

Effect of COVID-19 Infection On Levels of Beta trace, Haptoglobin And some Biochemical Parameters

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ABSTRACT: The study aimed to Effect of COVID-19 infection on levels Haptoglobin and Beta trace protein and some of Biochemical parameters COVID-19. The study groups included 30 patient men infected with COVID-19, 30 men who recovered and 30 healthy men as a control group. Protein and biochemical assays include: Beta trace protein , Haptoglobin , LDH, AST , Na, Albumin , ferritin , Albumin / creatinine ratio (ACR) .**The results** showed a significant increase at ($P \geq 0.05$) in levels of Beta trace Protein, haptoglobin, LDH, AST, and Na in infected patients compared to control and recovery groups, while infected men group showed a significant decrease in albumin and ferritin levels at ($P \geq 0.05$) compared to control and recovery groups, while recovery group showed a significant increase in levels of albumin/creatinine ratio compared to control and patient groups. While there was a substantial drop in the levels of haptoglobin, beta-trace protein, and LDH in the recovery group compared to the healthy group, the levels of AST and albumin did not differ significantly between the control and recovery groups.

Key words: COVID-19, Beta trace protein, Haptoglobin

Introduction

A zoonotic virus called SARS Covid-2 infects both humans and birds. It is made up of an RNA-dependent RNA polymerase (RdRP) polymerase and an envelop virus from the Coronaviridae family of viruses. Coronaviruses belong to the Orthocoronavirinae subfamily, which includes four different coronavirus genera: alpha, beta, gamma, and delta. SARS cov-2 is a member of the Betacoronavirus genus (Gorbalenya et al., 2020). Given that genetic study and comprehensive

genome sequencing revealed that the virus is a spiny protein from the Although the virus primarily affects the respiratory and immune systems, these spikes on the outside allow it to bind to human cells through enzyme receptors that are extensively distributed in the lungs and kidneys. On other systems, including the heart, blood vessels, and kidneys, the initial start of rapid viral replication results in the death of epithelial and endothelial cells as well as vascular leakage, which is an immune response and causes a large amount of pro-inflammatory chemokines and cytokines to be produced. (Yang., 2020)

Although the primary characteristics of COVID-19 were abrupt respiratory failure and extensive alveolar injury, additional organ involvement must also be considered. Following a lung infection, the invading virus may enter the bloodstream, build up in the kidneys, and harm the kidneys' resident cells. Huang et al.(2020). According to Su et al. (2020), 9 out of the 26 COVID-19 patients who passed away had autopsies, and the majority of those who had acute renal failure also had acute tubular necrosis (ATN) and multiple organ failure. Acute renal insufficiency, which is mostly indicated by diffuse proximal tubule damage and some frank necrosis on light microscopy, was seen in China.

One of the acute phase proteins, haptoglobin is released by the liver as well as other tissues like the lungs and kidneys. As it was recently demonstrated to considerably rise after two days of infection with the SARS-cov-2 coronavirus, this antioxidant has been proven to have antibacterial activity and has a role in controlling several elements of the acute phase response., Van Bilsen et al.(2021).

A novel biomarker for the assessment of glomerular filtration rate has been developed using the beta trace protein. Additionally, it plays a crucial role in the pathogenesis of cardiovascular illnesses since elevated BTP levels in urine and serum are positively correlated with patients' lower glomerular filtration rates. those who have chronic renal disease and have a marked rise in the disease's early stages (Mohammed et al., 2018)

A crucial enzyme in the anaerobic metabolic pathway, lactate dehydrogenase is a cytoplasmic enzyme present in nearly all tissues and in high quantities in the muscles, liver, and kidneys. Red blood cells also contain moderate concentrations of this enzyme. Nearly every human cell has lactate dehydrogenase (LDH), which is widely dispersed throughout the body (Acharya et al., 2018).

The majority of the serum protein in humans, or about 50%, is made up of albumin, which is also the most prevalent plasma protein. About 66 kDa is the molecular weight of albumin. It is mostly produced in liver cells, where it is then discharged right into the bloodstream. 40% of it is still in the bloodstream, with some of it being transferred to the interstitial space from within Vascularization (Levitt and Levitt, 2016)

Aspartate aminotransferase is one of the hepatic enzymes that is primarily produced in the liver but is also present in red blood cells, heart muscles, and skeletal muscles, indicating that it is not only produced in the liver and can also be found in the kidneys, heart, muscles, and pancreas in smaller amounts (Nishikawa et al., 2016). It is one of the enzymes that is released into the bloodstream when cell membranes rupture.

Most animals, including humans, some vertebrates, and microbes, use ferritin as their primary iron-storage protein. The liver, spleen, bone marrow, intestine (mucous cells), milk, synovial fluid, and to a lesser extent, the blood, all contain it. For the production of blood and physiological processes, such as the transfer of iron between different cell types, upkeep of cellular iron levels, removal of iron from invasive pathogens, defense against oxidative stress, stimulation of angiogenesis, and support of immunity (Theil et al., 2013).

Due to its significant osmotic effect, sodium plays an essential role in maintaining extracellular fluid volume (ECF), as well as in the regulation of fluid, electrolyte, and blood pressure balance. It is also crucial for the excitation of muscles and neurons, as well as the transport of nutrients and substrates across plasma membranes (Palmer et al., 2015)

Materials and methods

Samples

In this study, (90) blood samples were collected for the period from 1/11/2021 to 1/2/2022, where the study samples were divided into three groups. The first group included healthy people as a (control group), and their number was 30 samples, all of them males. who did not have a medical history, while the second group was for patients infected with Corona virus Covid-19, and their number was 30 samples, all of them were males, were present in The isolation ward in Balad General Hospital and some outpatient clinics in Al-Dholuiya and Samarra cities. As for the third groups, it included similar patients, and their number was also 30

samples, all of them males, their ages ranged between (70-20) years in all group, after careful diagnosis by specialist doctors, and based on clinical symptoms

Collect blood samples

Blood samples weighing around 5 ml were taken from the cuboidal vein. The samples were kept at room temperature for 15 minutes. The serum was then transferred to test tubes and centrifuged for 10 minutes at 5000 rpm.

Protein analysis:

The concentrations of protein (Synaptopodin and Nephrin) were measured via enzyme linked immune sorbent assay (ELIZA) by using the commercial kits (ELIZA kit, MyBioSource ,china) and procedures was followed as given in the kits catalogs.

Biochemical analysis:

Blood urea nitrogen, creatinine and calcium concentration quantified by following the procedure that given with kit (Biolabo, France)

Statistical analysis:

All values expressed as mean \pm S.D data analyzed done by using analysis of variance (ANOVA).

Results:

The results were shown in Table (1) as follows: significant increases in hemoglobin, beta-trace protein, LDH, AST, and sodium in the patient group when compared to the control group, recovery group, and follow-up group; significant decreases in albumin and ferritin levels when compared to the control group, recovery group, and follow-up group; and significant increases in albumin/creatinine ratio when compared to the control and patient groups in the recovery group. While there was a substantial drop in the levels of hemoglobin, beta-trace protein, and LDH in the recovery group compared to the healthy group, the levels of AST and albumin did not differ significantly between the control and recovery groups.

Parameters	Control	Patient	Follow-up group
Haptoglobin	23.859 \pm 6.76	42.103 \pm 4.99	20.923 \pm 3.84

Beta – trace protein	335.85±81.79	836.84±102.63	210.61±56.49
LDH	266.58 ± 64.24	411.36 ± 60.35	233.80 ± 44.16
AST	25.70 ±5.25	42.12 ± 9.76	25.35 ± 5.23
Albumin	4.07 ± 0.49	3.6207 ± 0.78	4.03 ± 0.48
ferritin	218.56 ± 35.05	126.14 ±31.28	104.54 ± 23.60
Na	131.43 ± 11.84	149.64 ±9.88	142.87 ± 5.68
Albumin / Creatinine ratio	3.91± 0.85	3.07± 0.97	5.90± 1.16

Discussion

It was recently observed that the levels of haptoglobin, compared to CRP, experienced the same early increase two days after infection with SARS-cov-2 virus, but it remained consistently elevated for at least 10 days after infection and for a longer period of time than CRP. Haptoglobin is one of the acute phase proteins and a sign of inflammation, as its level increases during infections, injuries, and malignancies. The use of haptoglobin as a sensitive biomarker of inflammation in chronic liver disease is described in Maisonnasse et al. (2022), Tamara et al. (2020), and Anisonyan et al. (2020). So far in patients at risk for NAFLD, haptoglobin levels were favorably linked with male sex, type 2 diabetes T2DM, obesity and interestingly with the degree of Steatosis in patients with NAFLD risk, including non-obese men, It has been shown that there is a correlation between serum haptoglobin levels and BMI, probably as a result of ongoing inflammation.

According to Donadio and Bozzoli (2016), when assessing patients with chronic kidney disease for renal excretory function as measured by glomerular filtration rate, increases in beta-trace protein concentrations in serum or plasma and urine correlate well with lower glomerular filtration. As hypertension with renal insufficiency is related with further increases in serum BTP and urine albumin concentrations, BTP is used as an alternative to serum creatinine to monitor kidney

function in addition to being a biomarker of cardiovascular disease. Sciacqua et al. (2014); Abdulwahed, et al.,(2020) ; Al-Samarraie et al.,(2022).

According to Zhang et al. (2020), the theory explaining the development of hypernatremia in covid-19 patients involves the strong binding of 2-SARS-Cov to the kidney's ACE2 angiotensin receptor, which results in the accumulation of angiotensin II and sodium reabsorption in the proximal convoluted tubules, where Corresponds to the increase in non-physiological renal sodium reabsorption brought on by the increase. This demonstrates the unexpected and varied effects of SARS-Cov-2 infection on organs and organ systems and that hypernatremia is a symptom of Covid-19 (Lippi et al., 2020). According to Redant et al. (2020), hypernatremia is also brought on by a drop in the ratio of total body water to total body sodium, which is frequently brought on by a drop in vascular fluid volume. There may be additional causes of hypernatremia, however they are extremely rare in COVID-19 situations.

Results from earlier research indicate a link between COVID-19 patients' poorer outcomes and greater LDH readings. In particular, patients with elevated LDH had a 6-fold increased risk of severe illness and a 16-fold increased risk of mortality. Furthermore, increased levels of LDH were discovered in 95% of non-survivors versus 60% of survivors in all three trials reporting mortality as an endpoint (Han et al.2020). Given that Covid-19 patients tended to be older and have concomitant conditions, a high LDH level is indicative of a greater mortality rate in these patients. Huang et al .(2020)

When compared to patients with mild COVID-19, patients with severe COVID-19 had significantly higher levels of AST and other liver function indices, and as they recovered, these levels gradually returned to normal. In mild COVID-19 patients, liver damage is frequently transient and can be reversed without special care (Zhang et al., 2020). Also According to Sonzogni et al study .s from 2020, 44.7% of patients with severe disease and 13.9% of patients with non-severe disease both had elevated AST levels. These findings suggest that liver damage is more common in severe COVID-19 patients than in mild ones. AST enzyme levels were found to be lower in the recovered, however this is consistent with An et al. (2021) and Deng et al.(2020) Within 14 days of their recovery, 163 of 253 COVID-19 patients had their serum liver function indexes compared to healthy individuals. who have never contracted SARS-Cov-2. Between healthy volunteers and discharged patients, no discernible alterations in baseline traits were found.

Ferritin decreased in COVID-19 patients, which is consistent with Toniati et al.(2020) .'s observations. Tocilizumab, a monoclonal antibody that targets the interleukin-6 (IL-6) receptor and is one of the few effective treatment options for COVID-19 patients, was one of the anti-cytokine agents that decreased ferritin consistently in COVID-19 patients. Researchers Ruscitti and Giacomelli (2020) suggested that COVID-19 patients who are critically ill may benefit from treatment with therapeutic approaches that target ferritin, such as the therapeutic plasma exchange technique. because it can lower cytokine and ferritin levels. Ferritin and IL-6 concentrations dropped as patients recovered, according to Gomez-Pasora et al. (2020) and Liu et al. (2020), Because ferritin levels declined together with IL-6 levels, this may indicate that blood ferritin is linked to inflammatory conditions in SARS-COV-2 infection. fewer inflammatory substances

Low blood albumin levels may be a sign of malnutrition, an underlying illness, or infectious processes in COVID-19 individuals, and they can also be a sign of severity and prognosis. According to Gonzales et al. (2015) and Su et al. (2020), various pathogenic pathways are connected to reduced serum albumin in COVID-19 patients. Capillary extravasation is an example of As seen in acute (ARDS distress syndrome) and sepsis, the physiological leakage rate of albumin may multiply under inflammatory conditions. This is presumably mediated by interleukin and interferon-interleukin-6. Albumin leaking into the lung interstitium is caused by this disruption of endothelial integrity. Patients with diseases like diabetes, hypertension, and chronic heart failure typically experience hypoalbuminemia, and these patients statistically have a higher risk of contracting the SARS-CoV virus. However, the researchers Carroll et al (2020) showed that in children who had recovered from SARS-CoV infection and who had multisystem inflammatory syndrome, which is characterized by fever and high inflammatory markers, serum albumin levels increased dramatically as a result of the inflammatory response after COVID-19. Diffuse acute encephalomyelitis, Guillain-Barre syndrome, and single or multiple organ failure (Chan et al., 2020; Mustafa et al.,2020).

According to Lazareth et al. (2020), hospitalized Covid-19 patients with acute kidney injury exhibited severe renal proteinuria, with urine albumin to creatinine ratios of 490 mg/mmol and serum albumin values of 2.8 g/dL indicating injury to the tubular space, respectively. Two days after being admitted to the hospital, a kidney biopsy revealed glomerular collapse with tubular dilatation, flattening of the tubular epithelium, loss of the brush border, and detachment of tubular

epithelial cells in the lumen. Nowak et al. (2021) also noted an increase in urinary albumin: creatinine (ACR) levels and proteinuria during the three weeks it took to recover from Covid-19. On computed tomography, there are protein deposits in the urine, urinary fascicles, and granular discs. The kidneys are also larger than usual.

CONCLUSION

COVID-19 may have relation with increase Beta- trace protein , Haptoglobin levels , LDH, AST and decrease ferritin and albumin levels in blood .

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