

Original Research Article

A comparative study of biochemical parameters in mild and severe cases of COVID-19

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ABSTRACT

Background: COVID-19 has a range of clinical manifestations, including cough, fever, breathlessness, diarrhoea. Diagnosis of COVID-19 is commonly made through detection of SARS-CoV-2 RNA by PCR testing of a nasopharyngeal swab or other specimens. Evaluation and management of COVID-19 depend on the severity of the disease. This study was done to analyse the difference in the laboratory findings of the mild and severe cases in patients with COVID-19.

Methods: In this study biochemical parameters of the patients with mild and those admitted in intensive care unit (ICU) of SKNMCGH, Pune were studied. Total 60 patients were included in this study. Standard deviation and mean were calculated from the values of biochemical parameters of COVID-19 patients in intensive care unit (ICU) and ward patients.

Conclusions: We found levels of lactate dehydrogenase (LDH), C-reactive protein (CRP), Aspartate aminotransferase (AST), alanine aminotransferase (ALT), ferritin were significantly elevated in severely ill ICU admitted patients than mild patients. This may be useful for predicting progression towards a more severe form of COVID-19.

Keywords: COVID-19, ICU, Healthcare, CRP, Ferritin, Severe, Mild

INTRODUCTION

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic has reminded us of the critical role of an effective host immune response and the devastating effect of immune dysregulation.¹

More severe cases of COVID-19 are more likely to be hospitalized and around one fifth, need ICU admission. In the absence of a directed therapy and expanding vaccine service for the disease, identification of critical laboratory biomarkers for disease severity at early stage could help monitor and prevent disease progression to the severe form.²

In this study, we perform a retrospective study of biochemical inflammatory markers in 60 COVID-19 patients (30 with mild disease and 30 with severe disease).

The presence of a huge inflammatory response, defined as “cytokine storm,” is being studied in order to understand what might be the prognostic factors implicated in the progression of the infection, with ferritin being one of such markers.³

LDH is an essential enzyme for anaerobic respiration, and its production has also been shown to be increased

under hypoxic conditions in the liver. LDH levels are considered as non-specific marker of cellular death.⁶

A new study found that the SARS-CoV-2 virus may bind to angiotensin-converting enzyme 2 (ACE2) on cholangiocytes, leading to cholangiocyte dysfunction and inducing a systemic inflammatory response leading to liver injury.⁴

CRP levels are correlated with the level of inflammation, and its concentration level is not affected by factors such as age, sex, and physical conditions. CRP levels can activate the complement and enhance phagocytosis, thus clearing pathogenic microorganisms invading the body.⁵

So, taking into consideration all of these facts, we compared ferritin, CRP, LDH, AST, ALT in the mild group and severe group of patients.

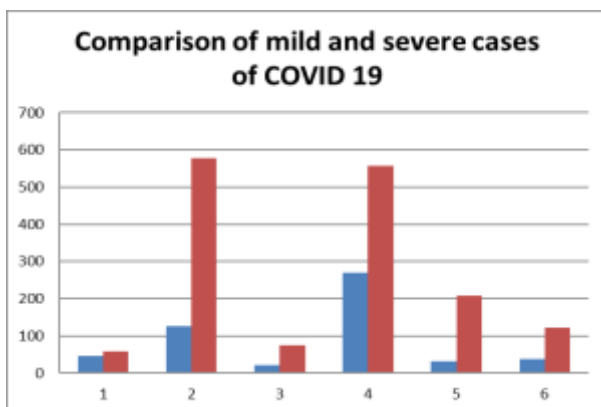
METHODS

Study design, participants, and definition

Present retrospective, observational study was done at Smt. Kashibai Navale medical college and general hospital, Pune. A total of 60 adult cases were confirmed at these centers from July to November 2020. All patients with 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.

Table 1: Comparison of baseline laboratory investigations (means) among patients with COVID-19, (n=30).

Parameters	Mild cases	Severe cases	Z score	P value
Age (Years)	45.96±14.12	57.36±12.83	-2.6628	0.00782
Ferritin (ng/ml)	126.16±70.63	578.28±318.33	-5.6338	0.00324
CRP (mg/L)	21.59±19.23	75.32±21.20	-5.5773	0.00058
LDH (U/L)	269.23±93.28	558±306	-4.4626	0.00632
AST (U/L)	32.26±10.55	208.28±123.84	-3.7089	0.00001
ALT (U/L)	37.07±23.34	121.72±57.08	-1.6863	0.4551



1-Age, 2-Ferritin, 3-CRP, 4-LDH, 5-AST and 6-ALT.

Figure 1: Marked difference in the mild and severe cases of COVID-19.

One of the following criteria was used to determine severe COVID-19 illness: respiratory rate ≥ 30 bpm, oxygen saturation $\leq 93\%$, arterial oxygen partial pressure (PaO₂)/oxygen concentration (FiO₂) ≤ 300 mm Hg, and intensive care unit (ICU) admission.

Mild cases were: having normal respiratory rate < 30 bpm, oxygen saturation $> 95\%$ with no ICU admission.

Data collection

The blood samples of the patients categorized as mild and those with ICU admissions were taken and processed in CCL of SKNMC GH, Pune. VITROS 1, 5 FS and VITROS 5600 dry chemistry analyzers were used. Serum ferritin, serum LDH, AST, ALT, CRP were estimated on these two sets of the patients.

Statistical analysis

Continuous variables were expressed as mean and standard deviation. For continuous variables, independent sample t test and Mann-Whitney U test were used to calculate the statistically significant difference.

RESULTS

A total of 60 patients with COVID-19 were included in the study. Of these, 30 patients (50%) were assigned to the severe group, while 30 patients (50%) were allocated to the mild group.

The differences in biochemical results, including, ALT, AST, CRP and ferritin, LDH, were statistically significant ($p < 0.05$) between patients with severe and mild COVID-19.

DISCUSSION

The ongoing COVID-19 contagion has spurred researchers to explore effective disease severity predictors that can aid in combating the SARS-CoV-2 virus. The main purpose of this research was to establish biomarkers that could accurately predict the severity of coronavirus disease, thereby guiding clinicians in the risk stratification and clinical management of the patients.

Our analysis showed that CRP is significantly elevated as compared to the mild course of the disease in severe

cases of COVID-19 and was an important predictor of severity of the disease. This result is consistent with the findings of a review article that concluded that CRP amounted to 60.7% of patients infected with SARS-CoV-2 and was a crucial marker for predicting COVID-19 prognosis and mortality in these patients.

CRP is an acute phase protein produced by the liver. CRP in our study is significantly elevated in patients who are admitted in ICU. A study showed CRP levels associated with 30-day mortality rate in CRP patients' higher serum ferritin associated with ICU admissions, ARDS, mortality and severe COVID-19. This is said to be due to secondary hemophagocytic lympho-histiocytosis (HLH).¹¹

An important finding of this study is elevated LDH levels and poor clinical outcome. This may be due to hypoxic conditions in liver cells, as LDH is an enzyme of anaerobic respiration. The COVID-19 is also associated with respiratory failure and hypoxia.⁹

Study conducted in Changsha also observed LDH as an important biomarker for disease severity. In that study, LDH were significantly elevated in patients with severe COVID-19; however, their mean values were three times lower as compared to our reported findings. Chen et al also documented an association of elevated levels of LDH in patients with disease severity.⁷

A study in Wuhan, China, found a strong association of serum ferritin as a marker for the severe disease. In this study we found significantly elevated levels of ferritin in ICU patients as compared to ward patients.⁸

Studies have confirmed ACE2 receptors to be the entry receptors of SARS COV 2. ACE 2 receptors are present in the bile duct 20 times more than hepatic cells. Pathological changes-macro-steatosis indicate liver injury either direct or drug induced.¹⁰

Our findings of elevated AST and ALT in severe COVID-19 cases confirm their association with the disease severity.

CONCLUSION

We studied the effect of various biochemical markers in the prognosis of COVID-19. Our findings concluded that, ferritin, CRP, LDH, AST, ALT were effective biomarkers in predicting the fatality of COVID-19.

Thus, assessing and monitoring these markers at the early stage of the disease could have a considerable role in halting disease progression and death.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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