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ORIGINAL RESEARCH

Assessment of kidney functions among COVID-19 patients in Isolation Center, Zawia-Libya

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ABSTRACT

Purpose: In December 2019, a coronavirus 2019 (COVID-19) outbreak was detected in Wuhan, Hubei Province, China, and soon expanded to neighboring countries. Although abrupt respiratory failure and diffuse alveolar damage were the most notable features, another organ involvement needs to be looked at further. This study aimed to investigate the renal function tests among COVID-19 patients.

Materials and Methods: The study surveyed a total of 247 patients hospitalized with COVID-19 at an isolation center located in Zawia, Libya over one year during 2020 and 2021. Laboratory analysis was performed on Urea, creatinine, chloride (Cl), sodium (Na), and potassium (K) parameters. Pearson correlation coefficient and interpretation in SPSS were used to analyze all tested samples.

Results: Male COVID-19 patients, in particular had higher levels of urea and creatinine levels than normal and there was a positive connection with the three elements, as well as a positive statistical significance (0.001) for all the renal function tests.

Conclusion: COVID-19 patients increase all of the elements listed above, either directly or indirectly, which is why conservative measures are the mainstay of contemporary renal trauma treatment. *(Open J Bio Med Res 2022;1:7-11.)*

Keywords

COVID-19, kidney function, Urea, Creatinine, Sodium, Potassium, and Chloride.

AUDIOABSTRACT

INTRODUCTION

On December 31, 2019, a number of instances of pneumonia were reported to the World Health Organization (WHO) at a seafood market in Wuhan, China, where the infection was rapidly spreading and was now known as Coronavirus disease 19 (COVID-19), which was caused by the designated severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).[1] The virus was dubbed 2019 novel corona virus (2019- nCoV) by the WHO in January 2020, and by the end of the same month was the statement of the second meeting for the Emergency Committee for the International Health Regulations (2005) in relation to the outbreak of new coronavirus (2019-nCoV).[2] WHO on March 11, 2020, declared COVID-19 a pandemic.[3] All investigations have found significant evidence that the coronavirus originated in bats, as bats are the intermediary host for the virus's transmission to humans.[4]

In addition to negatively impacting physical and mental health, COVID-19 also affects the economy. It is crucial to comprehend its pathogenesis, clinical course, treatment approach, and therapeutic response.[5]

The life-threatening effects of COVID-19 extend far beyond its respiratory symptoms. 11 of the 116 confirmed COVID-19 individuals from China with a median

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age of 54 who were in the initial single center cohort did not exhibit incident acute kidney injury (AKI).[6] However, other investigations found that the cumulative incidence of AKI in COVID-19 ranged from 0.9% to 29%, with severely sick patients having a higher risk of developing the condition.

Because kidney injury (KI) which leads to an increase in serum creatinine and urea levels (14–27% of cases),[7] is the most common cause of renal damage, with an incidence of 3-9%. A wide range of renal problems, including albuminuria (34%), hematuria (27%), proteinuria (63%), and proteinuria with hematuria (44%), are also included in the survey.[8]

kidney injury induced by COVID-19 has been linked to numerous pathways. The virus's directly negatively impacts podocytes, endothelial cells, and tubular cells whereas others result from reduced perfusion (shock), pigmenturia (rhabdomyolisis), microangiopathy (disseminated intravascular coagulation), hypoxia (respiratory insufficiency), immunological renal damage (cytokine storm), and drug toxicity.[9-15]

MATERIALS AND METHODS

Data Collection

The cases collection analysis covers 247 patients with COVID-19 who were hospitalized and treated at Abu Ghalasha Isolation Center in the City of Zawia-Libya by the medical team of the Libyan Ministry of Health during the year 2020 and 2021. All these cases were tested by Real Time Polymerase Chain Reaction test RT – PCR. The total cases mentioned above were 133 Males and 114 Females and all of these cases were confirmed positive for COVID-19.

The National Center for Disease Control in Libya (NCDC) was tasked with overseeing the national campaign to combat the COVID-19 epidemic. NCDC has branches in several cities and has managed to function on a national basis. It posts PCR-confirmed cases, deaths, recoveries, and other information on its website (http//ncdc.org.ly/Ar/).

Real Time-Polymerase Chain Reaction test (RT-PCR)

The nasopharyngeal swab was taken from all the patients who frequent the branches of the NCDC, some of these critical cases after receiving the positive result of COVID-19 were transferred to isolation centers to have intensive care.

These nasopharyngeal swab samples were transferred to a PCR laboratory in viral transport medium. Therefore, each sample was mixed well in Lysis buffer and the RNA extraction was performed by Automated Extraction Machine. The master mix was prepared according to the user company instructions and the extracted RNA adds to this master mix and finally loaded into this solution to be measured by the PCR machine (Bio-Rad). Results were conducted by curves and the number of cycles for each sample qualitatively.

Serum Urea and Serum Creatinine

Serum of COVID-19 blood samples has been used, and different reagents from Biomaghreb company were prepared and mixed in order to be used for each sample. The incubation time at a spectrophotometer 4040 machine was performed according to the instructions and preparation details of the company and three prepared cuvates were given names as follows (stander-blank- sample). Finally, samples were measured on the device and read the outputs.

Serum Electrolytes (Na-K-Cl)

The serum of blood samples was tested by a fully automated machine called EasyLyte. The principles of this instrument are the Flame Emission Photometry and Ion Selective Electrode where the voltage measure the electrolytes between the inner and outer surface of ISE.

Statistical Analysis

Pearson correlation coefficient and interpretation in (SPSS) V.25 was used to analyze the tested samples. All the data was collected from Abu Ghalasha Isolation Center in the city of Zawia-Libya. The Pearson's correlation was used to find the linear relationship between data variables. Standard deviation (SD) and mean (M) were used to express quantitative quantities.

RESULTS

The kidney functions of 247 COVID-19 patients admitted to the isolation center were examined in this study. All the characteristics of patients and their renal parameters were collected from the center filing system. The size of patient samples contained 133 males and 114 females (53.8%) and (46.2%), respectively. All these samples were analyzed with the same protocol.

The collected data such as kidney function tests including; Urea, Creatinine, and electrolytes (Cl, Na, and K) were analyzed by the lab machines. According to the study, subjects found that male COVID-19 patients, in particular, had higher levels of urea and creatinine than females COVID-19 patients. Moreover, in the electrolyte test results of the subjects, the mean of Na was 136.61±10.48 mmol/L, the mean of K was 4.23 ±0.69 mmol/L, and the mean of Cl was 103.51 ±9.21 mmol/L. Na, k, and Cl were statistically significant differences between groups, ($P<0.001$), ($P<0.001$), and ($P<0.002$), respectively Table1. Therefore, Na, k and Cl statistically significant differences were not observed between males and females Table 2.

The results showed that 48.8% of male patients and 38.6% of female patients had a high level of urea. While 23.3% of male patients and 17.5% of female patients showed a high level of creatinine Fig 1. However, the percentage of the electrolytes was almost in the same ratio between males and females whereas Na levels were 6% and 6.1%, respectively. While K levels were 3.7% and 4.3% for males and females, respectively. Nevertheless, the level of Cl was 9.7% and 8.7% in males and females, respectively Fig 1.

In general, the level of the elements was within the normal range in most patients, with a slight direct relationship with the levels of urea and creatinine, whether in male or female patients.

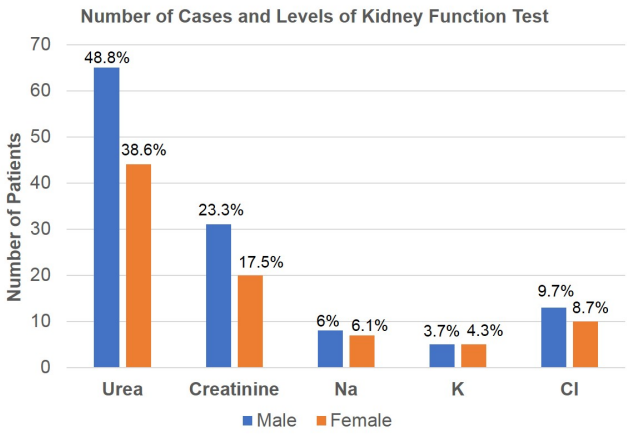


Fig 1. Number and ratio of elements levels according to the gender.

Table 1. Correlation of kidney function tests.

	N	Mean	Std. Deviation	R	P-value
Urea	247	55.11	53.80	1	0.001
Creatin	247	1.55	1.83	.547**	0.001
Na	247	136.61	10.48	.239**	0.001
K	247	4.23	0.69	.309**	0.001
Cl	247	103.43	9.21	.195**	0.002

r-Pearson Correlation, **. Correlation is significant at the P= 0.001 level.

Table 2. Frequency of kidney function tests according to the gender.

	Gender	N	Mean	Std. Deviation
Urea	Male	133	58.6316	56.25099
	female	114	51.0175	50.74140
Creatin	Male	133	1.5767	1.88289
	female	114	1.5351	1.77545
Na	Male	133	135.6541	13.02041
	female	114	137.7281	6.25743
K	Male	133	4.2421	.62136
	female	114	4.2219	.76780
Cl	Male	133	102.6165	10.87722
	female	114	104.3947	6.68987

DISCUSSION

This is the first data study in Zawia city, Libya, as far as we are aware. Our study included 247 patients with COVID-19 admitted to one of the Isolation Centers in the western region of Libya. All these cases were hospitalized when they were confirmed to be infected by COVID-19. This study assesses kidney function among COVID-19 patients.

As the worldwide epidemic of COVID-19, caused by the SARS-CoV-2, continues to evolve and spread, the whole range of effects, from mild, self-limiting respiratory tract sickness to severe, multiple organ failure, and death,[16] is becoming apparent. COVID-19 has a high rate of kidney involvement; at hospital admission, more than 40% of individuals exhibit abnormal

proteinuria.[17] AKI is common among critically ill COVID-19 patients, affecting around 20-40% of patients sent to intensive care unit (ICU), according to experience in Europe and the US,[18] and it is regarded as a marker of disease severity and a poor prognostic factor for survival.[16,17]

Additionally, because creatinine readings at admission may not reflect genuine preadmission baseline renal function, and earlier serum creatinine values may not be readily available, the overall burden of AKI in COVID-19 may be underestimated. Nearly 20% of COVID-19 patients admitted to ICU need renal replacement therapy at a median of 15 days after the start of their illness.[16] Early diagnosis of renal involvement in COVID-19 and the deployment of preventative and therapeutic treatments to stop additional AKI or progression to more severe stages are essential to lowering mortality and morbidity.

All renal function indicators showed a strong correlation with CRP, which was recently suggested as a marker to predict the likelihood of COVID-19 exacerbation.[19] The strong relationship between the estimated glomerular filtration rate, serum creatinine, and blood urea nitrogen and abnormalities in a number of indicators, including hematological markers and liver enzymes, is another intriguing discovery. This emphasizes the involvement of multiple organs, which was also seen during the SARS outbreak in 2003 and was confirmed during the COVID-19 outbreak.[20,21] Although the precise mechanism that could account for the involvement of the kidneys in the COVID-19 infection is still unknown, many different explanations have been put forth. These include direct tubular damage brought on by the virus itself, which is supported by the discovery that the SARS-CoV binding protein, angiotensin-converting enzyme receptor 2 (ACE2), is highly expressed in the kidney and renal tubular cells[22,23] and that viral RNA can be found in urine samples from COVID-19 patients.[24]

According to a study done by Sun-Gyu Kim and Hyun Ho Sung, there was a statistically significant difference in blood urea nitrogen between males and females and across age groups, respectively ($P<0.01$). males and females had statistically different creatinine ($P<0.01$), but there was no statistically significant difference in the ages group.[25] Sun-Gyu Kim and Hyun Ho Sung reported that individuals with COVID-19 were found to have blood urea nitrogen and creatinine levels that were greater than the typical reference range, particularly men and elderly patients (60s and 80s or older). The patients' serum electrolyte levels were seen to be within the standard ranges.[25]

The present study showed high levels of urea and creatinine especially in male COVID-19 patients more than in female patients. However, in the majority of patients, the levels of the elements were within the normal range with a slight direct relationship to the levels of urea and creatinine, regardless of the patient's gender.

CONCLUSION

Given the relationship between patients with COVID-19 and renal function, it is possible that COVID-19 infection could increase all of the elements, if not controlled, could damage kidneys. Commonly used markers for the assessment of renal function include urea and creatinine. As a result, finding impaired renal function in individuals with COVID-19 may be made possible by detecting kidney function tests and assessing the electrolytes of numerous indicators.

Understanding the behavior of the impact of the coronavirus on patients is critical because doing so will enable us to develop effective treatments and stop the disease from getting worse. Thus, early detection and treatment of renal abnormalities, including sufficient hemodynamic support and avoidance of nephrotoxic medications, may aid in the recovery of COVID-19 infected critically sick patients.

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