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تأثير كوفيد-19 على وظائف الكلى والكبد

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Effect of Covid-19 on kidney and Liver Functions

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الملخص:

يؤثر كوفيد 19 على الكلى والكبد، مما يؤدي إلى خلل في اختبارات وظائف الكلى والكبد في الحالات الشديدة. يعد فهم تلك التأثيرات أمرًا بالغ الأهمية للرعاية الطبية الفعالة ومعالجة الآثار الصحية للمرض، مع البحث المستمر والملاحظات السريرية. إن الهدف من البحث هو دراسة تأثير عدوى كوفيد-19 وارتباطها بضعف وظائف الكلى والكبد من خلال تقييم بعض العوامل، كالإنزيمات والمؤشرات البيوكيميائية في دم الأشخاص المصابين بعدوى كوفيد - 19. تم جمع 100 عينة دم شملت 50 عينة دم من المصابين بفايروس كورونا، وتم الحصول عليها من مستشفى الحروق والجراحة التجميلية / مدينة دهوك ومستشفى لالاف للعناية المركزة/ مدينة دهوك، وقد تم تشخيص إصابتهم حسب بروتوكول منظمة الصحة العالمية، وتم أخذ 50 مجموعة ضابطة (السليمة ظاهرياً) من كادر الجامعة الأصحاء ومرافقين المرضى الخاليين من المرض. أظهرت النتائج حصول إرتفاع معنوي في كل من فعالية إنزيمات ALP، ALT و ASTفي مصل دم المرضى المصابين بعدوى فايروس كورونا مقارنة مع مجموعة السيطرة السليمة، فضلا عن حصول ارتفاع معنوي في تركيز كل من اليوريا، حامض البوليك، الكرياتينين، البيليروبين الكلي وCystatin C في مصل دم مجموعة المرضى المصابين بعدوى فايروس كورونا مقارنة بالمجموعة الضابطة. تشير النتائج التي تم الحصول عليها الى التأثير السلبي لفايروس كوفيد-19 على الكلى والكبد، مما يؤدي إلى خلل في اختبارات وظائف الكلى والكبد في الحالات الشديدة. يعد فهم هذا التأثير أمرًا بالغ الأهمية للرعاية الطبية الفعالة وإدارة الآثار الصحية للمرض، من خلال اجراء الأبحاث المستمرة وتدوين الملاحظات السريرية.

الكلمات المفتاحية: كوفيد 19، الكرياتينين، حامض البوليك تسمم الكبد، تسمم الكلى.

Abstract:

COVID- 19 affects kidneys and liver, leading to abnormalities in kidney and liver function tests in severe cases. Understanding this interaction is crucial for effective

medical care and managing the disease's health implications, with ongoing research and clinical observations. The purpose of this study is to investigate the impact of COVID-19 infections and its link to kidney and liver function impairment by assessing certain enzymes and biochemical indicators in the blood of infected persons. 100 blood samples were collected, 50 from people infected with COVID-19, taken from the COVID-19 Hospital (Burns and Plastic Surgery Hospital/Duhok City and Lalav Hospital/Duhok City) who were diagnosed with the infection according to World Health Organization protocol, and 50-control group were taken from healthy university staff and healthy patient companions who are free of sickness. The results show that patients had significantly higher average in ALP, ALT and AST levels compared to control group, as well as higher average in urea, uric acid, serum creatinine, total serum bilirubin and Cystatin C levels compared to the control group. COVID-19 affects kidneys and liver, leading to abnormalities in kidney and liver function tests in severe cases. Understanding this interaction is crucial for effective medical care and managing the disease's health implications, with ongoing research and clinical observations.

Keywords: COVID -19, Creatinine، Uric acid، Hepatotoxicity, Renal toxicity.

Introduction:

Coronavirus belongs to the Coronavirus family. "COVID-19" is also known as "Coronavirus Disease 2019" because the disease was discovered and the first cases were reported in 2019(Hafeez et al.,2020؛ Mohammed et al., 2023). COVID-19 symptoms include fever, dry cough, shortness of breath, exhaustion, muscular and joint discomfort, headache, loss of smell and taste, cough with phlegm, red throat or painful throat, and diarrhea (Raveendran et al.,2021). The disease can have minor symptoms can be severe, causing serious respiratory and other health problems, particularly in those who have chronic disorders such as heart disease or diabetes, or who have a weakened immune system (Ejaz et al.,2020; Breesam et al., 2023)**.** Small droplets secreted by infected patients when they sneeze, cough, or even speak. The virus can also be spread by direct contact with infected individuals or by touching contaminated surfaces and then contacting the face. For certain infected patients, the novel coronavirus (COVID-19) damages the kidneys and produces an increase in blood creatinine levels, which is a symptom of poor kidney function. (World Health Organization 2020; Sami et al., 2024). COVID-19 can mimic viral hepatitis symptoms such as jaundice (yellowing of the skin and eyes), dark urine, and abdominal pain. However, the virus's direct participation in causing liver injury is still being investigated (Wang et al.,2020; Almughalles et al., 2024). Inflammation, which causes inflammation in the blood vessels and tissues surrounding the kidneys, is one of the pathophysiological pathways that may contribute to this impact. This inflammation can cause renal blood channel constriction and decreased blood flow to the kidneys (Zhang et al.,2022; Al-AAlim et al.,2020). It can produce blood clots, which can harm the renal blood arteries and obstruct blood flow to the

kidneys(Østergaard,2021). This virus also has a direct effect on the renal cells, since some reports indicate that the new Corona virus may directly attack and harm the renal cells (Vinayagam & Sattu,2021). Furthermore, certain COVID-19 patients may have excessive blood pressure, which can lead to decreasing renal function (Ahmadian et al.,2021; Sardu et al.,2020).

The purpose of this study was to compare the effect of COVID-19 infections on some biochemical changes in the blood of infected individuals, as well as the effect of these changes on both the kidneys and liver, to the same changes in healthy people.

2.Experimental design and measurements:

2.1. Sample collection:

A total of 100 blood samples were collected: 50 from patients infected with COVID-19 who were diagnosed with the infection according to World Health Organization protocol (Collect blood samples from COVID-19 patients at COVID-19 Hospital Burns and Plastic Surgery Hospital/Duhok City and Lalav Hospital/Duhok City). The samples for the control group were collected from healthy university staff and healthy patient companions who were not affected with any ailment. The subjects fasted for 12 to 14 hours. Venous blood samples (3-4 mL) were obtained, and the serum was separated using a centrifuge for biochemical analysis testing.

2.2. Biochemical analysis:

Biochemical analysis was performed by commercially available kits, Except for the Cystatin C Kit from the French company Veda Lab, all kits are from the French company Biolabo.

2.3. Ethics approval:

This investigation was carried out in accordance with the ethical guidelines outlined in the declaration of Helsinki. Prior to obtaining the sample, the patient’s consent was obtained through written and verbal communication, according to document (31- 10 – 24102021).

2.4. Statically analysis:

The statistical analysis used in the provided table is called the "Independent Samples T-Test." This test is used to compare means between two independent groups, in this case, the "Patient" group and the "Control" group, to determine whether there is a statistically significant difference between them based on important values such as the p-value (P-value). In this context, the test was used to analyze the differences in the mentioned biochemical parameters between the "Patient" and "Control" groups.

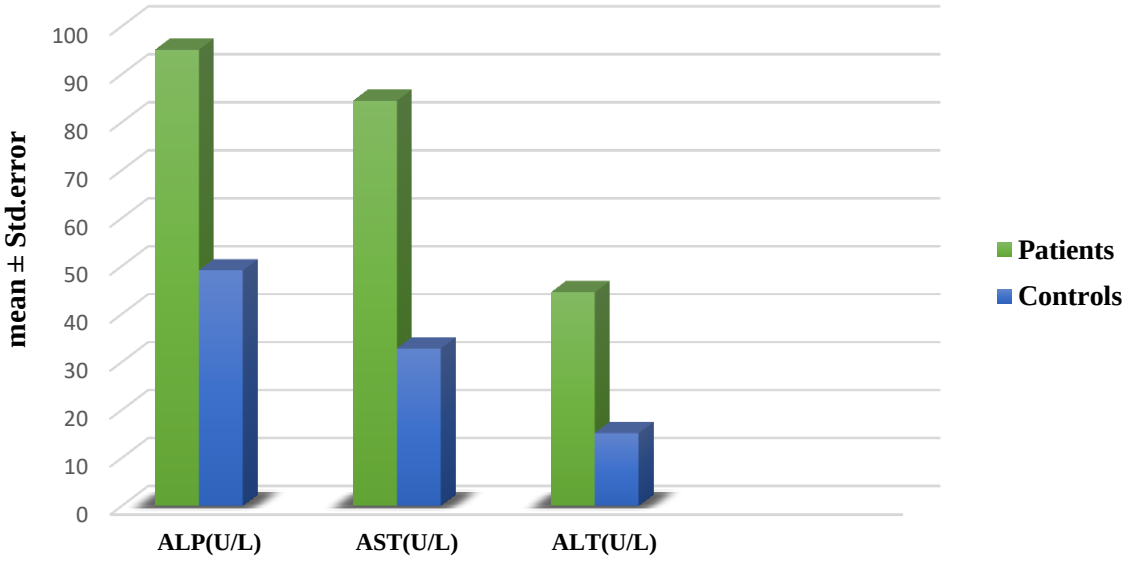
3.Results:

The table (**1 and 2**) shows statistical tests for two groups (Patient and Control) with a specified p-value. The results in (Table 1; fig.1) show that patients had significantly higher average ALP, ALT and AST levels, as compared with control. In addition, the results in (Table (2) and fig.2,3) show a higher average in uric acid, serum creatinine, uric acid, total serum bilirubin and Cystatin C levels compared to the control group. The p-values are less than or equal to 0.005, indicating a statistically significant difference. Patients generally had higher levels of these biochemical markers compared to the control group. The low p-values indicate the statistical significance of these differences. Overall, the results suggest significant differences between the patient group and the control group in all biochemical parameters.

Table 1: Statistical Analysis of (ALP, AST and ALT) between Patients and Controls

Biochemical Parameters	Controls n : 50	Patients n : 50
ALP(U/L)	49.100 ± 2.241	95.080 ± 2.098*
AST(U/L)	32.833 ± 2.589	84.460 ± 1.728*
ALT(U/L)	15. 200 ± 1.520	44.520 ± 1.854*

1. **Each group of 50 persons, Data as Mean ± Std. error , P- value ≤ 0.05**
2. ***represented significant difference from control groups**

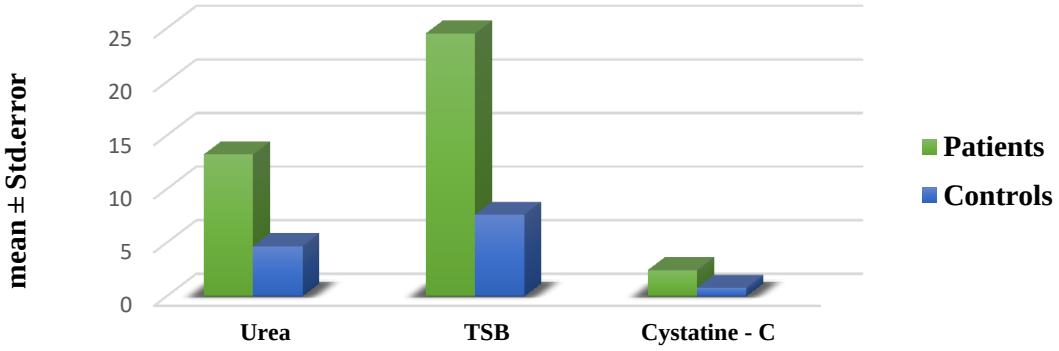


Figer1: show the level of ALP, AST &ALT

Table 2: Statistical Analysis of (Urea, U. A, S. Creatinine, TSB and Cystatin C) between Patients and Controls

Biochemical Parameters	Controls n : 50	Patients n : 50
Urea(mmol /L)	4.671 ± 0.200	13.228 ± 0.403*
Uric Acid (µmol / L)	142.400 ± 8.733	391.321 ± 2.193*
S.Creatinine (µmol / L)	46.657 ± 2.005	94.011 ± 2.193*
TSB (µmol / L)	7.619 ± 0.645	24.520 ± 0.988*
Cystatin C (mg / L)	0.796 ± 0.039	2.432 ± 0.111*

1. Each group of 50 persons, Data as Mean ± Std. error , P- value ≤ 0.05
2. *represented significant difference from control gr



figuer 2: shows the levels of Uream, TSB and Cyststinie - C

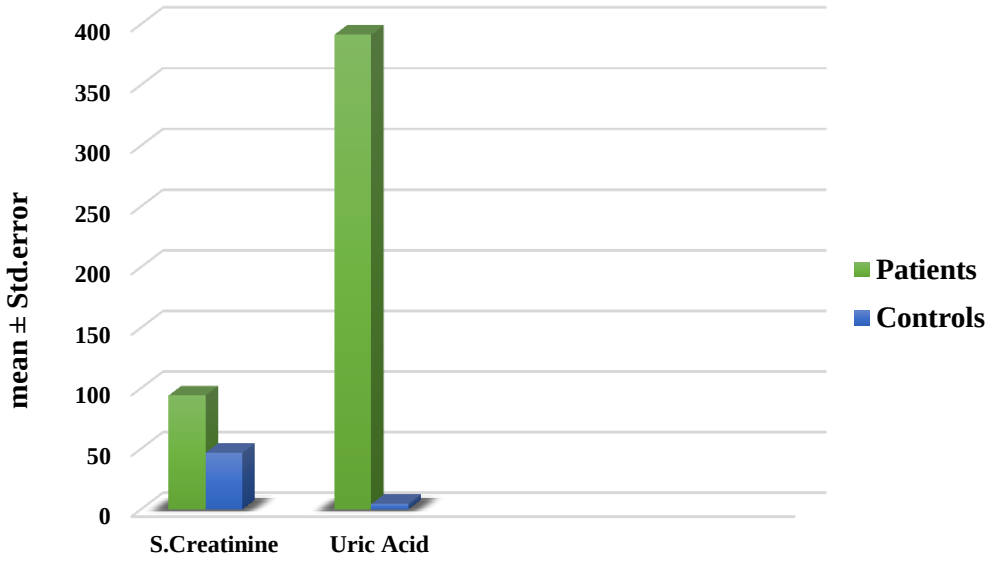


figure 3: shows the levels of S.Creatinine and Uric Acid

4.Discussion:

It is clear from the current results that changes in biochemical indicators indicate the presence of kidney and liver damage.

One of the pathophysiological mechanisms that may contribute to this impact is inflammation19, which induces inflammation in the blood vessels and tissues surrounding the kidneys. This inflammation can constrict renal blood channels and reduce blood flow to the kidneys (Wadman et al.,2020). Covid virus has the potential to cause blood clots, which can damage the renal blood vessels and impede blood flow to the kidneys (Wang et al.,2022). This virus also has a direct effect on renal cells, according to some reports, since the new Corona virus may directly assault and kill renal cells (Saba et al.,2020). Furthermore, certain COVID-19 patients may have high blood pressure, which can result in decreased renal function (Zaki et al.,2020).

COVID-19 can induce acute renal injury on rare occasions, especially in severe ones. High AKI (acute kidney injury) is characterized by a precipitous loss in kidney function and is typically accompanied with high blood urea creatinine levels, as found in our study (Ali et al.,2021). Because the kidneys remove waste and waste products from the blood, when kidney function is impaired, the amount of urea-creatinine in the blood may increase. This process generates urea and creatinine as metabolic products. If the kidneys aren't working properly, their levels in the blood can rise (Tulu et al.,2023). COVID-19 may cause proteins to accumulate in the body, increasing the molecular bulk of particles that the kidneys filter from the blood. This could put strain on the kidneys and lead to high urea levels (Weiss et al.,2020). Vasculitis (also known as cyclone myasthenia gravis) affects a tiny percentage of COVID-19 patients. This inflammation can damage muscle fibers and cause creatinine to be released into the blood (Sarkesh et al.,2020). It is caused by a number of processes, including direct viral invasion of kidney cells, the body's inflammatory response, and changes in blood circulation (Ahmadian et al.,2021). These findings are consistent with our current findings, which demonstrate a significant increase in creatinine and urea levels in COVID-19 patients. COVID-19 can also trigger a cytokine storm, which is characterized by an excessive immune response characterized by the release of pro-inflammatory cytokines. This affects kidney function by causing inflammation and endothelial dysfunction in renal blood vessels (Nicosia et al.,2021). Dehydration is caused by a loss of fluids in the body as a result of a lack of appetite, temperature, perspiration, and a lack of fluid intake due to illness, all of which can induce renal stress and contribute to kidney dysfunction (Askari et al.,2020).

The study found an increase in uric acid levels in patients, which could be linked to inflammation in tissues and organs, including joint tissues. When these infections arise, they can cause cell lysis and the release of purines, which are chemicals created by DNA breakdown and help to form uric acid (Morais et al.,2020). Also, a shortage of food or a shift in digestion rates. As a result of the breakdown of proteins and waste items in the

body, uric acid can be formed .High TSB (Total Serum Bilirubin) levels in some COVID-19 individuals may be linked to liver inflammation. This causes liver cell damage and the production of additional bilirubin, which is hydrolyzed to produce TSB (Wang et al.,2020). The study discovered that patients' uric acid levels had increased, which could be connected to inflammation in tissues and organs, including joint tissues. When these infections occur, they can cause cell lysis as well as the release of purines, which are molecules produced by DNA breakdown and aid in the formation of uric acid. Also, a lack of meals or a change in digestion rates. Uric acid can be generated in the body as a result of the breakdown of proteins and waste items (Kono et al., 2010)

High TSB (Total Serum Bilirubin) values in COVID-19 patients may be associated with liver inflammation. This damages liver cells and produces more bilirubin, which is hydrolyzed to create TSB (Chen et al.,2013). There is also an increase in fever and perspiration, which elevates the risk of dehydration and rises the TSB level in the blood (Huang et al.,2023) . The reason for the increased cysteine concentration is as follows: Infections with viruses can trigger cell disintegration and the release of chemical compounds like cysteine. In some cases, it may compromise liver function and increase cysteine production or accumulation in the blood (Bramer et al., 2023). Furthermore, excessive amounts of cysteine and TSB can be caused by cellular injury in the liver or other tissues (Vairetti et al.,2021).

COVID-19 has been linked to an increase in liver enzymes such as alkaline phosphatase (ALP), alanine aminotransferase (ALT) and aspartate aminotransferase (AST). Elevated liver enzymes may indicate liver inflammation or damage (Cai et al.,2020). Our data suggest that an increase in Covid liver enzyme levels is associated with liver damage. High levels of the liver enzymes ALP, ALT and AST in the blood of COVID-19 patients may suggest the virus's impact on the liver. ALT is an enzyme found in liver cells that is released into the bloodstream when the liver cells are injured or killed for any reason, such as hepatitis, the harmful effects of alcohol, or viruses such as Covid-19. High levels of ALT in the blood can indicate tissue damage or infection. In the case of hepatic cells (Wang et al.,2020). AST is another enzyme found in the liver and many other tissues such as the heart, muscles, and kidneys (Tabary et al.,2020). Increased AST levels in the blood may also indicate cell damage in a variety of tissues, including the liver. The AST/ALT ratio (AST-to-ALT ratio) can be utilized to estimate the kind of liver injury since AST elevation is greater than ALT elevation in liver damage caused by factors other than COVID-19 (Crisan et al.,2021). It should be mentioned that higher ALT and AST values in COVID-19 patients' blood may be due to the virus's effect on liver inflammation (Gholizadeh et al.,2020). The majority of COVID-19 patients have a small elevation in these enzymes, which usually does not require any additional therapy. However, the impact on liver function can be greater in particularly severe instances of the illness, and the patient may require additional medical care (Ding et al.,2021). Many COVID-19

treatments have the potential to compromise liver function. Some of these medications may cause an increase in the levels of the liver enzymes ALT and AST in the blood. Some COVID-19 drugs, such as antiviral medications and antibiotics, might have adverse effects that affect renal function like Antiviral drugs include Remdesivir, Lopinavir/Ritonavir, Dexamethasone, Hydroxychloroquine, and Chloroquine (Xie et al.,2020).

5.Conclusion: The study found that COVID-19 infections significantly affects kidney and liver function, with patients showing higher ALP levels and higher levels of uric acid, creatinine, bilirubin, ALT, AST, and Cystatin C compared to a healthy control group. These abnormalities highlight the importance of monitoring these parameters in severe cases, and further research and clinical observations are needed to better understand these effects and improve treatment strategies.

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7.Conflicted interest: None

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