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The SARS-CoV2 effect on renal function in patients after recovery from COVID-19

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Abstract

Objective: SARS-CoV-2 infects the kidneys through Angiotensin Converting Enzyme 2 (ACE2), which is overexpressed in comparison to some other organs. Thus, leads imbalance of renal function. Methods: This study involved four groups (G1: Healthy group, G2:Cardiovascular illness group, G3: Respiratory illness group, And G4: recovery from COVID-19 group). Collected blood samples from the COVID-19 epidemic center in Salah Al-din general hospital, with confirmed recovery from COVID-19. Results: The findings of this study demonstrated a significant difference in urea and creatinine concentrations in the G2 and G3 groups compared to the Healthy group in both genders. But the no statistical significance between G4 and Healthy group. and the other hand found a low significance in the concentration of potassium in G2, and G3 compared with the Healthy group in both genders. While showing a high significance in the concentration of potassium in the G4 compared with the Healthy group in males, but no significance in G4 in females. Conclusion: The renal disorders in patients after recovery from COVID-19, can lead to renal damage and impaired function. Maybe the reason is due to the SARS-CoV2 effect on renal epithelial cells and proximal tubule damage.

Keywords
COVID-19, Creatinine, Renal, SARS-CoV-2, Urea.

Three years ago appear new virus in China, which was named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)[1]. Offered in more reports that the respiratory system was not only infected but transported the virus to numerous organs in the human body[2]. The illness has the potential to affect several systems, for example, the gastrointestinal tract, Myocarditis, and liver dysfunction, There is mounting evidence that SARS-CoV2 infection may result in renal dysfunction and renal damage[3]. And identified several cases of renal impairment after being infected with COVID-19[4]. Which increases our knowledge of its effects on renal function has grown.

The emergence of the epidemic posed a danger and threat to the world, and the emergence of various mutants and a massive increase in patient numbers put doctors under extreme challenges with the disease and its complications[5]. The virus may enter the bloodstream, collect in the kidneys, and harm local renal cells[6]. According to the most recent statistics, there are dynamic changes in renal function following (SARS-CoV-2) infection. Acute kidney injury (AKI) occurred in 37% of COVID-19 patients in New York, while In China and Italy, the prevalence of AKI ranged between 0.5% to 29% [7]. The studies discovered that high levels of urea in the blood were related to and had substantial predictive qualities for poor COVID-19 results[4]. Inability to renal function can block the excretion of metabolites and poisons from the body, This will have a negative effect on the electrolyte and acid-base balance. in addition, Uremia occurs when renal function is severely impaired, endangering life [8]. The study aimed to evaluate the potential link between urea, creatinine, and potassium in individuals who have recovered from COVID-19. And informed on the link between renal parameters and renal failure.

Materials and Methods

After recovery, we conducted a detailed assessment of the clinical findings and blood routine results of recovery from COVID-19. the Creatinine was measured using the T80+ UV- Vis Spectrometer, and it's Using the Biolabo Kit made in France was used for the test. while urea and potassium are Determined by utilizing the Agappe Kit made in Switzerland and using the T80+ UV- Vis Spectrometer Machine made device UK in the serum by using the urea, Creatinine, and potassium measurement kit.

Between the middle of October 2021 and the middle of January 2022, ninety persons were sampled at the COVID-19 Epidemic Center, 24 cases were never infected with COVID-19 as the control group, and 44 cases were serious with Cardiac disease and respiratory disease divided into two groups. 22 cases were recovered from COVID-19.

A Rapid test for COVID-19 IgG/IgM results and the Resident Doctor's diagnosis were used to identify every patient.

1. -I performed the groups of control persons according to the following guideline: G1 (coronavirus non-infection and without a vaccine).
2. -the groups of cardiac Disease Patients: G2 (Healing from COVID-19, Have complications in the Cardiovascular system).
3. -the groups of Respiratory Disease Patients: G3 (Healing from COVID-19, Have complications in the Respiratory tract).
4. -the groups of Healing from COVID-19 patients: G4 (recovery from COVID-19, without clinical symptoms).
5. Six to eight weeks after the onset of symptoms, sample data were collected from the Epidemic Center. I carefully documented all clinical data and blood processes of patients from admission to discharge.

Statistical Analysis

Applications from the IBM SPSS 26.0 statistical package were used to review the data, and the Shapiro-Wilk test was utilized to determine if the data distribution was normal. The categorical data of the samples were examined using the Duncan test and a histogram. and a p-value of 0.05 was deemed statistically significant.

Results

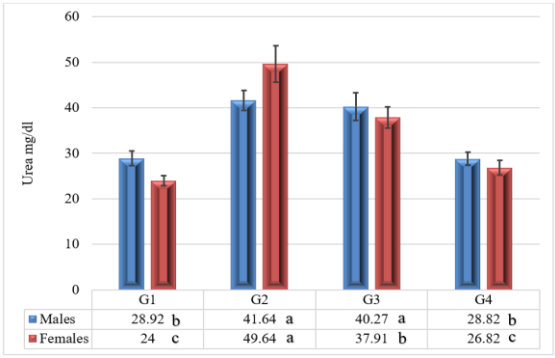

Figure 1: [The Level of Urea in study groups.]

* $P < 0.05$, the various letters manifestation a significant difference.

Figure 1. showed a significant increase in the concentration of urea in blood serum for the study groups G2 and G3 (41.64±2.22; 49.64±3.95), (40.27±2.98; 37.91±2.30) mg/dl respectively, compared to the control group (28.92±1.65; 24±1.13) mg/dl for both genders, at a significant level (P<0.05). Moreover, in the study group G4, there are no statistically significant differences, compared with the control group for both genders, at a significant level (P<0.05).

Figure 2. showed a significant increase in the concentration of Creatinine in blood serum for the study groups G2 and G3 (1.14±0.07; 1.54±0.17), and (1.47±0.18; 1.47±0.14) mg/dl respectively, compared to the control group (0.85±0.04; 0.71±0.03) mg/dl for both genders, at a significant level (P<0.05). Moreover, in the study group G4, there are no statistically significant differences, compared with the control group for both genders, at a significant level (P<0.05).

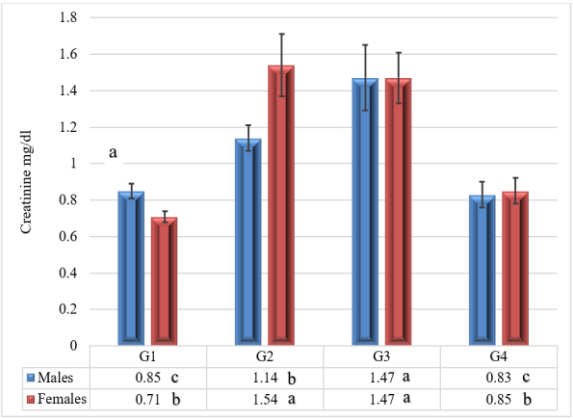

Figure 2: [The Level of Creatinine in study groups.]
* P < 0.05, the various letters manifestation a significant difference.

Figure 3. showed a significant decrease in the concentration of potassium ions in blood serum for the study groups G2 and G3 (3.34±0.33; 3.35±0.26), and (3.19±0.26; 3.34±0.82) mmol/L respectively, compared to the control group (4.39±0.21; 4.38±0.18) mmol/L for both genders, at a significant level (P<0.05). While, in the study group G4, A significant increase appeared in the study group G4 (5.14±0.21) mmol/L compared to the control group for males, but there are no statistically significant differences for females in G4, at a significant level (P<0.05).

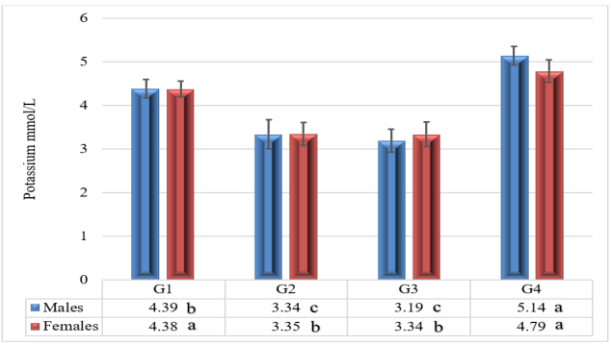

Figure 3: [The Level of Potassium in study groups.]
* P < 0.05, the various letters manifestation a significant difference.

Discussion

The number of people with COVID-19 has grown globally. When assessing the recovery from the COVID-19 pandemic, The evaluation of renal parameters is crucial. some studies have looked at the renal parameters that are associated with COVID-19 recovery. As a result, our research looked at renal Parameters. Such As Urea, Creatinine, and Potassium. G1:Healthy persons Group, G2:Cardiac disease Group, G3:Respiratory disease Group, and G4:recovered of COVID-19 Group. Studies have not yet discovered how SARS-CoV2 physiology affects kidney activity and function [9,10]. demonstrated that thrombosis does not only affect the venous system, Despite the stability of blood circulation, renal infarction may also still happen as a potential cause of acute kidney damage related to COVID-19 illness. SARS-CoV2 causes thrombosis via stimulating the development of anti-phospholipid antibodies or inducing endothelial cytopathic [2,11]. The pathophysiological process resulting from acute Coronavirus infection of the kidneys is unknown, The virus has cytotoxic effects on kidney tubular and endothelial cells, with indirect damage through cytokine production caused by immune cell interactions with the virus [2]. Renal function data from patients who died during treatment provide good evidence for predicting the risk of infection in COVID-19 patients [8]. The results of our study clarified the important role of urea and Creatinine parameters and prognostication for patients recovered from COVID-19, Patients should be regularly followed, and early therapeutic intervention may enhance the

survival rate of COVID-19 patients. this is consistent with the findings of the research [4]. The increase in urea following SARS-CoV2 infection might be related to the interaction of the SARS-CoV2 receptor ACE2 and its obvious expression in renal epithelial cells, High urea levels are an indicator and sign of renal dysfunction, the development of inflammatory disease, the development of thrombosis, the worsening of the inflammatory response, and organ injury [12].
The decrease in potassium levels in people recovering from COVID-19 is caused by electrolyte imbalance because of proximal tubule damage, endotheliitis, and an increase in Angiotensin Converting Enzyme 2 in kidney tissue [13]. Potassium loss in the renal is greater than in the gastrointestinal tract, and the majority of COVID-19 patients have low potassium levels. which plays a major role in the weakening of the heart muscle through the weakening of Hyper polarity cells [14].

Conclusion

The renal disorders in the patients after recovery from COVID-19, and rise in urea, and creatinine, decrease potassium maybe increase cause kidneys infraction and renal failure. the rise of potassium in recovery from COVID-19 groups because of the COVID-19 effect on kidney activity and function.
This decrease is due to the severity of the infection and the severity of complications, and it is found that there is no effect of sex on the urea, creatinine, and potassium level, while low potassium is a predictive marker of the risk of death, so the death rate is 1% out of 90 cases.

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Conflicts of Interest

There are no conflicts of interest in the publishing of this research, according to the authors.
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