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Effect of COVID 19 on Biochemical Parameters, Electrolyte Disturbances and Immune Biomarker in Humans

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Abstract

At the end of 2019, a cluster of pneumonia crises caused by a novel coronavirus (COVID19) was identified in Wuhan, China. COVID 19 was fast spread and progression without a particular therapeutic approach resulted in an epidemic. This study aimed to recognize the diversity of biochemical, electrolytes, and immunological parameters in COVID-19 patients. This study gathered and analyzed the data of 150 patients who were laboratory proved as SARS-CoV-2 infection. The patients' ages covered from 30 to 71. All samples were from Balsam Hospital in Erbil cite between Jun 20, and November 4, 2020. The results of COVID19, revealed a significant increase in LDH, D-dimer, ferritin, CRP, uric acid, creatinine, urea, ALT, total bilirubin, and direct bilirubin and a non-significant difference in AST, indirect bilirubin, calcium, phosphorous, potassium, and magnesium, while serum alkaline phosphatase, albumin, total protein, sodium, and chloride showed a meaningful decrease in COVID19 as compared to control group.

Keywords: COVID-19; biochemical; electrolytes; immune biomarker.

Introduction

At the end of 2019, a cluster of pneumonia cases caused by a novel coronavirus (Covid 19) was identified in Wuhan, China. COVID 19 was fast spread and progression without specific therapeutic strategy resulted in an epidemic [1].

The foremost common side effects of COVID-19 are fever, cough, myalgia, or fatigue and in some cases dyspnea [2]. Older patients, those with pre-existing comorbidities such as cardiovascular disease (CVD), hypertension, chronic kidney disease (CKD), chronic liver disease, and diabetes are reported to be more likely to be infected with COVID 19 [3] and are at the highest risk for severe illness or death [4,5]. Except for fever, cough, and dyspnea as the major clinical presentations [6], COVID-19 patients may also develop different degrees of liver injury [7, 8]. The Coronaviridae family consists of enveloped, single positive-strand RNA viruses classified in four sub-groups: α- coronavirus(α-COV), β-coronavirus (β-COV), δ-coronavirus (δ-COV) and γ-coronavirus (γ-COV) [5]; SARS-CoV-2 is a β- COV. The major mechanism of liver injury inCOVID-19 patients is thought to be the binding of SARS-CoV-2 to angiotensin-converting enzyme 2 (ACE2) receptor [9], which is highly expressed in bile duct cells [10], and then destroy bile duct cells, therebyresulting in abnormal liver biochemical tests reflected by elevated alkaline phosphatase (ALP) and gamma-glutamyl transpeptidase (GGT) [11].Increased inflammation-related pointers were detected in patients with COVID-19, including erythrocyte sedimentation rate (ESR), interleukin-6, and C-reactive protein (CRP) [12].In our study, patients who were diagnosed with COVID-19 disease were examined at the first admission to the hospital; AST, ALT, CRP, D-dimer, and LDH test values were examined in their serum. These test parameters, consisting of the most frequently used tests in all laboratories, were specifically selected. It is aimed to contribute positively to the process by including the AST/ALT ratio in these test parameters at the present day when searching for practical, easy-to-use, reliable biomarkers related to COVID-19.Some studies described imbalances of electrolyte levels, including sodium, potassium, chloride, and calcium, in COVID-19 patients [13, 14]. Specifically, hyponatremia and hypocalcemia have been associated with severe disease [15].

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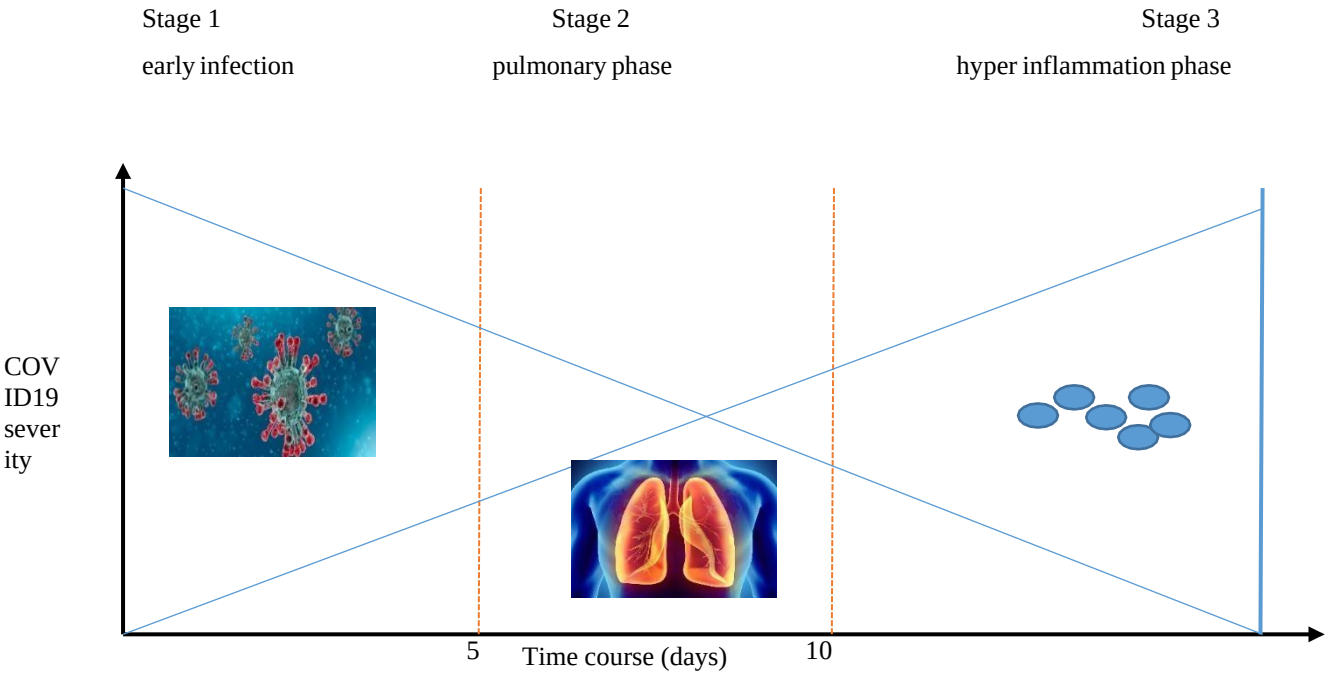

Figure 1: COVID19 disease progression

Methods

Study design and subjects

This study collected and analyzed the data of 150 patients who were laboratory confirmed as SARS-CoV-2 infection and 50 people negative with COVID-19 asa control group. The patients' ages ranged from 30 to 71. All cases were from Balsam Hospital in Erbil governorate of Iraq. All the cases of the current study were attended to the hospital between Jun 20, and November 4, 2020. Subjects were studied on admission for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)-infection by Chromate 4300 PC Controlled Elisa Microplate
Reader (Awareness Technology, USA) blood test for SARS-CoV-2 IgG andSARS-CoV-2 IgM antibodies a by (ELISA kit). Biochemical Parameters and Electrolytes were measured by using fully automated Biochemistry analyzer Cobas C311 (ROCHE, Germany), with diagnostic kits (Roche/Hitachi Cobas).

Statistical Analysis

Statistical analysis was performed with SPSS, v.23.0 statistical software (SPSS). data were expressed as the mean ± SEM and were analyzed using a t-test for comparison between two groups. P values below 0.05 were considered statistically significant.

Results and discussion

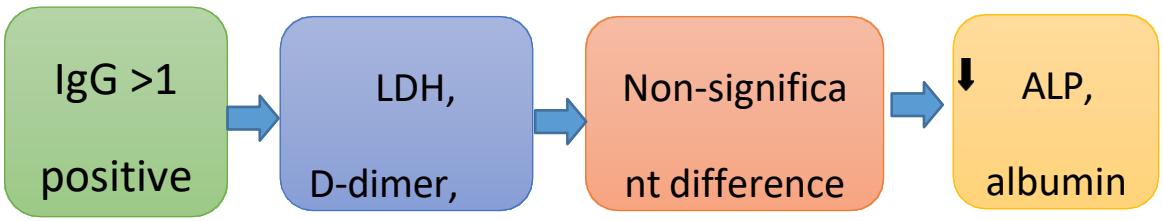

Figure2: Main laboratory findings.

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From the 200 patients analyzed, 150 (75%) were diagnosed positive with COVID-19 and 50 (25%) were diagnosed negative with COVID-19. The resultsof the current study are showed in (table1).
Lactate dehydrogenase (LDH) showed a significant increase in COVID19 patients as compared to the control group ($P < 0.013$) as shown in (table 1). LDH is a non-specific marker of tissue damage. Probably because it is found in many different tissues, LDH emerges as one of the most consistently elevated markers in patients infected with COVID-19 at higher risk of developing adverse outcomes [16, 17]. D-dimer levels were found to be increased in COVID-19 patients as comparedto non COVID19, which reflects the coagulation alterations [18, 19]. D-dimer levels are related to a poor outcome defined as an increased risk of acute respiratory distress syndrome (ARDS), Intensive Care Unit (ICU) admission, and mortality [20, 21].Ferritin increased in COVID19 as compared to the control group. Ferritin is a positive acute-phase protein, which is easily measured and may be a marker of adverse outcomes in individuals infected with SARS-CoV-2 [22, 23].Kidney injury is a relatively frequent complication in patients with COVID-19, especially in those with severe illness. Elevations of both serum creatinine showed significant elevation in COVID19 patients as compared to the control group, also uric acid, urea, and BUN showed a significant increase in patients with COVID19 when compared to non COVID19 person as shown in (table1), this results accepted with a previous study [24].
Liver biomarkers test results showed that the total bilirubin (T. Bil), direct bilirubin (D. Bil), and alanine transaminase (ALT) in COVID-19 patients were increased as compared to the control group. While Indirect bilirubin (I. Bil) and aspartate transaminase (AST) in COVID19 were basically within the reference range. Serum albumin levels, alkaline phosphatase (ALP), AST/ALT ratio, and total proteins in COVID19 patients were significantly lower than those in the control group as showed in (table1). Elevated values of aspartate aminotransferase (AST), alanine aminotransferase (ALT) and bilirubin, and lowalbumin concentrations have all been associated with poor outcome [25-27] Besides, some drugs used in the treatment of COVID-19 are associated with the development of elevated liver biomarkers [28-30].
In table1.The results showed a significant decrease in sodium and chloride concentration in COVID19 and non-significant differences in calcium, phosphorous, potassium, and magnesium as compared to the control group, these results are similar to the previous study [31, 32].

Table1: results of the patients with non-COVID and COVID-19 pneumonia

enrolled in the study.

Parameters	**Non COVID19 pneumonia**	**COVID 19 pneumonia**	**P-value**	**Reference value**
IgG	0.224±0.059	22.581±5.629	0.001	<1 negative >1 positive
IgM	0.076±0.024	0.895±0.602	0.235	<1 negative >1 positive
LDH (U/L)	245.5±33.34	500.3±89.50	0.013	135-225
D-dimer (mcg/ml)	0.329±0.117	2.302±0.679	0.048	< 0.5
Ferritin (ng/ml)	140.6±12.50	1175±184.9	0.0001	30-400

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CRP (mg/dL)	0.448±0.163	8.066±1.534	0.004	Up to 0.5
Uric acid (mg/dL)	2.880±0.627	4.490±0.169	0.002	2.4-5.7
Creatinine (mg/dL)	0.676±0.018	1.314±0.343	0.044	0.7-1.2
Urea (mg/dL)	27.52±1.532	55.75±5.138	0.0001	16.6-48.5
BUN (mg/dL)	16.17±2.399	39.35±8.154	0.048	6-20
ALP (U/L)	217.4±8.825	97.83±12.51	0.0001	40-129
Albumin (g/dL)	4.977±0.078	3.158±0.133	0.0001	3.9-4.94
ALT (U/L)	21.88±1.356	41.58±4.756	0.0001	Up to 40
AST (U/L)	34.17±1.379	33.53±2.986	0.837	Up to 40
AST/ALT ratio	1.080±0.079	0.689±0.062	0.002	1-2
Total bilirubin (mg/dL)	0.556±0.027	0.830±0.173	0.023	<1.4
Direct bilirubin (mg/dL)	0.137±0.011	0.490±0.162	0.001	Up to 0.5
Indirect Bilirubin (mg/dL)	0.337±0.059	0.340±0.049	0.975	Up to 1
Total protein (g/dL)	7.396±0.061	6.225±0.183	0.0001	6.6-8.7

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Calcium (mg/dL)	8.920±0.232	8.407±0.202	0.134	8.6-10.2
Phosphorous (mg/dL)	3.333±0.320	3.153±0.388	0.727	2.5-4.5
Sodium (mmol/L)	144.4±0.588	139.7±1.319	0.002	136-145
Potassium (mmol/L)	4.242±0.073	4.290±0.241	0.859	3.5-5.1
Chloride	106.4±0.385	98.82±1.083	0.0001	98-107
(mmol/L)				
Magnesium (mg/dL)	2.063±0.059	2.057±0.078	0.957	1.6-2.6
Results are express as mean ± SEM				
Abbreviations: LDH, dictate dehydrogenase; CRP, c-reactive protein; BUN, blood ureanitrogen, ALP, alkaline phosphatase; ALT, alanine aminotransferase; AST, aspartate aminotransferase.				

Conclusions

LDH, D-dimer, ferritin, CRP, uric acid, creatinine, urea, ALT, total bilirubin, and direct bilirubin and a non-significant variation in AST, indirect bilirubin, calcium, phosphorous, potassium, and magnesium, while serum alkaline phosphatase, albumin, total protein, sodium, and chloride pointed a significant reduction in COVID19 as compared to control group.

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