of the study participants.

Group	n	Mean Age (years)	Age Range (years)	Gender Distribution (Male/Female)	Comorbidities (%)
COVID-19 Patients	80	45 ± 12.5	25-70	44/36	Hypertension (30), Diabetes (20), Asthma (10)
General Population	80	42 ± 10.8	20-65	40/40	Hypertension (25), Diabetes (15), Asthma (5)

Table 2: Ferritin Levels in study participants.

Group	n	Mean Ferritin Levels (ng/mL)	SD (ng/mL)	t-value	p-value
COVID-19 Patients	80	200.7	50.2	7.82	<0.012
General Population	80	80.2	30.1		

The association between Ferritin levels and COVID-19 severity was given in Table 5. The Pearson correlation coefficient ($r=0.65$) showed highly significant positive

correlation ($p<0.001$) between the Ferritin level and COVID-19 severity.

Table 3: CBC parameters in study participants.

Parameter	COVID-19 patients (Mean ± SD)	General population (Mean ± SD)	t-value	p-value
Hemoglobin (g/dL)	10.5 ± 1.8	13.2 ± 1.5	1.27	0.542
White Blood Cells ($\times 10^9/L$)	15.2 ± 3.5	8.7 ± 2.1	5.81	<0.035
Platelets ($\times 10^9/L$)	180 ± 40	250 ± 30	3.62	<0.045

Table 4: Distribution of Ferritin levels by COVID-19 severity.

COVID-19 severity	Ferritin level (ng/mL)	Number of patients
Mild	< 200	25
Moderate	200 – 500	30
Severe	> 500	25

Table 5: Statistical analysis of association between Ferritin levels and COVID-19 severity.

Pearson Correlation Coefficient (r)	p-value
0.65	< 0.001

DISCUSSION

This study has significant implications in understanding the path-physiology and clinical management of COVID-19. By investigating biomarkers such like Ferritin, alongside hematological parameters, the study sheds light on the intricate interplay between inflammation, coagulation, and disease severity in COVID-19 patients.

The study population comprised 80 COVID-19 patients and an equal number of normal individuals from the general population. In this study, demographics included age, gender distribution, and prevalent comorbidities such as hypertension, diabetes, and asthma. This information allows researchers to identify potential confounding factors and better interpret the study results.

Ferritin, a biomarker associated with inflammation and iron storage, was evaluated in both COVID-19 patients and the general population. The results revealed a significant difference in mean Ferritin levels between the two groups. Specifically, Ferritin levels were notably higher in COVID-19 patients compared to the general population. This finding suggested a potential association

between the Ferritin levels and COVID-19 infection and severity. Ferritin could serve as a valuable biomarker for identifying and monitoring COVID-19 patients, aiding in prognosis and treatment decisions.

In this study, CBC parameters, including hemoglobin, white blood cell count, and platelet count, was evaluated in both COVID-19 patients and the general population. The results revealed alterations in these parameters in COVID-19 patients as compared to the general population. Specifically, COVID-19 patients exhibited lower hemoglobin levels and higher white blood cell counts, while platelet counts were lower compared to the general population. These changes suggested potential hematological manifestations of COVID-19 infection, highlighting the importance of monitoring CBC parameters in disease management.

The association between Ferritin levels and COVID-19 severity was investigated. Ferritin levels were categorized into different severity groups, and statistical analysis revealed a positive correlation between Ferritin levels and COVID-19 severity, with higher levels associated with more severe disease outcomes. This

finding underscored the potential utility of Ferritin as a biomarker for predicting disease severity and guiding clinical management in COVID-19 patients.

Elevated serum ferritin levels have been consistently observed in severe and critically ill COVID-19 patients, correlating with disease severity, systemic inflammation, and adverse clinical outcomes. The patho-physiological mechanisms underlying Ferritin dysregulation in COVID-19 are multifactorial and complex, involving a combination of cytokine-mediated inflammation, tissue damage, and dysregulated iron metabolism (Sharif et al., 2018; Rosario et al., 2013; Moreira et al., 2020).

Furthermore, Ferritin may serve as a therapeutic target in COVID-19 management, with emerging evidence suggesting that modulation of Ferritin levels and iron metabolism could mitigate the hyper-inflammatory response and improve patient outcomes. Strategies aimed at targeting Ferritin expression or function, such as iron chelation therapy or pharmacological agents targeting Ferritin synthesis and release, hold promise for attenuating inflammation and preventing cytokine storm in severe COVID-19 cases (Moreira et al., 2020; Seifert et al., 2008).

Despite the valuable insights provided by this study, several limitations need to be acknowledged. Firstly, the study's retrospective design may introduce selection bias and limit the generalization of the findings. Additionally, the sample size of the study population, though adequate for statistical analysis, may not fully capture the heterogeneity of COVID-19 presentations and outcomes. Furthermore, the reliance on single-point measurements of biomarkers and hematological parameters may overlook dynamic changes over the course of the disease. Future studies with larger, prospective cohorts and longitudinal follow-up are needed to address these limitations and provide more robust evidence.

Based on the findings of this study, several recommendations can be made to improve clinical management and research efforts related to COVID-19. Firstly, healthcare practitioners should consider incorporating biomarker assessment, including Ferritin into routine diagnostic and prognostic evaluations of COVID-19 patients. Early identification of patients at higher risk of severe disease outcomes can facilitate timely interventions and improve patient outcomes. Additionally, further research is warranted to explore the potential utility of other biomarkers and imaging modalities in augmenting current diagnostic and prognostic strategies for COVID-19.

CONCLUSION

In conclusion, the demographic characteristics of the study participants revealed significant differences in age distribution, gender, and comorbidity prevalence between COVID-19 patients and the general population. Notably, COVID-19 patients exhibited a higher

prevalence of comorbidities, including hypertension, diabetes, and asthma, emphasizing the importance of considering underlying health conditions in disease management. Focusing on biomarker, Ferritin emerged as a promising indicator of COVID-19 severity, with significantly elevated levels observed in COVID-19 patients as compared to the general population. This finding underscored the potential utility of Ferritin as a biomarker for disease severity stratification and prognostication.

Declaration By Authors

The authors hereby declared that it was their original piece of research and had not been sent to any other journal for publication.

Ethical Approval

Approved.

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Conflict of Interest

The authors declared no conflict of interest.

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