



COVID-19: A COMPARATIVE STUDY OF LABORATORY PARAMETERS AS A PREDICTOR OF DISEASE OUTCOME AT TERTIARY CARE HOSPITAL IN CENTRAL INDIA.

Biochemistry

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ABSTRACT

Introduction: Patients critically ill with COVID-19 infection presents with features of hyper inflammation and severe involvement of the respiratory, Cardiovascular and gastrointestinal tract as well as other body systems. The role of laboratory parameters in COVID-19 cases has not been established. **Objective:** This study aimed to evaluate the laboratory parameters in predicting cases with positive RT-PCR for COVID-19 which can help to support the diagnosis and follow up of the patients. **Material and Methods:** This single center case-control study was conducted on patients who were presented in OPD in April 2020 at Manorama Raje TB hospital associated with Mahatma Gandhi Memorial Medical College, Indore, Madhya Pradesh, India. A total of 140 patients were enrolled in the study, 70 patients of them with positive RT-PCR diagnosed as having COVID-19 infections, and 70 other participants were without symptoms. Blood samples were collected from all patients and serum LDH, serum ferritin, AST, ALT, D-dimer, and C-reactive protein, and CBC were estimated. **Results:** The patients with positive RT-PCR for covid-19 infection have mean age of 54.7 ± 11.61 and other participants as control with negative RT-PCR have mean age of 51.1 ± 12.2 . Patients with positive RT-PCR had significantly higher neutrophil count ($P < 0.001$) and C-reactive protein CRP ($P < 0.001$), LDH, ferritin, AST, ALT, and D-dimer. In addition, patients with positive RT-PCR had significantly lower WBC count ($P < 0.0001$) and lymphocytes count compared to Controls. **Conclusion:** Our findings suggest that level of LDH, CRP, D-dimer, ferritin, Total WBC count, Lymphocyte and Neutrophils can be used for early detection and to predict the result and prognosis of the COVID-19 patients.

KEYWORDS

COVID-19, RT-PCR, D-dimer, Complete blood count

INTRODUCTION

During worldwide pandemic of coronavirus disease (COVID-19), the identification of clinical and laboratory parameters as predictors of progression towards severe and fatal forms of Covid 19 were urgently needed. These predictors were guiding the patient management and were preventing the risk of developing the most severe & fatal form of the disease.¹ Additionally, recognition of laboratory parameters which were competent enough to differentiate between acute or chronic states, or those who are at high or low risk of mortality and for improved clinical condition in covid 19 patients.²

According to phylogenetic analysis, COVID-19 belongs to a specific subgenus of β -coronavirus like SARS-CoV (human severe acute respiratory syndrome coronavirus) and MERS-CoV (Middle East respiratory syndrome coronavirus). These two species explode in the last decade and causing drastic fatality.³

World Health Organization (WHO) has observed differences in the clinical picture of the diseases caused by Covid -19 and severe acute respiratory syndrome (SARS) and hence similarities were noted between these two viruses.⁴ Nevertheless, the estimated human death rate of Covid-19 was lower than that of SARS or MERS. The degree of the Covid-19 infection has caused larger casualties than either of SARS or MERS.⁵ In addition, recently human to human transmission of Covid-19 infection has been confirmed from various studies.²

In the Covid-19 infection, a wide range of signs & symptoms were seen with involvement of various body systems. Respiratory symptoms like pneumonia, fever, cough, dyspnea, and severe fatigue were noticed in majority of the patients.¹ Gastrointestinal, Cardiovascular, Neurological, and other body systems were also affected by Covid-19 disease.⁶

Laboratory investigation have demonstrated that COVID-19 infected patients showed lymphopenia, elevated Lactate dehydrogenase (LDH), D-dimer, serum Ferritin and CRP level, and liver function abnormalities with elevated ALT and AST.⁷ Previously published articles were focused on sign, symptoms, mortality rates and epidemiology of the Covid-19 disease however the studies about laboratory investigations specific to Covid-19 is limited.^{8,9}

The aim of this study was to assess and compare the laboratory parameters like total WBC count, Lymphocyte & Neutrophil count, D-dimer, LDH, serum Ferritin, and CRP as indicator of severity & outcome in patients with clinically diagnosed and confirmed covid-19 infection by positive RT-PCR and negative RT-PCR.

MATERIALS AND METHODS

This was a single-center study, a total of 140 patients were admitted from 2nd April 2020 to 30th April 2020 in Manorama Raje TB hospital (MRTB) associated with Mahatma Gandhi Memorial Medical College (MGMMC), Indore, Madhya Pradesh, India. In which 70 patients with symptoms of fever, cough, fatigue, and headache and were diagnosed as positive COVID-19 infection with nasal and pharyngeal swab by RT-PCR and blood sample were also collected. 70 another healthy participants with no symptoms were recruited. After the approval from the Ethical Committee, written informed consent was taken from all the participants.

Serum LDH, serum Ferritin, AST, ALT, and C-reactive protein (CRP) levels were determined on fully automated biochemical analyzer (Randox Laboratories Ltd., UK), and D-dimer analysis was done by coagulation analyzer (Sta Satellite Max, Stago Diagnostica, France) and CBC was done using five-part hematology analyzer (LH-750, Beckman Coulter, USA).

Statistical Analysis

The mean and standard deviation (SD) were analyzed by using SPSS-20 software. Analysis of variance (ANOVA) test and chi-square tests were used with P values < 0.05 were considered significant in all the cases.

RESULTS

Demographics Profile

Out of 140 participants recruited for the study, 70 participants were RT-PCR Positive for COVID-19 infection. In positive covid patients 68.6% (48) of them were males and 31.4% (22) of them were females. The mean age for Covid-19 positive patients was 54.7 ± 11.61 years. 70 patients with RT-PCR Negative with mean age 51.1 ± 12.2 and comprising 64.2% (45) males and 35.7% (25) of them were females. There was no significant difference regarding age ($P > 0.05$) between

the two study groups (Table-1).

Table-1: Comparison of Demographic Profile in Positive And Negative RT-PCR Test For Covid-19 Infected Patients.

Parameters	Positive PCR (n =70)	Negative PCR(n =70)
Gender (Male/Female)	(48/22) (68.6%/31.4%)	(45/25) (64.2%/35.7%)
Mean age $\pm$ SD (years)	54.7 $\pm$ 11.61	51.1 $\pm$ 12.2

SD= Standard deviation

Laboratory Parameters

The comparison amongst the laboratory investigation of individuals with positive and negative RT-PCR has shown in Table-2. Patients with positive RT-PCR had significantly high neutrophil count ($P<0.001$) and high serum concentration of LDH ($P<0.001$), CRP ($P<0.001$), ferritin ($P<0.001$), AST ($P<0.001$), ALT ($P<0.001$) and D-dimer ($P<0.001$) in comparison with negative RT-PCR group. In addition, patients with positive RT-PCR had lower WBC count ($P<0.0001$) and lymphocytes ($P<0.0001$) compared to others.

Table-2: Comparison Amongst Biochemical Parameters With Positive And Negative RT-PCR test for Covid-19 infected patients.

Parameters	Positive RT-PCR (n =70) Mean $\pm$ SD	Negative RT-PCR (n =70) Mean $\pm$ SD
WBC (per mm ³)	4461.42 $\pm$ 1692.29	6295.71 $\pm$ 2023.15*
NEU (%)	78.4 $\pm$ 7.43	63.9 $\pm$ 8.28*
LYH (%)	14.9 $\pm$ 7.21	28.2 $\pm$ 7.84*
LDH (U/L)	478.99 $\pm$ 132.15	332.87 $\pm$ 97.8*
CRP (mg/dl)	86.19 $\pm$ 46.94	25.11 $\pm$ 31.73*
Ferritin (ng/ml)	525.41 $\pm$ 501.47	206.76 $\pm$ 113.17*
ALT (IU/L)	42.78 $\pm$ 17.42	28.52 $\pm$ 15.21*
AST (IU/L)	43.42 $\pm$ 21.35	31.44 $\pm$ 15.24*
D-dimer (μ g/ml)	0.796 $\pm$ 0.707	0.318 $\pm$ 0.241*

Results are depicted as mean $\pm$ standard deviation. * $P<0.001$ when compared with respective controls. ALT: Alanine Aminotransferase; AST: Aspartate Aminotransferase; CRP: C reactive protein; LYH: Lymphocytes; NEU: Neutrophils; WBC: White blood cells

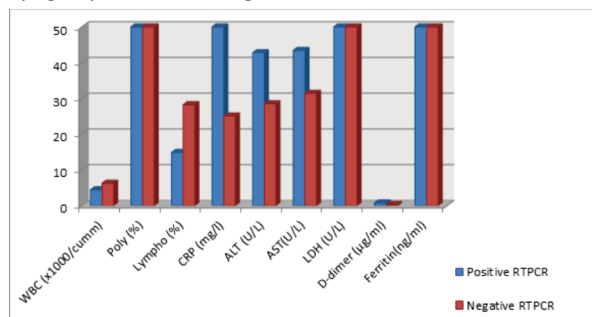


Figure-1: Comparison Amongst Biochemical Parameters With Positive And Negative RT-PCR Test For Covid-19 Infected Patient.

DISCUSSION

The findings of this study give effective favor to laboratory biochemical and hematological parameters for the assessment of patients who are infected with Covid-19. Occasionally, due to unavailability of the RT-PCR test we may trust on other clinical parameters like white blood cell count and percentage of lymphocytes and neutrophils, lactate dehydrogenase, CRP, AST, ALT, ferritin, and D-Dimer estimation. All these parameters have statistically significantly value in Covid-19 infection.¹⁰

Several studies have established that number of white blood cells; percentage of lymphocytes & neutrophils have statistically significant differences among the positive and negative RT-PCR cases for Covid-19. In our studies we found low white blood cell count and lymphocyte percentage in patients with positive RT-PCR Covid-19, while neutrophils percentage were higher in these patients.

Qu R., et al., in their studies, found a low lymphocyte count and white blood cell counts in most of the patients, which was similar to our study.¹¹ Study by Lei J., et al., showed low total white blood cell count

and lymphocytes with higher neutrophils counts.¹² Chen et al., also demonstrated that a substantial decrease in the number of lymphocytes declares that coronavirus impacts many immune cells and suppresses cellular immune function.¹³ Tsui (2020) reported in their study that in Covid-19 patients high neutrophil percentage and high LDH levels were found at the time of admission and were independent predictors of an adverse Clinical Outcome.¹⁴

Chen et al., also demonstrated that ALT and AST showed no significant changes, while LDH had a significance increase in most of the patients.¹³ High ALT, AST, and LDH values were reported in patients infected with MERS-Covid.⁷ Some other studies suggested that 2–11% of patients with covid-19 had liver co-morbidities and 14–53% of patients had abnormal serum ALT and AST levels during the progression of Covid-19 disease.¹⁴

Hence, liver injury is more dominant in patients with severe covid-19 as compared to mild covid infection. In another report, no difference was found in the liver functions among survivors (30%) and non-survivors (28%).¹⁰ In mild cases of Covid-19, liver damage is reversible unless associated with other comorbid conditions and can return to normal without any specific medication.¹⁵

In our study, high levels of significant CRP, D-dimer, and serum ferritin were observed in Covid-19 patients and results were similar to many studies published previously.^{16, 17, 18} The elevated level of these biochemical markers indicates the severity of infection as they are the acute phase reactant markers. Tabata S., et al., in their study shown that high levels of these biochemical markers indicated poor outcome in Covid-19 infected patients.¹⁹

CONCLUSION

Based on the findings of our study, results of routine laboratory tests in corona virus infection we conclude that low WBC counts and low Lymphocytes counts with a high level of LDH, CRP, D-Dimer and Serum ferritin can be used as a predictor early detection and severity with prognosis of COVID-19 infection in patients in cases of unavailability or high-cost of RT-PCR test.

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