



## Original Research Article

## COVID-19 Study of biochemical haematological parameters in patients dying from COVID-19 in a tertiary care centre

Ramakrishna Rachakonda<sup>1,\*</sup>, Kiranmayi Abburi<sup>1</sup>, Sai Ramya Gonuguntla<sup>1</sup>, Bhavanarayana Jannela<sup>1</sup>, Chakradhar Bolleddu<sup>1</sup>, DVC Nagasree<sup>2</sup>

<sup>1</sup>Dept. of Pulmonary Medicine, NRI Medical College, Chinnakakani, Guntur, Andhra Pradesh, India

<sup>2</sup>Dept. of Ophthalmology, NRI Medical College, Chinnakakani, Guntur, Andhra Pradesh, India



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## ABSTRACT

**Background:** COVID-19 pandemic resulted in a death of 419 patients among total admissions of 10682 with a death rate of 3.92% in the tertiary care COVID-19 hospital. We studied the biochemical and hematological parameters among 241 patients who died of the disease.

**Results:** CRP values were raised above 12mg/L in 58% of patients. 83% of patients had elevated LDH levels of >250 IU/L. Procalcitonin levels were above 0.5 microgram/L in nearly 66% of patients. Serum ferritin was more than 500 micrograms/L in 51% of patients. Elevated IL-6 were found in 83% of patients making it a significant inflammatory parameters. D-dimer levels were more than 500ng/ml in 74% of patients. HS Troponin I was raised in 83% of patients. Leukocytosis of more than 11000/Cu mm was seen in 38%. Leukopenia was seen in 35%. Thrombocytopenia was seen in 27% and normal platelet count was seen in 62%.

**Conclusions:** Biochemical parameters help in assessing the severity of inflammation in COVID-19 disease. They aid in the process of treatment particularly anticoagulants and corticosteroid. Specific parameters like IL-6 can help in decision making by treating physician regarding the use of anti IL-6 drugs like Tocilizumab. Elevated HS troponin I in our study showed myocardial injury played a significant role in mortality of COVID 19 patients at our centre.

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### 1. Introduction

COVID-19 pandemic originated in the city of Wuhan in Hubie province of China and within three months of its origin the disease extended to nearly 221 countries in the world. In India the pandemic started in the month of March 2020.

The disease has an incubation period of 2 to 5 days and spreads by droplet infection and surface contact. The lock down implemented in India controlled the spread of pandemic to some extent.

Autopsies done in Europe revealed the pathology of respiratory failure and ARDS in COVID-19 disease. Extrapulmonary manifestations involving heart, lung,

kidneys and bone marrow were found. Micro vascular injury and thrombosis were detected in pulmonary vessels.<sup>1</sup> Electron microscopy and molecular diagnosis helped in better understanding of the pathology predominantly occurring in the respiratory tract.<sup>2</sup> Endothelial inflammation, diffuse alveolar damage are associated with hyperreactivity and hyperinflammation of cellular immune system leading to severe hypoxia and acute respiratory distress syndrome.<sup>3</sup>

Italian experience of acute severe inflammation and microvascular pathology as the causes of respiratory distress in COVID 19 disease resulted in alteration of treatment strategies towards glucocorticoid and anticoagulant administration in the management of COVID-19 disease.<sup>4,5</sup>

\* Corresponding author.

E-mail address: [ramakrishna45@yahoo.co.in](mailto:ramakrishna45@yahoo.co.in) (R. Rachakonda).

The acute inflammation occurring in the lung leading to acute respiratory distress syndrome is atypical and differs from Berlin criteria of ARDS with the onset occurring in 8 to 12 days after onset.<sup>6</sup>

The acute inflammation in the lung and other parts of the body are assessed by several biochemical and hematological criteria. In the pandemic we analyzed the biochemical and hematological parameters in 241 deaths that have taken place from April to September 2020 in our tertiary care center.

## 2. Materials and Methods

We studied the CRP, LDH, Procalcitonin, Serum Ferritin, D-Dimer, IL-6 and HS Troponin levels. These parameters were repeated in intensive care unit depending upon the necessity. WBC count and platelet counts were studied. These values were analyzed among the patients who died in the hospital.

Place of Study-NRI Medical College Hospital, Chinnakakani, Guntur District, Andhra Pradesh.

Duration of Study March 2020 to September 2020

This prospective observational study was conducted after obtaining approval of Institutional Ethical committee of NRI Medical College, Chinnakakani, Guntur district.

## 3. Results

**Table 1:** CRP values

CRP Values	No. of Patients	Percentage
6mg/L or less	26	10.78%
6 to 12mg/L	76	31.53%
12 to 24 mg/L	83	34.43%
24 to 48 mg/L	04	1.65%
>48mg/l/L	53	21.57%

**Table 2:** LDH Values

LDH Values	No. of Patients	Percentage
<250 Units/L	39	16.18%
250 to 500 Units/L	90	37.34%
500 to 1000 Units/L	97	40.24%
1000 to 2000 Units/L	14	5.81%
>2000 Units/L	01	0.41%

## 4. Discussion

Biochemical Parameters are very essential in assessing the severity of COVID-19 disease where extensive inflammation of lung parenchyma along with microvascular changes is responsible for respiratory distress and ARDS leading to severe morbidity and mortality.

Normal CRP levels are in the range of less than 10 mg/L. Among the patients of our study 89% of the patients

**Table 3:** Procalcitonin levels

Procalcitonin Levels	No. of Patients	Percentage
<0.5 micrograms/L	83	34.44%
0.5 to 1 micrograms/L	67	27.8%
1 to 2 micrograms/L	34	14.10%
2 to 5 micrograms/L	26	10.78%
5 to 10 micrograms/L	10	4.14%
10 to 20 micrograms/L	08	3.32%
>20 ng/micrograms/L	13	5.39%

**Table 4:** Serum ferritin values

Serum Ferritin Values	No. of Patients	Percentage
<500 micrograms/L	117	48.54%
500 to 1000 micrograms/L	106	43.98%
>1000 micrograms/L	18	7.46%

**Table 5:** D-Dimer levels

D-Dimer Levels	No. of patients	Percentage
<500 ng/ml	63	26.14%
500 to 1000 ng/ml	69	28.63%
1000 to 3000 ng/ml	46	19.08%
3000 to 5000 ng/ml	17	7.05%
5000 to 7000 ng/ml	15	6.22%
>7000 ng/ml	13	5.39%

**Table 6:** IL-6 levels

IL-6 Levels	No. of Patients	Percentage
<7 picograms/ml	44	18.25%
7 to 20 picograms/ml	35	14.52%
20-100 picograms/ml	30	12.44%
100-200 Picograms/ml	30	12.44%
300-500 picograms/ml	27	11.20%
500 to 1000 picograms/ml	65	26.97%
>1000 picograms/ml	10	4.5%

**Table 7:** HS troponin I levels

HS Troponin Nanogram/ml	No. of Patients	Percentage
<11 Nanograms/ml	41	17%
11-50 nanograms/ml	128	53%
50-100ng/ml	26	11%
100-500ng/ml	36	15%
500-1000ng/ml	5	2%
>1000ng/ml	5	2%

**Table 8:** WBC counts at the time of admission COVID

White cell count	No. of Patients	Percentage
1000 to 4000/Cubic mm	85	35.36%
4000 to 11000	65	26.9%
11000 to 20000	52	21.57%
20000 to 30000	30	12.44%
>30000	09	3.73%

**Table 9:** Platelet count at the time of admission

Platelet count	No.of Patients	Percentage
<150000/cubic mm	65	26.97%
150 to 450000	149	61.82%
>450000	27	11.2%

showed an abnormal CRP levels. CRP levels are positively correlated with the severity of inflammation and reflect the severity of lung lesions.<sup>7</sup>

Another important parameter is LDH. Normal LDH values range from 140 to 250 units/L. Higher levels suggest tissue damage. Though the values are nonspecific because of extensive inflammation in COVID-19 disease LDH values are raised and reflect the severity of inflammation. In our study of patients elevated LDH levels were seen in 84% of patients. According to Shi et al., an advanced age and elevated LDH values are independent risk factors in mild COVID-19 patients for the development of severe disease.<sup>8</sup>

Procalcitonin is another inflammatory parameter. Normal values are less than 0.15 micrograms/L. In our study of 241 patients who died of COVID-19 disease had elevated procalcitonin of more than 0.5 micrograms/L are seen in 66% of patients making it an important inflammatory marker in COVID-19 disease. Rui Hu et.al revealed PCT levels were elevated four to five times in COVID-19 patients with moderate disease and eight times normal in COVID-19 patients with severe disease. PCT values decrease on recovery.<sup>9</sup> PCT values are also raised with bacterial infection.

Normal serum Ferritin values range from 24 to 300 micrograms /L. In our study 51% of patients showed >500 micrograms/L making it an important inflammatory parameter. Linlin Chang et.al study revealed that patients with comorbidities have higher levels of ferritin. Increased Ferritin levels are associated with poor prognosis.<sup>10</sup>

D-dimer levels are normally below 500 ng/ml. In our study elevated D-dimer levels were found in 74% of our patients. Elevated D-dimer levels also guide the physician in the dosage of anticoagulant. Elevated levels show increased severity of disease and indicate poor prognosis. The values predict mortality in intensive care unit.<sup>11</sup>

Another important parameter in the assessment of cytokine storm and severity of inflammation in COVID-19 disease is IL-6. Normal values are less than 7 picograms/ml. They are elevated in severe inflammation in COVID-19 disease. IL-6 levels are markedly elevated in sepsis and ARDS. Initial elevation of more than 80 picograms/ml is correlated with ARDS and death.<sup>12</sup> Raised IL-6 levels also guide the physician in using the anti-IL-6 drugs like Tocilizumab.

The elevation of several biochemical inflammatory parameters should be considered together in the assessment of inflammatory cytokine storm in COVID-19 disease. The

severity of the disease and there by assessment of prognosis is done by lymphopenia, CRP levels, Ferritin, PCT, D-dimer levels, IL-6 levels along with hypoxia status of the patient and elevated HS troponin I. When all the parameters are raised the course of the disease will be unfavorable.<sup>13</sup>

Elevated D-dimer and Fibrinogen degradation products indicates systemic hypercoagulability and fore sees the development of possible venous thromboembolism.<sup>14</sup>

One of the most important parameter in assessment of COVID-19 patients is measurement of High sensitivity Troponin I levels. Normally they are less than 4 nanograms/ml. In our study Elevation of HS Troponin was seen in 83% of patients. Elevated HS Troponin indicates myocardial injury. Myocarditis, myocardial injury and pericarditis can occur in COVID-19 disease. Mortality rates in COVID-19 disease are high among older people and those with preexisting cardiovascular disease.<sup>15</sup> Elevated HS troponin I in our study suggests that myocardial injury and cardiac arrest could be the cause of death among our COVID-19 patients. HS troponin should be considered as an early diagnostic marker in the assessment of prognosis of the COVID-19 patients.

Elevation of leukocyte count, lymphopenia and neutrophil lymphocyte ratio of >3:1 are considered as important parameters in assessing the severity of COVID-19 disease. Patients with these parameters have higher frequency of mechanical ventilation, ICU admission and disease severity. Old people with comorbidities tend to have higher leukocyte levels.<sup>16</sup>

Hypercoagulability state of the patient in COVID-19 disease is accompanied by microthrombi formation and platelet consumption leading to thrombocytopenia. Spike protein of coronavirus directly stimulates and activates the platelets. In our study only 27% of patients showed thrombocytopenia.<sup>14</sup>

## 5. Conclusions

Severity of disease, inflammatory storm and prognosis can be assessed by multiple biochemical parameters. Elevated D-dimer levels indicate hypercoagulability state and elevated HS troponin I is regarded as a marker for myocardial injury. All these parameters should be assessed together along with the hypoxia status and general condition of the patient

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## 8. Conflict of Interest

The authors declare they have no conflict of interest.

## References

1. Falasca L. Post-Mortem Findings in Italian Patients with COVID-19 - a Descriptive Full Autopsy Study of cases with and without comorbidities. *J Infect Dis.* 2020;222(11):1807–15.
2. Calabres F. Pulmonary pathology and COVID-19: lessons from autopsy. *Exp Eur Pulm Pathologists, Virchows Arch.* 2020;477:359–72.
3. Englisch CN, Tschernig T, Flockerzi F, Meier C, Bohle RM. Lesions in the lungs of fatal corona virus disease Covid-19. *Ann Anat .* 2021;234:151657. doi:10.1016/j.aanat.2020.151657.
4. Alexaki VI, Henneicke H. The Role of Glucocorticoids in the Management of COVID-19. *Horm Metab Res.* 2021;53(1):9–15. doi:10.1055/a-1300-2550.
5. COVID-19 Treatment Guidelines Panel. Coronavirus Disease 2019 (COVID-19) Treatment Guidelines. National Institutes of Health. Available from URL:- <https://www.covid19treatmentguidelines.nih.gov/>. Last accessed 2021 on May 1.
6. Li X, Ma X. Acute respiratory failure in COVID-19: is it "typical" ARDS? . *Crit Care.* 2020;24(1):198. doi:10.1186/s13054-020-02911-9.
7. Wang L. C-reactive protein levels in the early stage of COVID-19. *Méd Maladies Infect;*50:332–4.
8. Shi J, Li Y, Zhou X, Zhang Q, Ye X, Wu Z, et al. Lactate dehydrogenase and susceptibility to deterioration of mild COVID-19 patients: a multicenter nested case-control study, I. *BMC Med.* 2020;18:168.
9. Hu R. Procalcitonin levels in COVID-19 patients. *Int J Antimicrob Agents.* 2020;56(2):106051.
10. Chang L. Ferritin in the Corona Virus disease 2019(Covid 19). *J Clin Lab Anal.* 2020;34:23618.
11. Yao Y. D-dimer as a biomarker for disease severity and mortality in COVID-19 patients: a case control study. *J Intensive Care.* 2020;8:49.
12. Chen LYC, Hoiland RL, Stukas S, Wellington CL, Sekhon MS. Assessing the importance of interleukin-6 in COVID-19. *Lancet Respir Med.* 2021;9(2):e13. doi:10.1016/s2213-2600(20)30600-7.
13. Thirumalaisamy P, Meyer CG. Mild versus severe COVID-19: Laboratory markers. *Int J Infect Dis.* 2020;95:304–7. doi:10.1016/j.ijid.2020.04.061.
14. Wool GD, Miller JL. The Impact of COVID-19 Disease on Platelets and Coagulation. *Pathobiology.* 2021;88(1):15–27. doi:10.1159/000512007.
15. Chapman AR. High-Sensitivity Cardiac Troponin can be an ally in the fight against COVID-19. *Circulation.* 2020;141:1733–5.
16. Zhao K. Clinical features in 52 patients with COVID-19 who have increased leukocyte count: a retrospective analysis. *Eur J Clin Microbiol Infect Dis.* 2020;39:2279–87.

## Author biography

**Ramakrishna Rachakonda**, Professor and HOD

**Kiranmayi Abburi**, Assistant Professor

**Sai Ramya Gonuguntla**, Post Graduate Student

**Bhavanarayana Jannela**, Post Graduate

**Chakradhar Bolleddu**, Assistant Professor

**DVC Nagasree**, Professor

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