Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 3627 - 3630
Received 05 March 2021; Accepted 01 April 2021.

Serum Ferritin Level in Categorization of COVID-19 Patients

K.Murugavel[1], L.Karpagavel[1*], N.Manikandan3

[1]Assistant Professor, Department of Biochemistry, Chettinad Hospital and Research Institute, Chettinad Academy of Research and Education (CARE), Kelambakkam, Chennai, Tamil Nadu

[1]Professor, Department of Biochemistry, Chettinad Hospital and Research Institute, Chettinad Academy of Research and Education (CARE), Kelambakkam, Chennai, Tamil Nadu

[3] Lab Supervisor, Central Clinical Laboratory, Chettinad Hospital and Research Institute, Chettinad Academy of Research and Education (CARE), Kelambakkam, Chennai, Tamil Nadu

***Corresponding author**

Dr. L. Karpagavel,Professor,Departmentof Biochemistry,

Chettinad Hospital and Research Institute,Chettinad Academy of Research and Education (CARE),

Kelambakkam, Chennai, Tamil Nadu**Email:** karparg@yahoo.com

ABSTRACT

The current ongoing pandemic COVID-19 is characterized as highly contagious and deadly; early recognition of severe forms is absolutely essential for timely triaging of patients. While the clinical status, in particular peripheral oxygen saturation (SpO2) levels, and concurrent co-morbidities of COVID-19 patients largely determine the need for their admittance to ICUs, laboratory parameters may facilitate the assessment of disease severity . Hence the purpose of the present study is to estimate serum ferritin levels in covid-19 patients and analyze whether this inflammatory marker levels will be able to determine the severity and treatment protocol of COVID-19 patients. The study is a prospective observational study done in chettinad hospital & research institute. The study comprises of 100 patients diagnosed as covid -19 by qRT-PCR for SARS-CoV-2 and who were above 18 years. Pregnant or breast-feeding women, Patients with rheumatoid immunity, malignant tumor and other related diseases, long-term oral immunoregulatory drugs or who had used large doses of glucocorticoids within 14 days were excluded from the study. The study population was divided into two groups mild to moderate – Group I and severe to critical- Group II, depending on the following criterias like age, fever, respiratory rate, oxygen saturationand lymphocyte count. Serum ferritin levels were measured in both the groups using chemiluminesnce assay by unicelDxi -600 access immunoassay systems- Beckman coulter and analyzed. **Results:** The mean ferritin value for the Group –I was 190ng/ml and Group II was 833ng/ml. COVID-19 patients especially with extremely high ferritin levels exhibited frequent symptomatic presentations, severity, and critical illness, in group II ($P < 0.000$) and even in the group I, although the serum ferritin levels were within the biological reference range ,there was a statistically significant p –value ($P < 0.000$)

Keywords: Inflamatorymarkers ,Serum ferritin , COVID-19 , Mild and severe COVID-19 , Biomarkers

INTRODUCTION

Ferritin is a key mediator of immune deregulation, especially under extreme hyper-ferritinemia, via direct immune-suppressive and pro-inflammatory effects, contributing to the cytokine storm (1) . It has been reported that fatal outcomes by COVID-19 are accompanied by cytokine storm syndrome, thereby it has been suggested that disease severity is dependent of the cytokine storm syndrome (2) . Many individuals with

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 3627 - 3630
Received 05 March 2021; Accepted 01 April 2021.

diabetes exhibit elevated serum ferritin levels (3-5), and it is known that they face a higher probability to experience serious complications from COVID-19 (6). In one study with 20 COVID-19 patients, it was found that individuals with severe and very severe COVID-19 exhibited increased serum ferritin level (7).

The serum ferritin level combined with the clinical evaluation can allow a rapid assessment of the patient's condition to guide clinicians in finding the optimal approach and priority in these COVID-19 patients. Serum ferritin is particularly interesting due to its potential diagnostic and prognostic role. The purpose of the presentstudy is to determine the potential relationship of ferritin levels in categorization of COVID-19 patients.

MATERIALS AND METHODS:

This is a Prospective – Cross sectional study conducted in clinical biochemistry lab, Chettinad hospital and research institute, Kelambakkam, after approval by the institutional ethics committee. 100 Laboratory-confirmed COVID-19 patients above 18 years by qRT-PCR for SARS-CoV-2 wereincluded in this study after getting their Willingness to participate in the study with an informed consent. Pregnant or breast-feeding women, Patients with rheumatoid immunity, malignant tumor and other related diseases, long-term oral immunoregulatory drugs or who had used large doses of glucocorticoids within 14 days were excluded from the study. The study population was divided into two groups mild to moderate (Group –I)and severe to critical (Group –II) depending on the following criteria like age, fever, respiratory rate, oxygen saturation, lymphocyte count and CT chest findings (4). 2 ml of Blood sample was collected in red top vacationer tube and Serum ferritin was measured in both the groups using chemiluminesnce assay by unicelDxi -600 access immunoassay systems- Beckman coulter and analyzed.

Data collection

COVID-19 was diagnosed based on the World Health Organization interim guidance.(8) The patient information regarding demographic data, medical history, clinical manifestation, general physical examination, laboratory findings data were collected for data analysis. For clinical correlation, the study participants were segregated into two Groups based on the level of disease severity, as per the Indian Council of Medical Research (ICMR) guidelines.

Group –I: (Mild to moderate)

The mild illness group constituted COVID-19-positive patients with symptoms of upper respiratory tract infection including fever, cough, sore throat, headache, shortness of breath, myalgia, joint pain, etc. without evidence of viral pneumonia or hypoxia. SpO2 92%- 95% on room air.

Group –II: (Severe to critical)

The severely ill category had COVID-19-positive patients with clinical signs of pneumonia (fever, cough, shortness of breath, fast breathing) with respiratory distress and SpO2 < 90% on room air. The critically ill category had COVID-19-positive patients with clinical signs of severe pneumonia and radiological evidence of bilateral opacities in the chest with respiratory failure and COVID-19-related complication such as ARDS, sepsis, and septic shock after exclusion of other causes.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 3627 - 3630
Received 05 March 2021; Accepted 01 April 2021.

Statistical analysis

Quantitative data were expressed as mean and standard deviation. The level of significance was assigned at *P* < 0.05. Statistical Package for the Social Sciences (IBM SPSS statistics for windows, [IBM Corp, Amonk, N.Y., USA]) was used for the statistical analysis.

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
MildtoModerate	70	190.7786	97.94571	11.70675
SeveretoCritical	30	833.7400	314.05823	57.33893

One-Sample Test

	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
MildtoModerate	16.296	69	.000	190.77857	167.4242	214.1329
SeveretoCritical	14.541	29	.000	833.74000	716.4687	951.0113

Results & Discussion

In the current study, an association betweenferritin levels and Severity of COVID-19 was analyzed. A total no of 100 COVID patients diagnosed byqRT-PCR for SARS-CoV-2 were included in this study and they were divided into two groups, according to the criteria mentioned .ferritinis an important pro-inflammatory factor in the disease process of SARS-CoV-2. It contributes to COVID-19-associated cytokine storm, largely enhancing vascular permeability and impairing the organ function.

In the total of 100 COVID-19 patients in the study, of which 70 patients fell into Group 1(mild to moderate) with normal serum ferritin levels . Thirty patients in the severe to criticalgroup had a significant raise inserum ferritin level (>Three times of upper normal limit).

The mean value of Ferritin in the group- I was 190 ± 97 and the mean value of Feritin in the group II was 833 ± 314. In the present study it is clearly evident that there is an marked increase in the serum ferritin level only in the severe to critical group and not in the mild to moderate cases. So this clearly confirms an association between serum ferritin levelsand severity of the disease. Ferritin is an important pro-inflammatory factor involved in the contribution of COVID-19 cytokine storm, causing vascular permeability and impairing the organ function. The SARS-CoV-2 virus replication triggers the release of ferritin that causes inflammation of respiratory system and other bodily system with subsequent occurrence of ARDS or respiratory failure.

Conclusion

COVID-19- confirmed patients with high ferritin levels are definitely at high risk of severe and fatal infection, due to the increased inflammatory drive, induced by cytokines storm, leading to higher mortality. SARS-CoV-2-infected patients with extremely elevated ferritin levels are susceptible to develop severe and critical disease requiring intensive pharmacological as well as supportive treatment. Assessment of ferritin

levels early in the course of the disease might be a predictive marker of the disease severity in COVID-19 patients and also for standard clinical measure to predict impending adverse outcomes with high accuracy.

Declaration of interest:

I declare that there is no conflict of Interest that could be perceived as prejudicing the impartiality of the research reported.

Funding:

This research did not receive any specific grant from any funding agency in the public, commercial or not for profit sector.

REFERENCE

1. Abbaspour N, Hurrell R, Kelishadi R. Review on iron and its importance for human health. Research J Med Sci. 2014;19(2): 164–74.

2. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Lancet. 2020; 395:497-506.

3. Khalil UA, Seliem FO, Alnahal A, Awad M, Sadek AM, Fawzy MS. Association of serum ferritin with insulin resistance in offsprings of type 2 diabetes. Egypt J Intern Med. 2018;30:13-7.

4. Momeni A, Behradmanesh MS, Kheiri S, Abasi F. Serum ferritin has correlation with HbA1c in type 2 diabetic patients. Adv Biomed Res. 2015;4:74.

5. Son NE. Influence of ferritin levels and inflammatory markers on HbA1c in the Type 2 Diabetes mellitus patients. Pak J Med Sci. 2019;35(4):1030-35.

6. American Diabetes Association. How COVID-19 Impacts People with Diabetes. Available at: https://www.diabetes.org/corona virus-covid-19/how-coronavirus-impacts-people-with-diabetes Accessed May 22, 2020

7. Bo Zhou, Jianqing She, Yadan Wang. Utility of Ferritin, Procalcitonin, and C-reactive Protein in Severe Patients with 2019 Novel Coronavirus Disease; 2020. Available at https://doi.org/10.21203/ rs.3.rs-18079/v1 Accessed May 22, 2020

8. Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, *et al*. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: A descriptive study. Lancet 2020;395:507-13.