The Egyptian Journal of Hospital Medicine (October 2024) Vol. 97, Page 3986-3994

# Cardiac and Arrhythmic Complications in Patients with COVID-19 at Shibin-Elkom Chest Hospital

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## ABSTRACT

**Background:** Numerous pro-inflammatory mediators linked to SARS-CoV-2 infection are crucial in the pathogenesis of cardiac and arrhythmic consequences. Hospitalized COVID-19 patients were found to have cardiac damage, which was linked to an increased risk of in-hospital death. Consequently, it's possible that these people are significantly more susceptible to cardiac arrhythmias.

**Objectives:** The aim of the work was to identify cardiac and arrhythmic complications in patients with COVID-19 at Shebin Elkom Chest Hospital.

**Methods:** A set of 143 patients with COVID-19 who were admitted to Shebin Elkom Chest Hospital, 6 declined consent and 17 did not meet the inclusion criteria, 120 patients were willing to participate in the study and consented for participation, during the period time from March 2021 to March 2022. Thus, 120 patients with COVID-19 were analysed, 8 patients of them had mild grade, 54 had moderate grade and 58 patients had severe grade.

**Results:** Creatine kinase myocardial band was significantly increased among severe patients than mild and moderate patients. Also, positive troponin was the most common among the studied groups, with a significant difference. Moreover, referred to ICU was most common in severe patients (31.03%) compared moderate patients (5.56%) with significant difference among the studied groups.

**Conclusions**: Acute lung injury is a major complication of COVID-19 and causes severe morbidity and mortality. Nonetheless, growing clinical and epidemiological data indicates that COVID-19 infection is linked to cardiac damage and arrhythmic complications.

**Keywords:** Arrhythmic Complications, Cardiac Complications, Chest, COVID-19.

## INTRODUCTION

Since December 2019, a worldwide respiratory disease epidemic known as coronavirus disease 2019 (COVID-19) has been caused by the new coronavirus, known as severe acute respiratory syndrome related coronavirus (SARS-CoV-2) and is still rapidly expanding in over 100 countries [1].

Fever, exhaustion, and dry cough are typical symptoms, and they are invariably followed by anorexia, myalgia, dyspnea, and other symptoms [2]. Prolonged prothrombin time and lymphopenia are also the most prevalent traits. Major cardiac problems have been observed in a significant proportion of COVID-19 patients, despite the fact that the majority of the disease's clinical presentations are respiratory [3].

Numerous pro-inflammatory mediators linked to SARS-CoV-2 infection may be crucial in the pathogenesis of cardiac and arrhythmic problems [4]. One single site research found that 19% of hospitalized COVID-19 patients had cardiac damage, which was linked to an increased risk of in-hospital death [5]. Consequently, it's possible that these people are significantly more susceptible to cardiac arrhythmias [6]. The aim of the work was to identify cardiac and arrhythmic complications in patients with COVID-19 at Shebin-Elkom Chest Hospital.

## PATIENTS AND METHODS

A set of 143 patients with COVID-19 who were admitted to Shebin Elkom Chest Hospital, 6 rejected consent and 17 did not match the inclusion criteria. 120 patients were prepared to participate and consented in the study, during the period time from March 2021 to March 2022. Thus, 120 patients with COVID-19 were analyzed, 8 patients of them had mild grade, 54 had moderate grade and 58 patients had severe grade.

All patients with COVID-19 were diagnosed and categorized as mild, moderate, or severe according to the Ministry of Health and Population protocol (Version 1.8/ July 2022).

***Simplified case definition:*** Mild: no pneumonia- no hypoxia. Moderate: pneumonia without hypoxia. Severe: Pneumonia with hypoxia unresponsive to oxygen treatment and/or organ damage.

***Inclusion criteria****:* Patients diagnosed COVID-19 by clinical, lab and radiological investigations.

***Exclusion criteria****:* Pregnant female. Patients had cardiac diseases and hypertension.

***All selected cases undergo the following*:**

**Detailed history:** Complete current and past medical history, along with their demographic data. Personal data: age and gender.

**Clinical examination:** General: Patients with mild disease may appear healthy. Anxiety. Cyanosis. Vital Signs: Pulse, temperature: Fever (>100.4°F),



Received: 06/06/2024
Accepted: 07/08/2024

Respiratory rate: Tachypnea (> 30 breaths/min). Oxygen saturation: $SpO_2$ < 93-94%. Blood pressure. HEENT: Head exam: Patients with fluid retention. Eye exam, Nasal exam and Throat exam. Local examination: Lungs. Heart: Pulse pressure, palpation and cardiac auscultation. Abdomen: Inspection, palpation, percussion, and auscultation.

**Routine laboratory investigations** as complete blood count, (CBC) by The Sysmex XN-450/XN-430). Electrolytes (Na and K) by CX9 Beckman coulter auto analysis. Liver function tests included (alanine transaminase (ALT) and aspartate transaminase (AST)) by CX9 Beckman coulter auto analyses. Inflammatory markers included C-reactive protein (CRP) tested by slide latex agglutination test [Rapitex CRP kit, USA]. Kidney functions included blood urea and serum creatinine using the open system autoanalyzer synchron CX5 (Beckman, USA). Random blood sugar using Sysmex KX-21 automatized hematology analyzer (Sysmex corporation, Japan). Serum ferritin using ELISA Kit "EIA-01-Ferritin". D-dimer test (Fragment D-dimer test or fibrin degradation fragment test): By turbidimetric analyzer. Admission chest X-Ray: in all patients with suspected pneumonia. Arterial blood gases. Polymerase chain reaction (PCR). Serology including reverse. Cardiac enzymes: measured by the AIA-360 (TosohCorporation), which is an automated immunoassay analyzer. ECG. Radiological investigation included CT. Chest. ECHO: measured by Toshiba Nemio XG (SSA580A).

***Ethical consideration:***

**All participants volunteered. After describing the purpose of the study, all adult patients or their family, if the patient was unable to do so, were asked for written or informed permission. The Shebin Elkom Chest Hospital of Medicine's Ethical Scientific Committee approved the study procedure. Throughout its implementation, the study complied with the Helsinki Declaration.**

***Statistical Analysis:***

The statistical program SPSS Version 21.0 was used to examine the calculations. Parametric quantitative data were presented as mean±standard deviation (SD) and range and were compared using one way ANOVA (F) test. Non-parametric quantitative data were expressed as median and range and were compared using Kruskal-Wallis test (K). Categorical data were expressed as frequency and percentage (%) and were compared using the Chi-square test. Pearson correlation coefficient was employed to demonstrate how two continuous, normally distributed variables were correlated. A P value <0.05 was considered to be at a significant level.

**RESULTS**

One hundred twenty patients with COVID-19 were analyzed, 8 patients of them had mild grade, 54 had moderate grade and 58 patients had severe grade. There were not significantly differences among the studied groups regarding age and gender.

TLC, CRP, prolactin, IL6, D-dimer, serum ferritin levels, and creatine kinase myocardial band were significantly increased with severe patients than mild and moderate patients. Also, positive troponin was the most common among the studied groups, with a significant difference. While there were no significantly differences among the studied groups regarding lymphocytes, PLT, urea, creatinine, AST, ALT, Na and K (Table 1).

**Table (1):** Lab investigation among mild, moderate, and severe studied groups.

| Variable | COVID-19 patients | | | F | P-value |
|---|---|---|---|---|---|
| | Mild(N=8) | Moderate(N=54) | Severe(N=58) | | |
| **TLC** | | | | | |
| Median | 13.84±4.06 | 10.13±5.11 | 16.26±9.12 | 9.874 | **<0.001*** |
| Range | (7.92-19.10) | (3.10-22.90) | (3.58-70.00) | | |
| **LYM (x$10^9$/L)** | | | | | |
| Median | 7.63±8.98 | 6.29±4.95 | 9.38±6.63 | 1.031 | 0.360 |
| Range | (0.82-16.20) | (0.01-45.30) | (0.51-20.70) | | |
| **PLT (mcL)** | | | | | |
| Median | 205.00±82.89 | 212.61±93.39 | 236.10±115.37 | 0.846 | 0.432 |
| Range | (127.00-375.00) | (19.00-440.00) | (15.00-557.00) | | |
| **CRP (mg/L)** | | | | | |
| Median | 56.00±17.98 | 58.80±17.04 | 71.09±21.29 | 6.524 | **0.002*** |
| Range | (39.00-90.00) | (23.00-96.00) | (30.00-96.00) | | |
| **Prolactin** | | | | | |
| Median | 0.74±0.75 | 2.25±3.14 | 5.31±4.48 | 11.647 | **<0.001*** |
| Range | (0.05-2.00) | (0.05-20.90) | (0.73-20.90) | | |
| **IL6 (pg/mL)** | | | | | |
| Median | 77.09±105.60 | 74.00±98.86 | 225.89±206.58 | 13.286 | **<0.001*** |
| Range | (6.30-310.00) | (0.70-474.00) | (6.23-744.00) | | |
| **D-dimer (ng/mL)** | | | | 22.819 | **<0.001*** |
| Median | 0.43± 0.23 | 0.85± 0.84 | 2.71± 2.07 | | |
| Range | (0.19-0.90) | (0.02-3.30) | (0.17-9.11) | | |
| **Serum ferritin (ng/mL)** | | | | 4.259 | **0.016*** |
| Median | 279.38±250.73 | 402.98±401.55 | 870.36±1247.04 | | |
| Range | (50.00-838.00) | (33.60-2000.00) | (114.20-7000.00) | | |
| **Kidney functions** | | | | | |
| **Urea (mg/dL)** | 62.13±14.65 | 67.56±26.75 | 63.73±29.86 | 0.323 | 0.725 |
| Mean± SD | (45.00-88.00) | (23.00-154.00) | (8.20-176.00) | | |
| **Creatinine (mg/dl)** | 1.01±0.22 | 1.42±0.69 | 1.58±1.21 | 1.382 | 0.255 |
| Mean± SD | (0.60-1.20) | (0.60-3.40) | (0.70-7.30) | | |
| **Liver functions** | | | | | |
| **AST (U/L)** | 40.38±12.00 | 48.67±30.10 | 46.58±41.82 | 0.201 | 0.818 |
| Mean± SD | (26.00-60.00) | (5.50-134.00) | (1.70-288.00) | | |
| **ALT (U/L)** | 42.63±25.33 | 44.04±27.49 | 47.18±53.23 | 0.098 | 0.907 |
| Mean± SD | (19.00-96.00) | (9.10-136.00) | (1.60-380.00) | | |
| **CK-MB** | | | | **11.210** | **<0.001*** |
| Median | 16.19± 3.87 | 36.53± 55.81 | 127.26± 145.85 | | |
| Range | (10.50-22.00) | (0.50-331.00) | (12.70-865.00) | | |
| **Troponin** | **N** **%** | **N** **%** | **N** **%** | $X^2$= 58.354 | **<0.001*** |
| Positive | 0 0.00 | 16 29.63 | 54 93.10 | | |
| Negative | 8 100.00 | 38 70.37 | 4 6.90 | | |
| **Na (mmol/L)** | 137.20± 4.19 | 137.25± 5.39 | 138.16± 5.08 | 0.472 | 0.625 |
| Mean± SD | (131.00-143.00) | (123.60-149.70) | (130.00-146.00) | | |
| **K (mmol/L)** | 4.24± 0.43 | 4.02±0.70 | 4.01± 0.66 | 0.428 | 0.653 |
| Mean ±SD | (3.70-4.90) | (2.25-5.10) | (2.25-5.57) | | |

**CRP:** C-reactive protein. **IL6:** Interleukin 6. **CBC:** Complete blood count. **TLC:** Total leukocyltes count. **LYM:** Lymphocytes. **PLT:** platelet. **AST:** Aspartate aminotransferase **ALT:** Alanineaminotransferase. **F:** ANOVA F test. ***Significant. **CI:** Confidence interval for Mean. **CK-MB:** Creatine kinase myocardial band. **K:** Kruskal Wallis test. **NA:** Sodium. **K:** Potassium.

There was significant difference among the studied groups regarding CT chest as ground glass opacities, consolidation, pleural effusion, ground glass opacities + consolidation, ground glass opacities + pleural effusion and ground glass opacities + pericardial effusion. Also, the most CT chest was ground glass opacities that found in 37.50% of mild patients, and in 55.56% of moderate patients and in 94.83% of severe patients. While, there was no significant difference among the studied groups regarding pericardial effusion, lymphadenopathy, ground glass opacities + lymphadenopathy and ground glass opacities + consolidation + pleural effusion (Table 2).

**Table (2):** CT chest among mild, moderate, and severe studied groups.

| | CT chest | COVID-19 patients | | | | | | $X^2$ | P-value |
|---|---|---|---|---|---|---|---|---|---|
| | | Mild (N=8) | | Moderate (N=54) | | Severe (N=58) | | | |
| | | N | % | N | % | N | % | | |
| **Ground glass opacities** | Negative | 5 | 62.50 | 24 | 44.44 | 3 | 5.17 | 27.683 | **<0.001*** |
| | Positive | 3 | 37.50 | 30 | 55.56 | 55 | 94.83 | | |
| | Negative | 6 | 75.00 | 32 | 59.26 | 10 | 17.24 | 24.946 | **<0.001*** |
| | Positive | 2 | 25.00 | 22 | 40.74 | 48 | 82.76 | | |
| **Pleural effusion** | Negative | 8 | 100.00 | 49 | 90.74 | 43 | 74.14 | 7.264 | **0.026*** |
| | Positive | 0 | 0.00 | 5 | 9.26 | 15 | 25.86 | | |
| **Pericardial effusion** | Negative | 8 | 100.00 | 53 | 98.15 | 52 | 89.66 | 4.203 | 0.122 |
| | Positive | 0 | 0.00 | 1 | 1.85 | 6 | 10.34 | | |
| **Lymphadenopathy** | Negative | 8 | 100.00 | 51 | 94.44 | 53 | 91.38 | 1.034 | 0.596 |
| | Positive | 0 | 0.00 | 3 | 5.56 | 5 | 8.62 | | |
| **Ground glass opacities** | Negative | 8 | 100.00 | 44 | 81.48 | 28 | 48.28 | 18.161 | **<0.001*** |
| **+Consolidation** | Positive | 0 | 0.00 | 10 | 18.52 | 30 | 51.72 | | |
| **Ground glass opacities+** | Negative | 8 | 100.00 | 46 | 85.19 | 37 | 63.79 | 8.973 | **0.011*** |
| **Pleural effusion** | Positive | 0 | 0.00 | 8 | 14.81 | 20 | 34.48 | | |
| **Ground glass opacities** | Negative | 8 | 100.00 | 52 | 96.30 | 48 | 82.76 | 6.647 | **0.036*** |
| **+Pericardial effusion** | Positive | 0 | 0.00 | 2 | 3.70 | 10 | 17.24 | | |
| **Ground glass opacities** | Negative | 8 | 100.00 | 51 | 94.44 | 50 | 86.21 | 3.144 | 0.208 |
| **+ lymphadenopathy** | Positive | 0 | 0.00 | 3 | 5.56 | 8 | 13.79 | | |
| **Ground glass opacities** | Negative | | | | | | | | |
| **+ Consolidation+** | Positive | 8 | 100.00 | 53 | 98.15 | 53 | 91.38 | 3.148 | 0.207 |
| **Pleural effusion** | | 0 | 0.00 | 1 | 1.85 | 5 | 8.62 | | |

***:** Significant, **$X^2$:** Chi square.

Referring to ICU was most common in severe patients compared to moderate patients with significant difference among the studied groups. While patients who left hospital were most common in mild and moderate patients compared severe patients with significant difference among the studied groups (Table 3).

**Table (3):** Outcome among mild, moderate and severe studied groups.

| Variable | COVID-19 patients | | | | | | Total (n=120) | $X^2$ | P-value |
|---|---|---|---|---|---|---|---|---|---|
| | Mild (N=8) | | Moderate (N=54) | | Severe (N=58) | | | | |
| | N | % | N | % | N | % | | | |
| **Referred to ICU** | | | | | | | | | |
| Yes | 0 | 0.00 | 3 | 5.56 | 18 | 31.03 | 21(17.50%) | 14.392 | **<0.001*** |
| No | 8 | 100.00 | 51 | 94.44 | 40 | 68.97 | 99(82.50%) | | |
| **Leave hospital** | | | | | | | | | |
| Yes | 8 | 100.00 | 53 | 98.15 | 49 | 84.48 | 110(91.67%) | 7.615 | **0.022*** |
| No | 0 | 0.00 | 1 | 1.85 | 9 | 15.52 | 10(8.33%) | | |

Ischemic changes were the only risk factor associated with mortality in mild cardiac and arrhythmic patients with COVID-19, with a significant difference. As well as, CK-MB, troponin, ischemic changes, LTVT abnormalities, RTVT abnormalities, PAP, TLC, CRP, $PCO_2$, pulse, temperature, prolactin, IL6 and serum ferritin were the risk factors associated with mortality in moderate cardiac and arrhythmic patients with COVID-19, with a significant difference. Moreover, CK-MB, troponin, ischemic changes, LTVT abnormalities, RTVT abnormalities, PAP, temperature, prolactin and IL6 were the risk factor associated with mortality in severe cardiac and arrhythmic patients with COVID-19, with a significant difference (Table 4).

**Table (4):** Multiple regression analysis for the risk factors associated with mortality in mild, moderate, and severe groups of cardiac and arrhythmic patients with COVID-19.

| Variable | Mild | | Moderate | | Severe | |
|---|---|---|---|---|---|---|
| | OR (95% CI) | P value | OR (95% CI) | P value | OR (95% CI) | P value |
| **Intercept** | **-55.05** | **<0.001*** | -9.58 | **0.020*** | 24.20 | **0.001*** |
| **CK-MB** | 2884.3 (20.58-47.24) | 0.310 | 230167.5 (62.56-104.47) | **<0.001*** | 86728.7 (79.95-147.64) | **0.036** |
| **Troponin** | 0.6 (1.63-1.85) | 0.076 | 11.3 (1.31-1.44) | **<0.001*** | 6.09 (1.12-1.24) | **<0.001*** |
| **Rate** | 0.0 (1.81-2.12) | 0.872 | 1.0 (1.73-2.00) | 0.161 | 0.35 (1.62-1.99) | 0.432 |
| **Rhythm** | 0.1 (1.29-1.55) | 0.627 | 0.0 (1.32-1.50) | 0.946 | 0.05 (1.30-1.55) | 0.650 |
| **Ischemic changes** | 1.0 (1.30-1.54) | **0.043*** | 1.7 (1.16-1.32) | **0.002*** | 2.78 (1.11-1.28) | **<0.001*** |
| **LTVT abnormalities** | 0.0 (1.49-1.74) | 0.941 | 4.6 (1.32-1.49) | **<0.001*** | 1.23 (1.15-1.36) | **0.011*** |
| **RTVT abnormalities** | 0.4 (1.69-1.89) | 0.122 | 8.0 (1.40-1.56) | **<0.001*** | 4.23 (1.22-1.42) | **<0.001*** |
| **PAP (mmHg)** | 448.5 (26.75-32.48) | 0.065 | 12564.3 (38.79-44.46) | **<0.001*** | 6002.5 (44.21-52.39) | **<0.001*** |
| **TLC** | 95.8 (9.34-11.88) | 0.055 | 1051.7 (11.91-14.70) | **<0.001*** | 41.4 (13.82-18.11) | 0.463 |
| **LYM (x$10^9$/L)** | 12.6 (5.27-9.65) | 0.682 | 84.9 (7.07-10.01) | 0.243 | 67.0 (7.41-10.59) | 0.211 |
| **PLT (mcL)** | 403.6 (188.20-235.06) | 0.828 | 15433.2 (205.05-244.51) | 0.241 | 6801.3 (204.72-259.94) | 0.465 |
| **CRP (mg/L)** | 54.5 (54.08-62.79) | 0.668 | 4223.8 (61.54-68.79) | **0.001*** | 1600.1 (64.10-74.41) | 0.061 |
| **PH** | 0.0 (7.36-7.44) | 0.248 | 0.0 (7.39-7.43) | 0.146 | 0.0 (7.40-7.45) | 0.439 |
| **PCO2 (mmHg)** | 101.9 (36.73-46.43) | 0.599 | 1735.8 (42.24-50.07) | **0.049*** | 962.8 (43.38-53.69) | 0.144 |
| **PO2 (mmHg)** | 1262.9 (49.05-60.41) | 0.117 | 176.8 (49.74-60.59) | 0.647 | 842.7 (44.86-60.38) | 0.361 |
| **HCO3 (mmol/L)** | 1.1 (22.90-26.09) | 0.866 | 3.6 (23.42-25.84) | 0.770 | 0.0 (23.29-26.33) | 0.985 |
| **Urea (mg/dL)** | 205.5 (60.34-73.37) | 0.578 | 409.8 (60.25-70.89) | 0.478 | 18.1 (56.50-70.57) | 0.882 |
| **Creatinine (mg/dl)** | 1.1 (1.20-1.53) | 0.106 | 0.8 (1.32-1.69) | 0.375 | 2.3 (1.23-1.80) | 0.192 |
| **AST(U/L)** | 479.7 (40.34-54.86) | 0.447 | 122.7 (40.73-54.45) | 0.763 | 270.4 (36.07-55.58) | 0.680 |
| **ALT (U/L)** | 14.0 (36.94-50.78) | 0.891 | 274.9 (37.65-53.68) | 0.699 | 145.6 (34.10-59.15) | 0.813 |
| **SBP (mmHg)** | 45.0 (114.35-127.90) | 0.489 | 861.1 (119.18-130.64) | 0.340 | 113.7 (117.51-134.62) | 0.341 |
| **DBP (mmHg)** | 146.4 (73.55-81.93) | 0.466 | 204.0 (76.66-82.81) | 0.386 | 373.1 (75.92-84.38) | 0.266 |
| **Pulse** | 183.7 (77.84-88.36) | 0.515 | 1690.6 (83.34-92.24) | 0.086 | 1171.6 (83.58-96.35) | 0.192 |
| **Temp (ºC)** | 0.0 (37.11-37.34) | 0.866 | 203.3 (38.54-38.71) | **<0.001*** | 52.2 (39.49-39.70) | **<0.001*** |
| **RR (Breath/min)** | 6.6 (22.68-25.13) | 0.597 | 583.3 (25.08-27.20) | **<0.001*** | 90.9 (26.39-29.43) | 0.127 |
| **O2sat** | 4.2 (79.88-86.22) | 0.871 | 843.8 (77.36-83.25) | 0.068 | 156.6 (74.04-82.41) | 0.465 |
| **NA (mmol/L)** | 0.0 (135.91-138.58) | 0.980 | 23.3 (136.74-138.70) | 0.359 | 6.5 (152.11-202.89) | 0.611 |
| **K (mmol/L)** | 0.3 (3.88-4.22) | 0.392 | 0.0 (3.89-4.14) | 0.944 | 0.4 (136.82-139.27) | 0.343 |
| **Prolactin** | 15.9 (1.30-2.81) | 0.184 | 261.6 (3.10-4.56) | **<0.001*** | 146.7 (3.88-4.20) | **0.006*** |
| **IL6 (pg/mL)** | 66.3 (49.08-99.72) | 0.935 | 645141.0 (121.99-183.33) | **<0.001*** | 155671.7 (3.71-5.80) | **0.051*** |
| **Serum ferritin (ng/mL)** | 106447.5 (288.71-485.34) | 0.403 | 6108792.8 (469.00-821.03) | **0.010*** | 2455443.8 (159.15-256.56) | 0.189 |

**CK-MB:** Creatine kinase myocardial band. **LTVT:** Left- ventricular abnormality. **RTVT:** Right ventricular abnormality. **PAP:** Pulmonary artery pressure. ***:** Significant. **CI:** Confidence interval for mean. **CRP:** C-reactive protein. **IL6:** Interleukin 6. **CBC:** Complete blood count. **TLC:** Total leukocytes count. **LYM:** Lymphocytes. **PLT:** platelet. **AST:** Aspartate aminotransferase **ALT:** Alanineaminotransferase. **CI:** Confidence interval for Mean, **SBP:** Systolic blood pressure. **DBP:** Diastolic blood pressure. **RR:** Respiration rate. **$O_2$sat:** Oxygen saturation. **ABG:** Arterial blood gas**. PH:** Power of hydrogen. **$PCO_2$:** Partial pressure of carbon dioxide.**$PO_2$:** Partial pressure of oxygen. **$HCO_3$:** Bicarbonate. **NA:** Sodium. **K:** Potassium.

There were significant negative correlations between troponin with C-reactive protein, creatinine, respiration rate, D dimer, creatine kinase myocardial band, pulmonary artery pressure, prolactin, interleukin 6, serum ferritin and outcome leave hospital and positive correlation with partial pressure of oxygen, oxygen saturation, ischemic changes, referred to ICU, life-threatening ventricular tachyarrhythmia abnormalities, retinal vein thrombosis abnormalities, computed tomography chest, comorbidities, gastrointestinal tract symptoms, course during hospital deteriorate, outcome dead, Axis deviation, T wave inverted,wall motion, the ejection fraction, Rt sick dilated and echo (Table 5).

Also, serum ferritin had significant negative correlation with troponin, ischemic changes, left- ventricular abnormality, right-ventricular abnormality, computed tomography chest, axis deviation, wall motion, the ejection fraction, Rt sick dilated and echo and positive correlation with CRP, D dimer, CK-MB, pulmonary artery pressure, prolactin, interleukin 6, outcome leave hospital and stay athospital (Table 5).

**Table (5):** Correlation between troponin and serum ferritin with other studied parameters

| Variable | Troponin | | Serum ferritin | |
|---|---|---|---|---|
| | r | *P value* | r | *P value* |
| **Gender** | 0.107 | 0.244 | 0.025 | 0.788 |
| **Age (Years)** | -0.006 | 0.947 | 0.020 | 0.827 |
| **TLC** | -0.080 | 0.386 | 0.148 | 0.107 |
| **LYM (x10$^9$/L)** | 0.087 | 0.344 | 0.034 | 0.712 |
| **PLT (mcL)** | 0.016 | 0.859 | 0.010 | 0.912 |
| **CRP (mg/L)** | -0.273-** | **0.003*** | 0.218* | **0.017*** |
| **PH** | 0.050 | 0.591 | 0.047 | 0.607 |
| **PCO2 (mmHg)** | -0.087 | 0.346 | 0.085 | 0.356 |
| **PO2 (mmHg)** | 0.246** | **0.007*** | -0.035 | 0.702 |
| **HCO3 (mmol/L)** | -0.067 | 0.465 | 0.103 | 0.262 |
| **Urea (mg/dL)** | -0.049 | 0.593 | -0.011 | 0.904 |
| **Creatinine (mg/dL)** | -0.195-* | **0.033*** | 0.047 | 0.613 |
| **AST (U/L)** | 0.092 | 0.320 | 0.089 | 0.336 |
| **ALT (U/L)** | 0.028 | 0.759 | 0.037 | 0.691 |
| **SBP (mmHg)** | -0.001 | 0.994 | 0.113 | 0.221 |
| **DBP (mmHg)** | -0.017 | 0.855 | 0.086 | 0.352 |
| **Pulse** | -0.211-* | 0.021 | 0.092 | 0.318 |
| **Temperature (ºC)** | -0.337-** | **<0.001*** | 0.142 | 0.123 |
| **RR (Breath/min)** | -0.279-** | **0.002*** | 0.082 | 0.374 |
| **O2 sat** | 0.230* | **0.011*** | -0.040 | 0.664 |
| **NA (mmol/L)** | -0.031 | 0.738 | -0.020 | 0.825 |
| **K (mmol/L)** | 0.007 | 0.941 | -0.014 | 0.883 |
| **D dimer (ng/mL)** | -0.837-** | **<0.001*** | 0.509** | **<0.001*** |
| **CK-MB** | -0.821-** | **<0.001*** | 0.366** | **<0.001*** |
| **Troponin** | 1.000 | --- | -0.425-** | **<0.001*** |
| **Rate** | 0.159 | 0.082 | -0.092 | 0.315 |
| **Rhythm** | -0.063 | 0.495 | 0.050 | 0.587 |
| **Ischemic changes** | 0.676** | **<0.001*** | -0.320-** | **<0.001*** |
| **Referred to ICU** | 0.389** | **<0.001*** | -0.180-* | 0.049 |
| **LTVT abnormalities** | 0.211* | **0.020*** | -0.314-** | **<0.001*** |
| **RTVT abnormalities** | 0.798** | **<0.001*** | -0.507-** | **<0.001*** |
| **PAP (mmHg)** | -0.761-** | **<0.001*** | 0.507** | **<0.001*** |
| **Prolactin** | -0.593-** | **<0.001*** | 0.447** | **<0.001*** |
| **IL6 (pg/mL)** | -0.505-** | **<0.001*** | 0.397** | **<0.001*** |
| **CT chest** | 0.662** | **<0.001*** | -0.396-** | **<0.001*** |
| **Serum ferritin (ng/mL)** | -0.425-** | **<0.001*** | 1.000 | --- |
| **Fever** | 0.096 | 0.298 | -0.070 | 0.446 |
| **Respiratory symptoms** | 0.074 | 0.420 | -0.112 | 0.222 |
| **GIT symptoms** | 0.225* | **0.013*** | -0.151 | 0.099 |
| **Referred to ICU** | 0.321** | **<0.001*** | -0.173 | 0.059 |
| **Outcome leave hospital** | -0.194-* | **0.034*** | 0.187* | **0.041*** |
| **Axis deviation** | 0.306** | **0.001*** | -0.242-** | **0.008*** |
| **T wave inverted** | 0.380** | **<0.001*** | -0.167 | 0.068 |
| **T wave tall** | 0.176 | 0.054 | -0.092 | 0.317 |
| **wall motion** | 0.250** | **0.006*** | -0.203-* | **0.026*** |
| **EF** | 0.416** | **<0.001*** | -0.229-* | **0.012*** |
| **Rt sick dilated** | 0.355** | **<0.001*** | -0.195-* | **0.032*** |
| **Echo** | 0.573** | **<0.001*** | -0.437-** | **<0.001*** |

**TLC:** Total leukocytes count. **LYM:** Lymphocytes. **PLT:** platelet. **CRP:** C-reactive protein. **$PCO_2$:** Partial pressure of carbon dioxide. **$PO_2$:** Partial pressure of oxygen. **$HCO_3$:** Bicarbonate. **PCR:** Polymerase chain reaction. **AST:** Aspartate aminotransferase **ALT:** Alanine aminotransferase. **SBP:** Systolic blood pressure. **DBP:** Diastolic blood pressure. **RR:** Respiration rate. **$O_2$sat:** Oxygen saturation. **NA:** Sodium. **K:** Potassium. **CK-MB:** Creatine kinase myocardial band. **ICU**: Intensive care unit. **LTVT:** Left-ventricular abnormality**. RTVT:** Right ventricular abnormality. **PAP:** Pulmonary artery pressure. **CT:** Computed tomography. **IL6:** Interleukin 6. **GIT:** Gastrointestinal tract. **EF:** The ejection fraction. **r:** Correlation coefficient. ***:** Significant.

## DISCUSSION

This study showed that, TLC, CRP, prolactin, IL6, D-dimer and serum ferritin levels were significantly increased with severe patients than mild and moderate patients (P<0.05). While there weren't significant differences among the studied groups regarding lymphocytes, PLT count, urea, creatinine, AST and ALT (P>0.05).

In a recent research by **Qu *et al.* [7],** mild patients' liver and renal indices were compared to pre-severe values of severe patients. Severe patients had higher AST levels than mild patients (all p<0.05). Severe patients reported greater levels of ALT, AST, and D-dimer compared to moderate and post-severe patients (all p < 0.05). They showed that when severe patients progressed from pre-severe to severe, their D-dimer levels increased significantly (all p<0.05). Creatinine wasn't statistically different between the two groups.

In a study by **Kukla *et al.* [8]**, they discovered abnormalities in the patients' liver and renal indices. ALB levels were lower in severe patients than in mild patients, whereas ALT and AST levels were higher in severe patients (all p<0.001). The laboratory indicators' binary logistic regression analysis indicates that ALT and ALB could be risk factors for patients' progression from mild to severe. Increased neutrophils, reduced lymphocytes, and decreased albumin were seen in patients with COVID-19 liver damage. The knowledge that SARS-CoV-2 can harm hepatocytes by attaching to their ACE2 receptors and causing changes in liver enzymes may help to explain this outcome [9]. It is still unclear what the pathophysiology of kidney damage caused by COVID-19 is. Kidney damage during SARS may be caused by a number of processes; CoV-2 infection, which includes direct SARS-CoV-2 invasion of the renal parenchyma, an unbalanced RAAS, and microthrombosis, as well as kidney damage brought on by hemodynamic instability, inflammatory cytokines, and the side effects of ICU treatments (mechanical ventilation, nephrotoxic medications) [7].

In particular, CRP rose, and hematuria was often seen in patients with renal damage. These findings may be explained by a liver infection with SARS-COV-2 that leads in aberrant APTT58 and high CRP, as well as renal function impairment that results in hematuria. D-dimer is sensitive to the elevated risk of thromboembolism and can be used as a marker to identify thromboembolic processes. Patients with severe illness had considerably higher D-dimer levels. They are thought to be connected to severe infection and liver-kidney damage. The patient's condition worsens as a result of these mechanisms aggravating one another [10].

The present study showed that, creatine kinase myocardial band was significantly increased among severe patients than mild and moderate patients (P<0.001). Also, positive troponin was most prevalent among the groups under study, and there was a notable difference (P<0.001). Serum cardiac indicators of myocardial damage include CK-MB and high-sensitivity troponin I (hs-TNI), which are released into the bloodstream when myocardial necrosis occurs [11]. The relationship between hs-TNI and mortality in COVID-19 patients has been examined in study [12].

Similarly, a recent study conducted in Wuhan City by **Shi *et al.* [13]** discovered that severe COVID-19 cases were independently linked to higher levels of CK-MB, hs-TNI, and older age. In a prior study of 138 COVID-19 patients, **Bai *et al.* [14]** reported that 7.2% of patients had cardiac injury. **Yang *et al.* [15]** confirmed this finding in 187 COVID-19 patients, showing that 27.8% of patients had myocardial injury as indicated by elevated cardiac troponin T levels. Furthermore, CK-MB rose in 10.8% of patients with SARS, according to a 2003 research on respiratory illnesses by **Hsu *et al.* [16]**.

These findings showed that aberrant cardiac enzymes and myocardial damage were more important factors in COVID-19 patients' deaths. Additionally, **Zhang *et al.* [17]** discovered that 18 of the 157 COVID-19 patients had myocardial damage, and 83 of them had aberrant cardiac enzymes. Both the death rate and the percentage of severe cases were greater in the group with abnormal cardiac enzymes than in the normal group. those with cardiac damage had a more severe new coronavirus pneumonia type (72.2% vs. 31%) than those without myocardial injury. Additionally, a prior research found that the severe and death group had significantly higher cardiac troponin levels than the moderate and discharge group [18]. Also, a research by **Yang *et al.* [19]** discovered that both myoglobin and high CK-MB were independent risk factors for non-recovery and in-hospital mortality.

The results of the current study demonstrated that the groups under investigation differed significantly regarding CT chest as ground glass opacities, consolidation, pleural effusion, ground glass opacities + consolidation, ground glass opacities + pleural effusion and ground glass opacities + pericardial effusion (P<0.05). In a meta-analysis of 13 research, **Bao *et al.* [20]** found that ground glass opacity (GGO) was the most prevalent symptom, appearing in 83.31% of patients. GGO was the primary finding in 11 of the 13 studies that were included in the meta-analysis. We believe that the two studies that did not report GGO should be disregarded since they were clinical in nature rather than radiological, and they only indicated bilateral abnormalities in the CT chest [21]. The most frequent finding (68.1%) in a different meta-analysis by **Zhu *et al.* [22]** that included 32 publications and 4121 patients was ground glass opacification. The significant variability in the papers, which largely dealt with clinical or laboratory data, is the reason for the relatively low prevalence of GGO in their meta-analysis. Furthermore, in a research with 53 COVID-19 patients, **Guan *et al.* [23]** observed GGO in every patient (100%). According to **Ng *et al.* [24],** 86% of patients had GGO, while the remaining 14% had GGO with

consolidation.

In patients with COVID-19, pleural thickening and pleural effusion are comparatively less frequent observations. Pleural thickening is estimated to occur in 27–32% of cases [25]. Pleural effusions occur less often (2–5%). Every study agrees that pleural effusion indicates high viral load and high virulence and is associated with a bad outcome [26]. Recently, **Valette *et al.*** [27] found that patients with severe RDS who were brought to the ICU had a high prevalence of lymphadenopathy (66%) with some large lymph nodes, which they interpreted as an indication of critically unwell patients.

The current study showed that, ischemic changes was the only risk factors associated with mortality in mild cardiac and arrhythmic patients with COVID-19, with a significant difference (P=0.043). While, CK-MB, troponin, ischemic changes, LTVT abnormalities, RTVT abnormalities, PAP, TLC, CRP, $PCO_2$, pulse, temperature, prolactin, IL6 and serum ferritin were the risk factors associated with mortality in moderate cardiac and arrhythmic patients with COVID-19, with a significant difference (P<0.05). In prior research by **Xie *et al.*** [28], oxygen saturation is included in several COVID-19 treatment strategies and was linked to severity and death. This is similar to research by **Elsharawy *et al.*** [29], where it was one of the independent predictors of ICU admission with at a cutoff value ≤ 90 and moderate sensitivity and specificity.

**Limitation of the study:**

Due to the small sample size, this study therefore inevitably has certain limitations. As a result, 120 patients who had laboratory tests for cardiac biomarkers performed upon admission were ultimately included in the current study for analysis. We didn't create a validation set since there weren't enough events. Additional relevant large-sample research is required to investigate and validate our viewpoint.

## CONCLUSION

Acute lung injury is a major complication of COVID-19 and causes severe morbidity and mortality. Nonetheless, growing clinical and epidemiological data indicates that COVID-19 infection is linked to cardiac damage and arrhythmic complications.

**Conflict of interest:** None.
**Financial disclosures:** None.

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