Original Article

Common Laboratory Parameters in Moderate to Severely Affected COVID-19 Patients Admitted to Government Hospital, Ganganagar

Manish Kumar Chhabra[1], Kesar Singh Kamra[2], Jeevika Kataria[3]

[1]Department of Respiratory Medicine, Government District Hospital, Sri Ganganagar, Rajasthan, India,
[2]Department of General Medicine, Government District Hospital, Sri Ganganagar, Rajasthan, India,
[3]Department of Skin and VD, Government District Hospital, Sri Ganganagar, Rajasthan, India

ABSTRACT

Background: COVID-19 is a newly emerged disease with the pathogenesis being under investigation. **Aims and Objectives:** The objective of the present study was to evaluate the role of laboratory parameters in COVID-19 patients. **Materials and Methods:** Retrospective analysis of data pertaining to laboratory findings and severity of COVID-19 in a government hospital was done in the present study. For 269 patients admitted with moderate or severe disease the mean (±SE) age was 52.9 (±13.54) years with 74.5% being males. **Results:** For the 269 patients, 185 (68.7%) were presented with moderate class severity, and 84 (31.3%) patients had severe type severity of COVID-19. The most common comorbidity was hypertension (65.05%), followed by diabetes mellitus (38.28%) and then successively by heart disease, asthma, kidney disease, other lung disease, and tuberculosis. The hemoglobin levels, AST and LDH concentrations were lower in COVID patients but there were non-significant differences between the moderately and severely affected patients. Significantly higher (P<0.05) concentrations of total WBC, neutrophils, ESR, D-dimer and ALT were observed in severely affected patients compared to moderately affected patients whereas the lymphocytes were significantly lower in severely affected patients as compared to moderately affected patients. Severely affected patients also evidenced increased and highly significant (P<0.001) concentrations of total platelets, CRP and ferritin. **Conclusion:** It was concluded that more than 50 years age is a risk factor for COVID-19 and elevated levels of D-dimer, ESR, total platelets, CRP and ferritin indicate severe disease.

Key words: COVID-19, CRP, hemoglobin, D-dimer, ferritin, neutrophils, lymphocytes

INTRODUCTION

In the recent past Covid-19 spread rapidly affecting a large number of human beings in India.[1] This novel pandemic causes an illness that has a wide variety of clinical features, ranging from mild to moderate upper respiratory tract infection to severe systemic disease which involves respiratory as well as other body systems including cardiovascular, gastrointestinal, neurological, immunological, and hematopoietic system.[2,3] Although multiple involvements was found during the initial COVID-19 spread the most common cause of mortality and morbidities were due to thrombotic complications such as pulmonary embolism, deep vein thrombosis, and stroke[4] probably arising due to coagulopathies observed in many studies.[3,5,6] Relatively few studies have addressed the hematological parameters in COVID-19 patients.[4,7] A recent study mentioned

Access this article online	
Website: https://www.themmj.in	Quick Response Code
DOI: 10.15713/ins.mmj.67	

Address for correspondence:
Dr. Manish Kumar Chhabra, M.D, Department of Respiratory Medicine, Government District Hospital, Sri Ganganagar, Rajasthan, India. E-mail: chhabradrmanish@gmail.com

that the hematological abnormalities in COVID-19 are related with disease progression, severity, and mortality.[7] Lymphopenia, thrombocytopenia, abnormal coagulation profile, and sepsis leading to disseminated intravascular coagulation are very well documented in patients of COVID-19.[8] Hematological parameters can play a vital role in the early prediction of disease severity and can provide a better guide for prompt management of patients. In the present study, we evaluated the role of laboratory parameters in COVID-19 patients.

MATERIALS AND METHODS

The data of patients admitted to the government hospital (between May 2020 till December 2020) was analyzed retrospectively. A total of 269 patients, both genders between 17 and 75-year age were studied. Patients with known case of chronic liver disease and known hematological diseases were excluded from the study. Individuals diagnosed as positive COVID-19 by reverse transcription-polymerase chain reaction method and aged >18 years were included in the study. Patients receiving prior parenteral and or oral anticoagulant were excluded from the study. The pretested, structured case record form was used to enroll patients at admission in different wards. Patients were categorized into moderate and severe disease according to their clinical features. Mild and critical cases were not included in the present study.

Complete Blood Count and other tests were performed as per standard methods described previously.[9] Fever, sore throat, cough, and no indication of pneumonia on X-rays were considered mild symptoms. Fever and respiratory symptoms with <50% lung involvement on radiological imaging and oxygen saturation of 93% were considered moderate illness. As previously stated by Taj *et al*., patients with respiratory distress (respiratory rate >30 breaths/min, O2 saturation <93%, and more than % lung infiltration) were classed as having severe illness.[7]

D-dimer was measured using sodium citrate-treated tubes, a STA-R evolution coagulation analyzer, and the original reagents (Diagnostica Stago, Saint- Denis, France). The JM-103 transcutaneous bilirubinometer was used to test bilirubin. C-reactive protein (CRP) in serum was estimated by Nephelometric System using commercial kit (Dade Behring BN 100, USA). Serum ferritin was measured using XYEM enzyme linked immunosorbent assay (ELISA) test using ELISA reader.[9] The obtained values for moderately and severely affected patients were compared by *t*-test or other appropriate tests using SPSS software 25.0.

RESULTS

A total of 269 patients were included in the study, with a mean age of 52.9 (±13.54) years, and a median age of 54.0 years. Among them, 200 (74.5%) were males and 69 (25.65%) were females. Out of these 269 patients, 185 (68.7%) were presented with moderate class severity, and 84 (31.3%) patients had severe type severity of COVID-19. The most common comorbidity was hypertension (65.05%), followed by diabetes mellitus (38.28%) and then successively by heart disease, asthma, kidney disease, other lung disease, and tuberculosis [Table 1]. Surprisingly 17.47% of the patients admitted with moderate-to-severe COVID had no detectable or established disease.

The hemoglobin levels, aspartate aminotransferase and lactate dehydrogenase concentrations were lower in COVID patients but there were non-significant differences between the moderately and severely affected patients. Significantly higher ($P < 0.05$) concentrations of total white blood cell (WBC), neutrophils, erythrocyte sedimentation rate (ESR), D-dimer, and alanine aminotransferase (ALT) were observed in severely affected patients compared to moderately affected patients whereas the lymphocytes were significantly lower in severely affected patients as compared to moderately affected patients. Severely affected patients also evidenced increased and highly significant ($P < 0.001$) concentrations of total platelets, CRP, and ferritin [Table 2]. Thus, significant statistical association was observed between disease severity and laboratory findings.

Table 1: Associated disease in COVID patients admitted to hospital with moderate-to-severe signs

Associated Problem	Number	Percentage
Hypertension	175	65.05
Diabetes mellitus	103	38.28
Heart disease	30	11.15
Asthma	29	10.78
Other lung disease (COPD/ILD)	11	4.08
Kidney disease	23	8.55
Tuberculosis	05	1.85
No specific disease	47	17.47

Table 2: Comparison of laboratory findings in COVID-19 patients with moderate-to-severe disease

Parameter	Moderate (*n*=185)	Severe (*n*=84)	Total (*n*=269)	Difference
Hemoglobin (g/dL)	12.38±0.39	10.62±0.10	12.36±0.11	NS
Total WBC (/mm^3)	4913.58±359.16	9187.5±369.12	5115.91±307.90	*
Neutrophils (%)	70.4±0.88	73.17±1.34	70.97±0.78	*
Lymphocytes (%)	20.59±0.76	16.1±0.83	19.32±0.62	*
Total platelets (/mm^3)	274.32±7.67	361.5±13.88	922.02±62.43	**
ESR (mm at 1st min)	30.9±1.70	41.2±0.54	30.12±1.39	*
CRP (mg/dL)	28.5±2.17	150.9±11.66	41.4±3.06	**
Ferritin (ng/mL)	547.3±38.14	811.85±51.06	659.81±30.93	**
ALT (IU/L)	44.47±2.44	83.12±4.99	50.51±2.29	*
AST (IU/L)	34.51±1.07	29.43±1.24	36.56±0.98	NS
D dimer (µg/mL)	0.47±0.090	0.6±0.051	0.6±0.065	*
LDH (U/L)	376.34±13.86	412.44±13.97	424.65±13.47	NS
Bilirubin (mg/dL)	0.50±0.018	0.6±0.010	0.41±0.017	

*Significant at P<0.05, **Highly significant (P<0.001), NS: Non-significant, WBC: White blood cell, ESR: Erythrocyte sedimentation rate, CRP: C-reactive protein. AST: Aspartate aminotransferase, ALT: Alanine aminotransferase, LDH: Lactate dehydrogenase

DISCUSSION

In the present study, male patients above 50 years of age with some associated disease were the most severely affected patients. Similar age and gender bias have been reported in many studies on COVID-19.[4,10-12] Increased oxygen demand and parenchymal lung involvement were shown to be directly associated to older age in the current investigation. Previous studies[7,13] found that older age and male gender were risk factors for severe illness in COVID-19 patients with similar results. This study also noticed that 17.4% of the hospitalized patients had no detectable/established disease whereas majority of hospitalized patients had one or more of cardiac or respiratory disease or diabetes. Similar findings have been recorded in previous studies on hospitalized COVID patients.[4,14,15]

In the current study, individuals with COVID had decreased hemoglobin levels. Patients with a larger percentage of diabetes, hypertension, and general comorbidities, as well as those confined to the hospital, had lower hemoglobin levels.[7,16] It has been hypothesized that COVID-19 is more than simply a pulmonary inflammation, and there is hemoglobinopathy, dysregulation of iron metabolism causing altered oxygen transport, and ultimately oxygen deprivation.[17]

The total WBC count, neutrophils, ESR, D-dimer, and ALT were significantly higher in COVID patients with severe disease during the present study. Similar findings were observed in a previous study in Bangladesh (Islam *et al*.,[4]), Pakistan (Taj *et al*.,[7]), and China (Liao *et al*.,[18]). Higher WBC count has been recorded in previous studies by Islam *et al*.,[4] and Taj *et al*.,[7] COVID-19 cases are known to be associated with prominent elevations of ESR, as compared to non-severe cases.[19,20] The inflammatory process and the production of acute-phase proteins may produce an increase in ESR. D-dimer levels were shown to be elevated in previous research by Islam *et al*.,[4] and Taj *et al*.,[7] D-dimer levels correlate well with disease severity and are a reliable prognostic marker for in-hospital mortality in patients admitted with COVID-19 with D-dimer levels being higher in non-survivors than in-survivors.[21,22]

Significantly lower lymphocytes were observed in COVID patients with severe disease in the present retrospective study. Huang and Pranata[23] found in a meta-analysis that patients with poor outcome have a lower lymphocyte count. Zhou *et al*.,[6] also reported similar findings citing a significant reduction of lymphocyte count in the severe COVID-19 group compared to the non-severe group. Islam *et al*.,[4] also noticed similar findings.

In the present study severely affected patients also evidenced increased and highly significant (P < 0.001) concentrations of total platelets, CRP, and ferritin. CRP levels have been shown to represent the size of lung lesions and disease severity, as well as disease changes.[24] Higher plasma CRP levels have also been linked to severe COVID-19 pneumonia and extended hospitalization.[25,26] It has been hypothesized in many studies[27-29] that ferritin may have a significant role in inflammation, other than its classical role as iron storage, and it seems ferritin is related with severity of the disease. Moreover many studies on COVID-19 patients also found elevated levels of ferritin.[4,7] It was concluded that more than 50 years of

age is a risk factor for COVID-19 and elevated levels of D-dimer, ESR, total platelets, CRP and ferritin indicate severe disease.

CONCLUSION

It was concluded that more than 50 years age is a risk factor for COVID-19 and elevated levels of D-dimer, ESR, total platelets, CRP and ferritin indicate severe disease.

REFERENCES

1. Rimesh P, Yadav U. COVID-19 pandemic in India: Present scenario and a steep climb ahead. J Prim Care Community Health 2020;11:2150132720939402.
2. Mehta P, McAuley DF, Brown M, Sanchez E, Tattersall RS, Manson JJ. COVID-19: Consider cytokine storm syndromes and immunosuppression. Lancet (London, England) 2020;395:10229-330.
3. Tang N, Li D, Wang X, Sun Z. Abnormal coagulation parameters are associated with poor prognosis in patients with novel coronavirus pneumonia. J Thromb Haemostasis 2020;18:844-7.
4. Islam M K, Hossain MM, Sharif MM, Hasan P, Molla MM, Amin MR. Routine blood report and common laboratory parameters in COVID-19: Experience from Bangladesh. J Med 2021;22:132-8.
5. Wang Z, Yang B, Li Q, Wen L, Zhang R. Clinical features of 69 cases with coronavirus disease 2019 in Wuhan, China. Clin Infect Dis 2020;71:769-77.
6. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z. Clinical course and risk factors for mortality of adult inpatients with COVID- 19 in Wuhan, China: A retrospective cohort study. Lancet 2020;395:1054-62.
7. Taj S, Kashif A, Fatima SA, Imran S, Lone A, Ahmed Q. Role of hematological parameters in the stratification of COVID-19 disease severity. Ann Med Surg (Lond) 2021;62:68-72.
8. Lillicrap D. Disseminated intravascular coagulation in patients with 2019-nCoV pneumonia. J Thromb Haemostasis 2020;18:786.
9. Hoffman R, Benz EJ, Shattil SJ, Furie B, Cohen HJ, Silberstein LE, *et al*. Hematology Basic Principles and Practice. 3rd ed. Philadelphia, PA: Churchill Livingstone; 2000.
10. Bwire GM. Coronavirus: Why men are more vulnerable to Covid-19 than women? SN Compr Clin Med 2020;4:1-3.
11. Jordan RE, Adab P, Cheng KK. Covid-19: Risk factors for severe disease and death. Br Med J 2020;368:m1198.
12. Shim E, Tariq A, Choi W, Lee Y, Chowell G. Transmission potential and severity of COVID-19 in South Korea. Int J Infect Dis 2020;93:339-44.
13. Terpos E, Ntanasis-Stathopoulos I, Elalamy I, Kastritis E, Sergentanis TN, Politou M, *et al*. Hematological findings and complications of COVID-19. Am J Hematol 2020;95:834-47.
14. Richardson S, Hirsch JS, Narasimhan M, Crawford JM, McGinn T, Davidson KW. Presenting characteristics, comorbidities, and outcomes among 5700 patients hospitalized with COVID-19 in the New York city area. JAMA 2020;323:2052-9.
15. Sanyaolu A, Okorie C, Marinkovic A, Patidar R, Younis K, Desai P, *et al*. Comorbidity and its impact on patients with COVID-19. SN Compr Clin Med 2020;2:1069-76.
16. Taneri PE, Gómez-Ochoa SA, Llanaj E, Raguindin PF, Rojas LZ, Roa-Díaz ZM, *et al*. Anemia and iron metabolism in COVID-19: a systematic review and meta-analysis. Eur J Epidemiol 2020;35:763-73.
17. Cavezzi A, Troiani E, Corrao S. COVID-19: Hemoglobin, iron, and hypoxia beyond inflammation. A narrative review. Clin Pract 2020;10:1271.
18. Liao DF, Zhou L, Luo M, Xu H, Wang J, Xia X. Haematological characteristics and risk factors in the classification and prognosis evaluation of COVID-19: A retrospective cohort study. Lancet Haematol 2020;7:e671-8.
19. Lapiæ I, Rogiæ D, Plebani M. Erythrocyte sedimentation rate is associated with severe coronavirus disease 2019 (COVID-19): A pooled analysis. Clin Chem and Lab Med 2020;58:1146-8.
20. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. J Am Med Assoc 2020;323:1061-9.
21. Sakka M, Connors JM, Hékimian G, Martin-Toutain I, Crichi B, Colmegna I, *et al*. Association between D-Dimer levels and mortality in patients with coronavirus disease 2019 (COVID-19): A systematic review and pooled analysis. J Méd Vasc 2020;45:268-74.
22. Yao Y, Cao J, Wang Q, Shi Q, Liu K, Luo Z. D-dimer as a biomarker for disease severity and mortality in COVID-19 patients: A case control study. J Intens Care 2020;8:49.
23. Huang I, Pranata R. Lymphopenia in severe coronavirus disease-2019 (COVID-19): Systematic review and meta- analysis. J Intens Care 2020;8:36.
24. Wang L. C-reactive protein levels in the early stage of COVID-19. Méd Mal Infect 2020;50:332-4.
25. Chen W, Zheng KI, Liu S, Yan Z, Xu C, Qiao Z. Plasma CRP level is positively associated with the severity of COVID-19. Ann Clin Microbiol Antimicrob 2020;19:18.
26. Sahu BR, Kampa RK, Padhi A, Panda AK. C-reactive protein: A promising biomarker for poor prognosis in COVID-19 infection. Clin Chim Acta 2020;509:91-4.
27. Gómez-Pastora J, Weigand M, Kim J, Wu X, Strayer J, Palmer AF, *et al*. Hyperferritinemia in critically ill COVID 19 patients is ferritin the product of inflammation or a pathogenic mediator? Clin Chim Acta 2020;509:249-51.
28. Rosário C, Zandman-Goddard G, Meyron-Holtz EG,

D'Cruz DP, Shoenfeld Y. The hyperferritinemic syndrome: Macrophage activation syndrome, Still's disease, septic shock and catastrophic antiphospholipid syndrome. BMC Med J 2013;11:185.
29. Soundravally R, Agieshkumar B, Daisy M, Sherin J, Cleetus CC. Ferritin levels predict severe dengue. Infection 2015;43:13-9.

How to cite: Chhabra MK, Kamra KS, Kataria J. Common Laboratory Parameters in Moderate to Severely Affected COVID-19 Patients Admitted to Government Hospital, Ganganagar. MIMER Med J 2021;5(2):47-51.

Source of Support: Nil. **Conflict of Interest:** None declared.