Dysnatremia and its Clinical Significance in COVID-19 Era

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Background and study aim: One of the observed pathological changes in corona virus disease 2019 (COVID-19) is imbalance of sodium homeostasis.We wanted to look at the imbalance in blood sodium values in COVID-19 patients and detect whether dysnatremia affects the prognosis COVID-19 patients who were admitted with extreme acute respiratory disorder coronavirus2 (SARS-COV2).

Patients and Methods: A retrospective study on 163 patients with confirmed COVID-19. Clinical information was obtained from individuals' medical records, as well as electrolyte values. The authors addressed the correlations between sodium serum levels in COVID-19 patients, as well as the clinical characteristics, implications, and underlying severity and mortality.

Results: From a sum of 163 COVID-19, 71 patients had hyponatremia (under 135 mmol/L) and 9 patients had hypernatremia (over 145 mmol/L). Patients with sodium balance problems had more severe illness than those with normonatremia. A total of 53.5 percent of hyponatremia patients and 11.1 percent of hypernatremia patients had a mild or moderate condition, with lower ratios than normonatremia patients (38.5 percent). However, a total of 47.5 percent of hyponatremia patients and 88.9% of hypernatremia patients had serious or critical diseases with higher ratios than normonatremia patients (61.5 percent). Patients with dysnatremia had a greater death rate than those with normonatremia.

Conclusion: Hypernatremia is linked to an elevated risk of serious illness and mortality in the hospital. In patients with SARS-COV2 infection, hypernatermia was linked to a greater risk of mortality .

INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic in Egypt is part of a global COVID-19 pandemic induced by coronavirus 2 (severe acute respiratory symptoms) (SARS-CoV-2). While respiratory symptoms are the greatest frequent symptoms of SARS-CoV-2 infection, additional symptoms have been observed, several electrolyte abnormalities were noticed as well. **[1].** Hyponatremia **[2]** and hypernatremia **[3]** have been linked to an elevated risk of death in hospitalized patients, especially those with community-acquired pneumonia (CAP) **[4],** such as SARS-COV2.

The renin-angiotensin-aldosterone system (RAAS) and the pituitary's arginine vasopressin (VAP) interact to maintain fluid homeostasis, which includes electrolyte balance. Hypo- or hypernatremia may result from an imbalance between them. The angiotensin converting enzyme (ACE)-receptors, ACE2, that are extensively expressed in the human body, allow SARS-CoV-2 to enter the body. Angiotensin II levels were discovered to be higher in individuals with severe COVID-19, and "loss of brake" caused by suppressing ACE2 was thought to be part of the pathogenesis of the illness **[5]**.

Angiotensin II overactivity stimulates the production of aldosterone from the adrenal gland, accompanied by an elevation in the secretion of antidiuretic hormone, AVP. As a result, elevated aldosterone levels in the blood may lead to hypertension, hypernatremia, hypokalemia, and metabolic alkalosis. On the other hand, high levels of AVP cause hyponatremia. In COVID-19, the precise timing of RAAS overactivation and the resulting physiological implications are unknown. As a result, the electrolyte and acid-base patterns are erratic **[6]**.

In COVID-19, the impact of hypernatremia on death risk is yet unknown. Because of induced dehydration, hyperventilation, muscular cramps, rhabdomyolysis, and cerebral dehydration, hypernatremia is regarded as a dangerous illness with prolonged hospital stays and higher death rates **[7, 8]**.

Severe hyponatremia has also long been known to be a direct reason of mortality and lasting brain damage. Hyponatremia is generally minor in CAP patients. Mild/moderate hyponatremia, on the other hand, has been linked to an elevated death risk in hospitalized patients, particularly those with CAP. Mild hyponatremia might be a sign of the underlying illness rather than a direct cause **[9]**.

It's still unclear if hyponatremia and hypernatremia are linked to a bad prognosis in COVID-19 patients. Electrolyte changes have been recorded often during COVID-19, which might impact therapy, duration of hospital stay, and death. As a result, we set out to investigate sodium imbalance in COVID-19 patients and see whether dysnatremia is linked to death or sepsis in SARS-COV2 pneumonia patients.

Aim of the work:

The aim of this study is to study imbalance in blood sodium values in COVID-19 patients and detect whether dysnatremia affects the prognosis in COVID-19 patients who were admitted with acute respiratory disorder coronavirus2 (SARS-COV2).

PATIENTS AND METHODS

Our work is a retrospective study conducted in A retrospective observational cohort analysis of 163 hospitalized adult patients admitted to Ain Shams University Geriatric Isolation Hospital with RT-PCR-confirmed SARS-COV2 pneumonia. We took their admission serum sodium concentrations (SNa), and divided them into three groups depending on their sodium concentrations: hyponatremia (SNa < 135 mmol/L), normonateremia (SNa 135–145 mmol/L), and hypernatremia (SNa >145 mmol/L). Patients who were moved to another hospital in another area or who were released by permission were not included.

Age, gender, and comorbidities (diabetes mellitus, hypertension, and obstructive lung problems) were obtained, as well as a full history of symptoms and information on ICU admission, intubation, and duration of mechanical ventilation, mortality, and total hospital stay.

All of the patients were given a complete clinical examination. All patient's vital signs were measured, like body temperature, respiration rate, oxygen saturation, heart rate, and blood pressure.

Study outcomes:

The major goal was to study the incidence of dysnatremia in COVID-19 patients.

Secondary objectives included determining the relationship between admission dysnatremia and clinical outcome, as well as duration of hospital stay, ICU admission, and the necessity for invasive mechanical ventilation.

Statistical analysis:

SPSS (Statistical Package for Social Sciences), a software application version 23, was used to organize, classify, tabulate, input, and analyze the obtained data. To determine the relationship between the variables, the statistical significance and relationships were tested utilizing the arithmetic mean, standard deviation (SD), Wilcoxon Signed Ranks test (Z test), Pearson chi-square test (X2), and Pearson Correlation (r).

RESULTS

Characteristics of Patients:

A total of 163 COVID-19 patients were recruited [83 males (50.9%) and 80 females (49.1%), average age 65.20± 12.29 years (range 22–86)]. Fever (71.3%), tachypnea (69.6%), cough (56.4%), disturbed conscious level (14.1%), fatigue (12.3%), and diarrhea were among the hospitalized patients' clinical complaints (10.4 percent). The most prevalent comorbid condition was hypertension (74.8 percent). In terms of clinical significance, 90 patients (55.2%) and 63 patients (38.7%) of those hospitalized had diabetes and chronic kidney failure (CKD), respectively. In addition, 37 patients (22.7 percent), 25 patients (15.3%), and 21 patients (12.9%) had cardiac disease, neurological illness, and chronic liver disease, respectively. Other comorbidities were present in 33 individuals (20 percent). There were 163 patients in all, with 83 having normal serum sodium, 80 having salt problems, 9 having Hypernatremia, and 71 having Hyponatremia.

There were no statistically significant difference in demographic (table 2) and clinical features between hypernatremic, hyponatremic or normonatremic patients except for respiratory distress which occur in 88.9% of hypernatremic patients and in 59.2 % in patients with hyponatremia in comparison to 77.1% in normanatremic with statistically significant difference as shown in table 4. In addition, There were no statistically substantial variations in comorbidities among the three groups tested.

Results of blood tests and radiographic findings:

Table 2 shows the patient's median (IQR) and mean blood test results. According to computed tomography (CT) results, 24 patients (14.7 percent) had 0–2 lobes pneumonia, whereas 139 patients (85.3 percent) exhibited numerous mottling, ground-glass opacity, or both across the three lobes of their lung. (Table 1).

All laboratory studies revealed no substantial variations between individuals with hyponatremia and those with normonatremia (Table 4). When compared to normonatremia patients, hyponatremia patients had less 0–2 lobes lung pneumonia (12.7 percent vs 14.5 percent), but higher > 3–5 lobes lung pneumonia (87.3 percent vs 83.1 percent). While in hypernatremia, there were less 0–2 lobes lung pneumonia > 3–5 lobes lung pneumonia (11.1 percent vs 88.9%), with no statistical significance (Table 3).

Patients with hypernatremia had greater CRP, fibrinogen, D-Dimer, and lactate dehydrogenase levels than those with normonatremia, but no significant variations. Those with hyponatremia had greater CRP but lower fibrinogen, Dimer, and LDH than patients with normonatremia, with no statistically substantial changes. (Table 3).

Complications:

The overall percent of patients treated with oxygen was 92 percent, while the total percent of patients treated with mechanical ventilation was 29.4 percent. Hyponatremia patients also needed more intense oxygen therapy than normonatremia patients (87.1 vs 60.1 percent), which included oxygen inhalation, however, mechanical ventilation in normonatremic patients was 27 (32.5%) compared to hyponatremia observed in 6 patients (66.7%) and hypernatremia observed in 15 patients (21.1%) with statistically significant difference as shown in table 3.

In individuals with COVID-19, there was a link between salt balance abnormalities and disease severity and prognosis. Patients were classed as slightly unwell, moderately ill, terribly ill, or dangerously ill. There were 29 mild cases, 86 moderate cases, 46 severe cases, and 20 critically ill individuals among the 163 patients (Table 1). A total of 53 (32.5%) patients died during the follow-up period, whereas 110 (67.5%) patients recovered. Patients who survived spent an average of 10 (7-14) days in the hospital, with a range of (1-44) days.

A total of 53.5 percent of hyponatremia patients and 11.1 percent of hypernatremia patients had a mild or moderate condition, with lower ratios than normonatremia patients (38.5 percent). However, a total of 47.5 percent of hyponatremia patients and 88.9% of hypernatremia patients had serious or critical diseases with higher ratios than normonatremia patients (61.5 percent). Table 3 shows that individuals with sodium balance problems had a greater death rate than those with normonatremia. Patients with salt balance problems spent more time in the hospital than those with normonatremia ($p < 0.05$).

Table (1) : Demographic data of all patients.

		No. = 163
Age (years)	Mean ± SD Range	65.20 ± 12.29 22 – 86
Gender	Male Female	83 (50.9%) 80 (49.1%)
Duration of admission (days)	Median (IQR) Range	10 (7 - 14) 1 – 44
Condition on admission	Poor Mild Moderate Severe Critical Good Altered consciousness level	1 (0.6%) 26 (16.0%) 68 (41.7%) 46 (28.2%) 19 (11.7%) 2 (1.2%) 1 (0.6%)
Smoking	Non-smoker Ex smoker Smoker	119 (73.0%) 44 (27.0%) 0 (0.0%)
CT-findings:CO-RADS	Low probability Intermediate probability High probability	2 (1.2%) 22 (13.5%) 139 (85.3%)
APACHE II	Mean ± SD Range	30.58 ± 13.09 4 – 75

CO-RADS :COVID-19 Reporting and Data System, APACHE II :Acute Physiology and Chronic Health Evaluation 2

Table (2) : Co-morbidities and presenting symptoms of all patients.

	No.	%
Co-morbidities		
Hypertension	122	74.8%
Diabetes mellitus	90	55.2%
Obesity	5	3.1%
Heart disease	37	22.7%
Asthma	2	1.2%
Other chronic lung disease	5	3.1%
Immune deficiency	0	0.0%
Chronic Hematological disease	6	3.7%
Chronic Kidney disease	63	38.7%
Chronic Liver disease	21	12.9%
Chronic Neurologic disease	25	15.3%
Organ transplant recipient	3	1.8%
Bone marrow Recipient	1	.6%
Cancer/malignancy	9	5.5%
Pregnancy	0	0.0%
Surgery	1	.6%
Autoimmune disease	1	.6%
Symptoms		
Fever	100	61.3%
Cough	92	56.4%
Respiratory distress	114	69.9%
Diarrhea	17	10.4%
Malaise	20	12.3%
Sore throat	5	3.1%
Anosmia	0	0.0%
Ageusia	0	0.0%
Disturbed level of consciousness	23	14.1%
secondary infection	8	4.9%

Table (3) Characteristics of dysnatremia patients (presenting symptoms, laboratory results and their fate).

		Na (mEq/L)			Test value	P-value	P1	P2	P3
		Normal (135-145)	Hypernatremia (>145)	Hyponatremia (<135)					
		No. = 83	No. = 9	No. = 71					
Gender	*Male*	45 (54.2%)	6 (66.7%)	32 (45.1%)	2.226*	0.329	-	-	-
	Female	38 (45.8%)	3 (33.3%)	39 (54.9%)					
Age (years)	*Mean ± SD*	63.48 ± 13.80	72.00 ± 8.62	66.34 ± 10.36	2.540•	0.082	-	-	-
	Range	22 – 85	61 – 83	30 – 86					
Condition on admission	*Mild*	10 (12.0%)	0 (0.0%)	12 (16.9%)	15.658*	**0.016**	**0.046**	0.277	**0.002**
	Moderate	22 (26.5%)	1 (11.1%)	26 (36.6%)					
	Severe	37 (44.6%)	3 (33.3%)	26 (36.6%)					
	Critical	14 (16.9%)	5 (55.6%)	7 (9.9%)					
CT-findings: CO-RADS	*Low probability*	2 (2.4%)	0 (0.0%)	0 (0.0%)	2.151*	0.708	-	-	-
	Intermediate probability	12 (14.5%)	1 (11.1%)	9 (12.7%)					
	High probability	69 (83.1%)	8 (88.9%)	62 (87.3%)					
Fever	*No*	35 (42.2%)	2 (22.2%)	26 (36.6%)	1.581	0.454	-	-	-
	Yes	48 (57.8%)	7 (77.8%)	45 (63.4%)					
Cough	*No*	34 (41.0%)	4 (44.4%)	33 (46.5%)	0.476	0.788	-	-	-
	Yes	49 (59.0%)	5 (55.6%)	38 (53.5%)					
Respiratory distress	*No*	19 (22.9%)	1 (11.1%)	29 (40.8%)	7.494	0.024	0.415	0.016	0.082
	Yes	64 (77.1%)	8 (88.9%)	42 (59.2%)					
Diarrhea	*No*	75 (90.4%)	9 (100.0%)	62 (87.3%)	1.487	0.475	-	-	-
	Yes	8 (9.6%)	0 (0.0%)	9 (12.7%)					
Anosmia	*No*	83 (100.0%)	9 (100.0%)	71 (100.0%)	NA	NA	-	-	-
	Yes	0 (0.0%)	0 (0.0%)	0 (0.0%)					
DCL	*No*	72 (86.7%)	7 (77.8%)	61 (85.9%)	0.539	0.764	-	-	-
	Yes	11 (13.3%)	2 (22.2%)	10 (14.1%)					
ICU admission	*No*	24 (28.9%)	0 (0.0%)	29 (40.8%)	7.072*	**0.029**	0.061	0.120	**0.016**
	Yes	59 (71.1%)	9 (100.0%)	42 (59.2%)					
Mechanical ventilation	*No*	56 (67.5%)	3 (33.3%)	56 (78.9%)	8.746*	**0.013**	**0.042**	0.113	**0.003**
	Yes	27 (32.5%)	6 (66.7%)	15 (21.1%)					
Death	*Alive*	57 (68.7%)	1 (11.1%)	52 (73.2%)	14.160*	**0.001**	**0.001**	0.534	**0.000**
	Died	26 (31.3%)	8 (88.9%)	19 (26.8%)					
Bun (mg/dl)	*Mean ± SD*	42.96 ± 29.34	80.89 ± 34.09	52.73 ± 34.18	6.508•	**0.002**	**0.001**	0.059	**0.013**
	Range	9 – 128	40 – 136	8 – 130					
Creatinine (mg/dl)	*Mean ± SD*	1.90 ± 1.72	3.70 ± 3.62	2.73 ± 2.37	4.675•	**0.011**	**0.019**	**0.018**	0.207
	Range	0.5 – 10	0.9 – 12	0.5 – 11					
Creatinine	*Normal*	52 (62.7%)	3 (33.3%)	30 (42.3%)	7.731*	**0.021**	0.088	**0.011**	0.608
	Abnormal	31 (37.3%)	6 (66.7%)	41 (57.7%)					
CRP	*Median (IQR)* *Range*	46 (24 – 117) 0.2 – 420	85 (36 – 159) 8.8 – 670	60 (27 – 100) 0.5 – 400	2.409	0.300	-	-	-
Ferritin (mcg/L)	*Median (IQR)* *Range*	359 (178 – 871) 44 – 8656	670 (122 – 1394) 74 – 2000	240 (150 – 1000) 21 – 7986	0.893	0.640	-	-	-
D-dimer (mg/L FEU)	*Median (IQR)* *Range*	0.9 (0.5 – 2.15) 0.1 – 13	1.65 (0.55 – 4.0) 0.2 – 7.0	0.86 (0.4 – 2.60) 0.1 – 12.0	0.839	0.657	-	-	-
LDH (IU/L)	*Mean ± SD* *Range*	493.05± 305.34 26 – 1870	515.38±334.64 289 – 1302	441.79±190.74 165 – 866	0.736	0.481	-	-	-

ICU;Intensive care unit, BUN ;blood urea nitrogen, DCL;disturbed consciousness level, CRP;C-reative protein, LDH;lactate dehydrogenase

DISCUSSION

The angiotensin-converting enzyme 2 (ACE2) **[10]** receptor, which is extensively expressed in the kidneys, particularly in the proximal tubule, may bind to SARS-CoV-2. SARS-CoV-2 enters cells coupled with the membrane receptor, which is effectively eliminated from the membrane's external site, after binding. **[11].**

Surface ACE2 is further downregulated once the viral complex is endocytosed, leading to unopposed angiotensin II buildup. Angiotensin II may suppress ACE2 expression even further. **[12]**. Angiotensin II promotes sodium reabsorption in the kidney's proximal convoluted tubule by promoting sodium-hydrogen exchange. Renal sodium reabsorption is followed by renal chloride reabsorption and potassium excretion, possibly leading to hyperchloremia and hypokalemia. These changes occured considerably more often in hyponateremia patients than in those without hypernatremia, indicating that enhanced angiotensin II activity is a potential **[13]**.

The often-observed electrolyte abnormalities during COVID-19 might have an impact on therapy, hospital stay duration, and death. As a result, we set out to investigate whether dysnatremia affects the severity, mortality, or COVID-19 outocme in patients hospitalized with SARS-COV2.

A total of 163 individuals with SARS-CoV-2 infection were admitted to Ain Shams University for the present research. 80 of them had abnormal sodium levels in their blood, with 71 hyponatremic patients and 9 hypernatremic patients. Hyponatremia was more common upon admission, with a frequency of 8 to 28 percent **[14],** whereas hypernatremia was considerably less common, with a prevalence of 5.3 percent **[15].** Jin et al. found that hyponatremia was more commonly in COVID-19 patients than hypernatremia (9.9% vs. 2.4%), similar to our findings (44.5 percent vs. 5.5 percent) **[16].** In another research by Hirsch et al., dysnatremias were observed in over half of COVID-19 patients (51.7%) upon admission, with hyponatremia being the most prevalent. **[17]**. Hyponatremia was also common in Ruiz-Sánchez et al. where COVID-19 infected 4,664 individuals in hospitals, Hyponatremia was found in more than 20% of patients for a total of 957 cases. Hypernatremia, on the other hand, was found in just 3.7 percent of the people (174 in total) **[18].**

Due to syndrome of inappropriate antidiuresis (SIADH), which is a major cause of hyponatremia, particularly in viral pneumonia, euvolemic hyponatremia is the most prevalent dysnatremia in hospitalized patients. A case series of COVID-19-related SIADH has also been published earlier **[19, 20]**. Patients with hyponatremia and fever were shown to be a strong predictor of COVID-19 infection in this case study. Inflammatory cytokine production, ventilation–perfusion mismatch, intravascular volume depletion, stress, discomfort, and emotions are all possible causes of SIADH in COVID-19 infection. Positive-pressure ventilation (PPV) is another common cause of SIADH and hyponatremia. **[21]**.

Laboratory and radiographic data indicated substantial variations between hypernatremia and normonatremia patients in the Hu et al research. Additionally, hyponatremia patients needed more oxygen support than normonatremia patients **[22]**. In our study, 53.5% of hyponatremia patients and 11.1 percent of hypernatremia patients had a mild or moderate type case, with lower ratios than normonatremia patients (38.5%). However, a total of 47.5% of hyponatremia patients and 88.9% of hypernatremia patients had serious or critical diseases with higher ratios than normonatremia patients (61.5 %). Patients with salt balance problems had a greater death rate than those with normonatremia.

Fever (71.3%), shortness of breath (69.6%), cough (56.4%), disrupted conscious level (14.1%), weariness (12.3%), and diarrhea were among the hospitalized patients' clinical complaints (10.4 %). The most prevalent concomitant clinical condition was hypertension (74.8 %). In relation to clinical importance, 90 patients (55.2%) and 63 patients (38.7%) of those hospitalized had diabetes and chronic kidney failure (CKD), respectively. In addition, 37 patients (22.7 %), 25 patients (15.3%), and 21 patients (12.9%) had cardiac disease, neurological illness, and chronic liver disease, respectively. Other comorbidities were present in 33 individuals (20 %). Except for respiratory distress, which occurs in 88.9% of hypernatremic patients and 59.2% of hyponatremic patients compared to 77.1% in normanatremic patients with statistically substantial difference, there were no substantial differences in demographic and clinical features between hypernatremic, hyponatremic, or normonatremic patients. Furthermore, no substantial variations in comorbidities were seen amongst the three groups analyzed.

In Hu and colleagues' study, the hospital stays lengths for hypernatremia and normonatremia patients were not statistically variant. **[22]**. In our research, however, individuals with salt problems had a lengthier hospital stay. When compared to normonatremic individuals, COVID-19 patients with serum sodium abnormalities had a more severe presentation and worse clinical results, particularly hypernatremia.

In the Ruiz-Sánchez et al study, both admitting hyponatremia and hypernatremia were independently related to disease severity in admitted patients with RT-PCR-confirmed COVID-19 CAP **[18].** In our study, illness severity was greater in individuals with salt balance abnormalities as compared to the normonatremia group. A total of 53.5 percent of hyponatremia patients and 11.1% of hypernatremia patients had a mild or moderate condition, with lower ratios than normonatremia patients (38.5 %). However, a total of 47.5% of hyponatremia patients and 88.9% of hypernatremia patients had serious or critical diseases with higher ratios than normonatremia patients (61.5%). Patients with salt balance problems had a greater death rate than those with normonatremia.

Among a short retrospective analysis of 29 patients, Berni et al. discovered a more severe result and higher death in patients with hyponatremia admitted for COVID-19. **[24]**. Some studies have revealed no link between hyponatremia and pneumonia-related in-hospital death. Only a trend toward greater death in the hyponatremia group was seen in Zilberberg et al., retrospective investigation of individuals hospitalized with pneumonia. [**25**]. However, not all of the patients developed CAP. Cuesta et al. couldnot find more than a trend toward greater mortality in hyponatremia in CAP in their prospective research [**26**]. Differences in findings might be related to differences in the sample size of patients enrolled.

According to Sjöström et al, within the first two weeks of hospitalization, 65 percent of 223 patients with severe COVID-19 develop hypernatremia, requiring twice as long in the ICU and a greater risk of death than patients without hypernatremia. **[27].** They can't rule out the possibility that the high incidence of hypernatremia they discovered was due to iatrogenic causes, but our patients were hypernatremic from the start.

Hyperaldosteronism might be caused by RAAS overactivation due to high angiotensin II levels. Aldosterone operates on the Na/K channels in the distal tubule of the kidney, causing an increase in sodium input and potassium outflow as well as hydrogen ions. This causes hypernatremia. In addition, the hypernatremia group had a longer hospital stay and had a greater fatality rate than the non-hypernatremia group, according to the Sjöström et al research, suggesting that hypernatremia is a sign of serious disease.

Intervention studies examining the impact of active treatment of hyponatremia, on the other hand, are few. In a retrospective analysis of hospitalized patients with an SNa <126 mmol/L, Hoorn et al. discovered that a direct intervention to address hyponatremia reduced death by one-third compared to patients who received no therapy [28]. Patients with mild/moderate hyponatremia, on the other hand, were not investigated.

The response of admitted patients with heart failure and hyponatremia to chronic post-discharge treatment with tolvaptan was analyzed in a subgroup analysis of the Everest trial, and it was discovered that patients with hospitalized SNa concentrations < 130 mmol/L taking tolvaptan had a substantial 40% decrease in readmissions/death after a median follow-up of 8 months, compared to patients taking placebo. In fact, compared to the control group, more than twice as many patients on tolvaptan were discharged with eunatremia in this subgroup of the Everest study **[28]**.

Hyponatremia did not worsen the prognosis of COVID-19 patients in our study, possibly because the majority of our patients had mild hyponatremia, similar to Ruiz-Sánchez et al, who found that mild hyponatremia affects only 3.8 percent of patients with SNa < 130 mmol/L and 0.9 percent with SNa < 125 mmol/L. Hypoxia's involvement with cellular regulatory systems would not apply if there was no cellular edema linked to severe/acute hyponatremia [**18]**.

Our study had some particular limitations such as the absence of some investigations that carry particular importance in hyponatremia such as urine volume, urine sodium, serum osmolarity, and urine osmolarity; those were not feasible in isolation wards that we hope could be further improved in future studies.

CONCLUSION

Patients with salt balance abnormalities had longer hospital stays, had more severe symptoms, and had a greater fatality rate. Despite the fact that the demographic and clinical symptoms were comparable between groups, with the exception of respiratory distress, which was greater in the hypernatremic group, the severity was greater and the ICU stay was substantially longer in patients with sodium disorders, particularly hypernatremia. Hypernatremia may have led to a prolonged need for mechanical breathing, delaying ICU release. Our data imply that COVID-19 may also be complicated with hypernatremia. The electrolyte condition of COVID-19 patients should consequently be given special attention. The actual cause of hypernatremia has yet to be discovered. Given the therapeutic relevance of a disordered blood sodium level, further research into serum sodium disorders in COVID-19 patients is critical.

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Conflict of interest: None.

Ethical Consideration:

The ethics committee at Ain Shams University accepted the project. An informed consent form was signed by all participants.

HIGHLIGHTS

- Dysnatremia is common with COVID-19 infection.
- Hyponatremia is the most common form of dysnatremia.
- Hypernatremia is linked to an elevated risk of serious illness and mortality in the hospital. In patients with SARS-COV2 infection, hypernatermia was linked to a greater risk of mortality.

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