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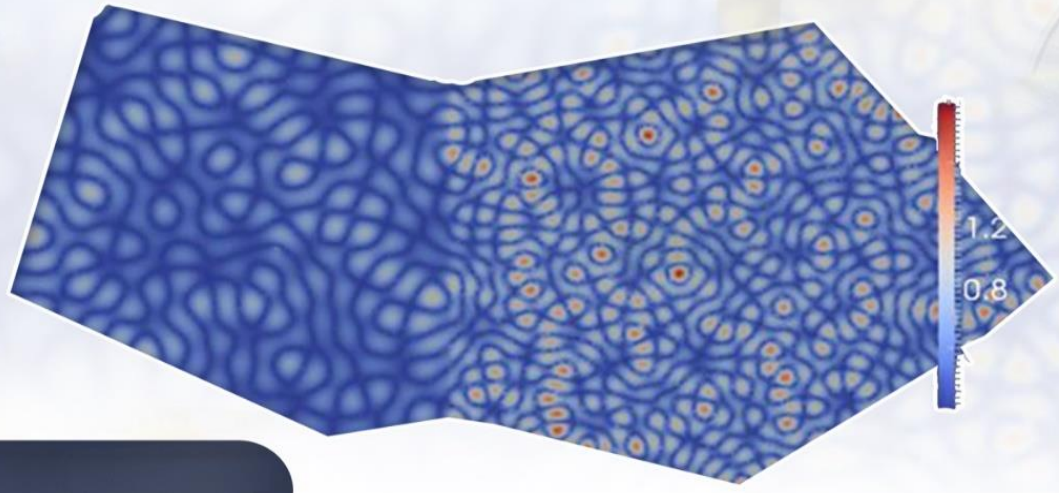

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Comparison between Alterations in some Hematological and Biochemical Parameters in COVID-19 and non-COVID-19 Patients Albaida, Libya

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A B S T R A C T

The COVID-19 outbreak has resulted in an unexpected health crisis all around the world. It was on March 11, 2020, when the WHO declared it as a pandemic. Ever since an exponential increase in the disease has been seen. The coronavirus disease 2019 or COVID-19 is a beta-coronavirus that has been closely related to the SARS-CoV-2 by means of genetic sequencing methods. This disease is associated with alterations in the complete blood picture and coagulopathies. In this present study, the role of hematological and biochemical parameters of blood in predicting COVID-19 infection w investigated, as these blood analyzes are considered a vital indicator for confirmation of infection. The present work was designed to diagnose COVID- 19 with five basic blood tests: white blood cells (WBC), lymphocytes (LYM), neutrophils (NEUT), platelets (PLT), and clotting factor D–dimer as well as the diagnosis of COVID-19 associated tests. Biochemical blood C-reactive protein (CRP), serum ferritin (FRR), and Lactic dehydrogenase (LDH). It was noted that the hematological and biochemical blood tests included in this study were capable of diagnosing COVID-19, due to their increase or decrease in the normal rates, according to what was shown in the results. N The diagnosis of COVID-19 using blood and blood biochemical tests in people who show some mild clinical symptoms, high and low levels of these parameters have been closely associated with COVID-19 infection and may also serve as biomarkers to predict infection.

1 Introduction

In December 2019, cases of pneumonia of unknown origin were discovered in Wuhan, the capital of Hubei province, China (Zhu *et al.*, 2020). The causative agent was named severe acute respiratory syndrome coronavirus (SARSCoV-2) (Gorbalenya *et al.*, 2020). The disease was named coronavirus disease (COVID-19). SARSCoV-2 is a highly contagious and moderately virulent virus, which was discovered soon after (Sanche *et al.*, 2020). SARS-CoV-2 spread around the world in the months after, and the World Health Organization (WHO) declared COVID-19 a pandemic on March 11, 2020 (World Health Organization, 2020). The COVID-19 diagnosis is crucial (Salathé *et al.*, 2020). The detection of RNA by reverse transcription polymerase chain reaction (RT-PCR) after upper respiratory tract sampling is used to diagnose COVID- 19) Although RT-PCR is critical in the event of a pandemic, it is a difficult test that requires large and sensitive infrastructure (Loeffelholz & Tang, 2020) Furthermore, even in completely symptomatic SARS- CoV-2 patients, the test is not always positive.

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The test's accuracy was only 30% to 60% (Li *et al*., 2020). In addition, there is a huge demand for RT-PCR testing, which is a barrier to managing the epidemic (Ai *et al*., 2020). In symptomatic COVID-19 illness cases (Lippi *et al*., 2020).

Recently, it has been reported that hematological and inflammatory parameters based on blood cell analysis have important value for predicting infection and susceptibility to many other diseases (Naess *et al*., 2017). High white blood cell count, neutrophil count, and low lymphocyte count are among the most relevant of these indications (Lagunas‐Rangel, 2020). There are simple basic criteria proposed for direct differentiation of COVID-19 patients (Ruan *et al*., 2020). T cells are vital in antiviral immunity. However, the reasons that promote T cell activation and reduction in COVID-19 patients are yet unknown (World Health Organization, 2020). Increased prothrombin time and D-dimer readings may also be markers of COVID-19 diagnosis (Azab *et al*., 2010), which is explained by COVID-19 patients' disordered coagulopathy. Inflammation-related biomarkers such as C-reactive protein (CRP) (Guan *et al*., 2020), serum iron and lactic dehydrogenase (LDH) appear to be useful prognostic indicators for determining whether COVID-19 cases are mild or severe (Assandri *et al*., 2020).

In this study, the role of hematological and biochemical blood parameters in predicting COVID-19 infection was investigated, as these blood tests are regarded a critical indicator for infection confirmation.

2 Materials and Methods

2.1 Sample Collection

The total number of patients was 75, and their blood samples were randomly collected from the laboratories of the Libyan city of Al-Bayda and were divided into two groups according to the COVID-19 antigen test. Biochemical and hematological examinations were performed on both groups.

2.2 Determination of Hematological Parameters

The hematological parameters, including white blood cell count (WBCs), lymphocyte (LYM), neutrophil (NEUT) and platelets (PLT) were estimated by Particle Counter (Sysmex, Europe. Model XP-300).

2.3 Determination of Coagulation

Determination of D-Dimer in human in whole blood\ plasma was determined according to the method of Bounameaux *et al*., (1994).

2.4 Determination of Biochemical Parameters

C-reactive protein (CRP) was assayed by the method of Shute and Maryon, (1966). Where, Lactate dehydrogenase (LDH) was measured as reported by Hochachka and Somero, (2002) method. While ferritin (FRR) of human in serum\ plasma was assayed by the method of Addison *et al*. (1972).

2.5 Statistical Analysis

Continuous variables were presented as mean ± standard deviation, median, or interquartile ranges based on the distribution of the data. Student t-test (0.01) is used for testing differences between the two study groups when relevant.

3 Results

The total number of samples included in this study is 75 samples. The results showed that 50 of these samples were from people infected with COVID-19, while 25 samples were from healthy people. Table (1) showed a significant ($P \leq 0.01$) increase in white blood cell count, neutrophils, D-dimer, C-reactive protein (CRP) levels, serum ferritin and lactic dehydrogenase (LDH) compared with normal for these parameters. However, there is a significant decrease ($P \leq 0.01$) in the number of lymphocytes and platelets compared to normal and healthy subjects.

Table (1). Hematological and biochemical parameters of blood for the diagnosis of patients with COVID-19 and non-patients COVID-19 compared to normal rates.

Paameter	Normal Value	Positive patients with COVID-19 N=50	*Negative patients with* COVID-19 *N*=25	*t*-Value	*p*-Value
WBC 10^3/ µL)	5-10	9.97±4.01	8.172±07	3.06	0.003
LYM (%)	20-40	18.59±8.60	27.06±6.27	-4.85	0.000
NEUT (%)	55-70	72.97±8.26	58.04±8.65	7.15	0.000
PLT 10^3/µL)	150-400	143±33.2	236±21.0	-14.69	0.000
D-Dimer (m cg/ml)	>4.0	1.03± 1.70	0.280± 0.07	3.11	0.003
CRP (mg/l)	Up to5.0	20.0 ±22.6	3.46 ±1.16	5.15	0.000
FRR (ng/ml)	13.0-40	299±218	93.4±21.4	6.60	0.000
LDH (U/L)	225-450	495± 121	284.8±24.0	11. 87	0.000

4 Discussion

Coronavirus disease 2019 is a dangerous illness caused by the Coronavirus 2 (SARS-CoV-2) of the severe acute respiratory syndrome (Huang *et al*., 2020). Respiratory distress syndrome is caused by a variety of processes in COVID-19 instances, including the activation of white blood cells, neutrophils (Ichikawa *et al*., 2013). The findings of routine blood and blood biochemistry analysis are presented in this study. The most important parameters in discriminating between COVID-19 patients and healthy people were coagulation activity, serum ferritin, and lactate dehydrogenase (Channappanavar & Perlman, 2017).

In this study, the results of those with COVID-19 showed that the number neutrophil significantly increase, whereas the levels of lymphocyte and platelet decreased in comparison to those who are not affected (Wu *et al*., 2020). It is then proposed as a suitable and potentially diagnostic marker for COVID-19. This is consistent with previous study (Wang *et al*., 2020).

The obtained results showed that, most investigations concentrating on abnormalities of immune inflammatory parameters in COVID-19 patients and documenting greater numbers of neutrophil in patients (Bo *et al*., 2020, Huang *et al*., 2020) this agreed with our findings. COVID-19 patients are more susceptible to bacterial and fungal infections as the disease progresses, due to diminished autoimmunity and greater neutrophil count, which represent higher levels of inflammation than mild patients (Li *et al*., 2020).

The rise in the number of neutrophil could be linked to viral invasion-induced cellular storms (Wang *et al*., 2020). Associated with decreased lymphocyte in COVID-19

Furthermore, the reasons for the platelet decrease in COVID-19 patients could be due to the followings: (1) Viral infection resulted in endothelial injury, platelet aggregation and pulmonary thrombogenesis (Yang *et al*., 2003). Megakaryocyte reduction, resulting in decreased platelet production and increased consumption; (2) the coronavirus directly invades hematopoietic cells or bone marrow stromal cells, inhibiting hematopoiesis (Eickmann *et al*., 2020). In addition, higher D-dimer levels have a strong link to the severity of COVID-19 infection. COVID-19 patients with acute respiratory distress syndrome will be treated according to our findings. Acute pulmonary inflammatory reaction may be linked to abnormal coagulation. Injuries to the lungs lining systemic endothelial injury with diffuse thrombosis of the small vessels or large veins coagulopathy with increased thrombi activity (Katneni *et al*., 2020). Deposits associated with inflammation within the alveolus Fibrin, systemic endothelial injury with diffuse thrombosis of the small vessels or large veins (Roncon *et al*., 2020) have coagulopathy with increased thrombi activity.

COVID-19 patients had higher levels of LDH, ferritin, and CRP, In addition to other cytokines, according to a previous study (García, 2020). Evidence suggests that ferritin can modulate the immune response by inducing anti- inflammatory cytokines and limiting free radical damage in the presence of chronic inflammation. Alternatively, new research reveals that ferritin may have a role in the inflammatory pathophysiology of illness (Kernan & Carcillo, 2017). In response to elevated levels of inflammatory cytokines, particularly IL-6, transcriptional activation of the CRP gene occurs mostly in hepatocytes. CRP, like ferritin, appears to be a crucial regulator of inflammatory processes rather than just a marker (Sproston & Ashworth, 2018). Additionally, Huang *et al*. (2020) and Wang *et al*. (2020), infections that produce lung tissue damage mediated by cytokine and LDH enzyme production had a significantly higher level of LDH (Martinez-Outschoorn *et al*., 2011). LDH-3 (LDH-3) is a coenzyme that is found in lung tissue.

5 Conclusions

Because high and low levels of hematological and biochemical parameters have been closely associated with COVID-19 as well as serving as biomarkers to predict infection, this pilot study highlights the potentials of the diagnosis of COVID-19 using blood and blood biochemistry tests in people who show some mild clinical symptoms.

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