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Estimation of the functions of kidney and liver in the infected COVID-19 patients

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Abstract---Coronavirus disease 2019 (COVID-19) is one of the respiratory system diseases with unknown etiology and clinical characteristics. Defects in the liver and kidneys appear to be common in Covid-19 patients. Aspartate transaminase (AST) enzyme, Urea, creatinine, and Alanine Aminotransferase (ALT) enzyme levels are frequently exalted at the start or within the infection. This pretext suggests that Covid-19 interferes with the functions of the liver and kidneys. The current study was aimed to estimate the biochemical biomarkers changes that related to liver and kidney functions, such as ALT, AST, urea, and creatinine, in infected patients. 50 patients were diagnosed with infected between May 1 and 1 August 2020, in Dayala Hospital. 100 samples included 50 control and 50 infected were carried out to evaluate the level of biochemical biomarkers (the plasma urea, creatinine, ALT and AST).The results showed increased of ALT, AST, BUN and creatinine levels in the infected samples compare with the control samples. The mean serum kidney parameter (Urea, creatinine) levels were 57.84 ± 10.46 , 1.61 ± 0.18 respectively,

while the mean value of serum liver enzyme (AST, ALT) levels were 41.94 ± 4.59 and 42.54 ± 4.45 , respectively, with high significant different ($P < 0.001$) with control healthy group.

Keywords---coronavirus disease, COVID-19, urea, creatinine, AST, ALT.

Introduction

The COVID-19 is considered as an infection caused by the intense serious respiratory syndrome coronavirus-2 (SARS-CoV-2) which have been find out originated in Wuhan, one of the China cities and has since prevalence to the rest of the world (Zhang, et al.2020). It spreads through respiratory droplets or aerosols produced by coughing, sneezing, or talking. Infection can also occur as a result of touching contaminated surfaces and then touching transmission routes such as the mouth, eyes, or nose (Phan, et al.,2020; Wu and McGoogan, 2010).COVID-19 symptoms include symptoms of upper airway infection, including fever, weariness, and dry cough. A runny nose with congestion, sore throat or diarrhea may arise in certain patients. Other people become infected without symptoms. Most (80%) patients therefore heal without treatment (Chen et al.,2020; Mohammed and Qasim). The most people that can be infected by COVID-19 and got acquire serious conditions are older persons and those with chronic health problems such as high blood pressure, cardiovascular disorders and chronic lung diseases. (Jalil et al., 2021).

This condition includes several different organs, including the cardiovascular system, the kidneys and the liver, but the lungs are the primary objective (Rismanbaf et al., 2020). Through the course of the disease, up to 11% of infected patients develop the comorbidities of liver, and 14 percent to 53 percent of patients develop ALT and AST (Zhang, et al.2020). Accumulating evidence suggests that the severity of the virus infection has a high link with the amount of hepatic enzyme increase. Those with a moderate case may not have an anomaly or just a slightly increased level of aminotransferase, while those with severe instances with greater levels may be (Mantovani, et al.2020) Acute liver damage can also occur in minor COVID-19 cases, however with a minimum treatment effort the liver can return to normal (Zhang, et al.2020).

The patients with the blood urea nitrogen (BUN) has been considered an independent mortality risk factor (Cheng et al., 2020). BUN levels above 7 mmol/L are considered as the standard of community acquired CURB-65 score for pneumonia, with high BUNs associated with poorer results in patients with cardiac failure (Aronson, Mittleman and Burger, 2004)(Ito et al., 2017) In patients with hospital-acquired, aspiration, and pneumonia that obtained community, recent investigations were demonstrated that the ratio of serum albumin to the BUN is one of the significant oracular factor for mortality and illness seriousness (Ugajin et al., 2012)(Feng et al., 2019; Ansari et al.,2022). A higher BUN/creatinine/BCR ratio has been suggested by several studies to be associated by longer care and mortality in critical illness patients. Therefore, it is necessary to find forecast indications of the severity of disease and to help take early actions

to avoid the worsening and the critically of death ill patients. Monotony blood laboratory tests can be predictive, as they can reflect the modified biology of the crucial disease (Haines et al., 2019;Sujino et al., 2019; Huldani et al.,2022; Bokov et al.,2022).

Materials and Methods

Sample collection: 50 infected patients have been collected. Male and female, with ages ranged from (20-80) at the Dayala Hospital in Dayala Province, Iraq from May, 2020 to August,2020. Also, the control group included 50 healthy people of different ages and genders. By using quantitative RT-PCR (qRT-PCR) on Nasopharyngeal and "samples of the swab Throat, all of the patients have been approved positive for COVID-19 in the lab. Biochemical tests were performed on blood samples. Biochemical Test: Biochemical tests were conducted on plasma of the 50 infected patients to evaluate urea , creatinine, AST and ALT levels in blood with 50 normal plasma and the Cobas C311 device was used for these tests

Statistical analysis

The Excel 2013 and SPSS v.22 were used to investigated the Statistical analysis. Mean \pm standard deviation (SD) was calculated. T-test was used to verify essential variations . The statistically significant P value was $P \leq 0.001$.The kind and degree of the association between variables was explained using Pearson correlation (R).

Results and Discussion

The current study found that the mean value for Urea parameters in patients was higher (57.84 ± 10.46) than in controls (24.38 ± 5.52), with a significant difference ($P < 0.001$) between study groups. As a result, the mean value for creatinine(1.61 ± 0.18) in patients was higher than in controls (0.71 ± 0.18), with a significant difference ($P < 0.001$) between study groups. In addition, the mean value for AST parameters in patients (41.94 ± 4.59) was higher than in controls (16.22 ± 3.2), with a significant difference ($P < 0.001$) between research groups. Finally, the result of present study shows the mean value was high for ALT (42.54 ± 4.45) parameters in patients than controls (18.54 ± 3.91) with high significant different ($P < 0.001$) between study groups as shown in the figure (1) and table (1).

Table 1
Comparative Liver functions variables between study groups by using student t-test

Groups		N	Mean	SD	P value
Urea	Patients	50	57.84	10.46	0.001***
	Controls	50	24.38	5.52	
Creatinine	Patients	50	1.61	0.18	0.001***
	Controls	50	0.71	0.18	
AST	Patients	50	41.94	4.59	0.001***
	Controls	50	16.22	3.2	
ALT	Patients	50	42.54	4.45	0.001***
	Controls	50	18.54	3.91	

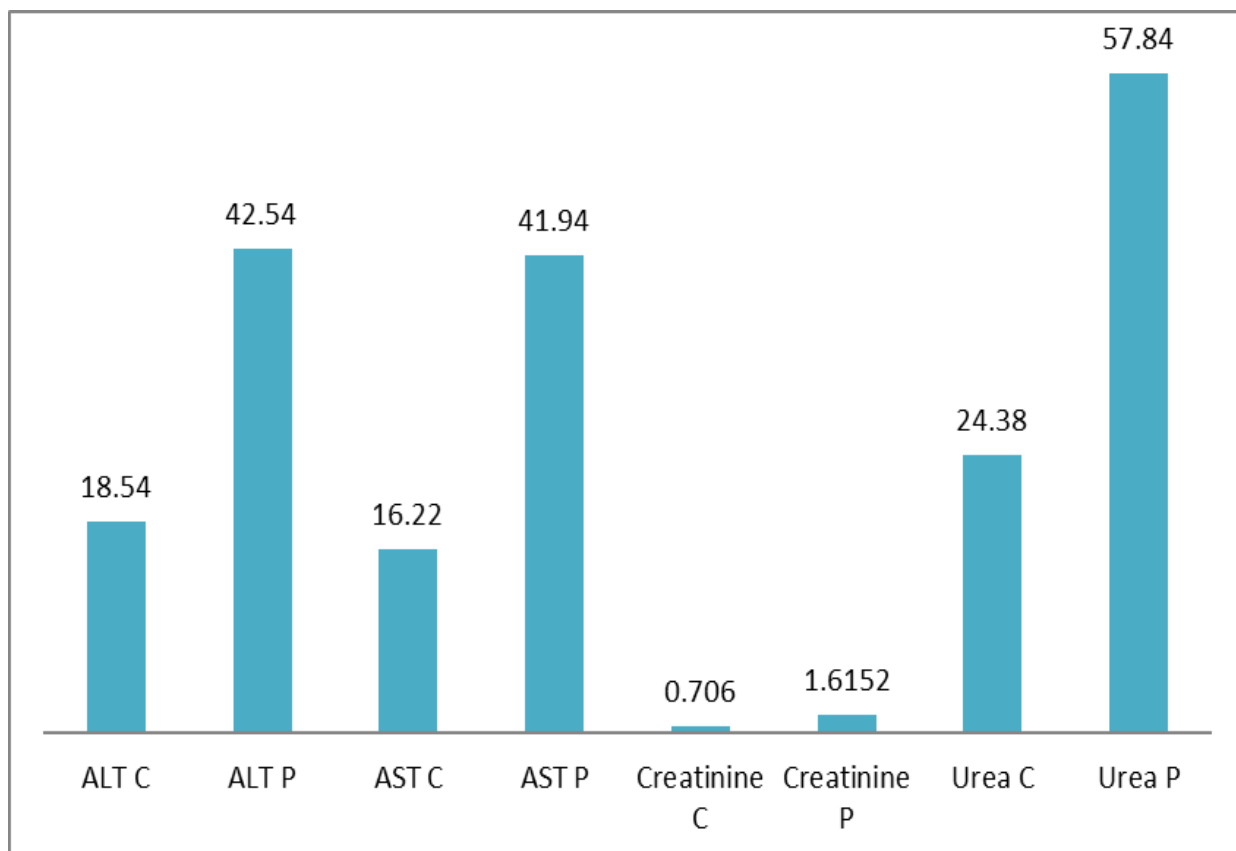


Figure 1. Comparative Liver and kidney functions variables between study groups where the liter (P) represent patients while (C) represent control level .

Result of present study shows the correlation relationship between Urea and (urea, creatinine, AST) was positive and negative between Urea and (ALT). The correlation between Creatinine and (urea, creatinine, and AST) is positive and negative between Creatinine and (ALT). The correlation between AST and (urea, Creatinine, and ALT) is positive. The correlation between ALT and (AST) is positive and negative between ALT and (Urea, and Creatinine). As shown in table (2).

Table 2
Correlation relationship among variables by using pearson correlation

		Urea	Creatinine	AST	ALT
Urea	R	1	.842**	.102	-.150
	P		.000	.480	.299
Creatinine	R	.842**	1	.187	-.118
	p	.000		.194	.416
AST	R	.102	.187	1	.300*
	P	.480	.194		.035
ALT	r	-.150	-.118	.300*	1
	p	.299	.416	.035	

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

There are significant differences in the parameters of the liver function and kidney functions markers for patients when compared with the control group at $P \leq 0.001$. However, AST, ALT, Urea and Creatinine Increase in patients with $P = 0.001$. COVID-19 is considered one of the caused emerging respiratory symptoms, and it may occur extrapulmonary effects, such as kidney and liver damage (Gupta et al., 2020) COVID-19 is a novel respiratory infection which has a elevated morbidity and fatality rate over the world. The first step in the infection of COVID-19 is to bind to the receptor on the enter the cells and host cell. As a result, a wide spectrum of nonrespiratory symptoms have been observed, inclusion that else organs, such as kidney, heart and liver, may be involved within the infection (Gorbalenya et al., 2020) (Zhou et al., 2020). Corona viruses feature a spike protein structure that is tightly linked to the human cell receptor ACE2. the ACE2 are behave as cells target, which lead to make them susceptible by COVID-19. Lin et al., (2020), recently discovered that the presence of ACE2 receptors in kidneys of human shows a possibility way to infection by COVID-19. Fan et al., (2020), also discovered that ACE2 receptors are evidenced in human kidneys in another investigation, 63 percent of COVID-19 patients exhibited a high degree of proteinuria.

These findings suggest that reduced kidney function caused by the COVID-19 may leading to death in COVID-19 patients (Lin et al., 2020). In this investigation, we discovered that the infected patients had higher urea and creatinine levels, which is harmonious with the outcomes of Luwen Wang et al., that has been documented to found that 12 (10.8 percent) of COVID-9 patients had higher BUN or creatinine levels after two days. Creatinine and urea levels grew much more over time (Fan et al., 2020). Cheng et al., (2020), was presented clinical data from 1,099 individuals who had their COVID-19 results validated. As a result of these tests, it appears that decreased kidney function is very prevalent following COVID19 infection. Recently, several researchers reported successfully isolating the particle of COVID-19 s from COVID-19 patients' urine samples, demonstrating that viral particles originating in the kidney can pass via glomerular filtration and into the urine.

These data prove that the human kidney is a site of the infection of COVID-19 and the proliferated occur not in the lungs, according to our and previous studies (Diao et al., 2020). However, the infected patients should have their renal function checked on a timely manner, especially if their plasma urea and creatinine levels are high. High levels of serum urea and creatinine. There are many reasons why COVID-19 is kidney impaired. First, viral loads of SARS-CoV-2 trigger renal resident cells to become cytotoxic. in the light biopsy renal in three infected patients, endothelial swelling of, vacuolar degeneration cellular, renal tubular epithelial swell, and decrease were seen. Second, the disease is most likely caused by fever, vomiting, diarrhea and shock. Third, viral load SARS-CoV-2 serum is highly linked to cytokine storm (Yao et al., 2020)).

Because renal transplant immunosuppression can "be protective," a COVID-19 patient with a kidney transplant had moderate illness (Chen et al., 2020)). Fourth, some medicines have nephrotoxicity. Organ crosstalk, such as rhabdomyolysis, hypoxia, and cardiorenal syndrome, can potentially lead to kidney damage (Ronco and Reis, 2020). Sixth, mechanical ventilation has the potential to cause AKI. Seventh, older individuals with comorbidities such as chronic heart disease, diabetes, hypertension, or liver of chronic disease are at risk of developing secondary renal disorders that may not be diagnosed before admission (Dai and Chen, 2017)).

Hepatic dysfunction was also observed in the infected patients with elevated the enzymes of liver (AST and ALT), which could be due to a variety of factors, inclusive direct injury of the liver, associated with hepatic ischemia, muscle breakdown congestive hepatopathy, drug-induced liver injury (DILI, and inflammatory responses, (Jothimani et al., 2020)). According to Schaefer et al., (2020) the meta-analysis, was about 3% of the infected patients had the chronic disease of the liver at the time of infection. Consequently, consultations on aberrant liver biochemistry are the most popular and cannot be resolved easily in COVID-19 individuals. The aim to restrict the exposure of personnel involved in or executing diagnostic tests further complicates the clarification of a diagnosis (e.g., liver biopsy or abdominal ultrasound). More details about the perfect way to estimate these patients is necessary in this situation (Mantovani, Beatrice and Dalbeni, 2020).

This study compatible with another studies who found elevation levels of liver enzymes. Cai et colleagues discovered that liver injury and abnormal liver tests were linked to the evolution of COVID-19 serious (Gori et al., 2020). In infected patients, Yip et al., (2021), has been discovered that ratio of ALT/AST has been altitude and the injury of acute liver are autonomously related with unfavorable clinical results such as admission to the intensive care unit, invasive mechanical ventilation, and/or death (Yip et al., 2021)). Saini et al prospectively examined the tests of liver function of 170 infected patients and discovered that 89 (58.5 percent) of the patients had elevated levels of any of the enzymes of the liver, of which 43 (48.31 percent) had injury of the liver, which apparently as intertied intensity in the ICU term ($p=0.0005$) (Saini et al., 2020)).

According to a study conducted by Singh et al., were documented that, the patients with previously existing disease of the liver, especially cirrhosis, are at a relatively high risk of hospitalization and death rates 76.3 percent of infected patients showed abnormal tests of the liver , and 21.5 percent during thier hospitalization were developed injury of the liver, defined as gamma-glutamyltransferase, total bilirubin, AST, and ALT levels has been rised to 3 tim the supernormal limit of the standard. Patients with liver tests abnormal has a considerably raised risk of acquiring severe pneumonia (Singh and Khan, 2020), according to the study (Gori et al., 2020)). These outcomes are also in line with our studies, which demonstrate a considerable increase in the levels of ALT and AST in infected patients.

Conclusion

Using the four value predictors, patients at risk of critical COVID-19 can be identified and may require aggressive care earlier during the disease.

Ethical approval

The medical ethics commission of Dayala Hospital has approved this study. All participants received written informed consent for publication.

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