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Evaluation of Ca^{++}, Na^{+}, Mg^{2+}, K^{+} and P levels in the 2019 novel coronavirus patients with mucormycosis

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Abstract

The new coronavirus disease 2019 (COVID-19) caused by SARS-CoV-2 is a risk factor for universal public health difficulties. Some COVID-19 patients have an increased risk of fungal infections particularly mucormycosis diseases. Current laboratory examinations especially mineral elements are very important tests in terms of both detection and severity of COVID-19. The aim of the present study was to evaluate Ca^{++}, Na^{+}, Mg^{2+}, K^{+} and P levels in the COVID-19 patients with mucormycosis. This study was done during 2021- 2022. All hospitalized COVID-19 (PCR positive test) patients with mucormycosis participated in the present study. Data included gender, age, hospitalization and recovery. The tested laboratory parameters included Ca^{++}, Na^{+}, Mg^{2+}, K^{+} and P rate. Finally, SPSS software analyzed the data. The results revealed that there was a statistically significant difference between the two groups admitted to the ward and ICU in terms of K^{+}. There was also a significant difference between recovery and K^{+} level. There was no significant difference in Ca^{++}, Na^{+}, Mg^{2+} and P in terms of gender, age, hospitalization and recovery. According to the findings, K^{+} level should be checked as a key element in the COVID-19 patients with mucormycosis.

Keywords: COVID-19, Mucormycosis, Ca^{++}, Na^{+}, Mg^{2+}, K^{+}, P.

INTRODUCTION

At the finish of 2019 a novel type of coronavirus called Acute Respiratory Syndrome (SARS) -CoV-2 emerged in China. This has spread rapidly around the world and poses major challenges to the individuals' health [1]. Typical cases of coronavirus disease 2019 (COVID-19) can differ in harshness from asymptomatic to dangerous pneumonia with fungal or bacterial co-infection [2,3].

Patients with COVID-19 experiencing ARDS, the individuals who need an extended stay in an emergency unit and ventilation, taking very high dosages of corticosteroids, are at enhanced risk of fungal infections particularly mucormycosis [3-6].

SARS-Cov-2 may adversely impact the equilibrium of mineral condition in the COVID-19 patients' blood, through a yet to be revealed way. It isn't realized whether mineral unevenness of the blood is a reason or a result of extreme COVID-19 disease. Since the ions assume a key part in both SARS-Cov-2 combination with the host cells, and they are cofactors of a few compounds especially enzymes, further examinations and clinical considerations should be done to explore the impact of the ions level on clinical state of COVID-19 patients with or without co-infection [7].

The aim of the current study was to investigate Ca^{++}, Na^{+}, $Mg2^{+}$, K^{+} and P levels in the COVID-19 patients with mucormycosis.

MATERIALS AND METHODS

This cross-sectional study was done during January 2021 to February 2022. It was approved in the ethics committee of Yazd Shahid Sadoughi University of Medical Sciences, Iran with the ethics code of

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IR.SSU.REC.1400.196. All hospitalized COVID-19 patients (PCR positive test) with mucormycosis were entered in this study. Also, exclusion criteria included patients with inadequate information.

The recorded data included gender, age, hospitalization and recovery. The tested laboratory parameters included Ca^{++}, Na^{+}, Mg^{2+}, K^{+} and P levels.

After collecting the data were entered into SPSS software (v. 22) and Chi-Square test was also used to analyze the data. In all cases, $p<0.05$ was considered as a significant level.

RESULTS

In this study, 33 patients with definitive diagnosis of COVID-19 were evaluated.

There was no significant difference in calcium (Ca^{++}) in terms of gender, age, hospitalization and recovery (Table 1).

The results showed that no significant difference was observed for Na^{+} (Table 2).

There was a statistically significant difference between the two groups admitted to the ward and ICU in terms of K^{+} (p=0.001). Also, there was a significant difference between recovery and K^{+} level (p=0.041) (Table 3).

The results showed that no significant difference was observed about Mg^{2+} between groups (Table 4).

There was also no significant difference based on P level (Table 5).

Table 1: Relationship between Ca^{++} level based on gender, age, hospitalization and recovery

Ca^{++} Recorded Data		**Normal N (%)**	**Above normal N (%)**	**Total N (%)**	**p-value**
Gender	Female	5 (29.4)	7 (43.8)	12 (36.4)	0.866
	Male	12 (70.6)	9 (56.3)	21 (63.6)	
	Total	17 (100)	16 (100)	33 (100)	
Age (year)	Below 55	8 (47.1)	8 (47.1)	16 (48.5)	0.392
	Above 55	9 (52.9)	8 (50)	17 (51.5)	
	Total	17 (100)	16 (100)	33 (100)	
Hospitalization	Ward	12 (70.6)	9 (56.3)	21 (63.6)	0.392
	ICU	5 (29.4)	7 (43.8)	12 (36.4)	
	Total	17 (100)	16 (100)	33 (100)	
Recovery	Complete	5 (29.4)	4 (25)	9 (27.3)	0.879
	Relative	8 (47.1)	7 (43.8)	15 (45.5)	
	Death	4 (23.5)	5 (31.3)	9 (27.3)	
	Total	17 (100)	16 (100)	33 (100)	

Table 2: Relationship between Na^{+} level based on gender, age, hospitalization and recovery

Na^{+} Recorded Data		**Normal N (%)**	**Above normal N (%)**	**Total N (%)**	**p-value**
Gender	Female	7 (31.8)	5 (45.5)	12 (36.4)	0.622
	Male	15 (68.2)	6 (54.5)	21 (63.6)	
	Total	22 (100)	11 (100)	33 (100)	
Age (year)	Below 55	10 (45.5)	6 (54.5)	16 (48.5)	0.443
	Above 55	12 (54.5)	5 (45.5)	17 (51.5)	
	Total	22 (100)	11 (100)	33 (100)	
Hospitalization	Ward	16 (72.7)	5 (45.5)	21 (63.6)	0.125
	ICU	6 (27.3)	6 (54.5)	12 (36.4)	
	Total	22 (100)	11 (100)	33 (100)	
Recovery	Complete	8 (36.4)	1 (9.1)	9 (27.3)	0.135
	Relative	10 (45.5)	5 (45.5)	15 (45.5)	
	Death	4 (18.2)	5 (45.5)	9 (27.3)	
	Total	22 (100)	11 (100)	33 (100)	

Table 3: Relationship between k^+ level based on gender, age, hospitalization and recovery

K^+ Recorded Data		Normal N (%)	Above normal N (%)	Total N (%)	p-value
Gender	Female	9 (33.3)	3 (50)	12 (36.4)	0.656
	Male	18 (66.7)	3 (50)	21 (63.6)	
	Total	27 (100)	6 (100)	33 (100)	
Age (year)	Below 55	14 (51.9)	2 (33.3)	16 (48.5)	0.643
	Above 55	13 (48.1)	4 (66.7)	17 (51.5)	
	Total	27 (100)	6 (100)	33 (100)	
Hospitalization	Ward	21 (77.8)	0 (0)	21 (63.6)	0.001
	ICU	6 (22.2)	6 (100)	12 (36.4)	
	Total	27 (100)	6 (100)	33 (100)	
Recovery	Complete	9 (33.3)	0 (0)	9 (27.3)	0.041
	Relative	13 (48.1)	2 (33.3)	15 (45.5)	
	Death	5 (18.5)	4 (66.7)	9 (27.3)	
	Total	27 (100)	6 (100)	33 (100)	

Table 4: Relationship between Mg^{2+} level based on gender, age, hospitalization and recovery

Mg^{2+} Recorded Data		Normal N (%)	Above normal N (%)	Total N (%)	p-value
Gender	Female	5 (35.7)	7 (36.8)	12 (36.4)	0.208
	Male	9 (64.3)	12 (63.2)	21 (63.6)	
	Total	14 (100)	19 (100)	33 (100)	
Age (year)	Below 55	5 (35.7)	11 (57.9)	16 (48.5)	0.947
	Above 55	9 (64.3)	8 (42.1)	17 (51.5)	
	Total	14 (100)	19 (100)	33 (100)	
Hospitalization	Ward	7 (50)	14 (73.7)	21 (63.6)	0.162
	ICU	7 (50)	5 (26.3)	12 (36.4)	
	Total	14 (100)	19 (100)	33 (100)	
Recovery	Complete	4 (28.6)	5 (26.3)	9 (27.3)	0.560
	Relative	5 (35.7)	10 (52.6)	15 (45.5)	
	Death	5 (35.7)	4 (21.1)	9 (27.3)	
	Total	14 (100)	19 (100)	33 (100)	

Table 5: Relationship between p level based on gender, age, hospitalization and recovery

P Recorded Data		Normal N (%)	Above normal N (%)	Total N (%)	p-value
Gender	Female	1 (14.3)	11 (42.3)	12 (36.4)	0.225
	Male	6 (85.7)	15 (57.7)	21 (63.6)	
	Total	7 (100)	26 (100)	33 (100)	
Age (year)	Below 55	5 (71.4)	11 (42.3)	16 (48.5)	0.223
	Above 55	2 (28.6)	15 (57.7)	17 (51.5)	
	Total	7 (100)	26 (100)	33 (100)	
Hospitalization	Ward	6 (85.7)	15 (57.7)	21 (63.3)	0.223
	ICU	1 (14.3)	11 (42.3)	12 (36.4)	
	Total	7 (100)	26 (100)	33 (100)	

Recovery	Complete	3 (42.9)	6 (23.1)	9 (27.3)	0.508
	Relative	3 (42.9)	12 (46.2)	15 (45.5)	
	Death	1 (14.3)	8 (30.8)	9 (27.3)	
	Total	7 (100)	26 (100)	33 (100)	

DISCUSSION

In the current study, there was no significant difference in Ca^{++}, Na^{+}, $Mg2^{+}$ and P in terms of gender, age, hospitalization and recovery. There was a statistically significant difference between the two groups admitted to the ward and ICU in terms of K^{+}. There was also a significant difference between recovery and K+ level.

In a study in 2020 in Kermanshah in COVID-19 patients, a significant difference was observed between ICU and outpatients in terms of $Mg2^{+}$ and Na^{+}, but in terms of K^{+} level no difference was found between the two groups [8].

Another study in India in 2020 on COVID-19 patients showed that serum Ca^{++} and P levels were significantly different between the patient and control groups and also patients had lower serum levels than controls [9].

In another 2020 study in China, COVID-19 patients with low Ca^{++} and P levels had more severe disease than those with normal serum levels of the two elements [10].

In 2020, hypokalemia and high serum Na+ levels were the predominant findings in Thailand. Most patients had mild hypokalemia [11].

A study in China in 2020 showed that 93% of COVID-19 patients with severe disease had hypokalemia. Loss of K^{+} in the urine was the cause of hypokalemia [12].

CONCLUSION

According to the findings, difference between the two groups (ward and ICU) in terms of K^{+} and also between recovery and K^{+} level shows that this factor should be considered as a key element in the COVID-19 patients with mucormycosis. Also, increasing the statistical population is essential in the next studies.

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Conflicts of interest

None declared.

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