How to Cite:
Mohammed, J. H., & Hassan, A.-S. U. (2022). Clinical analysis study of COVID-19 patients between arterial blood gases with electrolytes and some biochemical parameters by cohort study in Alfurat Alawst at 2021. *International Journal of Health Sciences*, *6*(S2), 6865–6876. https://doi.org/10.53730/ijhs.v6nS2.6703

Clinical analysis study of COVID-19 patients between arterial blood gases with electrolytes and some biochemical parameters by cohort study in Alfurat Alawst at 2021

Jinan H. Mohammed
B.Sc., student, Department of, Pathological Analysis, College of Health and Medical Techniques /Kufa, Al-Furat Al-Awsat Technical University, Iraq

A-S. U. Hassan
Ph.D. Professor, Department of, Pathological Analysis, College of Health and Medical Techniques /Kufa, Al-Furat Al-Awsat Technical University, Iraq

***Abstract*---**Background: Coronavirus is one of the most common respiratory infections in the world. SARS-CoV and MERS-CoV, two prior epidemics of coronaviruses (CoVs) that have been considered as major public health threats, are examples of past coronavirus outbreaks.Method: The current study included eighty-four covid – 19 patients who were attending in Al – Hussein – medical city, Al – Hayat unit, in Karbala and Al-Hakim General Hospital, Al-Shahid Hassan Hallous al_Hatmi Hospital/Al_amal in Najaf city; Marjan teaching hospital in Babylon Iraq. In period from November 2020 to march 2022. Results: the results show the levels of serum electrolytes elevated in mild group than the moderate and severe groups, and higher in moderate group when compared with severe. The study shows some correlation between electrolytes in blood gases. The study was showed positive significant correlation between serum ferritin and s. calcium in 5 and 8 intervals (r=.284** , p=.009, r= .261*, p=.016). Moreover there was a positive significant correlation between serum ferritin and chloride in the 3,4,5 and 7 intervals (r=.282**, p=.009, r= .420** , p=..000 , r=.291** , p=.007, r=.426** ,p=.000). Conclusion: The serum electrolytes show high levels in mild patients more than severe. This study shows some correlation between electrolytes and arterial blood gases in the covid – 19 patients. The serum ferritin and D – dimer are arising in severe group more than other and electrolytes also have some correlation with serum ferritin and D – dimer.

***Keywords*---**coronavirus, severe acute respiratory syndrome, middle east respiratory syndrome, arterial blood gases, electrolytes.

International Journal of Health Sciences ISSN 2550-6978 E-ISSN 2550-696X © 2022.
Manuscript submitted: 27 Feb 2022, Manuscript revised: 18 March 2022, Accepted for publication: 09 April 2022

Introduction

Coronavirus is one of the most common respiratory infections in the world. SARS-CoV and MERS-CoV are two examples of coronaviruses (CoVs) that have previously been characterized as a major public health danger.. Several patients were admitted to hospitals in the latter part of December 2019 with what turned out to be primary diagnoses of pneumonia of unknown origin. In Wuhan, Hubei Province, China, there was a seafood and wet animal wholesale market where these individuals were linked epidemiologically (1). Nonsegmented, single-stranded positive sense Rna is their nuclear material, and they are enveloped. Using an electron microscope, these viruses seem to have a crown-like look due to the appearance of club-shaped protein projections on the virus's surface (2). To the Coronavirinae subfamily, which has members that infect a broad variety of hosts with symptoms and diseases ranging from the common cold to deadly ones like SARS and MERS, there belongs the Coronavirus family (Coronaviridae). SARS-CoV-2 is one of seven members of the CoV family that infected people, according to the Centers for Disease Control (3). SARS-CoV-2 may be transmitted directly (through droplet or human-to-human transmission) or indirectly (by other people's bodily fluids) (contaminated objects and airborne contagion). When it comes to airborne illnesses, personal protective equipment (PPE) may be to blame (4).

For example, electrolytes are necessary for maintaining cell electrical neutrality, producing action potentials in the neurons and muscles, and transmitting them. Magnesium, calcium, phosphate, and bicarbonates are among the important electrolytes, as are sodium, potassium, and chloride. Our food and fluids include electrolytes, which are essential for a healthy body. High or low amounts of these electrolytes are possible when there is an electrolyte imbalance. Electrolyte imbalances may cause serious health problems and even death if left untreated (5). Illness caused by COVID-19 pathology is related with IL-6, and this cytokin produces electrolyte imbalance by stimulating the non-osmic production of vasopressin. A correlation between IL-6 and the PaO2/FiO2 (P/F) ratio has been shown to be inversely related to [Na+]. Patients with a greater IL-6 level had decreased [Na+] and P/F ratios (6).

A deficiency in potassium is one of the most prevalent electrolyte abnormalities seen in people with confirmed instances of Covid 19. There is evidence that both high and low blood potassium levels are independently associated with illness outcome (7). Hypokalemia may cause angiotensin-converting enzyme (ACE2) to be used and then degraded as a cell-entry receptor, a possible mechanism. The potassium content is mostly controlled by RAAS, which ACE-2 may interfere with. Covid-19 patients may have hypokalemia if the virus down-regulates ACE-2 function, resulting in an increase in RAAS activity (8).

The body's need for calcium cannot be overstated. Involved in bone mineralization, muscular contraction and nerve transmission, blood coagulation, and hormone production, among other things. Calcium is mostly obtained from food. Extracellular fluid contains the vast majority of this substance. The hormone-active form of vitamin D is principally responsible for controlling intestinal calcium absorption (9). chloride and bicarbonate concentrations are deducted from the sodium concentration to get the anion gap (AG). There must be equal amounts of cations and anions flowing throughout the body. There are many cations and anions in the blood, but the most abundant in the serum are sodium, potassium, calcium, magnesium, and cationic proteins. The most abundant anions in the blood are chloride, bicarbonate, and anionic proteins. However, sodium ions, potassium ions, chloride ions, and bicarbonate are the only ions that are frequently analyzed in this way. Unmeasured cations and anions are used to describe the residual cations and anions. Anions and cations that have not been measured yield AG. It is very uncommon for doctors to remove potassium while estimating a patient's glomerular filtration rate (AG), which is often calculated as the Na+–(Cl + HCO3) equation. There are three types of AG: high-AG, low-AG, and none at all. Acidosis individuals are more likely to have increased serum AG levels. Metabolic acidosis is the most prevalent cause of a high serum AG level (10).

Methodiology

The current study included eighty-four patients who were attending in Al – Hussein – medical city, Al – Hayat unit, in Karbala and Al-Hakim General Hospital, Al-Shahid Hassan Hallous al_Hatmi Hospital/Al_amal in Najaf city; Marjan teaching hospital in Babylon Iraq. In period from November 2020 to march 2022. Coronaviruses was classified according computed tomography into (severe, moderate and mild). The demographic, clinical, laboratory, data are extracted from medical records using a standardized data collection form which included age, gender. Serum electrolytes, ferritin, D- dimer and arterial blood gases tests are done for all patient.

Inclusion criteria: Positive results for covid-19 were found in all patients whose samples were tested using the real-time RT-PCR method on swabs taken from the nose and pharynx.

Exclusion criteria: : Patients with kidney diseases. Patient with pulmonary disease. Pregnancy women. Patient with Heart and liver disease. Smocking people. Patients who did not complete the follow-up process and dead through it.
Ethical Issue: Patients and controls were told that their blood will be used for research reasons prior to the collection of blood samples, and most of them were cooperative and helpful in the process. Al-Sadder medical city, Marjan teaching hospital, Al-Hussein medical city, Al-Hayat unit, in Karbala was granted the authorization.

Statistical Analysis: SPSS, a statistical software for the social sciences, was used to conduct statistical analyses (version 20.0 for windows, SPSS, Chicago, IL, USA). The mean and standard deviation are used to depict quantitative data. As a count or percentage, qualitative data might be seen. It was necessary to do a correlation test in order to determine whether or not two variables are related. To see whether there were any differences between the groups, we utilized the ANOVA test. It was deemed statistically significant when the P value was more than 0.05.

Blood Sample Processing: A disposable syringe was used to extract five millimeters of artery from 84 individuals, all of whom had an artery and vein puncture. It has been shown that the arterial blood gases and serum electrolytes can be determined using the blood that was drawn. Health and safety precautions were performed throughout the sample process (wearing a mask, gloves, goggles and face shield).

Results

As a standard, demographic data is presented in the table (1). SARS-COV-2 – specific RT-PCR was performed on NP swabs from 84 people with COVID, and 19 of them were confirmed to have SARS-COV-2-specific disease. Patients with COVID-19 were divided into three groups based on computed tomography results: mild, moderate, and severe. N=24 instances of moderate and 47 severe cases, in addition to 13 mild cases, have been selected. 28.2 percent of the group was male, whereas 70 percent of the group was female. Participants' ages ranged from 35 to 84 years old, with an average of 57.14. According to the experts, the severity of the disease was related to the age of the patient. The researchers found that the more serious the problem was, the older the sample was (1).

Table (1): Demographic data of the studied groups

Total number	84		*P* value
Gender	Male 24 (28.2%) Female 60 (70.6%)		.000
Age Mean ±SD	57.14 ±12.17		
Age groups	Frequency	Percent	
(35-44)	12	14.1%	.000
(45-54)	24	28.2%	
(55-64)	18	21.2%	
(65-74)	24	28.2%	
(75-84)	6	7.1%	
Clinical stage	Frequency	Percent	
Mild	13	15.3%	.000
Moderate	24	28.2%	
Severe	47	55.3%	

The electrolyte values of COVID-19 patients are shown in the table (2). Elevated levels of blood electrolytes were seen in severely ill individuals, although the rise in electrolyte concentrations was substantially greater in patients with mild or moderate illness. S. sodium (p=.037) and s. sodium and potassium (p=.022, p=.014) were significantly different among the patient groups in the third intervals (p=.022, p=.014), however. Furthermore, in the fourth and fifth intervals, there was a significant difference in S. chloride (p=.040) and S. potassium (p=.003) among the patient groups. Calcium, sodium, and chloride levels in the patient groups varied significantly at intervals 6 and 8, whereas at intervals 7 and 8 there was a substantial variation in calcium, sodium, and chloride levels across the patient groups, as shown in the table (2).

Table (2): Comparison mean of the serum electrolytes in the studied sample according to the intervals

	Mean±SD				
Intervals	Parameters	Mild N.(13)	Moderate N.(24)	Severe N.(47)	P-value
0-10 days	Calcium	1.0500±.06671	1.0452±.06149	1.0696±.07059	.315
	Sodium	140.08±10.420	140.35±9.257	136.02±4.996	.037
	Potassium	4.015±.3412	3.883±.4053	3.765±.3676	.085
	Chloride	97.85±7.946	96.00±6.310	95.50±5.206	.460
10-20 Days	Calcium	1.0746±.05797	1.0738±.05181	1.0453±.08697	.226
	Sodium	139.85±9.642	140.09±9.477	139.17±5.839	.881
	Potassium	3.946±.4943	3.887±.4556	3.694±.3721	.065
	Chloride	95.62±6.838	95.39±7.832	95.27±6.613	.987
20-30 Days	Calcium	1.0454±.17793	1.0487±.18560	1.0329±.15227	.922
	Sodium	142.85±9.082	142.43±7.763	138.69±4.228	.022
	Potassium	3.746±.2537	3.743±.2573	3.554±.3066	.014
	Chloride	98.38±5.409	97.04±5.531	94.60±6.118	.068
30-40 Days	Calcium	1.0469±.07554	1.0383±.06095	1.0390±.08009	.935
	Sodium	143.00±9.644	142.83±8.451	139.46±6.277	.122
	Potassium	3.777±.6483	3.770±.5473	3.508±.5724	.123
	Chloride	99.77±7.247	97.87±7.181	94.71±6.977	.040
40-50 Days	Calcium	1.0238±.13451	.9822±.18669	1.0281±.09727	.385
	Sodium	142.00±8.746	141.91±8.246	139.42±5.255	.244
	Potassium	4.123±.5388	4.170±.6725	3.760±.4041	.003
	Chloride	97.31±8.390	96.13±7.194	95.96±5.724	.806
50-60 Days	Calcium	1.0685±.08385	1.0839±.07488	1.0348±.07184	.029
	Sodium	141.15±10.885	141.91±9.194	136.81±5.956	.023
	Potassium	3.708±.3662	3.717±.3433	3.640±.3517	.631
	Chloride	95.15±8.405	96.35±8.277	91.56±7.217	.039
60-70 Days	Calcium	1.0531±.10889	1.0600±.09858	.9981±.10967	.046
	Sodium	142.31±9.801	142.39±8.462	139.56±5.776	.225
	Potassium	3.831±.6061	3.765±.5928	3.658±.3332	.410
	Chloride	95.08±8.391	94.04±6.846	94.31±8.372	.931
70-80 Days	Calcium	1.0408±.14756	.9922±.19559	1.0550±.09367	.198
	Sodium	144.38±10.634	144.35±9.291	138.81±6.420	.009
	Potassium	3.700±.8246	3.874±.9077	3.679±.6137	.573
	Chloride	95.92±8.722	95.35±7.946	93.46±7.357	.462

In table (3) illustrates the majority of the biochemical indicators, D. dimer, serum ferritin distribution according to illnesses severity (mild, moderate and severe) (mild, moderate and severe). According to D-dimer, serum ferritin parameters the result revealed that there was no significant link between illnesses severity and examined parameter. Moreover, there was differential in the levels of D. dimer, S. ferritin between the mild and the other groups were no statistically significant except in the intervals 6 there was significant among D – dimer in the patient groups (P = .011). as a results in table (3).

Table (3): Comparison mean of the serum ferritin, D-dimer in the studied sample

	Mean±SD				
Intervals	Parameters	Mild N.(13)	Moderate N.(24)	Severe N.(47)	P-value
0-10 days	Ferritin	712.77±452.725	704.00±415.889	777.50±434.023	.761
	D-dimer	1394.77±1327.248	1267.61±1233.713	903.23±639.119	.146
10-20 Days	Ferritin	774.15±460.434	743.22±430.484	738.58±385.693	.962
	D-dimer	1837.77±2015.888	1476.17±1731.063	1532.56±1799.822	.834
20-30 Days	Ferritin	747.08±467.264	697.22±446.478	692.46±373.930	.911
	D-dimer	920.46±667.711	818.00±631.324	693.50±443.075	.344
30-40 Days	Ferritin	728.85±432.414	661.52±425.464	672.25±389.156	.882
	D-dimer	1319.23±1306.429	1137.52±1241.321	841.77±679.025	.213
40-50 Days	Ferritin	631.31±392.225	626.48±376.099	591.71±255.973	.870
	D-dimer	1271.08±1023.430	1076.22±932.862	1111.19±982.317	.836
50-60 Days	Ferritin	589.54±361.019	536.09±314.194	596.96±314.605	.752
	D-dimer	1498.62±1267.026	1341.87±1218.885	769.15±634.965	.011
60-70 Days	Ferritin	649.38±418.594	596.65±400.767	581.60±378.289	.858
	D-dimer	1174.69±701.494	1062.04±715.231	954.96±720.894	.585
70-80 Days	Ferritin	695.69±404.364	635.39±382.293	626.38±342.386	.829
	D-dimer	1347.15±914.176	1139.52±829.930	956.50±921.325	.346

In table (4) correlation analyses were done between arterial blood gases with serum levels electrolytes in COVID-19 patients. A significant positive significant correlation was observed between in arterial blood gases with serum levels calcium in the second, third, fourth and seventh intervals ($r=0.430^{**}$, P=.000, $r=.370^{**}$, p=.001, $r=.537^{**}$ p=.000, $r=.374^{**}$, p=.000, respectively) .Moreover, a positive significant correlation notably among the arterial blood gas with serum sodium in fourth intervals ($r=.262^{*}$, p=.016).and with potassium in 5, 6 intervals ($r=.368^{**}$, p=.001, $r= .315^{**}$, p=.003 respectively), there was a positive significant correlation notably among arterial blood gas with serum chloride in 4,7 and 8 intervals ($r=.324^{**}$, p=.003, $r=.290^{**}$ p=.007, $r=.461^{**}$, p=.000 respectively).

Table (4): Pearson's Correlation Coefficients among electrolytes with arterial blood gases in studied samples according to the intervals

Parameter	Correlation of serum ferritin according to the intervals								
	PC & P-value	0-10 days	10-20 days	20-30 days	30-40 days	40-50 days	50-60 days	60-70 days	70-80 days
Calcium	R	-.056-	.032	-.183	$-.332^{**}$	$.284^{**}$	.137	.204	$.261^{*}$
	P	.610	.769	.096	.002	.009	.214	.063	.016
Sodium	R	-.069-	-.214-	-.055	.143	-.120	-.118	.067	-.176-

	P	.536	.051	.622	.196	.277	.286	.544	.108
Potassium	R	.042	-.030-	.108	-.098-	-.372-**	-.173-	-.044-	-.241*
	P	.704	.786	.328	.373	.000	.115	.692	.027
Chloride	R	-.057-	-.037-	.282**	.420**	.291**	.050	.426**	.018
	P	.606	.739	.009	.000	.007	.651	.000	.871
**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).									

on a dining room table (5) When correlation between s. ferritin and s. calcium levels, the research found a statistically significant link between the two in 5 and 8 intervals of time (r=.284**, p=.009, r=2.61*). In addition, serum ferritin and chloride showed a significant positive connection at the 3,4,5, and 7 time points (r=.282**, p=.009, r=.420**, p=.000, r=.291**, p=.007, r=.426**,p=.000). With respect to intervals, there was a substantial negative association between the serum ferritin and electrolytes

Table (5): Pearson's Correlation Coefficients of serum ferritin with serum electrolytes in studied samples according to the intervals

Parameter	Correlation of serum ferritin according to the intervals								
	PC & P-value	0-10 days	10-20 days	20-30 days	30-40 days	40-50 days	50-60 days	60-70 days	70-80 days
Calcium	R	-.056-	.032	-.183	-.332**	.284**	.137	.204	.261*
	P	.610	.769	.096	.002	.009	.214	.063	.016
Sodium	R	-.069-	-.214-	-.055	.143	-.120	-.118	.067	-.176-
	P	.536	.051	.622	.196	.277	.286	.544	.108
Potassium	R	.042	-.030-	.108	-.098-	-.372-**	-.173-	-.044-	-.241*
	P	.704	.786	.328	.373	.000	.115	.692	.027
Chloride	R	-.057-	-.037-	.282**	.420**	.291**	.050	.426**	.018
	P	.606	.739	.009	.000	.007	.651	.000	.871
**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).									

Table (6) lists the electrolyte values for the patients who were studied. Serum calcium levels show no connection to D-dimer. D-dimer and serum sodium, potassium, and chloride showed a significant positive connection.

Table (6): Pearson's Correlation Coefficients of D- dimer with serum electrolytes in studied samples according to the intervals

Parameter	Correlation of D - dimer according to the intervals								
	PC & P-value	0-10 days	10-20 days	20-30 days	30-40 days	40-50 days	50-60 days	60-70 days	70-80 days
Calcium	R	-.199-	.172	.151	.009	-.011-	-.104-	-.133-	-.094-
	P	.069	.117	.171	.932	.923	.346	.229	.393
Sodium	R	.455**	.353**	.630**	.189	.636**	.769**	.552**	-.016-
	P	.000	.001	.000	.086	.000	.000	.000	.884
Potassium	R	.510**	.363**	.424**	.471**	.208	.259*	.218*	-.007-
	P	.000	.001	.000	.000	.058	.018	.046	.951

Chloride	R	.147	.335**	.239*	.418**	.548**	.606**	.483**	-.201-
	P	.182	.002	.029	.000	.000	.000	.000	.067
**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).									

Discussion

In Usul et al2020 .'s (11) research, the average age of men was found to be lower than that of girls. As shown in the table (1), males were found to have more severe instances than females, according to the clinical grading of severity of the condition (12). It has been shown that the incidence of SARS-CoV-2 in men is much higher than that in females, suggesting that males are more vulnerable to SARS-CoV-2 infection (13). SARS-CoV-2 infection is more common among women, according to a new research. This is particularly true among older women. This strain of SARS-CoV-2 infects people predominantly via the ACE2 receptor, which acts as a point of entrance into the body's tissues for the virus (14).

The age gap between literature and the present study has numerous possible causes, one of which is that the sample was drawn from a public health institution designed for adults. Patients may also be directed to private hospitals and/or clinics for diagnosis and treatment rather than public health institutions, which might explain the raised threshold of illness reporting in older age groups, as seen in our data.

Serum electrolyte levels were higher in the mild group than the moderate and severe groups, and higher in the moderate group than in the severe group, a finding that is at odds with Lippi et al., 2020 (15), who claim that COVID-19 severity correlates with lower serum concentrations of sodium, potassium, and calcium. The current study is disagreement with Tezcan et al., 2020 [16] In Turkey, in a study of 408 patients hospitalized with COVID-19, those with hyponatremia, hypochloremia and hypocalcemia had worse outcomes.

Serum potassium and calcium levels were shown to decline in COVID-19 patients in another investigation by Chen et al., 2020 (17). Among patients with severe COVID-19, a decreased blood calcium level was found (WMD: -0.20 mg/dL [95 percent CI: 0.25 to 0.25 mg/dL], p 0.001), which was statistically significant (15). Only calcium was considerably lower in individuals with severe COVID-19 in a research by Lippi et al., 2020 (15) comparing electrolytes (sodium, potassium, chloride, and calcium) between COVID-19 patients with and without severe illness. The severity of COVID-19 was shown to be linked with decreased levels of sodium, potassium, and calcium in the blood, according to a meta-analysis of five investigations.

Patients with abnormal Na and K levels (both hypo- and hyper-levels) had 1.321 and 1.269 times the chance of getting serious illness as those with normal Na and K values. When fluids are lost from the body, renal impairment occurs, and medication is taken for treatment of the disease and/or concurrent conditions, electrolyte imbalances may occur. Angiotensin-converting enzyme 2 (ACE2), which is purported to be a receptor for the severe acute respiratory syndrome coronavirus 2 (SARS-CoV2), has also been linked to an increased risk of SARS. As a result of this electrolyte imbalance, the body's ability to respond appropriately to the stress created by the illness may be compromised, resulting in worsening symptoms, complications, and even death. A number of additional studies show that both high and low levels of Na and K are related with severe illness (17, 15). There were substantial differences between the 19 patient groups evaluated in this research.

Serum ferritin levels were significantly higher in the mild group than in the other groups investigated. A high amount of D. dimer was found in mild individuals, which is a significant difference when compared to other groups of patients. The pro-inflammatory properties of serum ferritin make it an important immune system mediator. It adds to the cytokine storm by increasing inflammation (18). The severity of COVID-19 has been linked to ferritin and D-dimer levels in many investigations. There was a considerable drop in D-dimer and ferritin levels by day 14 in this research by Abdelnaby et al., 2021 (19), which was similar to results from a previous study by Biran et al2020. (20). A study published in 2020 (13) by Chen et al. indicated that levels of D-dimer remained high. An auto-analyzer discovered no significant difference between blood gas machine and auto-analyzer potassium readings, however the discrepancy in salt measurements was considerable.

For critically unwell patients, Nanda et al., 2015 (22) discovered that arterial sodium and arterial potassium values may be utilized in place of venous sodium and venous potassium levels. We wanted to see whether there was any correlation between the levels of sodium, potassium, and calcium in serum and arterial samples in the present investigation. So that the data acquired from both sources may be utilized in practice depending on the effectiveness of the data collection.

Results from arterial samples (Na correlation = 0.944, K correlation = 0.679, and Ca correlation 0.399) are strongly linked to serum samples. In the ABG and blood, we found a substantial correlation between the amounts of Na, K and calcium. Our findings show that the results of arterial blood gas analysis and serum may be relied upon to make significant decisions .For the different electrolytes and both treatments, there was no statistically significant time difference. A substantial correlation was found between electrolytes in the ABG and those in the serum (21, 22, 23). The level of calcium in the blood may be a biomarker for the severity of a disease. For the most part, the basic blood test that can be performed in most emergency circumstances serves as a reliable indicator of calcium levels. If COVID-19 is caused by hypocalcemia (24.)

SARS-CoV-2 is predicted to reduce ACE2 protein expression and elevate angiotensin II pathologically, which might lead to renal potassium loss and hypokalemia. According to Chen et al, people with COVID-19 have a high rate of hypokalemia (17). Zhang et al.,2020 investigated the link between hyponatraemia and the severity of COVID-19 (25) COVID-19 patients with electrolyte problems, five trials comprising 1415 participants, shown a connection between lower blood sodium levels and disease severity. Ca^{2+} is essential for maintaining heart and coagulation functions. We found that Na+, K+, and Cl levels were all normal in COVID-19 infected persons, however Ca^{2+} levels were much lower in patients with severe COVID-19 infection. A recurrence of coagulation dysfunction is possible with infection with COVID-19. The coagulation function indicators of patients with mild and severe COVID-19 infection were compared (26).

Qi et al. conducted out a correlation study of factors connected to the reduction in Ca2+, coagulation function, and inflammation in COVID-19 patients .There is a correlation between D-dimer and Ca2+ in these studies as well as other indicators. D-dimer and Ca2+ showed a strong negative association, as expected.

Potassium hyperkalemia is associated with a higher mortality rate in COVID-19 patients for reasons that are yet unclear. But there are a lot of possible theories that might partly explain the present situation. Elevated potassium levels affect the resting membrane potential of the myocardium, increasing the risk of ventricular arrhythmias (27). Hyperkalemia, which lowers ventricular excitability, may induce heart block and sinus halt.

Elevated potassium levels in the blood have also been linked to an increased risk of severe brady-arrhythmia. Second, those who are very ill and often have organ dysfunction and frequently use medicines that alter K+ control are more likely to have abnormal K+ concentrations. Severe acute respiratory distress syndrome may be indicated by an elevated plasma potassium level as a third symptom of acid-base imbalance (27).

Conclusion

The study showed that the serum levels of electrolytes are elevated in mild patients while the levels of ferritin and D – dimer are increased in severe COVID – 19 patients. The study was show signification correlation between the electrolytes and arterial blood gases and also there was signification correlation between the electrolytes and serum ferritin and D – dimer. This study may be helpful to detected the electrolytes effects on the arterial blood gases in covid – 19 patients.

Acknowledgments

The physicians and nurses tackling the COVID-19 epidemic deserve our gratitude. It is much appreciated by those patients whose data was utilized in this study. Everyone on the medical staff who helped us collect this data should be thanked as well.

References

1. Bogoch, I. I., Watts, A., Thomas-Bachli, A., Huber, C., Kraemer, M. U., & Khan, K. (2020). Pneumonia of unknown aetiology in Wuhan, China: potential for international spread via commercial air travel. Journal of travel medicine, 27(2), taaa008.
2. Pal, M., Berhanu, G., Desalegn, C., & Kandi, V. (2020). Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2): an update. Cureus, 12(3).
3. Zhu, N., Zhang, D., Wang, W., Li, X., Yang, B., Song, J., ... & Tan, W. (2020). A novel coronavirus from patients with pneumonia in China, 2019. *New England journal of medicine*.

4. Yuan, L., Zhi, N., Yu, C., Ming, G., Yingle, L., Kumar, G. N., ... & Ke, L. (2020). Aerodynamic characteristics and RNA concentration of SARS-CoV-2 aerosol in Wuhan hospitals during COVID-19 outbreak. *BioRxiv*.
5. Shrimanker, I., & Bhattarai, S. (2019). Electrolytes.
6. Berni, A., Malandrino, D., Parenti, G., Maggi, M., Poggesi, L., & Peri, A. (2020). Hyponatremia, IL-6, and SARS-CoV-2 (COVID-19) infection: may all fit together?. *Journal of endocrinological investigation*, *43*, 1137-1139.
7. De Carvalho, H., Richard, M. C., Chouihed, T., Goffinet, N., Le Bastard, Q., Freund, Y., ... & Montassier, E. (2021). Electrolyte imbalance in COVID-19 patients admitted to the Emergency Department: a case–control study. *Internal and Emergency Medicine*, 1-6.
8. Silhol, F., Sarlon, G., Deharo, J. C., & Vaïsse, B. (2020). Downregulation of ACE2 induces overstimulation of the renin–angiotensin system in COVID-19: should we block the renin–angiotensin system?. *Hypertension Research*, *43*(8), 854-856.
9. Veldurthy, V., Wei, R., Oz, L., Dhawan, P., Jeon, Y. H., & Christakos, S. (2016). Vitamin D, calcium homeostasis and aging. *Bone research*, *4*(1), 1-7.
10. Li, M. Y., Li, L., Zhang, Y., & Wang, X. S. (2020). Expression of the SARS-CoV-2 cell receptor gene ACE2 in a wide variety of human tissues. *Infectious diseases of poverty*, *9*(1), 1-7.
11. Usul, E., Şan, İ., Bekgöz, B., & Şahin, A. (2020). Role of hematological parameters in COVID-19 patients in the emergency room. Biomarkers in Medicine, 14(13), 1207-1215.
12. Jin, J. M., Bai, P., He, W., Wu, F., Liu, X. F., Han, D. M., ... & Yang, J. K. (2020). Gender differences in patients with COVID-19: focus on severity and mortality. Frontiers in public health, 8, 152.
13. Chen, J., Wang, X., Zhang, S., Liu, B., Wu, X., Wang, Y., ... & Xie, Y. (2020). Findings of acute pulmonary embolism in COVID-19 patients.
14. Batlle, D., Wysocki, J., & Satchell, K. (2020). Soluble angiotensinconverting enzyme 2: a potential approach for coronavirus infection therapy?. Clinical science, 134(5), 543-545.
15. Lippi, G., South, A. M., & Henry, B. M. (2020). Electrolyte imbalances in patients with severe coronavirus disease 2019 (COVID-19). Annals of clinical biochemistry, 57(3), 262-265.
16. Tezcan, M. E., Gokce, G. D., Sen, N., Kaymak, N. Z., & Ozer, R. S. (2020). Baseline electrolyte abnormalities would be related to poor prognosis in hospitalized coronavirus disease 2019 patients. New Microbes and New Infections, 37, 100753.
17. Chen, D., Li, X., Song, Q., Hu, C., Su, F., Dai, J., ... & Zhang, X. (2020). Assessment of hypokalemia and clinical characteristics in patients with coronavirus disease 2019 in Wenzhou, China. JAMA network open, 3(6), e2011122-e2011122.
18. Abbaspour, N., Hurrell, R., & Kelishadi, R. (2014). Review on iron and its importance for human health. Journal of research in medical sciences: the official journal of Isfahan University of Medical Sciences, 19(2), 164.
19. Abdelnaby, H., Aboelhassan, W., Al-Jarallah, M., Rajan, R., Dashti, R., Zhanna, K. D., ... & Mahmoud Fouad, A. (2021). Outcomes of tocilizumab therapy in severe or critical COVID-19 patients: A retrospective cohort, single-centre study. Tropical Medicine & International Health, 26(12), 1689-1699.

20. Biran, N., Ip, A., Ahn, J., Go, R. C., Wang, S., Mathura, S., ... & Goldberg, S. L. (2020). Tocilizumab among patients with COVID-19 in the intensive care unit: a multicentre observational study. The Lancet Rheumatology, 2(10), e603-e612.
21. Jain, A., Subhan, I., & Joshi, M. (2009). Comparison of the point-of-care blood gas analyzer versus the laboratory auto-analyzer for the measurement of electrolytes. International journal of emergency medicine, 2(2), 117-120.
22. Nanda, S. K., Ray, L., & Dinakaran, A. (2015). Agreement of arterial sodium and arterial potassium levels with venous sodium and venous potassium in patients admitted to intensive care unit. Journal of clinical and diagnostic research: JCDR, 9(2), BC28.
23. Budak, Y. U., Huysal, K., & Polat, M. (2012). Use of a blood gas analyzer and a laboratory autoanalyzer in routine practice to measure electrolytes in intensive care unit patients. BMC anesthesiology, 12(1), 1-7.
24. Sarvazad, H., Cahngaripour, S. H., Roozbahani, N. E., & Izadi, B. (2020). Evaluation of electrolyte status of sodium, potassium and magnesium, and fasting blood sugar at the initial admission of individuals with COVID-19 without underlying disease in Golestan Hospital, Kermanshah. New Microbes and New Infections, 38, 100807.
25. Zhang, W., Lu, S., Zhang, M., Zheng, H., Huang, Y., Chen, S., ... & Wu, S. (2020). Correlation between hyponatremia and the severity of coronavirus disease 2019. Zhonghua wei Zhong Bing ji jiu yi xue, 32(7), 774-778.
26. Qi, X., Kong, H., Ding, W., Wu, C., Ji, N., Huang, M., ... & Tang, J. (2021). Abnormal coagulation function of patients with COVID-19 is significantly related to hypocalcemia and severe inflammation. Frontiers in medicine, 8, 698.
27. Liu, S., Zhang, L., Weng, H., Yang, F., Jin, H., Fan, F., ... & Li, J. (2021). Association between average plasma potassium levels and 30-day mortality during hospitalization in patients with COVID-19 in Wuhan, China. International journal of medical sciences, 18(3), 736.