ISSN NO: 2770-2936
Date of Publication:17-04-2023

Study the variation in blood cell counts in patients with moderate to severe COVID-19 infection

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Abstarct : The current study aimed to evaluate some immune variables in COVID-19 patients for chronic and acute conditions, as the study included the collection of (120) blood samples for individualssuspected of having respiratory distress syndrome and of both sexes and a age ranging from 29 years to 60 years for a period from 15/12/2021 to 20/7/2022 from a hospital Nineveh AlAhly and Ibn Sina Governmental Hospital. The samples recorded in the study after the confirmation of the diagnosis of COVID-19 were divided into two groups, the first groupincluded (25) patients withchronic respiratory distress syndrome who are in the intensive care unit and need Ventilator support, the second group included (25) patients who suffer from moderate symptoms and the control sample included (25) blood samples for healthy individuals. Through the study, some immune variables of the study sample were evaluated, which included the total numbers of white blood cells, the absolute numbers of neutrophil, lymphatic, mononucleus, acidophilic cells.

Results: The results showed a significant increase in the number of white blood cells, neutrophils, mononucleated cells and eosinophils in chronic COVID-19 patients compared to both acute patients and the control sample, and on the contrary, a significant decrease in the number of phagocytes in chronic and acute cases of COVID-19 patients compared to the control sample was observed at a significant level of $P \leq 0.05$. The results showed an inverse and significant correlation between (Neutrophil) and (phagocytosis), (RBCs) and (Hb) respectively, as the value of the correlation coefficient was (-0.491), (-0.703), (-0.621) respectively, and the existence of a direct and significant correlation between (Neutrophil) and An inverse and significant correlation appeared between Lymphocytes and phagocytosis, RBCs and Hb, respectively, with a correlation coefficient of -0.853, -0.592, and -0.520, respectively.

Keywords: COVID-19; Blood cells; Neutrophil; Severe

Introduction

COVID-19 is an epidemiological challenge caused by thenovel coronavirus SARS-CoV-2 (1) which is currently putting severe pressure on many health systems around the world. The virus belongs to the family of coronavirus viruses that include SARS-CoV-1 and Middle East respiratory syndrome (MERS-CoV). Viruses Corona is a special receptor for lung cells (2). SARS-CoV-2 is known to use the same receptor 1-SARS-CoV to enter the host cell, angiotensin-converting enzyme (ACE-2). (3). Acute and chronic SARS-CoV-2 patients experience a wide range of clinical manifestations, ranging from mild asymptomatic symptoms (colds) to severe , often fatal e. The latter form usually appears with interstitial pneumonia and is moderate to severe in oxygen saturation and therefore hypoxia. Many patients develop respiratory failure, called acute respiratory distress syndrome (ARDS), requiring immediate admission to the intensive care unit. Unlike the usual acute respiratory distress syndrome, patients with chronic conditions show general and progressivedamage to lung tissue and often require a continuous positive airway (pressure) (5). As a result, patients, especially in chronic conditions, suffer from Respiratory failure, which is called interstitial pneumonia (6). Cytokines mainly stimulate immune cells such as macrophages, neutrophils, and lymphocytes to the site of injury – the lungs and respiratory passages (7). There are specific immune cells called macrophages within the lung tissue (especially around the air sacs called alveoli) that provide the next level of resistance to theRussian virus. These cells develop anti-neurotic immune compounds, but can stimulate the

ISSN NO: 2770-2936
Date of Publication:17-04-2023

formation of serious lung tissue damage (8). Because the reaction of immune responses has an effect equivalent to the virulence of this virus, it was necessary to evaluate the immune responses of COVID-19 patients in patients with chronic and acute conditions to find out the most important factors that stimulate the high immune reaction, so the study aimed to evaluate total white blood cell counts of COVID-19 patients in chronic and acute cases and comparing them to a control sample and to estimate the total absolute numbers of neutrophil, lymphatic, mononucleated, and acidic cells of COVID-19 patients in chronic and acute conditions and compare them with the control sample.

Materials and Methods

A number (120) blood samples were collected for individuals suspected of having respiratory distress syndrome of both sexes and from 29 years to 60 years for the period from 15/12/2021 to 20/7/2022 from Nineveh National Hospital and Ibn Sina Governmental Hospital. The samples recorded in the study were divided after confirming the diagnosis of COVID-19 into two groups. , The first group included (25) patients with chronic respiratory distress syndrome and are lying in the intensive care unit and need ventilator support, the second group included (25) patients with moderate symptoms such as cough, fever, and runny nose with upper respiratory tract infections pneumonia, and do not need oxygen from an external source, and the control sample included (25) blood samples for healthy individuals and ages ranging from 24years to 52 years and of both sexes do not suffer from any communicable diseases or viral orbacterial infections or autoimmunediseases. EDTA tubes were used to collect venous blood in size (2ml) for a period not exceeding two hours, to perform blood tests, including complete blood image (CBC) and phagocytic activity.

Result

There were no significant differences in the total numbers of white blood cells between the control sample and Non-sever cases of COVID-19, in terms of the p-value value of (0.335), which is greater than (0.05). There were significant differences in the total white blood cell counts between Sever cases of COVID-19 and the control sample, as well as significant differences between Sever cases of Covid- 19 and Non-sever cases of COVID-19.

Table 1: Mean of WBCs in the studied groups

TYPE		N	Mean	SD.
Control	WBCc Cell/µl	25	7114.2	2053.46
Non -sever cases of COVID-19		25	8708.3	3735.94
Sever cases of Covid -19		25	13131.2	7266.15

Table 2: **Duncan test for two pairs of comparisons and test the level of the variable (white blood cell count)**

WBC			
Duncan			
TYPE	N	Subset for alpha = 0.05	
		1	2
Control	25	7114.2	
Non -sever cases of COVID-19	25	8708.3	
Sever cases of Covid -19	25		13131.2500
P-value		0.33	1.000

**P≤ 0.05*

Table (3) refers to a set of statistical indicators represented by (sample size, arithmetic mean, standard deviation, lowest value, and highest value) of the variable of absolute numbers of neutrophil cells for the study groups.

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Table 3: Mean of Neutrophils in the studied groups

Case Summaries						
TYPE		N	Mean	SD.	Min	Max
Control	Neutrophils Cell/µl	25	4228.2857	1670.5	2332	8475
Non -sever cases of COVID-19		25	5338.8	2793.1	1740	13167
Sever cases of Covid -19		25	8970.3	4787.03	3720	18560

Table 4 refers to a set of statistical indicators represented by (sample size, arithmetic mean, standard deviation, lowest value, and highest value) of the variable of absolute numbers of lymphocytes of the study groups.

Table 4: Mean of Lymphocytes in the studied groups

Case Summaries						
TYPE		N	Mean	SD.	Min	Max
Control	Lymphocytes Cell/µl	25	2175.07	625.5	966	3145
Non -sever cases of COVID-19		25	2501.8	876.2	1209	5225
Sever cases of Covid -19		25	2848.8	2188.7	800	7830

The results of the Duncan test for the comparison pairs, as shown in Table (5), show that there were no significant differences in the absolute numbers of lymphocytes between all study groups (control sample, Non-sever cases of COVID-19 and Sever cases of COVID-19) in terms of the p-value value, which reached (0.179), which is greater than (0.05).

Table 5: **Duncan test for two pairs of comparisons and test the level of significance at the variable (**absolute **numbers of lymphocytes)**

Lymphocytes		
Duncan		
TYPE	N	Subset for alpha = 0.05
		1
Control	25	2175.0714
Non -sever cases of COVID-19	25	2501.8750
Sever cases of Covid -19	25	2848.8750
P-value		.179

**P≤ 0.05*

The results of the analysis of the confusion relationship, as indicated in Table (6) , between the neutrophilic cell variant and the rest of the immune parameters showed as follows: The existence of an inverse and significant correlation between (Neutrophil) and (phagocytosis), (RBCs) and (Hb) respectively, with the value of the correlation coefficient (-0.491), (-0.703), (-0.621) respectively.

Table 6: Correlation between Absolute Numbers of Neutrophila Cells and a Range of Immunological and Hematological Variables in Sever Cases of Covid -19 Patients

		Phagocytosis	RBCs	Hb
Neutrophil	Pearson Correlation	-.491*	-.703**	-.621*
	P-value (2-tailed)	.034	.002	.010
	N	25	25	25

**P≤ 0.05*

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The existence of an inverse and significant correlation between (Lymphocytes) and (phagocytosis), (RBCs) and (Hb) respectively, as the value of the correlation coefficient was (-0.853), (-0.592), (-0.520) respectively.

Table 7: Analysis of the Correlation between Absolute Numbers of Lymphocytes and a Group of Immunomodulatory and Hematological Variables in Sever Cases of Covid-19 Patients

		Phagocytosis	RBCs	Hb
Lymphocytes	Pearson Correlation	-.853**	-.592*	-.520*
	P-value (2-tailed)	.000	.016	.039
	N	25	25	25

$P \leq 0.05$

The existence of an inverse and significant correlation between (Esinophils) and (phagocytosis), (RBCs) and (Hb) respectively, with the value of the correlation coefficient (-0.644), (-0.714), (-0.652) respectively.

Table 8: Analysis of the Correlation between Absolute **Numbers of Acid Cells and a Group of Immunomodulators and Blood Variables in Sever Cases of Covid -19** Patients

		phagocytosis	RBCs	Hb
Esinophils	Pearson Correlation	-.644**	-.714**	-.652**
	P-value (2-tailed)	.007	.002	.006
	N	25	25	25

$P \leq 0.05$

Discussion

Compared to our findings in our current study, several recent studies have shown that patients with chronic COVID-19 conditions tend to have a higher mononucleosis count (9) showed that COVID-19 patients have a significant increase in the number ofwhite blood cells. Leukocytosis has been associated with the chronic condition of patients.

A study by the researcher (Fan, 2020) (10) revealed that when patients were admitted to the hospital, most of them had a normal number of white blood cells. In addition, Salih *et al*. (11) showed that the highest average of white blood cell counts was observed in COVID-19 patients with severe infection compared to mild infections. In the early stages of the disease, the white blood cell count decreases and then gradually increases to become elevated. In severe cases. Thus, the differentiation of peripheral white blood cells may indicate weakened immunity in the early stage of the disease.While a study done by Elderdery *et al*., (12) found no significant difference in the total white blood cell count, the number of lymphocytes, and the average number of basophils between the two groups. This may explain the discrepancy in the results between the current study and the reported reports, as most of the data were collected from the intensive care unit (ICU) .

The rise in the levels of white blood cell counts may indicate the presence of an inflammatory condition as a result of infection with the Covid virus, the inflammatory condition may appear as a result of the presence of secondary bacterial infections in the vicinity of the lung, especially at the sites of infection, and the presence of an inflammatory interaction between the virus particle and its own receptor on the surface of cells may be an important factor in the release of inflammatory cytokines, whichstimulate the bone marrow to produce white blood cells (1,5). Neutrophils are one of the vital immune cells in the human body. When pathogenic microorganisms invade the body, immune cells tend to quickly collect chemically at the site of infection and perform the role of host defense and immune regulation (13). The body's immunity, and is therefore considered an important marker of the systemic inflammatory response (14). Neutrophils, except in patients with bacterial

ISSN NO: 2770-2936
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infection or super infection, are associated with hyperinflammatory condition and cytokine storm, and are embedded in the causative mechanism of COVID-19. Neutrophils are involved in several respiratory diseasesassociated with acute respiratory distress syndrome (15). Previous studies have shown that patients with chronic COVID-19 conditions show low numbers of lymphocytes as lymphocytopenia has been reported as an indicator in COVID-19 patients (1,7,8). Lymphocytes play an important role in maintaining immune balance during a thousandviruses, especially SARS-CoV-2 as several cohort studies have reported that Lymphopenia can predict prognosis in COVID-19 patients (16). Moreover , some studies have found that Lymphopenia was associated with poor predictive traits. (17). Thus, the differentiation of peripheral white blood cells may indicate weakened immunity in the early stage of the disease. SARS-CoV-2 has been shown to stimulate peripheral lymphocyte remodeling, and a more robust humoral immune response occurs in severe infection (18). Decreased lymphocyte production, apoptosis, and redistribution together may lead to the generalization of Lymphopenia (19).

In agreement with our findings, Elderdery *et al*., (12) also showed an inverse association between lymphocytes and hemoglobin levels and red blood cell countsamong COVID-19 patients. In chronic conditions, a decrease in lymphocytes in patients with chronic virus infections may coincide with high cells Phagocytes indicate that their numbers decrease with the onset of viral infection, and a continuous decline in their numbers is expected as evidenced by our results and the results of many previous research (20,21), which results in an inverse proportion between them and phagocytes (22). A they include the functions of eosinophils associated with parasitic infections and asthma. Under such conditions, eosinophil populations in the blood increase (eosinophilia). Previous studies show that eosinophils protect against parasitic infections but play a detrimental role in severe asthma. However, recent emerging data from mouse studies show that eosinophils have antiviral activity. By reducing eosinophil populations, increasing viral loads in both humans and mice. , Maintaining a physiological eosinophil count and antiviral function can be important for fighting viral infections. (23)

Conclusions

The most important conclusions of the study wereas follows:

1. Significantly higher white blood cell counts, neutrophils, mononucleated cells and eosinophils in chronic COVID-19 patients compared to both acute patients and control sample.
2. Significant decrease in the number of phagocytes and the effect of phagocytosis in chronic and acute cases of COVID-19 patients compared to the control sample.

Recommendation

1. Follow-up of the effect of variation in immunological measures after recovery from infection with the Corona virus, especially in patients with chronic conditions.
2. Perform a lymphoblast transformation test to see how T cells respond to slicators such as Phytohaemagglutinin.
3. Estimation of CD4+/CD8+ in COVID-19 patients , especially patients with chronic conditions.
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