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The Relationship between Some Heamatological Parameters (CBC) in COVID-19 Patients in Kerbala

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Abstract

Objective: This study is aimed at examining the role of hematological parameters among COVID-19 patients in Kerbala, Iraq.

Methods: During the months of September and October 2021, blood samples were taken from 80 COVID-19 participants who attended private medical clinics and 80 people without COVID 19. Complete blood count (CBC), white blood cell (WBC), red blood cell (RBC), and platelet count (PLT) messages were compared in patients with and without confirmed COVID-19 infection.

Results: The average age of the patients was 32.72, compared to the mean age of healthy people, which was 58.4. The ages of male COVID-19 patients were lower than females. The most common blood group of patients is O (42.5%). WBC, neutrophils (Gran) and Gran% were increased significantly ($P<0.05$) in patients (10.29 10^3/uL, 8.41 10^3/uL and 81.62%, respectively) compared with the healthy group. RBC messages (RBC, HGB, HCT, MCV, MCH, MCHC, RDW-CV, and RDW-SV) and PLT messages (PLT, MPV, PDW, PCT, P-LCR, and P-LCC) differed significantly but within normal limits.

Conclusions: The study concluded that young people are more susceptible to infection with COVID-19. It is possible that high concentrations of WBC, neutrophils, and Gran% as indicators of COVID-19 infections have a significant relationship with this infection.

Keywords: COVID-19, WBC, RBC, PLT, Karbala.

Introduction

In December 2019, in Wuhan, China, a Coronavirus Disease 2019 (COVID-19) outbreak has been detected[1,2]. It quickly spread into a pandemic, infecting more than 206 million people globally. Until August 14, 2021, a total of 4.35 million people have died in 191 countries and regions. On February 24,

2020, In Iraq, a first incidence was verified, and by April 2022, there had been 2,322,551 laboratory-confirmed cases in Iraq[3].

More study is needed to uncover risk factors for severe and critical COVID-19 patients, such as laboratory data and biomarkers. Medication in the lab has a key role in the beginning phases of identification, diagnosis, and therapy of numerous disorders, as previously stated[4,5]. In patients infected with SARS-COV-2, a variety of hematological markers are being used to predict prognosis, mortality, and therapy[4].

Patients with clinical symptoms and radiographic signs of parenchymal illness are more likely to develop pneumonia. The majority of the patients had a minor illness, 13.8 percent have severe disease, and 4.7 percent have a serious illness[6]. Proinflammatory cytokines such as interleukins and tumor necrosis factor- were found to be higher in the plasma of patients admitted to icu, implies that individuals with acute illnesses may suffer a cytokine storm[7].

According to previous papers, blood cell count analysis is a straightforward, cost-effective, and rapid routine laboratory technique for identifying pathogens inflammatory reactions and the prevalence of COVID-19. Critical patients had higher leukocyte and neutrophil counts, but lower lymphocytes, at the end of treatment, The number of red blood cells, hemoglobin amount, and platelet count were all assessed[8]. In addition, a cross-sectional investigation of 148 patients found that older age, neutrophilia, lymphopenia, eosinopenia, a high neutrophil-lymphocyte ratio, and a high neutrophil-monocyte ratio were linked to severe and critical COVID-19 infection. The percentages of lymphocytes, monocytes, and eosinophils were all found to be adversely linked with illness severity[9]. Serious and dangerously sick individuals had a much lower lymphocyte count, red blood cell count, and hemoglobin than healthy COVID-19 patients, according to a comparable study of COVID-19 hematological parameters[10]. Hemoglobin levels in COVID-19 people with acute and critical illnesses are much lower than that of other with moderate disease, according to a conceptual[11].

Hematological disorders are linked to severe COVID-19 pneumonia for a variety of reasons. COVID-19 hematological abnormalities are linked to disease development, severity, and mortality. COVID-19 patients have been shown to have lymphopenia, thrombocytopenia, a coagulation profile that is abnormal, and sepsis that causes disseminated intravascular coagulation (DIC)[12]. In the critical care unit, platelet count is a basic and easily accessible hematological metric that is separately related with illness severity and mortality risk (ICU)[13]. Hematological biomarkers (complete blood count) can contribute significantly in the intensity of early sickness prediction and can provide a better guidance for appropriate patient therapy, reducing disease morbidity and mortality. The aim of the present study is to look into the relationship between hematological parameters (CBC) and COVID-19 disease.

Materials and Methods:

Patents classified as COVID-19 patients by PCR were given data for two months, September 2021 to October 2021. A total of 80 patients with COVID-19 were investigated, with both genders ranging in age from 3 to 84 years old. GenoTEK was used to perform a complete blood count.

The independent t-test was utilized to make a comparison between the data, followed by Tukey post-hoc analysis. The X^2 test was used to analyze categorical values. SPSS 20.0 was used to conduct all of the analyses (SPSS Inc., Chicago, IL., USA). A statistically significant two-sided P-value of 0.05 was used.

Results and Discussion:

Gender and Age: Among the 80 patients and 80 healthy people, the percentage of females was 55% and males 45%. While the percentage of healthy females was 47.5% and healthy males was 52.5%. The results in Table 1 indicate that there are no significant differences (P > 0.05) between both sexes for COVID-19 patients, not even between patients and the healthy group.

The results also indicated that the average age of patients was 32.27 years, which is significantly less than the average age of healthy people, which was 58.4 years. The average age of male patients was significantly lower than that of female patients. As the average age of each of them is (28.22 and 36.40) years, respectively.

Table 1 : Gender and Age Parameters of the healthy and COVID 19 patients.

Factor	Gender	Control (N=80)	Patients (N=80)	Total (N=160)	P value
Gender N(%)	**Female**	38 (47.5 %)	44 (55.0 %)	**82 (51.25%)**	**0.5075**
	Male	42 (52.5 %)	36 (45.0 %)	**78 (48.75%)**	**0.4969**
	Total	**80 (100 %)**	**80 (100 %)**	**160 (100%)**	**1.0000**
	P value	**0.6547**	**0.3710**	**0.7518**	
Age (Years) Mean ±	**Female**	57.57 ± 11.02	36.40 ± 19.95	**46.21** ± 19.49	**0.0001****
	Male	59.14 ± 10.22	28.22 ± 14.18	**44.87** ± 19.69	**0.0001****
	Total	**58.4 ± 10.57**	**32.72 ± 17.96**	**45.56 ± 19.53**	**0.0001****
	P value	**0.515**	**0.0419 ***	**0.6676**	

*denotes statistically significant differences (P < 0.05). ** indicates significant differences (P < 0.001).

Based on the results of our study, COVID-19 infection does not differ in males from females, with the same prevalence rates. These results are in agreement with each of Jin *et al* [14]. In patients with COVID-19, advanced age and a great percentage of comorbidity were related with higher morbidity and mortality. Whereas The frequency of both men and women was like that, COVID-19-positive men are more likely to contract poor results and death, regardless of age[15]. When the characteristics associated to illness severity at presentation were included in the multivariable analysis, gender was not found to be a significant determinant of dying (p = 0.898)[16].

Blood Groups: Through the results of Table 2, it was found There were no substantial differences within COVID-19 individuals (P > 0.05) and healthy people for each blood group separately. The most common patient group is O (42.5%), followed by B, A, and AB (22.5, 20.0, and 15.0%), respectively.

Table 2 : Blood groups of the healthy and COVID 19 patients.

Blood Group	Control (N=80)	Patients (N=80)	Total (N=160)	P value
A	28 (35.0 %)	16 (20.0 %)	**44 (27.5%)**	**0.07044**
B	14 (17.5 %)	18 (22.5 %)	**32 (20.0%)**	**0.4795**
AB	8 (10.0 %)	12 (15.0 %)	**20 (12.5 %)**	**0.37109**
O	30 (37.5 %)	34 (42.5 %)	**64 (40.0)**	**0.61708**
Total	**80 (100%)**	**80 (100 %)**	**160 (100 %)**	**1.00000**

P value	**0.00064 ****	**0.00291***	**0.00001 ****	

*denotes statistically significant differences (P < 0.05). ** indicates significant differences (P < 0.001).

The ABO and Rh blood group categories are associated to a variety of illnesses, involving cancer, inflammatory, non-infectious, bacterial, and viral problems. According to studies, blood types A and O are associated with a higher and lower risk of coronavirus illness 2019 positive, respectively.

According to one report, COVID-19 disease is more common in blood types A, B, and Rh+, whereas it is less common in blood types O, AB, as well as Rh. There was no link discovered between blood types and vulnerability to illness severity or death[17]. In one Iranian study that indicates the most of the cases had O+ (29.6 percent) [18]. Blood type O (62.4 percent) was the most common in COVID-19 Saudi patients, next by blood type A (25.5 %), blood type B (10.1 %), and blood type AB (2.0 %)[19].

WBC Message: The results in Table 3 indicate that there are significant differences (P< 0.05) between the hematological parameters of white blood cells (WBC) and the parameters that are associated with them in COVID-19 patients compared to healthy controls.

In WBC, there is a significant increase (P<0.05) in patients (10.29 10^3/uL) compared to its concentration in the healthy group. There is also a significant increase (P<0.05) in neutrophils (Gran) and Gran% of COVID-19 patients, which amounted to 8.41 10^3/uL and 81.62%, respectively. While the percentage of lymphocytes decreased significantly (P<0.05), as it was 14.4% in patients.

As for the rest of the parameters (Lym, Mid, and Mid%), the differences were significant (P<0.05) between patients and healthy groups, but within the normal range for each parameter.

Table 3 : Hematological Parameters (WBC Message) of the healthy and COVID19 patients.

Factor	Gender	Control (N=80)	Patients (N=80)	Total (N=160)	P value
WBC	**Female**	6.36 ± 1.61	9.76 ± 2.87	**9.33 ± 3.53**	**0.0001****
	Male	8.26 ± 2.27	11.06 ± 4.16	**8.30 ± 2.95**	**0.0003****
	Total	**7.36 ± 2.19**	**10.29 ± 3.56**	**8.83 ± 3.29**	**0.0001****
Lym	**Female**	2.36 ± 0.76	1.38 ± 1.00	**2.17 ± 1.08**	**0.0001****
	Male	2.80 ± 0.82	1.60 ± 0.88	**1.89 ± 0.99**	**0.0001****
	Total	**2.59 ± 0.81**	**1.48 ± 0.95**	**2.03 ± 1.04**	**0.0001****
Gran	**Female**	3.44 ± 1.12	7.93 ± 2.62	**6.68 ± 3.37**	**0.0001****
	Male	4.91 ± 1.67	9.00 ± 3.43	**5.93 ± 3.01**	**0.0001****
	Total	**4.21 ± 1.61**	**8.41 ± 3.04**	**6.31 ± 3.21**	**0.0001****
Mid	**Female**	0.60 ± 0.16	0.34 ± 0.22	**0.47 ± 0.26**	**0.0001****
	Male	0.54 ± 0.22	0.45 ± 0.36	**0.49 ± 0.27**	**0.1801**
	Total	**0.57 ± 0.19**	**0.39 ± 0.30**	**0.48 ± 0.27**	**0.0001****
Lym %	**Female**	37.01 ± 8.29	14.34 ± 7.44	**25.24 ± 12.44**	**0.0001****
	Male	34.44 ± 6.57	14.24 ± 4.20	**24.70 ± 13.07**	**0.0001****
	Total	**35.66 ± 7.50**	**14.3 ± 6.16**	**24.98 ± 12.71**	**0.0001****
Gran %	**Female**	52.87 ± 8.35	81.86 ± 8.05	**68.90 ± 14.63**	**0.0001****
	Male	58.37 ± 7.46	81.32 ± 6.24	**68.46 ± 15.71**	**0.0001****

	Total	**55.76 ± 8.31**	**81.62 ± 7.25**	**68.69 ± 15.12**	**0.0001****
Mid %	**Female**	10.06 ± 3.16	3.80 ± 2.63	**5.83 ± 3.52**	**0.0001****
	Male	7.18 ± 2.98	4.42 ± 3.62	**6.82 ± 4.30**	**0.0004****
	Total	**8.55 ± 3.38**	**4.08 ± 3.11**	**6.31 ± 3.94**	**0.0001****

*denotes statistically significant differences (P < 0.05). ** indicates significant differences (P < 0.001).

Numerous studies indicated that severe COVID-19 pneumonia cases exhibited neutrophilia (absolute neutrophil count outside the reference; 3–7.5 109/L) and/or lymphocytopenia (lymphocyte count 1.5 109/L) and were related with a bad outcome. In the initial phases of SARS CoV-2 infection, the neutrophil to lymphocyte ratio (NLR) has also been demonstrated to indicate symptom severity. Preliminary studies, on either hand, in relative to non, serious patients exhibit a considerable drop in granulocytes[20].

According to the findings of another study, a more serious illness linked to substantial neutrophilia and lymphopenia, In critically ill individuals, this was amplified. Irregular WBC shape was connected to milder disease, notably in monocytes and lymphocytes, but the anomalies diminished as the disease advanced. Substantial differences in morphology-related research parameters between COVID-19-positive and COVID-19-negative[21].

In some other research, the SARS-CoV-2 group had a lesser white blood cell count (WBC) and absolute neutrophil number (NEU#) than the MP and Flu A/B groups; the eosinophil percentage (EO percent) and absolute eosinophil count (EO#) were both lower in the SARS-CoV-2 class than that of the MP group (p0.05). (2) Aspartate aminotransferase (AST) showed significant decrease after patients were hospitalized (p < 0.05), EO percent and EO# recovered upon discharge, and restored to normal levels throughout follow-up (p0.05). (3) Lymphocyte percentage (LY percent) and absolute lymphocyte count (LY#) reduced (p0.05) whenever the nucleic acid test was negative but the stool was still significant. (4) EO# demonstrated a steady pattern as the nucleic acid's cycle threshold (Ct) value increased or decreased. Blood cell count indexes at the time of arrival at the hospital could be advantageous in offering some advice for diagnosing SARS-CoV-2 infection, Flu A/B infection, and MP infection; and AST and EO# could be used to predict patient outcome. Low fecal nucleic acid Ct levels were inversely related to the patient's level of recuperation, and LY# was lower during the fecal-positive phase[22].

RBC message: The blood parameters associated with the RBC message (RBC, HGB, HCT, MCV, MCH, MCHC, RDW-CV, and RDW-SV) showed a variety of significant differences among patients compared to healthy people according to sex. Despite that, all of them are within normal values (Table 4).

We investigated immune reactions utilizing erythrocytes in COVID-19 sufferers as a diagnostic tool since erythrocytes have complement receptors and are capable of binding inflammatory cells. One study found increased C3b and C4d deposition on erythrocytes in COVID-19 and non-COVID sepsis patients compared to healthy controls, indicating that complement plays a role in sepsis-related organ harm. Their findings show that erythrocytes can help with a precision medicine approach to sepsis by observing supplement dysregulation in COVID-19-sepsis and non-COVID sepsis, and categorizing patients who might benefit from complement-targeted medicines[23].

Several diseases, including diabetes, cancer, and neurodegenerative disorders, influence the morpho-functional features of red blood cells, disrupting their normal metabolism in the process. The shape and metabolic characteristics of erythrocytes are examined as part of the hematological alterations. Changes in the functionality of these cells may, in fact, aid in the provision of crucial information regarding the severity and development of disease. The viral infection produces considerable changes in the size, stiffness, and dispersion width of blood cells.

Table 4 : Hematological Parameters (RBC Message) of the healthy and COVID19 patients.

Factor	Gender	Control (N=80)	Patients (N=80)	Total (N=160)	P value
RBC	**Female**	4.64 ± 0.58	4.28 ± 0.51	**4.33 ± 0.50**	**0.0037 ***
	Male	4.60 ± 0.54	4.87 ± 0.34	**4.85 ± 0.44**	**0.0115 ***
	Total	**4.62 ± 0.55**	**4.55 ± 0.52**	**4.58 ± 0.54**	**0.4094**
HGB	**Female**	12.91 ± 1.35	12.47 ± 1.65	**12.11 ± 1.49**	**0.1945**
	Male	12.4 ± 1.60	14.28 ± 1.40	**13.85 ± 1.38**	**0.0001****
	Total	**12.64 ± 1.50**	**13.28 ± 1.78**	**12.96 ± 1.67**	**0.0150 ***
HCT	**Female**	39.83 ± 4.05	36.48 ± 4.65	**36.57 ± 3.87**	**0.0009****
	Male	38.47 ± 4.17	41.65 ± 4.03	**41.21 ± 3.97**	**0.0010****
	Total	**39.11 ± 4.14**	**38.55 ± 4.92**	**38.83 ± 4.54**	**0.4372**
MCV	**Female**	86.24 ± 7.25	85.25 ± 6.62	**84.74 ± 7.55**	**0.5200**
	Male	83.94 ± 7.98	84.38 ± 6.36	**85.17 ± 6.60**	**0.7908**
	Total	**85.04 ± 7.68**	**84.86 ± 6.48**	**84.95 ± 7.08**	**0.8729**
MCH	**Female**	28.00 ± 2.86	29.14 ± 2.91	**28.09 ± 3.28**	**0.0784**
	Male	27.07 ± 3.31	29.40 ± 2.61	**28.70 ± 2.81**	**0.0010****
	Total	**27.51 ± 3.12**	**29.26 ± 2.77**	**28.39 ± 3.07**	**0.0002****
MCHC	**Female**	32.41 ± 1.07	34.14 ± 1.37	**33.08 ± 1.70**	**0.0001****
	Male	32.18 ± 1.58	34.83 ± 1.19	**33.67 ± 1.69**	**0.0001****
	Total	**32.29 ± 1.35**	**34.45 ± 1.33**	**33.37 ± 1.72**	**0.0001****
RDW-CV	**Female**	13.13 ± 1.28	12.98 ± 0.70	**13.30 ± 1.59**	**0.5046**
	Male	13.39 ± 2.59	13.08 ± 0.62	**12.98 ± 1.46**	**0.4857**
	Total	**13.27 ± 2.06**	**13.03 ± 0.66**	**13.15 ± 1.53**	**0.3225**
RDW-SD	**Female**	45.33 ± 5.16	44.62 ± 3.58	**44.95 ± 5.23**	**0.4665**
	Male	45.56 ± 7.74	44.37 ± 3.11	**45.01 ± 5.28**	**0.3903**
	Total	**45.45 ± 6.60**	**44.51 ± 3.36**	**44.98 ± 5.24**	**0.2580**

*denotes statistically significant differences ($P < 0.05$). ** indicates significant differences ($P < 0.001$).

According to various studies, a change in the quantity of antioxidant enzymes promotes a degree of oxidative stress in red blood cells that is damaging. In red blood cells, a shift in antioxidant enzyme level has been demonstrated to produce a harmful condition of oxidative stress, according to several studies. Decreased levels of hemoglobin and anemia have been documented in various studies, and a modification in the exposure of antioxidant enzymes is seen to advertise a scary situation of peroxidation in red blood cells. Hematological alterations increased in patients with severe COVID-19, showing a gradual worsening as COVID-19 severity increased. As a result, monitoring hematological changes in COVID-19 patients may play an essential role in patient care and lowering the risk of a severe course of the illness. Finally,

alterations in erythrocytes and blood in general could be one of the causes of the Long COVID syndrome[24].

PLT message: The blood parameters associated with the PLT message (PLT, MPV, PDW, PCT, P-LCR, and P-LCC) showed a variety of significant differences among patients compared to healthy people according to gender. Despite that, all of them are within normal values (Table 5).

Table 5 : Hematological Parameters (PLT Message) of the healthy and COVID19 patients.

Factor	Gender	Control (N=80)	Patients (N=80)	Total (N=160)	P value
PLT	**Female**	258.21 ± 57.04	255.09 ± 63.16	**256.53 ± 60.05**	**0.8162**
	Male	239.71 ± 47.32	240.77 ± 70.40	**240.20 ± 58.70**	**0.9372**
	Total	**248.5 ± 52.65**	**248.65 ± 66.47**	**248.57 ± 59.77**	**0.9874**
MPV	**Female**	10.28 ± 1.30	8.84 ± 0.64	**9.50 ± 1.23**	**0.0001****
	Male	10.06 ± 0.98	8.44 ± 0.81	**9.31 ± 1.21**	**0.0001****
	Total	**10.17 ± 1.45**	**8.66 ± 0.75**	**9.41 ± 1.22**	**0.0001****
PDW	**Female**	14.26 ± 2.68	10.81 ± 1.18	**12.41 ± 2.65**	**0.0001****
	Male	13.3 ± 1.58	9.9 ± 1.54	**11.73 ± 2.31**	**0.0001****
	Total	**13.75 ± 2.21**	**10.40 ± 1.42**	**12.08 ± 2.50**	**0.0001****
PCT	**Female**	0.26 ± 0.06	0.225 ± 0.05	**0.24 ± 0.06**	**0.0051 ***
	Male	0.23 ± 0.03	0.199 ± 0.04	**0.22 ± 0.04**	**0.0003****
	Total	**0.25 ± 0.05**	**0.213 ± 0.05**	**0.23 ± 0.05**	**0.0001****
P-LCR	**Female**	29.05 ± 9.18	19.76 ± 4.35	**24.07 ± 8.38**	**0.0001****
	Male	27.8 ± 6.52	17.37 ± 5.55	**22.98 ± 8.00**	**0.0001****
	Total	**28.39 ± 7.87**	**18.69 ± 5.04**	**23.54 ± 8.19**	**0.0001****
P-LCC	**Female**	55.10 ± 12.46	50.04 ± 16.50	**52.39 ± 14.90**	**0.1258**
	Male	65.28 ± 13.43	39.16 ± 9.19	**53.23 ± 17.50**	**0.0001****
	Total	**60.45 ± 13.87**	**45.15 ± 14.67**	**52.80 ± 16.17**	**0.0001****

*denotes statistically significant differences ($P < 0.05$). ** indicates significant differences ($P < 0.001$).

COVID-19 produces a wide spectrum of symptoms; certain patients have a substantial proinflammatory response that is connected to a specific coagulopathy and procoagulant endothelial phenotype. Initially, infection with COVID-19 results in a large rise in fibrinogen and D-dimer/fibrin(ogen) degradation products. This is associated to a high rate of venous thromboembolism and systemic hypercoagulability. The degree of D-dimer increase is linked to mortality in COVID-19 patients. Thrombotic events are also caused by COVID-19 in the arteries (such as strokes and ischemia limbs) as well as microvascular thrombotic diseases (as evidenced by autopsy findings in the pulmonary venous pathways). Moderate thrombocytopenia is common in COVID-19 individuals, as is increased platelet intake, that seems to be matched by an increase in platelet synthesis. Disseminated intravascular coagulopathy (DIC) and thrombotic episodes are uncommon in COVID-19 patients. We examine the present level of information about COVID-19 and hemostasis in this article[25].

The mean platelet volume, in addition to the patients' lung capacity, could be utilized in COVID-19 individuals as an additional test for predicting death One study showed that oxygen level at entry and the MPV change between the first and third days of illness were significant predictors of death in COVID-19 participants. While patients with oxygen saturation below 90% at the time of admission had an 8.4 times greater mortality rate, Increases in MPV by one unit risen significantly by 1.76 moments[26].

Conclusions:

We can conclude from the current study that infection with COVID-19 is the same for both sexes, and that young ages are the most infected, and infected males are younger than infected females. The blood group that is most susceptible to infection is O blood group, and that there is a significant increase from the normal limits in the WBC number, neutrophil and their percentage in patients with COVID-19. While the proportion of lymphocytes for patients decreased significantly from its normal limits. These indicators can be used as additional clues for diagnosing people with the disease.

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