Original Article

Influence of Coronavirus Disease 2019 on some Physiological Blood Parameters in Patients with Kidney Failure in Iraq

Rahman Mohamed Al-Saedi, M[1] *, Yahia Hassan Almurshidi, S[2], Fadel Mohammed, H[1]

1. Altoosi University College, Department of Medical Laboratories Techniques, Najaf, Iraq
2. University of Kufa, Faculty of Sciences, Department of Medical Laboratory Techniques, Kufa, Iraq

Abstract

Coronavirus disease 2019 (COVID-19) is an infectious disease caused by a novel coronavirus (Severe Acute Respiratory Syndrome Coronavirus 2; SARS-CoV-2), which is related to the SARS-CoV-2 and the Middle East Respiratory Syndrome Coronavirus, which caused serious outbreaks in 2003 and 2012. This study aimed to determine if there is an association between ABO blood types/renal failure and infection with COVID-19. Furthermore, the effects of COVID-19 infection on some blood parameters and electrolyte levels were investigated in this study. In the current study, 90 samples were obtained from males and females aged between 21-68 years old. The data were collected from September to February 2021 in a Kidney Center of Alsaader Teaching Hospital. The participants were divided into three groups (n=30) of A) kidney failure, B) kidney failure with COVID-19, and C) kidney failure with COVID-19 recovery after one month. The variables of this study included blood group types, blood electrolytes, and some blood biochemical parameters. According to the results, regarding the frequency of blood groups, in the control group, 34, 20, 14, and 36 participants belonged to the A , B, AB, and O blood groups, respectively. The recorded data showed that participants who had suffered from kidney failure and were infected with COVID-19 belonged to the A, B, AB, and O blood groups (25%, 10%, 27%, and 45%), respectively, while kidney failure patients who had recovered after one month from COVID-19 had blood groups of A, B, AB, and O (25%, 22%, 105%, and 45%, respectively). The recorded data showed a significant decrease (*P*<0.05) in the levels of Potassium (K), Sodium (Na), and Calcium (Ca) in the B group, compared to the A group, while the levels of K, Na, and Ca had significantly improved in group C (*P*<0.05), compared to group B. The Chloride level showed no significant differences among the groups. Furthermore, non-significant differences (*P*>0.05) were observed in the red blood cells (RBC), hemoglobin (Hb), and white blood cell count (WBC) in the COVID-19 group (Group B), compared to group A; however, there was a significant raise (*P*<0.05) in WBC and platelet (PLT), as well as a significant decrease (*P*<0.05) in lymphocyte (LYM), RBC, Hb, and hematocrit (HCT) in group C, compared to groups A and B. In conclusion, blood group O obtained the lowest level of resistance to COVID-19, compared to blood group A which had the highest response to recovery. The COVID-19 patients with kidney failure showed a significant decrease in blood parameters, such as RBCs, Hb, LYM, PLT, HCT, and electrolytes.

Keywords: Blood types, Coronavirus, COVID-19, Electrolytes, Renal failure

1. Introduction

Coronavirus disease 2019 (COVID-19) is an infectious disease caused by a novel coronavirus (Severe Acute Respiratory Syndrome Coronavirus 2, SARS-CoV-2) (1), which is related to the SARS-CoV-2 and the Middle East Respiratory Syndrome Coronavirus (MERS-CoV), which caused serious outbreaks in 2003 and 2012 (2). The disease began in December 2019 in China's capital, Wuhan, and was caused by a new zoonotic coronavirus strain known as

SARS-CoV-2 (1). It has quickly spread around the globe as a pandemic, and to date (09/01/2022) has killed over 5,504,000 people and infected over 306,000,000 worldwide (3). In the majority of COVID-19 cases (80%), a mild flu-like syndrome has been observed; however, approximately, 22% of cases had other complications, such as interstitial pneumonia with varying degrees of respiratory failure in addition to thromboembolic disorders, such as venous thromboembolism, ischemic stroke, myocardial infarction, and acute coronary syndrome which have been observed by Chen, Wu (4). Although widespread alveolar damage and severe respiratory failure are the most common symptoms associated with COVID-19 (5), renal impairment has been observed with acute kidney injury occurring often in SARS-COV-2 patients. Furthermore, more than 20% of the deceased are due to Chronic Kidney Disease (CKD) (6). Like other coronaviruses, SARS-COV-2 mostly causes respiratory signs, such as flu-like symptoms and interstitial pneumonia, which can quickly develop into acute respiratory distress syndrome requiring admission to the intensive care unit. Other organs are also affected, especially the kidneys; in addition, the liver and heart, are compromised, and some patients die as a result of multi-organ dysfunction (7).

COVID-19 is an infectious illness that causes signs, such as a dry cough, vomiting, fever, sputum production, hemoptysis, headache, and diarrhea (8). Molecular diagnosis of COVID-19 necessitates using Reverse Transcription Polymerase Chain Reaction (RT-PCR). Furthermore, additional assays based on serological tests of viral antigens, including enzyme-linked immunosorbent assay, have begun to be utilized efficiently (9).

CKD has spread over the world, with an incidence of 14% in the United States and 5%-15% worldwide (10). Renal failure is defined as the kidneys' inability to conduct excretory functions, resulting in the retention of nitrogenous waste products in the blood. There are two types of kidney failure, namely acute and chronic renal failure. Acute renal failure is a reversible disease in which the glomerular filtration rate drops suddenly (hours to days) and is usually reversible according to the KDIGO criteria in 2012. The diagnosis of acute renal failure is defined based on creatinine rise of 0.3 mg/dL in 48 h, creatinine rise to 1.5 times of baseline within the past seven days, and urine volume less than 0.5 ml/kg per hour lasting for 6 hours (11). Men with chronic pulmonary or cardiovascular illnesses, hypertension, and diabetes were the most prevalent COVID-19 complex individuals (12). Most of the patients had pre-existing comorbidities, and over 20% had CKD.

COVID-19 can cause death, especially in severe cases, and the risk of death is higher in the elderly and/or those with chronic diseases (13). COVID-19 and kidney disease are described in previously published research presenting a comprehensive perspective of the impact of coronavirus 2 on the electrolytes and different renal compartments (glomeruli, tubules, and vascular compartments). Clinical presentations included antidiuretic hormone secretion syndrome and acute kidney disease. On the other hand, previous research revealed an association of the ABO blood group with cardiovascular disease, cancer, and susceptibility to SARS (14). The current study aimed to investigate the effect of the COVID-19 virus on some blood parameters and electrolyte levels in the blood; moreover, it was attempted to evaluate its relationship with kidney failure and ABO blood groups.

2. Materials and Methods

2.1. Subjects and Study Design

In the current study, 90 samples were obtained from males and females aged between 21 and 68 years old. The data were collected from September to February 2021 in a Kidney Center affiliated to Alsaader Teaching Hospital. The participants were divided into three groups (n=30) of A) kidney failure, B) kidney failure with COVID-19, and C) kidney failure with COVID-19 recovery after one month. The variables of this study included blood group types, blood electrolytes, and some blood biochemical parameters.

2.2. Blood Sampling and Analysis

Blood samples were drawn intravenously from patients with renal failure before dialysis. The samples were placed in test a tube, and all patients showed positive results of COVID-19 using the PCR device and nasopharyngeal swabs within 48 h after the appearance of symptoms (9). Briefly, the blood was collected in non-anticoagulant tubes and allowed to clot. Serum was separated from the clot by centrifugation at 3000 rpm for 10 min, and it was then collected in Epindroff tubes and stored at -20°C for electrolyte analysis (Calcium [Ca], Sodium [Na], Potassium [K], and Chloride [Cl]). Blood parameters (platelets [PLT], hematocrit [HCT], human chorionic gonadotropin [HCG], red blood cells [RBC], lymphocyte [LYM], and white blood cells [WBC]) were assessed by complete blood count (CBC) device. Moreover, the samples were undergone blood typing to identify the patients' blood types.

2.3. Statistical Analysis

The obtained data were analyzed in SPSS software (2006) using ANOVA, and the results were expressed as mean±SEM. Moreover, the differences between means were considered statistically significant at $P<0.05$ using the analysis of variance in the least significant difference test.

3. Results and Discussion

According to the results, regarding the frequency of ABO blood types in the three groups, the control group showed that 34, 20, 14, and 36 participants belonged to the A, B, AB, and O blood groups, respectively. In addition, the recorded data showed that participants who had suffered from kidney failure and were infected with COVID-19 belonged to the blood groups of A, B, AB, and O (25%, 10%, 27%, and 45%, respectively), while kidney failure patient who had recovered after one month from COVID-19 had the blood groups of A, B, AB, and O (25%, 22%, 10%, and 45%, respectively) (Table 1).

The recorded data showed a significant decrease ($P<0.05$) in the levels of K, Na, and Ca in group B, compared to group A, while in group C, the levels of K, Na, and Ca had significantly improved ($P<0.05$), compared to group B (Table 2). The Cl level showed no significant differences among the groups.

The results of this study showed non-significant differences ($P>0.05$) in RBC, hemoglobin (Hb), and WBC in the COVID-19-infected group (Group B), compared to group A; however, there was a significant raise ($P<0.05$) in WBC and PLT, followed by a significant decrease ($P<0.05$) in LYM, RBC, Hb, and HCT in group C, compared to groups A and B (Table 3).

Table 1. Distribution of blood groups

Blood groups	Group A (%)	Group B (%)	Group C (%)
A	34	25	45
B	20	10	23
AB	14	27	10
O	36	45. 5	22

Table 2. Effect of infection with COVID-19 on the levels of electrolytes in the blood serum of patients with kidney failure

Electrolytes type	Group A (n=30) (mean±SE)	Group B (n=30) (mean±SE)	Group C (n=30) (mean±SE)
K	5.99±0.086[a]	4.423±0.136[b]	5.75±0.149[a]
Na	141.20± 0.72[a]	122.20±1.25[b]	140.13±0.564[a]
Cl	107.30±0.55[a]	106.0±0.730[a]	105.33±0.69[a]
Ca	3.13±0.084[a]	1.933±0.087[b]	3.00±0.060[a]

The results are presented as Mean±SE

Table 3. Blood parameters

Blood Parameters	Group A (n=30) (mean±SE)	Group B (n=30) (mean±SE)	Group C (n=30) (mean±SE)
WBC	6.630±0.236[a]	5.6833±0.228[a]	9.260±0.479[b]
LYM	35.40±1.325[a]	24.67±2.338[b]	20.780±2.361[c]
RBC	4.72±0.085[a]	4.06±0.112[a]	3.040±0.119[b]
Hb	14.58±0.206[a]	13.74±0.211[b]	9.310±0.212[c]
HCT	44.33±0.525[a]	40.50±0.75[b]	28.36±0.58[c]
PLT	179.80±8.185[a]	168.06±7.949[b]	192.90±10.861[c]

The results are presented as Mean±SE

The SARS-COV-2 virus has had various impacts on the worldwide population, and those who are older and with comorbidities, such as kidney illnesses, have been proven to be more vulnerable to severe diseases (15). The results of the current study were in agreement with the findings of a study conducted by Alhawary, Al-Abdallat (15), who showed that a higher prevalence of COVID-19 was detected in blood groups A and O; moreover, lower infection incidence was recorded in blood groups A and AB. The recorded results by Hassoon, Melconian (16) showed that patients with renal failure belonged to the blood groups O and B. The results of the study conducted by Nalbant, Aydın (17) were in agreement with our results revealing that the incidence of COVID-19 has increased in the younger population and in the O blood group. On the other hand, the results of our study disagreed with one of the new studies showing that people with blood type O were less susceptible to COVID-19, while people with blood group A were more at risk (18) which may be due to small size of the study sample. The results of another study demonstrated that the risk of death was increased for type AB and decreased for types A and B (17). This study may give the interpretation of why our results revealed the highest percentage of blood group A in the recovery group. The results of this study were in agreement with the findings of a study conducted by Lippi, South (19) who mentioned that the severity of COVID-19 was associated with low levels of Na, K, and Ca in serum. However, the results of the current study reveal that the recovered group has improved levels of electrolytes. The recoded data of the current study were in agreement with the results of a study

conducted by Waris, Din (20) who showed a significant increase in WBC count and granulocyte count, while the mean PLT count and RBC volume distribution width were lower in the acute infection, compared to patients in the mild group. LYM count was decreased in the acute infection, compared to mild patients. Another study mentioned that the neutrophil level of patients in the acute infection was higher in the progressive phase of infection (21).

In conclusion, from the results of the current study, it can be concluded that blood group O had lower resistance to COVID-19, and blood group A had the highest response to recovery. The COVID-19 patients with kidney failure showed a significant decrease in blood parameters, such as RBCs, Hb, LYM, PLT, HCT, and electrolytes.

Authors' Contribution

Study concept and design: M. R. M. A.

Acquisition of data: S. Y. H. A.

Analysis and interpretation of data: H. F. M.

Drafting of the manuscript: M. R. M. A.

Critical revision of the manuscript for important intellectual content: S. Y. H. A.

Statistical analysis: H. F. M.

Administrative, technical, and material support: M. R. M. A.

Ethics

The study protocol was approved by the medical ethics board of the 1. Altoosi University College, Department of Medical Laboratories Techniques, Najaf, Iraq. The study included only adults and written

informed consents were provided by all the subjects participated in the study

Conflict of Interest

The authors declare that they have no conflict of interest.

References

1.   Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, et al. A novel coronavirus from patients with pneumonia in China, 2019. N Engl J Med. 2020.

2.   Zaki AM, Van Boheemen S, Bestebroer TM, Osterhaus AD, Fouchier RA. Isolation of a novel coronavirus from a man with pneumonia in Saudi Arabia. New England Journal of Medicine. 2012;367(19):1814-20.

3.   WHO-Dashboard W. Coronavirus Disease (COVID-19) Dashboard. WHO; 2020.

4.   Chen G, Wu D, Guo W, Cao Y, Huang D, Wang H, et al. Clinical and immunological features of severe and moderate coronavirus disease 2019. J Clin Invest. 2020;130(5):2620-9.

5.   Rapezzi C, Ferrari R. The Cardiologist at the time of Coronavirus: a perfect storm. Oxford University Press; 2020.

6.   Boraschi P. COVID-19 pulmonary involvement: is really an interstitial pneumonia? Acad Radiol. 2020;27(6):900.

7.   Wiersinga WJ, Rhodes A, Cheng AC, Peacock SJ, Prescott HC. Pathophysiology, transmission, diagnosis, and treatment of coronavirus disease 2019 (COVID-19): a review. JAMA. 2020;324(8):782-93.

8.   Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet. 2020;395(10223):497-506.

9.   Corman VM, Landt O, Kaiser M, Molenkamp R, Meijer A, Chu DK, et al. Detection of 2019 novel coronavirus (2019-nCoV) by real-time RT-PCR. Eurosurveillance. 2020;25(3):2000045.

10.   De Nicola L, Zoccali C. Chronic kidney disease prevalence in the general population: heterogeneity and concerns. Nephrol Dial Transplant. 2016;31(3):331-5.

11.   Chertow GM, Burdick E, Honour M, Bonventre JV, Bates DW. Acute kidney injury, mortality, length of stay, and costs in hospitalized patients. J Am Soc Nephrol. 2005;16(11):3365-70.

12.   Fasina FO. Novel coronavirus (2019-nCoV) update: What we know and what is unknown. Asian Pac J Trop Dis. 2020;13(3):97.

13.   Li Z, Wu M, Yao J, Guo J, Liao X, Song S, et al. Caution on kidney dysfunctions of COVID-19 patients. WHO. 2020.

14.   Zhao J, Yang Y, Huang H, Li D, Gu D, Lu X, et al. Relationship between the ABO blood group and the coronavirus disease 2019 (COVID-19) susceptibility. Clin Infect Dis. 2021;73(2):328-31.

15.   Alhawary SY, Al-Abdallat ME, Alamro SAA, Saada RJ, Alshboul AAM, Alsmadi T, et al. Frequency of Blood Groups Amonga Sample of Patientswith Renal Failure at Royal Medical Services. Eur Sci J. 2015;11(33).

16.   Hassoon WA, Melconian AK, AL-Safar JM. Study the relationship between hemodialysis (HD) patients and their ABO blood grouping as well as screening of hemodialysis access-related bacterial infections. J Biol Sci. 2013;5(6):291.

17.   Nalbant A, Aydın A, Yaylacı S, Kaya T, Wermeulen CL, Cinemre H. Association of ABO blood group and age with COVID-19 positive test. Rev Assoc Med Bras. 2021;67:46-50.

18.   El-Shitany NA, El-Hamamsy M, Alahmadi AA, Eid BG, Neamatallah T, Almukadi HS, et al. The Impact of ABO Blood Grouping on COVID-19 Vulnerability and Seriousness: A Retrospective Cross-Sectional Controlled Study among the Arab Community. Int J Environ Res Public Health. 2021;18(1):276.

19.   Lippi G, South AM, Henry BM. Electrolyte imbalances in patients with severe coronavirus disease 2019 (COVID-19). Ann Clin Biochem. 2020;57(3):262-5.

20.   Waris A, Din M, Khalid A, Abbas Lail R, Shaheen A, Khan N, et al. Evaluation of hematological parameters as an indicator of disease severity in Covid-19 patients: Pakistan's experience. J Clin Lab Anal. 2021:e23809.

21.   Yang H, Xu Y, Li Z, Yan L, Wang J, Liao P. The Clinical Implication of Dynamic Hematological Parameters in COVID-19: A Retrospective Study in Chongqing, China. Int J Gen Med. 2021;14:4073.