

Original Research Article

An Epidemiological Study on Selected Blood Parameters among COVID-19 Infected patient in a Tertiary Care Centre of India**Tarun Kumar Das¹, Saikat Bhattacharya², Soumitra Mondal³, Shibasish Banerjee^{4*}, Debopam Hazra⁵, Debasis Das⁶**¹Medical Officer, Baroma Covid Hospital, Panskura, West Bengal, India²Assistant Professor, Department of Community Medicine, Medical College, Kolkata, West Bengal, India³Demonstrator, Department of Community Medicine, Medical College, Kolkata, West Bengal, India⁴Assistant Professor, Department of Community Medicine, Medical College, Kolkata, West Bengal, India⁵Medical Superintendent, Baroma Covid Hospital, Panskura, West Bengal, India⁶Professor and Head of the Department, Department of Community Medicine, Medical College, Kolkata, West Bengal, India

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Abstract

Background: Patients with COVID-19 present with multiple hematological abnormalities. **Objectives:** This study investigated the impact of selected blood markers in COVID-19 positive patients and to determine any correlation with disease severity. **Methods:** This cross-sectional study was conducted in a tertiary care dedicated COVID hospital. Study period was March 2021 to April 2021. All moderate and severe category COVID 19 positive patients those were admitted in study period, were included as study participants by complete enumeration method. Blood samples were collected during admission at emergency and Blood parameters like total leukocyte count (TLC), C-reactive Protein (CRP), Neutrophil to Lymphocytes ratio (NLR), Albumin, Globulin, Alanine aminotransferase (ALT), Aspartate Aminotransferase (AST), alkaline phosphatase (ALP), sodium, potassium, urea, creatinine were assessed. **Results:** Mean of CRP was 33.91 mg/L. Mean of NLR and TLC were 5.8 and 11644.9/cc respectively. Lymphopenia was seen with lowest value was 4% and mean 20.16. Hyponatremia and hypokalaemia were seen 45.9% and 17.3% patients respectively. Blood urea and creatinine were raised almost 44.9% and 28.6% patients respectively. Only 12.2% patients had hypoalbuminemia. Positive correlation with statistical significant association was found with NLR with CRP ($R=0.225$, $p=0.026$) and NLR with TLC ($R=0.625$, $p=0.000$). Negative correlation was found with CRP and albumin though no statistical significant was seen ($R=-0.024$, $p=0.813$). **Conclusion:** With this findings it can be concluded that routine blood parameters like CRP, TLC, NLR, albumin, urea, creatinine, sodium and potassium should be advised all patients irrespective of disease category as a screening tool for disease progression.

Keywords: COVID-19, CRP, NLR, Urea, Creatinine, Electrolytes

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Introduction

The coronavirus disease (COVID-19) has been labelled a pandemic by the World Health Organization (WHO) on 11th March, 2020. Severe Acute Respiratory Syndrome coronavirus-2 (SARS-CoV-2) is responsible for these infections. It was a novel coronavirus belonging to the family Coronaviridae. It was seen to be highly homologous to the SARS coronavirus (SARS-CoV), which was responsible for the respiratory pandemic during the 2002–2003 period [1]. Compared to seasonal influenza, COVID-19 is more contagious, has a longer incubation period, and is associated with higher hospitalization and mortality rates [2–4]. Older ages, male gender, obesity, and chronic comorbidities such as cardiovascular disease, diabetes, chronic respiratory disease, and cancer were more likely to have worse outcomes [4–6].

COVID-19 has a wide range of clinical presentations, varying from asymptomatic carrier state to viral pneumonia in addition to various

extra-pulmonary manifestations including liver affection [7], cardiac [8], nervous [9], renal [10], gastrointestinal [11] and coagulation [12] systems. It is a potentially fatal disease and its primary target is the respiratory system. In the respiratory system, SARS-CoV-2 induces severe pneumonia and causes acute respiratory distress syndrome [13]. SARS-CoV-2 is likely to bind to the angiotensin-converting enzyme 2 receptor, which is highly expressed in the nasal epithelial cell [14,15] and undergoes local replication and propagation, along with the infection of ciliated cells in the conducting airways [16]. After that, there is migration of the virus from the nasal epithelium to the upper respiratory tract via the conducting airways. Due to the involvement of the upper airways, the disease manifests with symptoms of fever, malaise and dry cough. There is a greater immune response during this phase involving the release of C-X-C motif chemokine ligand 10 (CXCL-10) and interferons (IFN- β and IFN- λ) from the virus-infected cells [17].

The incubation period of COVID-19, which is the time period from exposure to the virus to symptom onset, is 5–6 days, but can be up to 14 days. During this period, also known as the 'pre-symptomatic' period, the infected individuals can be contagious and transmit the virus to healthy individuals in the population. The patients of

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COVID-19 belong mostly to the 40–70 years age group, and most commonly present with fever, body aches, breathlessness, malaise and dry cough. Some patients may also present with gastrointestinal symptoms such as abdominal pain, vomiting and loose stools. The complications seen in patients with COVID-19 infection are caused mostly due to the 'cytokine storm'. Patients with COVID-19 present with multiple hematological abnormalities, of which lymphopenia and thrombocytopenia were prominent. In few COVID-19 studies, some evidence has been provided that electrolyte disorders may also be present upon patient's presentation, including sodium, potassium and chloride abnormalities[18-19]. Acute phase reactants like C-reactive protein, lactate dehydrogenase, ferritin, and D-dimer have also been well correlated with disease severity and progression[20]. There are very few studies on blood parameters in eastern India. With this background present study was conducted to find out impact of selected blood markers in COVID-19 positive patients and to determine any correlation with disease severity.

Materials and Methods

This cross-sectional study was conducted in a tertiary care dedicated COVID hospital of Panskura of West Bengal. Study period was March 2021 to April 2021. All the COVID 19 positive patients admitted in this hospital with moderate and severe disease during study period were selected by Complete Enumeration methods. Ethical clearance was taken from Institutional Ethics Committee of Medical College, Kolkata. Permission from the Superintendent of the designated COVID Hospital was also obtained. According to Indian council of medical Research (ICMR) anyone whose respiratory rate ≥ 24 /minutes and having breathlessness and $spO_2 \leq 93\%$ in room air was considered as moderate disease and those having respiratory rate ≥ 30 /minutes and $spO_2 < 90\%$ in room air was categorized as severe disease.[21] Only moderate and severe category patients were admitted and mild symptomatic cases were managed at home isolation. All moderate and severe category patients those were admitted in study period, were included as study participants. Mild cases and those who were refused for sample collection were excluded from analysis. Blood samples were collected during admission using aseptic technique in EDTA and Plain vial and sent institute laboratory. Reports were delivered to ward after 8-12 hours. Blood parameters like total count, C-reactive Protein(CRP), Neutrophil to Lymphocytes ratio(NLR), Albumin, Globulin, Alanine aminotransferase(ALT), Aspartate Aminotransferase(AST), alkaline phosphatase (ALP), sodium, potassium, urea, creatinine were assessed. NLR was calculated by dividing absolute neutrophil to

absolute lymphocytes count. Patients age, sex, history of comorbidity and medication history and initial investigation reports were collected from Bed Head Ticket(BHT).

Hyponatremia and hypokalaemia were considered if sodium and potassium values were <135 mmol/L and <3.5 mmol/L respectively. Normal value of sodium, potassium, albumin and globulin were 135-150 mmol/L, 3.5-5 mmol/L, 3.5-5 g/dL and 2-3.5 g/dL respectively. Urea >40 mg/dL and creatinine >1.4 mg/dL were considered as elevated. CRP cut off was >6 mg/dL. Normal value of ALT, AST, ALP was 5-40 U/L, 5-40 U/L, 50-147 U/L respectively. Normal value of leukocyte count was 4000-11000/cc. Hospital laboratory cut off was considered in this study. According to ICMR NLR >3.33 was associated with moderate to severe disease[21].

Data were entered in MS excel and analysed by SPSS 23. Results were presented in tabular form in mean and percentage and Pearson correlation coefficient was calculated to find out significance. P value less than 0.05 was considered as significant.

Results

Most of patients were male (52%). Mean age was 47.18 years (SD 16.02). Minimum age was 18 and maximum was 86. At hospital admission, mean value of CRP was 33.91 (SD 32.76) maximum value was 127.6 mg/L. Mean value of NLR and TLC were 5.8 (SD 4.72), 11644.9 (6266.32) respectively. Minimum and maximum value of NLR was 1.1 and 23. Minimum and maximum value of TLC was 4400/cc and 28100/cc. Lymphopenia was seen with lowest value was 4% and mean 20.16(SD 10.65). Range of neutrophil count was 38%-92% with mean 71.62(SD 13.68). Range of albumin was 2.9-4.7 g/dL (Table 1). Minimum value of sodium and potassium were 86 mmol/L and 1.71 mmol/L respectively with mean value 134.37(SD 9.272) and 4.06(SD 0.75). Hyponatremia and hypokalaemia were seen 45.9% and 17.3% patients respectively. Maximum value of urea and creatinine were 396 mg/dL and 93 mg/dL respectively. Mean value of urea and creatinine were 63.57(SD 69.44) and 2.73(SD 9.51). Blood urea and creatinine were raised almost 44.9 % and 28.6% patients respectively. Only 12.2 % patients had hypoalbuminemia at admission (Table 1 and Table 2). Positive correlation with statistical significant association was found with Neutrophil to Lymphocyte ratio (NLR) with C-Reactive Protein (CRP) (person correlation = -.225, $p=0.026$) and NLR with Total Leukocyte count (TLC) (person correlation = .625, $p=0.000$). Negative correlation was found with CRP and albumin though no statistical significant was seen (person correlation = -.024, $p=0.813$).

Table 1: Distribution of blood parameters (n=98)

| | Minimum | Maximum | Mean | Std. Deviation |
|-------------|---------|---------|-----------|----------------|
| Sodium | 86 | 156 | 134.37 | 9.272 |
| Potassium | 1.71 | 6.10 | 4.0634 | .75669 |
| CRP | 2.0 | 127.6 | 33.915 | 32.7694 |
| ALBUMIN | 2.9 | 4.7 | 4.039 | .4217 |
| Urea | 18 | 396 | 63.57 | 69.448 |
| Creatinine | 0.43 | 93.00 | 2.7334 | 9.51542 |
| SGOT | 30.0 | 66.0 | 45.469 | 12.3465 |
| SGPT | 22.0 | 56.0 | 40.316 | 10.9305 |
| NLR | 1.1 | 23.0 | 5.802 | 4.7202 |
| TLC | 4400.0 | 28100.0 | 11644.898 | 6266.3250 |
| ALP | 130.0 | 305.0 | 229.031 | 52.0354 |
| Neutrophil | 38 | 92 | 71.62 | 13.786 |
| Lymphocytes | 4 | 48 | 20.16 | 10.652 |
| Globulin | 2.0 | 3.7 | 3.010 | .4380 |

Table 2: Categorical distribution of electrolytes and renal function and albumin (n=98)

| Parameters | Frequency | Percentage |
|-------------------|-----------|------------|
| Sodium(mmol/L) | | |
| 135-150 | 50 | 51 |
| <135 | 45 | 45.9 |
| >150 | 3 | 3.1 |
| Potassium(mmol/L) | | |
| 3.5-5.5 | 79 | 80.6 |
| <3.5 | 17 | 17.3 |
| >5.5 | 2 | 2 |
| Urea(mg/dL) | | |
| >40 | 44 | 44.9 |
| ≤40 | 54 | 55.1 |
| Creatinine(mg/dL) | | |
| >1.4 | 28 | 28.6 |
| ≤1.4 | 70 | 71.4 |
| Albumin(g/dL) | | |
| <3.5 | 12 | 12.2 |
| ≥3.5 | 86 | 87.8 |

Discussion

The aim of study was to find out changes of selected blood parameters in moderate and severe category COVID 19 positive patient. In this study it was found that TLC, NLR and CRP was raised in most of patients and there was significant positive correlation among them. Similar findings was found a study conducted at Pakistan[22]. A study conducted at Italy also concluded that those NLR more than 4 were more chance for admission in critical care and mortality also high[23]. In our study Mean value of NLR was 5.8. As CRP was a marker for severity of disease and NLR was also positively correlated, so NLR could be used as a screening tool for severity for COVID patients. In a meta-analysis it was found that NLR was increased in COVID patient due to angiotensin-converting enzyme 2 (ACE2) receptors and cluster of differentiation (CD) 147-spike proteins. Decreased levels of CD3⁺, CD4⁺, CD8⁺ T lymphocytes, and increased regulatory T cells were also seen. The rise of pro-inflammatory cytokines with T cell lymphopenia predisposes severe COVID-19 patients to cytokine storm, thus resulting in more lymphocytic apoptosis and multi-organ failure. Overall, the decreased levels of CD4⁺ and CD8⁺ T lymphocytes correlated with disease severity, which can lead to increase NLR. Here hyponatremia and hypokalaemia was found during admission with lowest sodium value was 86 mmol/L. Similar Findings were seen in a meta-analysis [23]. Around 45.9 % patients developed hyponatremia and hypokalemia was seen 17.3% patients. Similar findings were observed others study and baseline hyponatremia was considered as poor prognostic marker. Impaired renal function with elevated urea and creatinine was seen in this study. In some patients very high value of urea and creatinine were seen and renal replacement therapy was required. Similar findings was found analysis from Health Outcome Predictive Evaluation(HOPE) registry. Higher proportion of elevated urea and creatinine was found compared to a study conducted at China [28] where prevalence of Elevated urea and creatinine 6.29% and 5.22% respectively with poor outcome. Hypoalbuminemia was found in COVID positive patients and considered as poor prognostic factor[22]. Here only 12.2% patients had hypoalbuminemia though no significant correlation was seen with CRP. ALT, AST and ALP were not significantly raised in this study.

Conclusion

With this findings it can be concluded that routine blood parameters like CRP, TLC, NLR, albumin, urea, creatinine, sodium and potassium should be advised all patients irrespective of disease category as a screening tool for disease progression.

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