

Correlation of some biomarker with severity of infection in COVID19 patients

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Abstract

104 patients. The participants were made up of 30 controls, patients with COVID-19 are, 37 severe patients, and 37 moderate patients (47 males and 57 females) with age range from (30 to 85) years, who were attending in Healing Specialist Center for Crisis in Medical City and Hospital Ibn AlKhatib. during the period from November 2021 to April 2022. in the study patients were divided into three groups based on the severity of their lung involvement as determined by their pulmonary computed tomography scores: severe, moderate, and control. The results showed that no significant Different between R1 and R2 with ($P = 0.58$) in sever group ,but there was found a significant difference between R1 and R2 with ($P < 0.001$)in moderate group, while high significant different comparison of sever group and moderate group with control group ($P < 0.001$) sever group was the higher concentration in ferritin than moderate group and also than control group and moderate group was higher than control and LDH the results showed there was significant Difference between severe group R1 and R2 ($P < 0.001$)and in Moderate group R1 and R2 ($P < 0.001$) and these two group with control group ($P < 0.001$) sever group was the higher concentration in LDH than moderate group and also than control group and moderate group was higher than control , this results showed high elevated significant different in sever group between reading one and reading two($P < 0.001$)R1 was less than R2 while in moderate group R1 was higher than R2 ($P < 0.001$) Regarding pro BNP : showed no significance different between R1 and R2 in sever group ($P = 0.2$) , as well as in moderate group no significant different between R1 and R2 ($P = 0.34$) , but there was a high significant difference between studied groups, moderate group and sever group with ($P = 0.004$), additionally the both group comparison with control group showed highly significant difference at ($P < 0.001$) .The result showed highly significant difference between R1 and R2 with ($P < 0.001$), in sever group as well as highly significant difference between R1 and R2 ($P < 0.001$) in moderate group while no significant difference between R2 in sever group and R1 in moderate group at ($P = 0.11$) and there was high significant difference in comparison of these two groups with control group $M \pm SD$ 0.01 ± 0.004 with ($P < 0.001$) the higher level was in sever group. Regarding D. dimer: The results showed no significant different between R1 and R2 with ($P = 0.67$) in sever group, as well as no

significant different between R1 and R2 ($P=0.47$) in moderate this results showed significant elevated level between Moderate group and sever group at ($P<0.001$), and this group showed high significant different comparison with control group at ($P<0.001$). LDH, D. Dimer, troponin I, Ferritin, Pro BNP . In conclusion there was significant difference in the levels of biomarkers between patients and control, so covid 19 shows effect on normal range in each of (LDH, ferritin, D. dimer, Troponin I, pro BNP), and also in reading 1 and reading 2 in sever and moderate regarding (CRP, LDH, Troponin I, pro BNP) while there was significant difference between reading 1 and reading 2 in moderate group only regarding S. ferritin.

Keywords: COVID-19, Severity of COVID-19, LDH, D. Dimer, troponin I, Ferritin, Pro BNP.

ارتباط بعض العلامات الحيوية مع شدة الإصابة في مرضى COVID19

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الخلاصة

حيث شملت الدراسة 104 مساهماً قسمت الى ثلاث فئات مرضية (37 من فئة الإصابة الشديدة و 37 من فئة الإصابة المتوسطة و 30 مساهماً من فئة الاصحاء) (47 ذكر و 57 انثى) تتراوح أعمارهم بين (30-85) عاملاً والذين حضروا الى المركز الشفاء التخصصي للالزيمات و في مستشفى ابن الخطيب التابعه الى محافظة بغداد خلال الفترة من نوفمبر 2021 الى ابريل 2022 في هذه الدراسة تم الاعتماد على الاعراض وشبه إصابة الرئة في الفايروس الذي يكشف المفراس الحزوني في الاشعة في تقسم المجاميع المرضية. مستويات الفيريتين في الدم: أظهرت النتائج عدم وجود اختلاف معنوي بين R1 و R2 مع ($P=0.58$) في المجموعة الحادة ولكن وجد فروق معنوية بين R1 و R2 مع ($P<0.001$) في المجموعة المتوسطة بينما كانت مرتفعة جدا في مجموعة الحادة وفرق معنوي بين المجموعة الحادة والمجموعة المتوسطة مقارنة مع المجموعة الاصحاء ($P<0.001$) كانت المجموعة الحادة هي التركيز الأعلى في الفيريتين عن المجموعة المتوسطة وأيضاً من المجموعة الاصحاء والمجموعة المتوسطة كانت أعلى من المجموعة الاصحاء وأظهرت النتائج وجود فروق معنوية. بين المجموعة الشديدة R1 و ($P<0.001$) وفي المجموعة المعتدلة R1 و ($P<0.001$) وهاتان المجموعتان مع المجموعة الضابطة ($P<0.001$) كانت المجموعة الشديدة هي التركيز الأعلى في LDH من المجموعة المعتدلة و أيضاً من المجموعة الاصحاء والمجموعة المتوسطة كانت أعلى من المجموعة الاصحاء ، وأظهرت هذه النتائج ارتفاعاً معنوياً مختلفاً في المجموعة الحادة بين القراءة الاولى والقراءة الثانية ($P<0.001$) كان R1 أقل من R2 بينما في المجموعة المعتدلة R1 كان أعلى من R2 ($P<0.001$) فيما يتعلق بBNP: لم تظهر أي اختلاف معنوي بين R1 و R2 في مجموعة ($P=0.2$) ، وكذلك في المجموعة المتوسطة لا يوجد فرق معنوي بين R1 و R2 ($P=0.34$) ، ولكن هناك كان هناك فرق معنوي كبير بين المجموعات المدروسة والمجموعة المتوسطة والشديدة مع ($P=0.004$) ، بالإضافة إلى أن مقارنة المجموعتين مع مجموعة الاصحاء أظهرت فرقاً معنوياً عالياً عند ($P<0.001$). فيما يتعلق بالتروبونين: أظهرت النتائج فروق ذات دلالة إحصائية بين R1 و R2 مع ($P<0.001$) ، في المجموعة الحادة وكذلك فرق معنوي للغاية بين

R1 و R2 (P = <0.001) في المجموعة المتوسطة بينما لا يوجد فرق معنوي بين R2 في مجموعة الفصل و R1 في المجموعة المتوسطة عند (P = 0.11) وكان هناك فرق معنوي مرتفع مقارنة بهاتين المجموعتين مع المجموعة الاصحاء $M \pm SD 0.01 \pm$ مع (P = <0.001) وكان المستوى الأعلى في المجموعة الحادة. فيما يتعلق بـ D. dimer: أظهرت النتائج عدم وجود فرق معنوي بين R1 و R2 مع (P = 0.67) في المجموعة الحادة ، وكذلك عدم وجود فرق معنوي بين R1 و R2 (P = 0.47) في المتوسط. المجموعة والمجموعة الحادة عند (P = <0.001) ، وأظهرت هذه المجموعة اختلافًا معنويًا عاليًا مقارنة مع مجموعة الاصحاء عند (P = <0.001)

الكلمات المفتاحية : شدة كوفيد-19 مع العلامات الحيوية.

Introduction

Coronavirus one of the major infections that target the human respiratory system [1]. Epidemiological data linked these people to a seafood and wet animal wholesale market in Wuhan, Hubei Province, China [2]. After the first cases of this primarily respiratory viral infection were first noted in Wuhan, Hubei Province, China, in late December 2019 the worldwide coronavirus pandemic (COVID-19)-CoV-2 swiftly spread throughout the world in a short period of time, globally, decimating millions, forcing the World Health Organization (WHO) to proclaim it a global pandemic on March 11, 2020. COVID-healthcare systems responded once it was declared a global epidemic [3, 4]. Depending on the severity and prognosis, Three clinical phases have been identified for this infection [5,6] Stage I is characterized by mild nonspecific symptoms, such as headache, myalgia, a subfebrile fever with a dry cough, but not by laboratory or radiographic abnormalities. Stage II is marked by a cough, a high temperature, dyspnea, abnormal chest imaging, lymphopenia, and increased inflammatory marker levels. Stage III culminates in acute respiratory failure with a poor prognosis and clinical signs of a severe systemic inflammatory disease. Several inflammatory markers have values that are abnormally high at this point in the disease, furthermore a number of research have demonstrated that COVID-19 increases the risk of thrombosis in the arteries and veins in humans. [7] Once a clot has developed, the fibrinolytic system disassembles the fibrin mesh. The D-dimer is created when the plasmin enzyme is activated and is composed of two fibrin D fragments. This implies that a damaged fibrin is present in the bloodstream. D-dimer is a marker for active coagulation and fibrinolysis systems [8]. Deep vein thrombosis (DVT), pulmonary embolism (PE), and other diseases are frequently ruled out in clinical practice with the D-dimer test, which is also frequently used to confirm the diagnosis of disseminated intravascular coagulation (DIC)[9,10] Risk of developing macrophage activation syndrome [11]. According to reports, COVID-19 infection can result in coagulopathy, which is indicated by increased D-dimer and lactate dehydrogenase levels as well as little to no changes in PT and PTT. [12, 13] Therefore, a more accurate and focused COVID-

19 pneumonia disease-progression marker is needed, the enzyme lactate dehydrogenase (LDH), which is elevated during tissue breakdown, is involved in the conversion of lactate to pyruvate in the cells of the majority of bodily tissues. Consequently, a wide range of clinical problems, including hemolysis, cancer, Severe infections and sepsis, hepatic conditions, hematologic malignancies, and cancer, among many others, have elevated serum LDH levels. Here, we put up the hypothesis that a particular LDH alteration might be associated to the progression of COVID-19 pneumonia, the measured LDH levels, and their relationship to the severity and status of the disease. Numerous studies suggest serum LDH as a potential indicator of COVID-19 pneumonia therapy efficacy [14].

Ferritin, a 24 H- and L-subunit spherical nanocage protein expressed in a wide variety of kinds of tissues and cells, is also found in bodily fluids, serum and blood plasma in particular. Unlike ferritin from the heart, kidney, and brain, which mostly contains H-subunits, While the L-subunit is primarily found in ferritin expressed in the liver and spleen. Since L-subunits make up the majority of serum ferritin, it is likely hepatic in origin. The storage of iron ions through interaction with Fe(II), oxidation to Fe(III), and deposition in the cavity in a crystalline state is the aspect of cellular ferritin that has received the greatest attention from researchers [15].

Therefore, in order to assess whether iron reserves are low or high, serum ferritin is used as a clinical diagnostic. Ferritin, however, is an acute phase protein that is increased and more abundant during viral and non-infectious inflammation [16]. Because of this, determining someone's iron status based on their ferritin content is greatly influenced and difficult in inflammatory conditions [17]. Theoretical explanations for the cardiac harm caused by COVID-19 are consistent with earlier findings regarding the SARS and Middle East respiratory illness outbreaks. Increases in troponin, a measure of illness severity and a predictor of future cardiovascular events, are frequently linked to acute respiratory infections as well as sepsis.[18,19] Numerous studies have described the inflammatory biomarker characteristics of people with SARS- CoV-2 infection that has been proven in the lab. Among the published biomarkers for assessing the severity and prognosis of patients' illnesses, serum ferritin and troponin appear to be relevant [16]. Brain natriuretic peptide (BNP) is a member of the vasoactive hormone family, which directly interacts with the kidney and the systemic vasculature to control blood pressure and volume. Three different natriuretic peptides have been discovered: Heartbeat is regulated by There are three different natriuretic peptides: the A-type (atrial) peptide (ANP), the B-type (brain) peptide (BNP), and the C-type natriuretic peptide (CNP). The main function of natriuretic peptides, which all have a 17-amino acid ring structure, is to shield the circulatory system from the negative effects of volume overload. They trigger natriuresis, diuresis,

and vasodilatation. ANP and BNP are predominantly secreted from the heart and circulate as hormones, acting in a variety of tissues. In reaction to ventricular stretching and wall stress [20] .

Methods

Study Design

This study is Case controls study conducted during the period from November 2021 to April 2022. including 104 people who have been diagnosed with lung involvement into (37 severe, 37 moderate and 30 control) who were attending Healing Specialist Center for Crisis in Medical City and Hospital Ibn al Khatib (pulmonary computed tomography used to make the diagnosis of lung involvement), Clinical symptoms and RT PCR test were recorded. The patients were diagnosed as COVID-19 positive case .The information included gender, age, and presence and absence of chronic diseases, smoker or not. The following laboratory tests were also included: Lactate dehydrogenase (LDH), S. ferritin, D- Dimer, troponin I and pro BNP.

Patients

The research included 104 individuals with coronaviruses (Covid-19), aged 30 to 85, who were split into three groups (severe, moderate, and control) based on sign and symptoms and the degree Patients with COVID 19 have a greater risk of developing lung involvement, as seen by pulmonary computed tomography were identified that classified as severe, 37 patients as moderate, and 30 patients as control. Frequent fever, a dry cough that turns into an aggressive cough, occasional wheezing, no obvious evidence of Acute hypoxia or breathlessness, and maybe rhonchi on lung auscultation were the patient's presenting symptoms of pneumonia [21]. The five lung lobes were visually assessed. rated on a scale of 1 to 5, with a score of 1 representing involvement below 5%, a score of 2 representing involvement between 5% and 25%, a score of 3 representing involvement between 25% and 50%, a score of 3 representing involvement between 50% and 75%, and a score of 5 representing involvement over 75%. The sum of the individual lobar values was used to determine the overall lung involvement. Based on the research model developed by Chung, the score ranges from 8 mild, 9 to 15 moderate, and >15 severe [22] the total lung score out of was categorized as mild, moderate, and severe.

Blood Sample Processing

104 patients had their blood drawn using venipuncture, 7-10 millimeters of venous were drawn using a disposable syringe and placed in a tube using a sterilizing process then, allowed to clot; following that, let the serum to coagulate for 10 to 20 minutes at room temperature in a gel tube. Centrifuge for 20 minutes at 2000–3000 RPM. the serum was collected and some biomarker was

tested at the time of collection and then stored at -20°C for use in an pro BNP. When sampling, safety and health precautions were used (sporting a face shield, gloves, goggles, and a mask) Lactate dehydrogenase (LDH) France kit by use Pro S SELECTRA INDIA S. ferritin, France kit by use Pro S SELECTRA INDIA D- Dimer, troponin I -China kit by use AIA-900 TOSOH (automated immunoassay Analyzers-Japan Pro BNP (ELISA kit) -China kit by use Elisa system Human / Germany.

Results and discussion

Correlation of LDH, Ferritin with studies groups

Distribution of the parameters LDH, and serum ferritin in relation to the degrees of disease (normal, moderate, and severe) The outcome demonstrated a strong correlation between the examined parameter and the severity of the disease, Regarding LDH the results showed there was significant Difference between severe group $R1M \pm SD 473.4 \pm 31.66$, and $R2M \pm SD 518.23 \pm 244.01$ with ($P < 0.001$) and in Moderate group $R1 M \pm SD 339.46 \pm 101.48$, and $R2 285.35 \pm 135.36$ with ($P < 0.001$) and these two group with control group $M \pm SD 221.6 \pm 71.15$ with ($P < 0.001$) sever group was the higher concentration in LDH, than moderate group and then control group and moderate group was higher than control, this results showed high elevated significant Different in sever group between reading one and reading two ($P < 0.001$) $R1$ was less than $R2$ while in moderate group $R1$ was higher than $R2$ ($P < 0.001$) as in the table (1).

Tables (1): Correlation of LDH with studies groups.

LDH		P. value (sig ≤ 0.05)			
Group	M \pm SD	Sever R2	Moderate R1	Moderate R2	Control
Sever R1	518.4 \pm 31.66	<0.001	<0.001	<0.001	<0.001
Sever R2	587.23 \pm 244.01		<0.001	<0.001	<0.001
Moderate R1	339.46 \pm 101.48			0.1	0.001
Moderate R2	285.35 \pm 135.36				0.06
Control	221.6 \pm 71.15				

This result agrees with [23] whom approved that LDH may be used to be an effective predictor of early diagnosis of lung injury in severe COVID-19 patients. another study by [24] demonstrate that

LDH and CRP should be regarded as a helpful test for the early detection of individuals who need more intensive respiratory monitoring and supportive medications that are more aggressive, the current results are similar that found by [25] lactate dehydrogenase (LDH) are readily available biomarkers that represent the role of the host immune response in the seriousness of SARS-CoV-2 infection and correlate with the severity of COVID-19, the necessity for hospitalization, and mortality. another study show indicated the severe COVID-19 group had substantially raised percentages and high LDH levels, according to the findings on systemic organ indices; In addition, patients in the severe group showed greater levels of than those in the moderate group, indicating that these variables may be risk factors connected to the severity of COVID-19 in the general population. These findings are in line with those of earlier research that found anomalies in many metrics across all COVID-19 severity groups. in terms of in each of (CRP, LDH and ferritin)[26] .

The results of Ferritin showed that no significant difference between R1 M±SD 620.53±286.64 and R2 M±SD 593.85±269.72 with (P =0.58) in sever group ,but there was found a significant difference between R1 M±SD 356.76±91.33 and R2 M±SD 419.54±194.68 with (P=<0.001)in moderate group, while high significant Different comparison of sever group and moderate group with control group M±SD 147.78±43.91 with (P=<0.001) sever group was the higher concentration in ferritin than moderate group and then control group and moderate group was higher than control. As in table (2)

Tables (2): Correlation of Ferritin with studies groups.

Ferritin		P value (sig≤0.05)			
Group	M±SD	Sever R1	Moderate R1	Moderate R2	Control
SeverR1	620.53±286.64	0.58	< 0.001	< 0.001	<0.001
Sever R2	593.85±269.72		< 0.001	< 0.001	<0.001
Moderate R1	356.76±91.33			0.19	<0.001
Moderate R2	419.54±194.68				<0.001
Control	147.78±43.91				

This study agrees with [27] whom showed that Compared to individuals in the mild to moderate category, patients in the severe to critical category had considerably higher serum ferritin levels, another study by [28] showed that As a result, high serum ferritin levels have been linked to COVID-19 with more severe disease and poorer outcomes, making serum ferritin levels an essential predictive biomarker for COVID-19 therapy. special with severe cases, another study [29] showed that this review points to increased levels of , ferritin as markers for severe and intermediate COVID-19

patients. Because ferritin is an important biomarker, an increase in ferritin levels may be a symptom of systemic inflammation.

Correlation of pro BNP with studies groups

The Current study showed no significance different between R1 $M \pm SD$ 408.54 ± 83.34 , and R2 384.65 ± 89.17 respectively in sever group with ($P = 0.2$), as well as in moderate group no significant different between R1 $M \pm SD$ 372.6 ± 72.48 , R2 354.83 ± 86.2 with ($P=0.34$), but there was significant difference or high disparity between studied groups moderate group and sever group with ($P= 0.004$) respectively, additionally the both group comparison with control group showed highly significant Difference at ($P=<0.001$), as show in the table (3).

Table (3): Correlation of BNP with studies groups.

BNP		P value (sig ≤ 0.05)			
Group	M \pm SD	Sever R2	Moderate R1	Moderate R2	Control
Sever R1	408.54 ± 83.34	0.2	0.52	0.05	<0.001
Sever R2	384.65 ± 89.17		0.11	0.004	<0.001
Moderate R1	372.6 ± 72.48			0.34	<0.001
Moderate R2	354.83 ± 86.2				<0.001
Control	256.68 ± 59.37				

The current results agree with (30) who showed Participants' aseline features were divided into two groups according to low and high pro BNP levels. Compared to the participants in the pro BNP low group, the patients in the pro BNP high group were noticeably older and had more comorbid conditions. revealed no correlation between two groups with varying amounts of pro-BNP. Another study [31] who showed Patients with severe COVID-19 demonstrated lower BNP levels than those with acute. No patients had COVID-19, and there were notable differences in BNP levels between mild and severe instances. another study [32] whom showed. The importance of natriuretic peptides for prognostication in these patients is highlighted by monitoring, which reveals that pro BNP levels increased dramatically during hospitalization in non-survivors but remained static in patients who survived. another study by [33] whom showed. The 30-day mortality rate in non-critically ill COVID-19 patients and the independent predictive value of inflammation and cardiac biomarkers for moderate, acute COVID-19 patients were compared. Acute was found to have a mortality rate of 35.1% among patients infected with variations of concern. were connected with severe COVID-19 patients.

Correlation of D. dimer with studies groups

The results showed no significant Difference between R1 $M \pm SD$ 6.07 ± 1.7 , and R2 5.93 ± 2.36 with ($P = 0.67$) in sever group, as well as no significant different between R1 $M \pm SD$ 1.67 ± 0.57 , R2 1.9 ± 0.7 with ($P = 0.47$) in moderate this results showed significant elevated level between Moderate group and sever group at ($P < 0.001$), and this group showed high significant Different comparison with control group at ($P < 0.001$) As shown in Table (4).

Table (4): Correlation of D-dimer with studies groups.

D Dimer		P value (sig \leq 0.05)			
Group	M \pm SD	Sever R2	Moderate R1	Moderate R2	Control
Sever R1	6.07 ± 1.7	0.67	<0.001	<0.001	<0.001
Sever R2	5.93 ± 2.36		<0.001	<0.001	<0.001
Moderate R1	1.67 ± 0.57			0.47	0.01
Moderate R2	1.9 ± 0.7				0.002
Control	0.81 ± 0.33				

This study agree with [34] whom show D-dimer values are usually higher in COVID-19 patients. When patients with COVID-19 are admitted, D-dimer levels are a reliable predictor of in-hospital mortality and correlate with the severity of the disease. Addition this finding with [35] that show COVID-19 pneumonia's level of severity with severe instances is highly connected with elevated D-dimer levels assessed at admission, and this correlation may be used to predict mortality in hospitalized patients. Another study by (36) showed that Fever, coughing, and weariness were typical clinical signs. Severe cases were more likely to have dyspnea, lymphopenia, and greater D-dimer values compared to mild instances. additional study bt [37] whom showed that D-dimer and CRP levels were significantly higher in severe patients than in mild cases. another study by [38] suggest that D-dimer levels in COVID-19 patients correlate with outcome, but more research is required to determine their utility in predicting prognosis. D-dimer levels are believed to rise in COVID-19 individuals as their clinical or radiological symptoms deteriorate. Additional study by [35] showed Significantly connected with the severity of COVID-19 pneumonia with severe cases include elevated D-dimer levels assessed at entry, which may be used to predict death in hospitalized

patients. substantially linked with the severity of COVID-19 pneumonia in patients who have severe cases and may be used to predict patient mortality.

Correlation of Troponin I with studies group

The result showed highly level significant difference between R1 $M \pm SD$ 0.45 ± 0.23 and R2 0.15 ± 0.12 with ($P = < 0.001$), in sever group as well as highly significant difference between $M \pm SD$ R1 0.1 ± 0.05 , and R2 0.56 ± 0.19 at ($P = < 0.001$) in moderate group while no significant difference between R2 in sever group and R1 in moderate group at ($P = 0.11$) and showed high significant Difference in comparison of these two groups with control group $M \pm SD$ 0.01 ± 0.004 with ($P = < 0.001$) the higher level was in sever group. As shown in Table (5).

Table (5): Correlation of Troponin I with studies groups.

Troponin I		P value (sig \leq 0.05)			
Group	M \pm SD	SeverR2	Moderate R1	Moderate R2	Control
Sever R1	0.45 ± 0.23	< 0.001	< 0.001	0.002	< 0.001
Sever R2	0.15 ± 0.12		0.11	< 0.001	< 0.001
Moderate R1	0.1 ± 0.05			< 0.001	0.02
Moderate R2	0.56 ± 0.19				< 0.001
Control	0.01 ± 0.004				

This study agree with [39] Their findings are consistent with a prior COVID-19 analysis of cardiac troponin I, which discovered that individuals with COVID-19 severe disease had considerably higher cardiac troponin I levels than those with lesser infection, another study by [40] show that It appears from our results that sufferers of a severe SARS-CoV-2 infection have significantly higher troponin I values than patients with milder forms of the disease. Recent literature suggests that troponin I concentration is only slightly elevated in all patients with SARS-CoV-2 infection. further study by [41] showed Increase in troponin I, are signs that a COVID infection may cause heart damage, and its cardiac injury biomarkers increase above normal at the halfway point of hospitalization and peak just before death, which seems to be more common in severe cases. additional study by [42] approved that Increased troponin I in individuals with COVID-19 may suggest the severity of the clinical picture in patients already suffering from heart disease or may be useful together with the electrocardiographic, echocardiographic picture to suggest a diagnosis of acute myocarditis, Taking into account the rise in troponin I may be related to pathological conditions not only confined to the heart, such as pulmonary embolism, renal failure or a general involvement of endothelial cells, another study similar to current result by , [43] that showed Increase of concentration level of

troponin are signs of potential heart damage during COVID infection, and its cardiac injury biomarkers increase above normal at the halfway point of hospitalization and peak just before death, which seems to be more common in severe cases. Furthermore, elevated troponin levels were observed in patients hospitalized with COVID-19. Person positive Correlation showed highly significant difference in comparison with age at ($P < 0.001$) and BNP at ($P < 0.001$), Person Correlation showed high significant also with CRP and Ferritin at ($P < 0.001$) while with D-dimer the Correlation was less significant $p (0.02)$, the higher the greater the infection's severity, the levels of each BNP, CRP, IL6 and ferritin, A statistically significant difference link between the degree of elevation in cardiac and inflammatory biochemical markers, including elevated C-reactive protein, serum ferritin, type-B natriuretic peptide, interleukin-6 level, and D-dimers, in the majority of patients, As shown in Table 5.

Table (6): Correlation between Troponin I and another biomarker.

Factors		Person Correlation	Sig (2-tailed)
Troponin	Age	0.263	<0.001
Troponin	BNP	0.328	<0.001
Troponin	Ferritin	0.290	<0.001
Troponin	CRP	0.309	<0.001
Troponin	D-DIMER	0.172	0.02

Conclusion

This study, has concluded the following:

- 1 -The most biochemical marker for differentiating severe infection from moderate was Ferritin-LDH-Troponin I
- 2- The most hematological biomarkers were –D-dimer- H that highly in cases among severe COVID 19 severe cases (This biomarker increased in severe cases)
- 3- This study found that there was significant difference (LDH- D. Dimer – Troponin) at the beginning of infection and after a period of infection (after taking treatment) so these biomarkers were a good indication for disease prognosis.

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