# Validity of Markers and Indexes of Systemic Inflammation in Predicting Mortality in COVID-19 infection: A Hospital based Cross Sectional Study

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The circulating biomarkers representing the immune system and inflammation have been considered as a prognostic indicator in COVID-19 positive patients and they can be easily performed and inexpensive. However their utility in predicting mortality is less explored.

## Materials and Methods

This is a cross sectional study conducted at Bhagawan Mahaveer Jain hospital, Girinagar, Bangalore, from October 2020 to December 2020. All consenting consecutive patients with COVID-19 infection admitted to the hospital during the study period were enrolled in the study. Informed written consent was taken from the patients and the study protocol was approved by the Bhagawan Mahaveer Jain hospital Ethics Committee (BMJH/ECHR/29/2020). Patients were evaluated on arrival to the hospital and triaged to ward, high dependency unit or Intensive Care Unit (ICU) as per clinical assessment. A focused history including age, gender, symptoms, duration of onset of symptoms, comorbidities were collected and base line saturation, general physical examination, systemic examination were done for all the enrolled patients and patients were categorized into mild (patients with mild symptoms without evidence of breathlessness and hypoxia), moderate (pneumonia with no signs of severe disease including SpO2<94% (range 90-94%) on room air, respiratory rate>24/min) and severe category (with clinical signs of pneumonia plus one of the following: respiratory rate>30/min, severe respiratory distress, SpO2<90% on room air) accordingly.

Chest X ray and blood investigations including CBC, serum electrolytes, renal and liver function tests, inflammatory markers – CRP, D-dimer, serum ferritin, LDH were done at baseline. IL 6 and HRCT were done whenever indicated. Different CBC derived inflammatory indexes were calculated including NLR, PLR, MLR, SIRI (neutrophils X monocyte) / Lymphocytes and SII (neutrophils X platelet) / Lymphocyte**.**

### Statistical analysis

Data analysis was done using SPSS for Windows version 19.0 (IBM SPSS Statistics). Study variables were presented using descriptive measures like mean ± SD or median with minimum-maximum range. Continuous variables were compared by Mann Whitney test and frequency proportions by the Chi-square test or Fisher's exact test. Statistical significance was set at $P<0.05$. Receiver Operating Characteristics (ROC) curve analysis was performed to estimate optimal cut off values, sensitivity and specificity for

| | | | |
|---|---|---|---|
| Platelets (X 105/cumm) | 2.4 (0.95-4.95) | 2 (0.97-2.8) | 0.03 |
| AST (u/l) | 29 (10-125) | 40 (20-50) | 0.38 |
| ALT (u/l) | 29 (10-140) | 44 (13-52) | 0.58 |
| Serum creatinine (mg/ml) | 0.7 (0.1-2) | 2 (1-4) | 0 |
| CRP (mg/L) | 18 (0.2-329) | 62 (5-314) | 0.08 |
| D-dimer (ng/ml) | 307 (32-1000) | 604 (395-1803) | 0.02 |
| Serum ferritin (ng/ml) | 222 (5.54-3000) | 480 (310-2000) | 0.02 |
| LDH (u/l) | 239 (48.8-938) | | |

| Parameters | AUC | Cut off | Sensitivity (%) | Specificity (%) |
|---|---|---|---|---|
| D-dimer | 0.759 | >532 (ng/ml) | 85 | 65 |
| Serum ferritin | 0.755 | >312 (ng/ml) | 85 | 72 |
| LDH | 0.735 | >279 (u/l) | 85 | 72 |
| CRP | 0.696 | >18.4 (mg/L) | 85 | 51 |
| NLR | 0.787 | >2.98 | 85 | 51 |
| PLR | 0.358 | >205 | 42 | 49 |
| MLR | 0.346 | >17.2 | 28 | 49 |
| SIRI | 0.578 | >1520 | 71 | 71 |
| SII | 0.571 | >10.8 | 71 | 53 |

Note: CRP- C Reactive Protein, LDH- Lactate Dehydrogenase, MLR- Monocyte to Lymphocyte Ratio, NLR - Neutrophil to Lymphocyte Ratio, PLR- Platelet to Lymphocyte Ratio; SII - Systemic Immune-Inflammation Index, SIRI - Systemic Inflammation Response Index.

Å Coexisting lactic acid acidosis in some at risk patients may also inhibit lymphocyte proliferation [15].

A high leukocyte count is common in critically ill patients because damaged cells induce innate inflammation in the lungs, which is largely mediated by proinflammatory macrophages and granulocytes and neutrophilia may also indicate superimposed bacterial infection, a finding described by Fan et al in ICU hospitalized COVID-19 patients [16]. Thrombocytopenia which was more prominent among non survivors in our study may be due to abnormal coagulation function leading to increased platelet consumption and decreased platelet number. In addition, increased damage to the ACE2-receptor-rich kidney tissue in SARS-CoV-2infection by various inflammatory factors can lead to reduced erythrogenesis and increased destruction of

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