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HEMATOLOGICAL AND SEROLOGICAL PARAMETERS FOR DETECTION OF COVID-19

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ABSTRACT

Coronavirus disease (COVID-19) appeared as outbreak in 2019 in Wuhan, China. It has been classified as pandemic disease and more severe than predicted; with infections already recorded in a variety of countries. This study aims to confirm the COVID-19 infection through the following tests: hematological, C-reactive protein (CRP). Samples were collected from the infected patients and sent to the National Flu Center (Central Public Health Laboratory) for COVID-19 (positive or negative) diagnosis by the RT-PCR technique. In this study, sixty five of COVID-19 patients and twenty five of healthy control samples male and female were collected in Iraq. There are significant differences in the parameters of the hematological markers for patients in comparing with the control group and no significant differences were observed in Hb when RBC and GRAN percent rise in patients relative to the control group with P=0.0395 and P=0.0354 respectively comparing with the control group. White blood cells (WBC), Lymphocyte (LYM%), Platelets (PIT), monocyte (Mid%), hematocrit (HCT), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean platelet volume (MPV), plateletcrit (PCT) was drop dramatically in patients compared to control group. Fifty-one of patients for whom the test was given exhibited a positive (CRP) result. Likewise, the results showed that few patients were negative to CRP test. The Hematological parameters levels (HCT, MCV, MCH, Pelt, WBC, LYM, Mid, MPV, PCT) decreased, but Hb, RBC, GRAN% increased. C-reactive protein test showed a positive result in 85% of patients which can be considered an indicator for predicting severity infection with COVID-19.

Keywords: COVID-19, Coronavirus, CRP, SARS-CoV-2, Pandemic Disease

INTRODUCTION

Previously, COVID-19 known as the 2019 novel coronavirus (2019-nCoV), the World Health Organization announced on 30 January 2020 an emergency in public health **(Sohrabi *et al*., 2019).** Dramatic steps were placed in place to the stop virus spreading. The coronavirus is extremely infectious and causes pneumonia in 2019 **(Yi *et al*., 2020)**. It was first reported in Wuhan, Hubei Province, China, in December 2019 and then accompanied by an outbreak in Hubei Province and other sections of the world. There is no authorized simple and effective treatment at this period **(Cui *et al*., 2019)**. Several reports have identified the clinical characteristics of newly infected coronavirus (SARS-CoV-2) pneumonia (COVID-19) patients showing a higher lymphocyte neutrophil ratio (LNR) in serious patients. Several studies including travel-related and non-travel-related incidents from China and other countries, have been reported in leading international science and medical journals. Many of these experiments have tried to resolve research questions like patterns and consequences, possible risk factors and health **(Rodriguez-Morales *et al*., 2020)**. Experimental and imaging findings; while longitudinal experiments and meta-analysis typically include randomized controlled trials aimed at offering a more precise assessment of cancer or disease risk factor effects; there has also been considerable use of synthesized empirical research, especially over the past several decades. Possible forms of transmission involve droplets of water, touch, fomites and the fecal-oral path **(Driggin *et al*., 2020)**. There is currently no definitive proof of airborne SARS-CoV-2 transmission, although historical experience suggested that aerosol-producing procedures can be transmit SARS-CoV-2, usually intubation with the trachea. Like other respiratory infections, it was deemed contagious when patients become symptomatic but asymptomatic individuals also can transmit this novel virus. The early results indicate that the transmissibility of SARS-CoV-2 is low, with a simple reproductive amount of about 2 **(Atri *et al*., 2020)**. SARS-CoV-2 human to human transmission occurs primarily between members in family, relatives, and close friends. According to reports, 31.3 percent of recent non-resident patients visited Wuhan, and 72.3 percent of patients who interacted with people visited Wuhan **(Xu *et al*., 2020)**. China's National Health Commission reported that COVID-19 transmitted to 3.8% of health workers. Conversely, SARS-CoV and MERS-CoV had been identified primarily via nosocomial transmission **(Jalil, 2020)**. In MERS-CoV cases, health care staph infections accounted for 33–42 percent of SARS cases and the most common routes of infection were a patient transmission (62–79 per cent). SARS-CoV-2 's primary transmitter channel is due to close contact with intermediate host animals or wildlife intake **(Yeo *et al*., 2020)**. This study aims to confirm that COVID-19 infection can be detected through hematological and C-reactive protein testing.

MATERIAL AND METHODS

Sample collection

Samples were collected from (65) patients from both male and female, infected with COVID-19 at the Al Furat General Hospital in Baghdad, Iraq by Nasopharyngeal and Throat swabs. These swabs were transferred into a transport media virus (TMV) and sent to the National Flu Center (NFC) and a central public health laboratory in Baghdad for COVID 19 diagnosis by using an rRT-PCR technique as recommended by CDC. Also, the control group included 25 healthy people of similar ages and genders.

Hematologic tests

The analyzer (DIAGON D-Cell60 hematological) used to measure CBC parameters. Besides, Diaton-D-Diluent was replaced with a portion of the first dilution. After the second sample dilution, the impedance particle analysis was then introduced to measure red blood cell counts (RBC) and thrombocyte counts (PLT). A Lysing Reagent was added (Diaton-Lyse-D) to the rest of the first dilution for measuring Hemoglobin (HGB), lymphocyte counts (LYM), white blood cell counts (WBCs), and GRAN, mid-percent, HCT,
MCV, MCH, MPV, PCT **(Ike *et al*., 2010)**.

Crp latex tests

CRP-Latex Test is a fast slide agglutination method based on a serum modification of the latex fixing method, developed to directly detect and semi-quantify C-reactive protein (CRP). The test was performed by testing with anti-human CRP antibodies, a suspension of latex particles coated against unknown serum. The presence of a visible agglutination in the tested samples indicates an increase in CRP levels above the reference interval's upper limit (CRP-Latex, kit).

Statistical analysis

Statistical analysis was carried out by SPSS Version 17 (SPSS, Inc., Chicago, IL, USA), mean ± standard deviation (SD) was calculated. T-test was used to verify essential variations between the classes. The statistically significant P value at P≤0.05 was considered in the past.

Ethical considerations

All subjects consented to be included in this study. The research was reviewed and approved through the local Committee of Study.

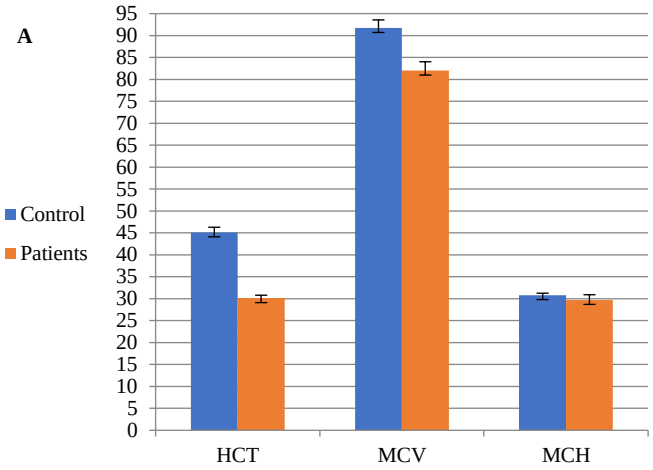
RESULTS

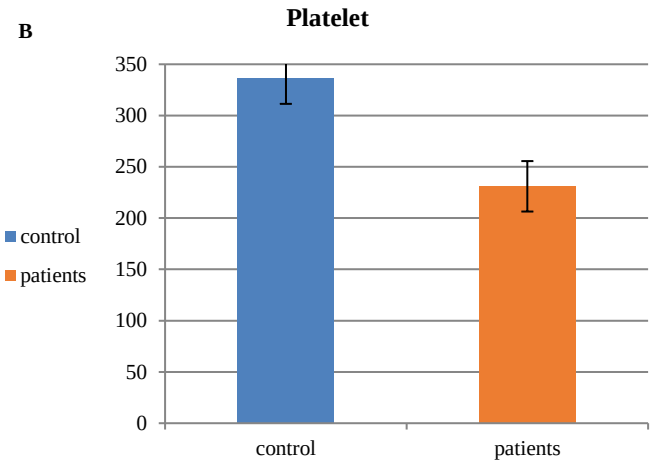
Table 1 Assessment of hematological markers and control group in COVID-19 infections.

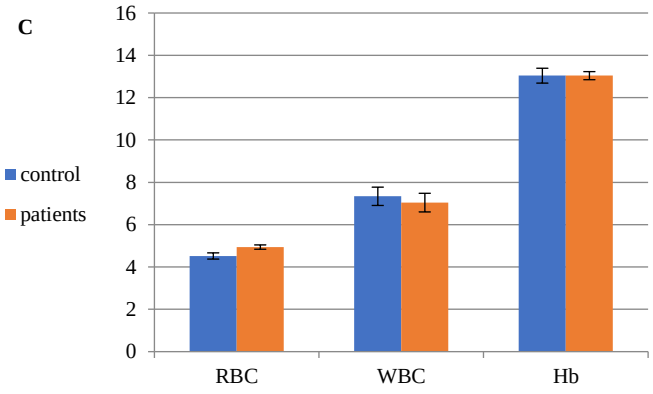
Tests	Groups		*P*-value
	Patients	Control	
Hb (g\dl)	13.04 ± 0.191	13.04 ± 0.351	N.S.**
RBC(*10^{12}\L)	4.94 ± 0.101A	4.52 ± 0.146b	0.0395
WBC (*10^{9}\L)	7.04 ± 0.441	7.34 ± 0.433	N.S.
LYM %	22.3 ± 1.63B	30.4 ± 1.71a	0.0107
GRAN %	67.0 ± 1.77A	59.9 ± 1.64b	0.0354
PLT (*10^{9}\L)	231 ± 10.9B	336 ± 24.6a	0.0001>
Mid %	6.18 ± 0.233B	8.03 ± 0.862a	0.0047
HCT %	30.1 ± 0.712B	45.4 ± 1.20a	0.0001>
MCV (fL)	82.0 ± 1.39B	90.7 ± 1.39a	0.0016
MCH (pg)	29.7 ± 1.28	30.8 ± 0.453	N.S.
MPV (fL)	8.58 ± 0.228	9.27 ± 0.412	N.S.
PCT %	0.154 ± 0.007B	0.202 ± 0.013a	0.0035

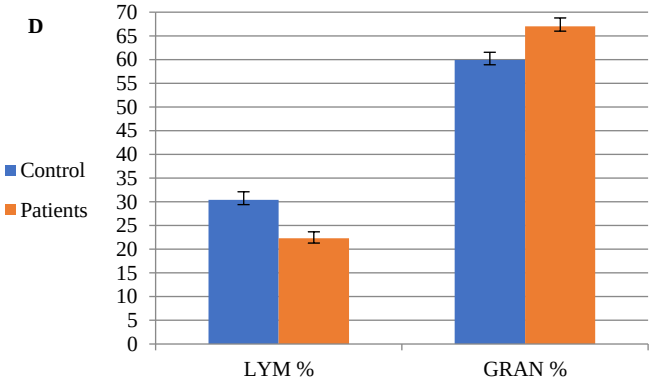
* Means ± Standard Error.
** N.S.: Non-Significant
a, b, c: means in the same Row with different superscripts differ significantly at probability value (P≤0.05).

There are significant differences in the parameters of the hematological markers for patients when compared with the control group at P≤0.05 (Table 1) and no significant differences were observed in Hb when compared with the control group (Figure 1.A). However, RBC Increase in patients with P=0.0395 (Figure 1.C), a slight decrease in WBC (Figure 1.C), decrease in LYM% with P=0.0107 (Figure 1.D), Increasing in GRAN% with P=0.0354 was found (Figure1.D), while a decrease in PIT with 0.0001>P (Figure1. B), mid% with P=0.0047(Figure1.E), HCT with 0.0001> P (Figure 1.A) and MCV with P=0.0016 (Figure 1.A), a slight decrease in MCH (Figure 1.A), MPV (Figure 1.E), and PCT (Figure 1.F) with P=0.0035.









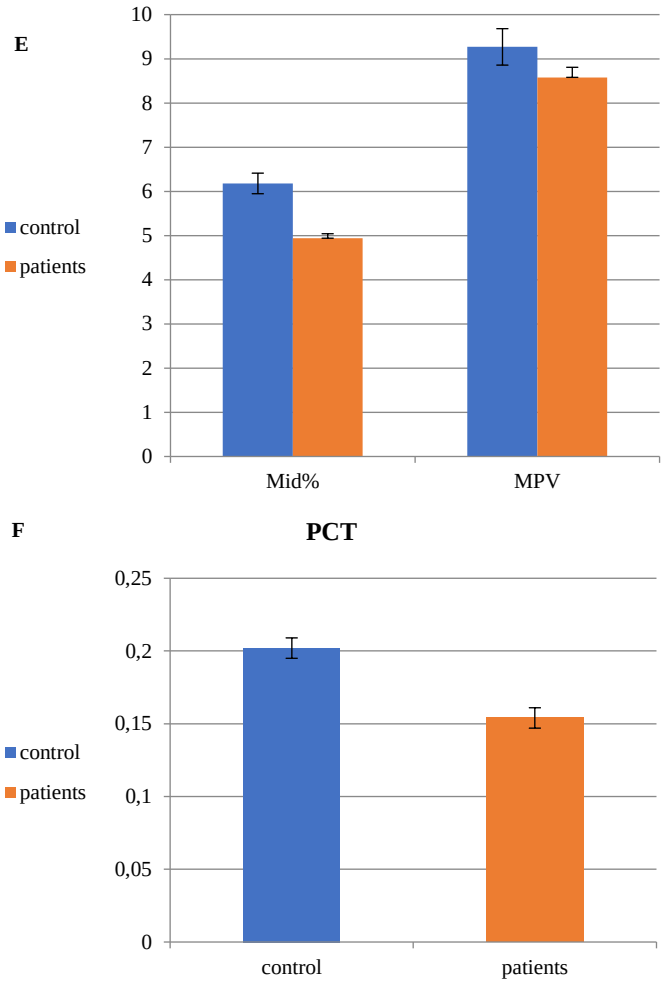


Figure 1 A- distribution HCT (%), MCV (fL), and MCH (pg) among COVID-19 infection. B- distribution PLT (*10^9\L) among COVID-19 infection. C- distribution RBC (*10^{12}\L), WBC(*10^9\L), and Hb(g\dl) among COVID-19 infection. D- distribution LYM (%) and GRAN (%) among COVID-19 infection. E- distribution Mid (%) and MPV (fL) among COVID-19 infection. F- Distribution PCT (%) among COVID-19 infection.

The results of the CRP test showed that most patients (85%) exhibited a positive (CRP) results, while 15% of them showed a negative test (CRP), as shown in Figure 2.

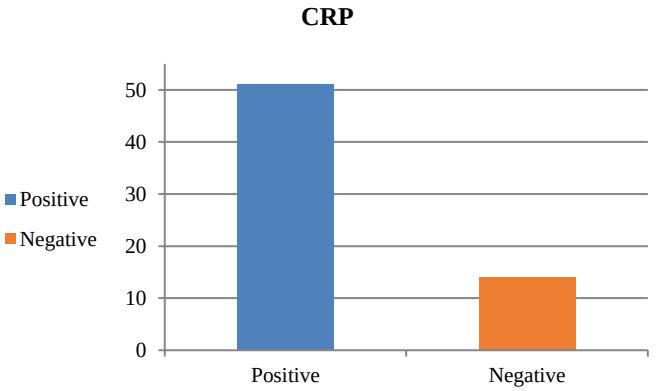


Figure 2 Distribution C-reactive protein (Mg/L) among COVID-19 infection.

DISCUSSION

Previous findings showed that the most common symptom of Covid-19 and Cough in both sexes and ages is extreme throat, though diarrhea was not common, accompanied by fever, and some patients had no symptoms at all **(Kim *et al.*, 2020)**. Coronaviruses are a large family of viruses found in several distinct groups of animals; including camels, goats, cats and bats. Rarely, coronaviruses in animals will spread to human and then transmission among human, such as MERS, SARS and now SARS-CoV-2 **(Mackay and Arden, 2015)**. There are decreases in WBCs among patients when compared with the control group (Figure1.C) and this result is consistent with those of **Huang *et al.* (2020)** and **Fan *et al*. (2020)**. Only one patient with severe leukopenia (WBC<2 x 109 / L) in 19 patients (29.2 percent) were observed with leukopenia (WBC < 4 x 109 / L). Our findings are similar to a standard range line in several cases. This research publishes findings for adult COVID-19 patients with hematopoietic and infection associated biomarkers. In the current study, (Figure1.D) Lymphopenia is common in COVID-19 patients; indicating an impairment of the immune system during SARS-CoV-2 infection. It is found that LYM decreased in most patients and it was below the normal ratio, this result agrees with the result of **Gao *et al*. (2020)** and **Zhou *et al*., (2020)** Also, the results are consistent with the study of **Fan *et al*. (2020)** regarding that the platelets are low in patients. The current study revealed no decrease in hemoglobin in patients (Figure1.A) and this outcome coincides with the results of **Hadadi et *al*. (2020).** A slight rise in red blood cells and GRAN (Figure1.C andFigure1.D) is also observed, in contrast with the finding of **Liu *et al*. (2020)**. The PCT result showed a decrease in patients, unlike the result of **Fan *et al*. (2020)**. Among the 140 patients, PCT increased respectively. In the SG, the proportion of patients with elevated IL-6, CRP and PCT levels was significantly higher than the MG. Nevertheless, in contrast with healthy individuals, HCT, MCV, and Mid% reported relatively low p-value (Table 1), which may be affected by pathological conditions. This may be of clinical significance for diagnosing COVID-19. The association between platelet and disease was observed (Table 1); this was consistent with the study of **Cheng *et al*. (2020)** which revealed an important correlation between low platelet count and COVID-19 patients. Our findings are consistent with those of **Luo *et al*. (2020)** since the values of HCT, MCV, MCH and MPV COVID-19 patients decreased as compared to the control group. Therefore, a simple blood test is helpful in detecting false/ negative rRT-PCR tests but can also be used as a cost-effective and usable in developing countries, otherwise identifying potential COVID-19 patients with rRT-PCR reagents and/or specialist laboratories **(Ferrari *et al*., 2020; (Saleh *et al*.,2020).** CRP is an inflammatory agent used to detect multiple diseases and morbidities and to track them. In extreme COVID-19 cases, the degree of inflammation-related CRP and its concentration are not affected by such factors such as age, gender and physicality health **(Bilgir *et al*., 2015)**.
CRP levels may promote phagocytosis and activate the complement, thus cleaning up pathogenic microorganisms that invade the organism may be used for early detection of CRP levels **(Warusevitane *et al*., 2016)**, and elevated CRP rates in extremely pneumonia cases. This is an important index for identifying and assessing serious infectious pulmonary diseases **(Chalmers *et al*., 2019)**. Testing with Matsumoto also showed the levels of CRP increased as the disease progressed with severe pneumonia. CRP rates have been positively linked with lung lesions and the extent of the disease. This indicates that CRP levels at the early COVID-19 may indicate lung lesions and the severity of the disease. **Liu *et al*. (2020)** reported that CRP increased by 65 percent of COVID-19 patients. The current COVID-19 study indicates that rates of CRP are substantially different between the deceased party and the living community, which may act as a possible prognostic marker **(Ruan *et al*., 2020) (Zhang *et al*., 2020)**. CRP is well patient severity correlated with COVID-19 patient symptoms and is therefore suitable for evaluating patient conditions along with other clinical findings.

CONCLUSION

The study was conducted on 90 people included 65 patients infected with Covid-19 and 25 healthy persons as a control group, the following biomarkers can be adopted for diagnosis of the virus and the adoption of these tools, the levels of the Hematological parameters decrease (HCT, MCV, MCH, Pelt, WBC, LYM, Mid, MPV, PCT), and increase in (Hb, RBC, GRAN%). C-reactive protein test showed a positive result in 85% of patients which will be considered an indicator for predicting severity infection with COVID-19.

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