

# The Adaptation of Hemoglobin (Hb) and White Blood Cells (WBCs) in Severe Cases of SARS-Cov-2

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## Abstract

SARS-CoV-2 cause alterations in the hematological parameters and many studies have concentrated on this area and correlated these with severity of disease. A retrospective study of severe cases of COVID-19 were reviewed. The data of hemoglobin (Hb) and white blood cells (WBCs) were accounted and documented. Patients recruited at period from March to July, 2021. Retrospectively, data extracted on the Hb level and WBC counts from Lab reports both at admission and when patients discharge. The frequencies of anemia or erythrocytopenia (Hb <12 g/dL) and leukocytosis (WBC >11×10<sup>3</sup>/μL) was calculated in the studied population. Of 3637 SARS-COV-2 cases, 250 patients with severe conditions of COVID-19 as define by WHO, which were either admitted to ICU or died. Of 250, 80(32%) were entered to ICU, and the rest 170 cases (68%) who died. While the mean age of the patients was 55.46±17.49 years, patients with the severe condition were significantly older than those with the mild-moderate condition (mean age of 50.68 vs. 68.59; P: <0.01). The mean number of white blood cells (WBC) was 8.88±7.29 ×10<sup>9</sup>/L in all SARS-COV-2 patients, which is significantly higher in the severe cases compared to those with the mild-moderate disease (10.56 vs. 8.95; P: <0.01). The Hb level (<12 g/dL) was lower in the severe COVID-19 than other groups; however, it was not statistically significant. Increased number of WBCs and dropped Hb level during hospitalization of SARS-COV-2 patients may predict a poor outcome. We concluded that not only the mean number of WBCs was significantly higher in the severe cases also leukocytosis was a common finding; indicating that an increased number of WBCs may probably predict a poor outcome. Also, the level of Hb was higher in the mild-moderate group; however, it was not statistically significant.

**Keywords:** SARS-COV-2; COVID-19; Hemoglobin; White Blood Cells

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## Introduction

The unforgotten month in the new history is December 2019 when an outbreak of COVID-19 in Wuhan, China discovered and became a big issue in the emergent public health [1]. Yet, the disease course has many peaks of severity in most countries and the number of recovered cases is increasing [2], but the deaths number is increment gradually [3]. The respiratory system involvement was mostly seen at the majority of patients but recently many studies estimated the hyper-inflammatory nature of the COVID-19, which may affect different systems in the body [4,5]. Several studies have recorded the alterations in hematological parameters as indicator of severity [6]. Nearly all studies are documenting an increased number of WBC count in severe SARS-COV-2, thus the level of Hb may be affecting or not [7]. In evidence term, some studies have indicated the prognostic values of thrombocytopenia [8,9], neutrophilia, and lymphopenia [10-12] in SARS-CoV-2 infection, while other studies have documented no significant changes [13] and a few reports showed a decrease in the parameter level [14].

Here, we evaluate the alteration of Hb and WBC during severe COVID-19 infection. Also, we investigate if there is any correlation between the blood counts and severity of SARS-CoV-2.

## Methods

A retrospective study of 250 severe COVID-19 cases was conducted, which approved by the AL-Karama Teaching Hospital Ethics Committee. Patients recruited at period from March to July, 2021. All COVID-19 cases were proven diagnosed by chest CT scan and PCR testing. Retrospectively, data extracted on the Hb level and WBC counts from Lab reports both at admission and when patients discharge. The frequencies of anemia or erythrocytopenia (Hb <12 g/dL) and leukocytosis (WBC >11×10<sup>3</sup>/μL) was calculated in the studied population. The entrance to the intensive care unit (ICU) was defined as criteria for the severity of the COVID-19. All the statistical analyses were performed using the IBM SPSS version 24.0 (IBM Corp., NY, USA). The normally distributed variables were described as the means± standard deviation (SD). Categorical variables were summarized as frequencies (percentages). The normally distributed continuous variables were compared between mild-moderate and severe groups using the two independent sample t-test. A P value of less than 0.05 was considered to indicate a statistically significant difference.

## Results

Of 3637 SARS-COV-2 cases, 250 patients with severe conditions



of COVID-19 as define by WHO, which were either admitted to ICU or died. Of 250, 80 (32%) were entered to ICU, and the rest 170 cases (68%) who died. While the mean age of the patients was 55.46±17.49 years, patients with the severe condition were significantly older than those with the mild-moderate condition (mean age of 50.68 vs. 68.59; P: <0.01). The mean number of white blood cells (WBC) was 8.88±7.29 x10<sup>3</sup>/μL in all SARS-COV-2 patients, which is significantly higher in the severe cases compared to those with the mild-moderate disease (10.56 vs. 8.95; P: <0.01). Of particular interest, the same finding was found concerning the level of hemoglobin in these patients. The Hb level (<12 gm/dL) was lower in the severe COVID-19 than other groups; however, it was not statistically significant. Increased number of WBCs and dropped Hb level during hospitalization of SARS-COV-2 patients may predict a poor outcome.

**Table 1:** Baseline features and hematologic data of the study.

	Mild - moderate cases	Severe	Total	P value	
	No. (%) / mean±SD				
<b>COVID-19 patients</b>	3387 (93.13)	250 (6.87)	3637	0.01	
<b>Age (years)</b>	50.68±13.4	68.59±10.65	55.46±17.49	0.01	
<b>Gender</b>	<b>Male</b>	2011 (92.5)	163 (7.49)	0.09	
	<b>Female</b>	1376 (94.04)	87 (5.96)		1463
<b>WBC</b>	>11	10.56± x10 <sup>3</sup>	8.95± x10 <sup>3</sup>	8.88±7.29 x10 <sup>3</sup>	0.01
<b>Hb</b>	<12	13.19±2.5	10.49±2.33	11.24±1.34	0.06

## Discussion

Coronavirus disease-2019 is a type of respiratory syndrome symptomatically spanning from healthy carriers to patients with life-threatening complications and may lead to death. Although most cases display no or mild-to-moderate clinical symptoms, some patients are admitted with a severe condition necessitating specialized management at intensive care units (ICU) [15]. Thus far, multiple lines of studies have focused on the identification and application of novel approaches to precisely estimate SARS-COV-2 outcome. The results of a recent study have demonstrated that analysis of the laboratory parameters not only provides an appropriate diagnostic significance but the alteration of these parameters may also predict unfavorable outcomes in SARS-CoV-2 infection [16]. In this retrospective Double Centre study reviewing the results of the WBC and Hb counts of SARS-COV-2 patients (250 of whom had severe disease), we found that the number of WBC was higher in the severe COVID-19, which was significantly higher when compared to those with the non-severe disease. Accordingly, we found that leukocytosis is a common finding among severe SARS-COV-2 patients; indicating that an increased number of WBC may probably predict a poor outcome. In consistent, Huang et al. documented that the percentage of severe SARS-COV-2 patients who had increased WBC counts was significantly higher than non-severe counterparts (54% vs. 19%), further highlighting the fact that the extent of deviation from normal white blood cell counts associates with disease severity [15]. Our results were also in agreement with several studies that reported the occurrence of leukocytosis in 32% [17], 30% [11], 24% [18], 22% [19], and 21% [20,21] of infected cases. In addition, anemia or low level of Hb was noted in severe COVID-19 cases with no significant association. In agreement, Wang et al. reported that SARS-COV-2 cases who died of the disease displayed a higher number of WBCs during hospitalization than those who survived [12]. Al-Saadi EAKD, et al. (2021) [22], concluded that the monitoring hematological changes in patients with COVID-19 can predict patients needing additional care and stratify the risk for severe course of the disease.

More studies are required in Iraq to reflect the hematological changes in COVID-19 as compared to global data.

## Conclusions

We revealed that not only the mean number of WBCs was significantly higher in the severe cases also leukocytosis was a common finding; indicating that an increased number of WBCs may probably predict a poor outcome. Also, the level of Hb was higher in the mild-moderate group; however, it was not statistically significant. Further investigations in the field of the identification and application of laboratory biomarkers that can enable to rapidly and economically predict SARS-COV-2 prognosis will pave the way to better management.

## References

- Lu H, Stratton CW, Tang YW (2020) The Wuhan SARS-CoV-2-What's next for China. *J Med Virol* 92: 546-547. <https://doi.org/10.1002/jmv.25738>
- Wu Z, McGoogan JM (2020) Characteristics of and important lessons from the coronavirus disease 2019 (SARS-COV-2) outbreak in China: summary of a report of 72,314 cases from the Chinese Center for Disease Control and Prevention. *JAMA* 323: 1239-1242. <https://doi.org/10.1001/jama.2020.2648>
- Du Y, Tu L, Zhu P, Mu M, Wang R, et al. (2020) Clinical features of 85 fatal cases of SARS-COV-2 from Wuhan. A retrospective observational study. *Am J Respir Crit Care Med* 201: 1372-1379. <https://doi.org/10.1164/rccm.202003-0543OC>
- Yang Y, Shen C, Li J, Yuan J, Yang M, et al. (2020) Exuberant elevation of IP-10, MCP-3 and IL-1ra during SARS-CoV-2 infection is associated with disease severity and fatal outcome. *medRxiv*. <https://doi.org/10.1101/2020.03.02.20029975>
- Xiong Y, Liu Y, Cao L, Wang D, Guo M, et al. (2020) Transcriptomic characteristics of bronchoalveolar lavage fluid and peripheral blood mononuclear cells in SARS-COV-2 patients. *Emerg Microbes Infect* 9: 761-770. <https://doi.org/10.1080/22221751.2020.1747363>
- Lippi G, Plebani M (2020) Laboratory abnormalities in patients with COVID-2019 infection. *Clin Chem Lab Med* 58: 1131-1134. <https://doi.org/10.1515/ccm-2020-0198>
- Lu G, Wang J (2020) Dynamic changes in routine blood parameters of a severe SARS-COV-2 case. *Clin Chim Acta* 508: 98-102. <https://doi.org/10.1016/j.cca.2020.04.034>
- Lippi G, Plebani M, Henry BM (2020) Thrombocytopenia is associated with severe coronavirus disease 2019 (SARS-COV-2) infections: A meta-analysis. *Clin Chim Acta* 506: 145-148. <https://doi.org/10.1016/j.cca.2020.03.022>
- Yang X, Yang Q, Wang Y, Wu Y, Xu J, et al. (2020) Thrombocytopenia and its association with mortality in patients with COVID-19. *J Thromb Haemost* 18: 1469-1472. <https://doi.org/10.1111/jth.14848>
- Yuan J, Zou R, Zeng L, Kou S, Lan J, et al. (2020) The correlation between viral clearance and biochemical outcomes of 94 SARS-COV-2 infected discharged patients. *Inflamm Res* 69: 599-606.
- Huang C, Wang Y, Li X, Ren L, Zhao J, et al. (2020) Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet* 395: 497-506. [https://doi.org/10.1016/S0140-6736\(20\)30183-5](https://doi.org/10.1016/S0140-6736(20)30183-5)
- Wang D, Hu B, Hu C, Zhu F, Liu X, et al. (2020) Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. *JAMA* 323: 1061-1069. <https://doi.org/10.1001/jama.2020.1585>
- Liu J, Li S, Liu J, Liang B, Wang X, et al. (2020) Longitudinal characteristics of lymphocyte responses and cytokine profiles in the peripheral blood of SARS-CoV-2 infected patients. *EBioMedicine* 55: 102763. <https://doi.org/10.1016/j.ebiom.2020.102763>
- Sanchez-Cerrillo I, Landete P, Aldave B, Sanchez-Alonso S, Sanchez-Azofra A, et al. (2020) Differential redistribution of activated monocyte and dendritic cell subsets to the lung associates with severity of SARS-COV-2. *medRxiv*. <https://doi.org/10.1101/2020.05.13.20100925>
- Xu Z, Shi L, Wang Y, Zhang J, Huang L, et al. (2020) Pathological findings of SARS-COV-2 associated with acute respiratory distress syndrome. *Lancet Respir Med* 8: 420-422. [https://doi.org/10.1016/S2213-2600\(20\)30076-X](https://doi.org/10.1016/S2213-2600(20)30076-X)
- Perisetti A, Gajendran M, Mann R, Elhanafi S, Goyal H (2020) SARS-COV-2 extrapulmonary illness – special gastrointestinal and hepatic considerations. *Dis Mon* 66: 101064. <https://doi.org/10.1016/j.disamonth.2020.101064>



17. Shi H, Han X, Jiang N, Cao Y, Alwalid O, et al. (2020) Radiological findings from 81 patients with SARS-COV-2 pneumonia in Wuhan, China: a descriptive study. *Lancet Infect Dis* 20: 425-434. [https://doi.org/10.1016/S1473-3099\(20\)30086-4](https://doi.org/10.1016/S1473-3099(20)30086-4)
18. Chen N, Zhou M, Dong X, Qu J, Gong F, et al. (2020) Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *Lancet* 395: 507-513. [https://doi.org/10.1016/S0140-6736\(20\)30211-7](https://doi.org/10.1016/S0140-6736(20)30211-7)
19. Chen H, Guo J, Wang C, Luo F, Yu X, et al. (2020) Clinical characteristics and intrauterine vertical transmission potential of SARS-COV-2 infection in nine pregnant women: a retrospective review of medical records. *Lancet* 395: 809-815. [https://doi.org/10.1016/S0140-6736\(20\)30360-3](https://doi.org/10.1016/S0140-6736(20)30360-3)
20. Zhou F, Yu T, Du R, Fan G, Liu Y, et al. (2020) Clinical course and risk factors for mortality of adult inpatients with SARS-COV-2 in Wuhan, China: a retrospective cohort study. *Lancet* 395: 1054-1062. [https://doi.org/10.1016/S0140-6736\(20\)30566-3](https://doi.org/10.1016/S0140-6736(20)30566-3)
21. Chen L, Liu H, Liu W, Liu J, Liu K, et al. (2020) Analysis of clinical features of 29 patients with 2019 novel coronavirus pneumonia. *Zhonghua Jie He He Hu Xi Za Zhi* 43: E005. <https://doi.org/10.3760/cma.j.issn.1001-0939.2020.0005>
22. Al-Saadi EAKD, Abdulnabi MA (2021) Hematological changes associated with COVID-19 infection. *J Clin Lab Anal* 16: e24064. <https://doi.org/10.1002/jcla.24064>