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Predictors of mortality in Egyptian patients with Covid – 19

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Abstract

COVID-19 pandemic caused great panic since world health organization announcement in December 2020. The disease is characterized by severe respiratory dysfunction that can cause death. Several studies have revealed many laboratory measures as well as assessment tools for better prediction of death in patients with COVID-19 including APACHE II score, SOFA, D-Dimer and procalcitonin. This study aimed to estimate the predictors of morbidity and mortality in Egyptian patients with confirmed cases of Covid-19 treated in 2 charity hospitals one in Cairo while the other was in upper Egypt and a private hospital in Cairo- Egypt between March 2020 and July 2020. 120 patients from 3 different hospitals were included in our study where various laboratory parameters including D-Dimer, procalcitonin along with kidney function, liver function, chest computerized tomography have been done to all included patients. Our patients mean age was 61.50 ranging between 32-86 years old. APACHE median score was 19.5 and ranged between 9-36. A significant correlation between APACHE II and HR (r=0.380), potassium(r=0.392), creatinine levels (0.759), hematocrit (r=r=-0.556), PH(r=-0.208), HCo39 r=-0.585), GCS (r=-0.759), lactate (r=0.397), BUN (r=0.692), lymphocytes (r=-0.223), CRP (r=0.334), PCT was detected. Our study recommends the use of APACHE II and SOFA as strong predictors for the clinical status of COVID-19 patients after 24 hours of ICU admission.

Keywords: COVID-19- mortality.

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1. Introduction

In December 2019, mysterious cases of pneumonia of unidentified cause; particularly at Wuhan City, Hubei Province of China was first detected and caused panic around the world (Gao et al., 2021; WHO, 2020a). The national Chinese authorities have quarantined and received treatment in Wuhan hospitals. The reported signs were mainly fever, while some others have reported difficulty in breathing, with invasive lesions detected in both lungs (WHO, 2020a). The Coronavirus disease detected in 2019 which is now known as (COVID-19) belongs to Coronaviridae family. Coronaviruses was first known after the outbreak occurred in 2002-2003 and was named Severe Acute RespiratorySyndrome (SARS). Two strains were detected including; HCoV-NL63 and HCoV-HKU1 (Alipoor et al., 2021). The United States government SARS-CoV-2 Interagency Group (SIG) has classified SARS-CoV-2 into four subgroups (CDC, 2022a). The most predominant signs associated with COVID-19 include; fever, coughing, fatigue, loss of taste or smell. While less public signs include; pharyngitis, headache, aches and pains, diarrhea, a rash on skin, or discoloration of fingers or toes, and red or irritated eyes. Nevertheless, more severe symptoms include; trouble breathing or shortness of breath, loss of speech or mobility, or confusion, and chest pain (WHO, 2022a). High fatality rates were associated with conditions of cardiovascular disease (10.5%) when compared with diabetes (7.3%), COPD (6.3%), hypertension (6.0%), and cancer (5.6%). In the contrary, patients with no comorbidities had low fatality rate (American College of Cardiology, 2020). Moreover, blood coagulation biomarkers have revealed significant risk of coagulation in non-survival group. Platelet count showed much lower levels compared to survival group while D-dimer was higher. Additionally, prothrombin time was slightly raised in the non-survival group in addition to, creatinine levels and Blood Urea Nitrogen (BUN) were found independently higher among the non-survived patients indicating worse kidney function at the time of hospitalization (Tian et al., 2020).

1.1 Aim of the Work

This study aimed to estimate the predictors of morbidity and mortality in Egyptian patients with confirmed cases of Covid-19 treated in two different private hospitals and another charity hospital in Cairo- Egypt between March 2020 and July 2020.

2. Subjects and Methods

2.1. Study Design

A multi-center retrospective cohort study was conducted for the estimation of the predictors of mortality of 120 COVID-19 patients, who had been hospitalized in two different private hospitals and another charity hospital in Cairo- Egypt between March 2020 and July 2020. The study included patients above 18 years old with respiratory symptoms, gastrointestinal tract symptoms, with laboratory or Radiological finding suggestive for COVID-19 according to CORADS score, confirmed diagnosis with COVID-19 using (PCR). While patients with negative RT-PCR for SARS COV-2, asymptomatic patients or patients with mild symptoms (bone ache, sore throat, headache, mild cough), Not hypoxic, don't have high grade fever, and don't have any respiratory or cardiac problems) and patients with terminal illness or severe end organ failure or end stage malignancy were excluded from the study.

2.2. Patients' selection

Selection of patients was done according to WHO guidelines (WHO, 2022). Patients were retrospectively collected and analyzed in accordance with the policy for public health outbreak investigation of emerging infectious diseases (Institute of Medicine (US) Forum on Emerging Infections, 2000). Between March to July 2020, data of 120 consecutive patients with confirmed COVID-19 who were hospitalized was collected. The definite diagnosis of COVID-19 was established according to the case definition by Egyptian Ministry of Health.

2.3. Sampling Method and data collection

All included patients were subjected to the following:

- Full history including age and Sex. Risk factors: smoking, diabetes, hypertension, liver cirrhosis, heart diseases, chronic kidney disease on regular dialysis, thyroid diseases, cerebrovascular events, malignancy and autoimmune diseases.
- Full clinical examination: a. (Systolic blood pressure, Mean Arterial Pressure, Heart Rate, Respiratory. b. Rate, Temperature and Urine output) and Glasgow coma scale (GCS).

2.4. Laboratory investigations

All of the following laboratory tests were conducted at 1st, 3rd and 7th day of admission: Routine Laboratory tests including: complete Blood Count (CBC), arterial Blood Gases (ABGs), for Pao2/ So2 ratio calculation, liver Function Tests (LFTs), kidney Function Tests: Creatinine and Blood Urea Nitrogen (BUN) and electrolyte: Na, K.

- Specific Labs included Lactate, D-Dimer, CRP, IL-6, Ferritin, LDH and Procalcitonin

2.5. Imaging studies

Including (CT chest) CT chest according to CO-RADS score system.

2.6. Disease severity evaluation

This study has involved Scoring System, Acute Physiology and Chronic Health Evaluation II (APACHE II) score as well as Sequential Organ Failure Assessment (SOFA) score for the appraisal of disease severity and both were obtained at first day of admission.

2.7. APACHE II

The APACHE II score has revealed a good calibration and discriminatory value across a wide range of diseases. It uses a point score based upon values of 12 routine physiologic measurements (taken during the first 24 h after admission), age and previous health status to provide a general measure of severity of disease. An integer score from 0 to 71 is then computed based on these measurements; higher scores imply a more severe disease and a higher risk of death (Huang et al., 2019). APACHE II score was calculated for each patient as an indicator of illness severity and predictor of mortality.

2.8. SOFA score

The SOFA score was intended to offer population level insights into the acute morbidity of ICU patients (taken during the first 24 h after admission). SOFA Score is relied on 6- different parameters for the respiratory, cardiovascular, hepatic, coagulation, renal, and neurological systems. The maximum SOFA score offers a measure of the degree of organ dysfunction reached by each patient during an ICU stay; as the maximum SOFA score upsurges, so does the mortality rate (Vincent et al., 1996). All the patients were assessed according to CORADS score for COVID-19 patients:

2.9. Statistical Analysis

The information for all patients, including demographic data, clinical characteristics, laboratory parameters and outcomes, were collected prospectively. Two researchers independently reviewed the data collection forms to double-check the collected data. Descriptive statistics included frequency analysis (percentages) for categorical variables and mean ± sd or median and interquartile range for continuous variables. Comparisons were determined by t-test or Mann–Whitney U-test for continuous variables, as appropriate, and by the use of the Chi-squared test or Fisher exact test for categorical variables. Univariate and multivariate logistic regression was performed to explore the association of clinical characteristics and laboratory parameters and the risk of death. The backward conditional method was used to select imaging variables entering the scoring system. The statistical significance level was set at 0.05 (two-tailed).

3. Results and Discussion

It shows significant correlation between APACHE II and HR (r=0.380), potassium(r=0.392), creatinine levels (0.759), hematocrit (r=r=-0.556), PH(r=-0.208), HCo39 r=-0.585), GCS (r=-0.759), lactate (r=0.397), BUN (r=0.692),lymphocytes (r=-0.223), CRP (r=0.334), PCT (r=0.539), PLT (r=-0.336), AST 9r=0.453), ALT (r=0.476), bilirubin (r=0.237), and UOP (r-=-0.576) all p(<0.001). In the mean while SOFA score showed significant correlation with MAP (r=0.385), PH (r=-0.248), creatinine (r=0.455), HCo3 (r=0.516), WBCs (r=0.383),GCS (r=-0.468), lactate (r=0.409), BUN (r=0.200), Bands (r=0.325), CRP (r=0.345),lymphocytes (r=-0.256), D-D 9r=0.449), PLT (r=-0.319), AST 9r=0.613), ALT 9r=0.598), pO2/ FIO2 (r= -.343), BIL (r= 0.430), UOP (r= -0.483) at first day. SARS-CoV-2 has shown various personal and societal consequences, with more than half a million deaths (Hacker et al., 2021). In facts, global statistics revealed that mortality rate of SARS-CoV-2 is 4.3% (Haybar et al., 2020). Since SARS-CoV-2 is a disease that causes severe respiratory distress, physical as well as emotional impact have been

associated with major disease burden. Patients with chronic diseases demonstrate profound disease impact (i.e. heart disease, diabetes mellitus, cancer, COPD, CKD, and obesity). Thus, COVID-19 demonstrates direct as well as indirect influences on people with chronic disease including higher morbidity and mortality. Increased rates of spreadability and various mitigation efforts such as lockdown have disturbed lives and created social and economic challenges (Hacker et al., 2021). In this study, mean age of the studied patients was 61 years ranging between 32-86 years old with equal percentage of both sexes. In Italy, women appear to be less likely affected by the disease in comparison to men, irrespective to their age (Penna et al., 2020). Similarly, Scully et al. have agreed that men are more susceptible to COVID-19 severe\ lethal effect than women which may be a consequence of biological sex difference. This difference can evident themselves in vulnerability to infection, early pathogenesis, distinctive viral control, adaptive immune responses or the processes of inflammation and tissue repair during the infection (Scully et al., 2020). The mechanism underlying this difference has been explained through the protective effect of estrogens as well as numerous X-linked genes (such as ACE-2) and Y-linked genes (SRY and SOX9). The expression of ACE-2 and the Transmembrane Protease, Serine 2 (TMPRSS2) has been found to bind to spike (S) protein of coronaviruses, while TMPRSS2 ruptures the S-protein at sites S1/S2 and S2, preferring the binding and combination of the virus to cell membranes; respectively. ACE-2 is mainly expressed in organs targeted and damaged by SARS-CoV-2. ACE-2 is positioned on the X chromosome and is one of the genes escaping X inactivation (Gagliardi et al., 2020). It can be assumed that the second X chromosome could defend females from fatal polymorphisms that make the COVID-19 more aggressive in males. Consequently, it is crucial in protecting women from devastating effect of COVID-19 (Gebhard et al., 2020; Penna et al., 2020). This agrees with our findings where a statistically significant difference between mortality and sex of the studied patients has been revealed as higher mortality rate was associated with males (83.3%) than females (16.7%). On the other hand, older age has been associated with increased susceptibility of COVID-19 infection starting from 50 years old and rises in 60s, 70s, and 80s. Patients in 85 and older are the more prone to severe consequences (CDC, 2021). Furthermore, another study revealed that patients over 75 years showed 13-folds mortality risk in comparison to those under 65 years (Ho et al., 2020). These studies agree with ours where most of our patients were in their 60s although no significant difference was revealed. Moreover, our study revealed that 60% of our patients had HTN, 46.7% had DM, 16.7% had COPD, and similar percentage for liver diseases, 26.7% had renal diseases, 43.3% had IHD, 10% had thyroid diseases, 6.7% had immunological diseases. Similarly, cardiovascular diseases have been associated with higher virus lethality. Furthermore, older age increased the association between these predictors and COVID-19 mortality (Ho et al., 2020). Thyroid diseases as well has been demonstrated as a sequalae of COVID-19 infection including Graves' disease, euthyroid sick syndrome, Hashimoto's thyroiditis and subacute thyroiditis. COVID-19 has been asociated with triggering the activation of pre-existing thyroid disease or autoimmunity. Additionally, patients with uncontrolled thyrotoxicosis were at risk of SARS-CoV-2 infection-related consequences (Murugan and Alzahrani, 2021; Naguib, 2022). These studies agree with ours as highly significant association was seen between mortality rate and hypertension, renal disease, and to lesser extent; thyroid diseases, immunocompromised patients, and causes of COVID-19 (All $P<0.001$). While significant association was detected between mortality and COPD, liver, and IHD diseases (all $P<0.05$). Furthermore, our study revealed that 43.3% had high CORADS score, and 40% had very high CORADS scores. Also, APACHE median score was 19.5 and ranged between 9-36. SOFA median score was 7 ranging between 5-10, median ICU stay was 16 days ranging between 2-39 days. Readmission was detected in 3.3% only and mortality rate was 20% among the studied patients with insignificant association between mortality rate and readmission ($P>0.05$). Additionally, a negative weak correlation between SOFA score and ICU stay was seen. While no statistically significant correlation between APACHE and ICU stay was seen. Additionally, a statistically significant weak positive correlation was detected between APACHE and SOFA score as well as a moderate positive correlation with age. Nevertheless, a negative weak correlation between SOFA score and ICU stay was seen. Similarly, in Yao et al. study, 108 COVID-19 patients were assessed. The study revealed that 23.1% have developed severe disease in which 48% have died. Additionally, higher APECHE II as well as SOFA scores were associated with greater risk of development of severe COVID-19, and so were lower lymphocyte count and albumin level, In fact, higher SOFA score (OR 2.450, 1.302–4.608; $p = 0.005$), and lymphocyte count less than 0.8×109 per L (OR 9.017) augmented the risk for severe COVID-19 (Yao et al., 2020). In the same line, a multicenter, prospective cohort study enrolled critically COVID-19 ill patients from 30 ICUs from Spain and Andorra revealed that among 663 patients, mortality rate from ICU was 31%. Furthermore, age was linked to higher mortality. Each 5-point increase in APACHE II increased the odds of mortality by 1.508, $p = 0.015$(Ferrando et al., 2020). Similar conclusion was demonstrated by Estella et al. where age, APACHE II, and SOFA of more than 6 points, accompanied by vasopressor requirements or RRT have been recognized as predictive factors of mortality at six weeks ICU admission (Estella et al., 2022). Furthermore, another study revealed that mortality was associated with older age (70 years), several comorbidities (DM and coronary disease). Additionally, increased SOFA score over 48 hours, and a total of 11 points at day 1 has been linked with poor outcomes in those patients. Also, an increase in SOFA score in the first 48 hours after admission was correlated with a significant ICU mortality in critically COVID-19 ill patients. This can also predict similar findings in no COVID19 patients which suggest that SOFA score is a crucial tool in predicting mortality in critically ill patients with COVID 19 (Martinez et al., 2020).

Highly significant difference is detected in all readings obtained at 1st, 3rd and 7th day of different laboratory variable and vital signs where temperature, heart rate, respiratory rate, hematocrit, white blood cell counts decrease over time. Nevertheless, MAP, Pao2, Hco3 increase over time. While, sodium and potassium levels have fluctuated over time (all $P<0.001$). Only creatinine shows insignificant fluctuation between 1st, 3rd and 7th day ($P>0.05$) (figure 29). Comparable results have been obtained from the Gundogan et al. study where high APACHE II and SOFA scores were

linked to poorer outcomes (Gundogan et al., 2020). As shown in table 6, highly significant difference is seen in all variables except for D- dimer, bands and PCT (all p>0.05). For instance, lactate, lymphocytes, CRP, ferritin, AST, ALT, and bilirubin, platelet counts decrease over time. While a highly significant fluctuation is detected in BUN and LDH. Nevertheless, oxygen saturation and urinary output increase over time (all P>0.01) (figure 30). As shown in table 7, an insignificant difference is detected among patients who took vasopressin or have Renal Replacement Therapy (RRT) (P>0.05). Similarly, no significant difference is seen among patients on Mechanical Ventilation (MV) or who have invasive ventilation at 1st, 3rd and 7th day. Table 8 shows that there is no statistically significant difference between mortality and mean age of the studied patients (figure 31) while there is a statistically significant difference between mortality and sex of the studied patients where higher mortality rate is associated with males than females (figure 32). Highly significant association is seen between mortality rate and hypertension, renal disease, thyroid diseases, immunocompromised patients, and causes of COVID-19 (All P<0.001) while significant association is detected between mortality and COPD, liver, and IHD diseases (all P<0.05). Nevertheless, no significant association is seen between mortality and CORADS and DM(P>0.05) (figures 33 & 34) (table 7). A highly significant association is seen between mortality and temperature, respiratory rate, Pao2, HCo3, creatinine level, and GCS (all P<0.001). Nevertheless, significant association is seen between mortality and mean arterial pressure, sodium, potassium, and hematocrit (all p<0.05). No significant association is seen in heart rate or white blood cell counts(P>0.05) at the first day of assessment (figures 35). The negative value of t-test indicates the higher values in the survived group in all variables' measures.

Table 11 shows a highly significant association is detected in all variables except for mechanical ventilation at first day. The negative value of t-test indicates the higher values in the survived group in all variable's measures. Table 12 shows insignificant association between mortality rate and readmission (P>0.05), significant association with ICU stay (P<0.05), and highly significant association between SOFA score and mortality rate (P<0.001). The negative value of t-test indicates the higher values in the survived group in all variable's measures. There is no statistically significant correlation between APACHE and ICU stay while a statistically significant weak positive correlation is detected between APACHE and SOFA score as well as a moderate positive correlation with age. Nevertheless, a negative weak correlation between SOFA score and ICU stay is seen. according to table 13. The severity of illness scores has been identified in many studies as predictors for death or required ICU admission. In one study, patients with APACHE II score at the time of presentation < 8 or SOFA of 0 did not require ICU admission. Furthermore, all patients with APACHE II score < 10 or SOFA score of 0 survived until hospital discharge (Haybar et al., 2020; Martinez et al., 2020; Wilfong et al., 2021). Regarding CO-RADS, In Iraq, 64% of the COVID-19 patients were males and 36% were female, 46% were overweight, 60% had no comorbidity, 78% presented with mild/moderate disease, 70% had typical chest CT scan finding (CO-RAD 5. The mortality rate was 16%. The severity and consequence were correlated with predictive factors and comorbidity (Ghazzay et al., 2021). Similarly, CO-RADS has shown 89% sensitivity and 97% specificity in differentiating mild to moderate and severe disease (Zayed et al., 2021). Another study has detected significant correlation between the severity of pulmonary involvement revealed by CO-RADS classification, and N-Terminal Pro-Brain Natriuretic Peptide (NT-proBNP) (r= 0.47, p= 0.002) (Saleh et al., 2020), a protein involved in Acute Pulmonary Embolism (APE) that causes right ventricular overload (Pruszczyk, 2005). In addition, our study has revealed highly significant difference in all readings obtained at 1st, 3rd and 7th day of different laboratory variable and vital signs where temperature, heart rate, respiratory rate, hematocrit, white blood cell counts decreased over time. Nevertheless, MAP, Pao2, Hco3 increased over time. While, sodium and potassium levels have fluctuated over time (all P<0.001). Only creatinine shows insignificant fluctuation between 1st, 3rd and 7th day (P>0.05). Furthermore, highly significant difference was seen in all variables except for D- dimer, bands and PCT (all p>0.05). For instance, lactate, lymphocytes, CRP, ferritin, AST, ALT, and bilirubin, platelet counts decreased over time. While a highly significant fluctuation was detected in BUN and LDH. Nevertheless, oxygen saturation and urinary output increased over time (all P>0.01) through 1st, 3rd and 7th day of assessment. In the same line, patients with AKI [OR: 2.468, $p < 10^{-4}$)], cardiac arrest [OR: 11.099, p = 0.0001], and septic shock [OR: 3.224, p = 0.002] have been found associated with increased risk-of-death in patients with COVID-19. Furthermore, the study revealed that non-survived patients at ICU admission were more hypoxemic [SpO_2 with non-rebreather mask, 90 (IQR 83–93) vs 91 (IQR 87–94); p < 0.001]. Complications were more recurrent in dead patients including; ARDS, AKI, shock, and arrhythmias (Ferrando et al., 2020). In the contrary, in another study, older age, associated hypertension, higher blood leukocyte count, neutrophil count, higher sensitive CRP levels, and D-dimer level were associated with more risk of developing severe COVID-19 symptoms while lower lymphocyte count and albumin level were observed. Also, lymphocyte count less than 0.8×109 per L (OR 9.017) was correlated with severe COVID-19 (Yao et al., 2020). In the same line, in comparison with non-survivors, survivors showed low APACHE II and SOFA scores, lower D-dimers levels, a higher baseline acceptable respiratory function, and less frequent heart failure (Mantzarlis et al., 2022). In our study, a highly significant association was seen between mortality and temperature, respiratory rate, Pao2, HCo3, creatinine level, and GCS (all P<0.001). In the contrary, lower SpO2 and higher body temperature during acute phase of COVID-19 and female sex have been found to predict 60.7% of the difference in the physio-affective phenomena of long covid-19 (Al-Hadrawi et al., 2022).

Similarly, a retrospective study assessed COVID-19 hospitalized patients with severe symptoms. The study revealed that older age, high temperature, myalgia, and diarrhea were correlated with low SpO2 in-hospital death in COVID-19 patients (Mphekgwana et al., 2022). Furthermore, presence of hypoxia can predict worse clinical prognosis following the infection (J. Duan et al., 2020; Xie et al., 2020). Oxygen Saturation above 90.5% was found correlated with higher survival rates while dyspnea was an independent predictive factor for mortality (J. Duan et al., 2020). Moreover, 98% of COVID-19 patients have reported fever along with other symptoms (Shahid et al., 2020).

Furthermore, although fever is recognized when body temperature reaches 38.0°C or more (Farojeh et al., 2018; Van Son and Eti, 2021), some studies have pointed to lower body temperature in older adults of 36.4°C, while others have defined baseline temperature in older adults as low as 34.4°C (Blatteis, 2012). Additionally, nasal prongs and a face mask with a reservoir for respiratory support cannula were predominantly involved in patient interfaces to provide supplemental oxygen, with the use of only a High-Flow Nasal Cannula (HFNC) being minimal (7%). However, most hospitalized COVID-19 patient mortalities had normal body temperature (Mphekgwana et al., 2022). Regarding neurological function assessed by GCS, COVID-19 has been known to impair consciousness along with other neurological function such as memory and insight (Alamri et al., 2021; Sorokin et al., 2022). In one study, 55 hospitalized patients with COVID-19 reported impaired consciousness, memory, and insight which indicate clinical risk assessment. The study has also concluded that age, lung lesions, oxygen saturation, respiratory rate, CRP level, and platelet count were independent prognostic factors for mental status (Sorokin et al., 2022). In the same line, blood biomarkers of CNS injury including glial fibrillary acidic protein as well as inflammation (CRP), and GCS were correlated with COVID-19 severity and poorer mental status (Fällmar et al., 2021). Furthermore, in Indonesia, low GCS was correlated to poorer outcome in acute stroke patients with COVID-19 (Kembuan et al., 2021). Nevertheless, our study revealed significant association between mortality and mean arterial pressure, sodium, potassium, and hematocrit (all $p<0.05$). No significant association was seen in heart rate or white blood cell counts($P>0.05$) at the first day of assessment. In agreement with ours, hypertensive patients who were older, had high blood CRP (9.4 ± 9.2 vs. 5.3), MAP (11.4 ± 4.8 vs. 8.9 ± 3.2; $P = 0.002$) showed higher in-hospital death in comparison to those without hypertension. Additionally, a positive correlation was detected between blood pressure and age, levels of CRP, CK-MB, NT-proBNP, creatinine and in-hospital death (all, $P < 0.05$) (Nam et al., 2021). In the same line, another study has revealed the same conclusion regarding positive association between high MAP ICU admission and death particularly; Systolic Blood Pressure (SBP) and diastolic BP (Ran et al., 2020). In addition, malignancies were detected in 10% of the patients, skin diseases in 6.7% and other miscellaneous diseases comprise 36.7%. Many studies have revealed the vulnerability of cancer patients to infection compared with normal patients due to immunocompromised state and anticancer treatments. Thus, cancer patients have elevated risk of COVID-19 with poorer prognosis (Dai et al., 2020; Liang et al., 2020). Surprisingly, in an online survey in UK, 17% of positive COVID-19 cases reported skin rashes at their first presentation, and 21% as the only clinical sign of COVID-19 (Visconti et al., 2021). Similarly, a meta-analysis of 65 articles revealed that rashes were the most recurrent manifestations in 54% of the total symptoms. Rashes include erythematous maculopapular/morbilliform, urticarial/annular, vesicular/varicelliform or petechial/purpuric by order of frequency. Around 70% of all patients had pruritus other symptoms include burning and pain (Matar et al., 2020). Electrolyte imbalance has been also reported with COVID-19. In 594 positive COVID-19 patients with electrolyte imbalance whom been compared to 594 non-COVID-19 electrolyte im-balance, showed that hyponatremia was more predominant among positive COVID-19 patients compared to controls, as well as hypokalemia and hypochloremia. Hyponatremia and hypokalemia are independently correlated with COVID-19 infection in adults and could involve as biomarkers for suspected COVID-19 patients (De Carvalho et al., 2021). It is well established that COVID-19 can cause kidney injury through direct impact on the kidney tissue, as ACE-2 and members of the serine protease family. It is known that hypokalemia, a consequence of COVID-19, can aggravate ARDS and surge the risk of heart injuries in patients with COVID-19 (Lippi and Plebani, 2020; Pourfridoni et al., 2021). Unfortunately, in our study, an insignificant difference was detected among patients who took vasopressin or have Renal Replacement Therapy (RRT) ($P>0.05$). Similarly, no significant difference was seen among patients on Mechanical Ventilation (MV) or who have invasive ventilation at 1st, 3rd and 7th day. Similarly, Moreno-P et al., assessed 306 COVID-19 patients in Spain with potassium. The study revealed that hypokalemia was independently linked with IMV, nonetheless, mortality was not influenced by low potassium (Moreno-Pérez et al., 2020). In the contrary, COVID-19 patients who require IMV are usually experiencing a mortality rate between 35 to 97% (Auld et al., 2020). In addition, our study revealed highly significant mortality rate associated with higher age points, higher APACHE II score, and presence of malignancies (all $P< 0.001$) while insignificant association was seen in higher median values of chronic health points, skin diseases or any other miscellaneous diseases ($P>0.05$). This comes in the line with another study where higher APACHE II scores, SOFA and presence of malignancies were linked to higher mortality rate along with presence of malignancies (Beigmohammadi et al., 2022). Another study concluded that APACHE II score ≥ 17 is a good prognostic tool that serves as an early warning sign of death and may offer guidance for further clinical decision (Zou et al., 2020). In another study, 100 patients with positive COVID-19, where 14 patients died and the rest 86 survived ICU. The Mean APACHE II score (22.21 ± 6.05) was comparatively higher in patients who were submitted to death while the mean APACHE II score of 9.87 ± 4.40 in patients who have survived the infections ($p < 0.001$). It was also found that APACHE II score was associated with hospital mortality (OR, 1.07; 95% CI, 1.01-1.13) and area under the curve of 0.966. Similar to Zou et al. a cut-off value of 17 and above in APACHE II could predict the death (Karthick et al., 2020). This comes also with the conclusion of Karthick et al. study where a sensitivity of 96.15% and specificity of 86.27% was detected with APACHE II (Karthick et al., 2020). In the contrary, APACHE II score recorded the lowest sensitivity for detecting mortality in comparison with Pneumonia Severity Index and Confusion, Urea, Respiratory Rate, Blood Pressure, Age $\geqslant 65$ (CURB-65) (Artero et al., 2021; Chen et al., 2020). Another study has revealed that SOFA was more sensitive than Pneumonia Severity Index but comparable to CURB-65(Zhang et al., 2020). Since our patients mean APACHE II score was 19.5, this can explain death among those patients. Comparing between last day and first day in our study revealed highly significant association is detected in all variables except for mechanical ventilation at first day.

Table 1: Demographic data of the studied patients.

		No. = 120
Age	Mean ± SD	61.50 ± 15.14
	Range	32 – 86
Sex	Male	60 (50.0%)
	Female	60 (50.0%)

Mean age of the studied patients is 61.50 ranging between 32-86 years old. Additionally, equal percentage of both sexes is detected according to table 1.

Table 2: Co-morbidities of the studied patients.

		No.	%
HTN	Yes	72	60.0%
	No	48	40.0%
DM	Yes	56	46.7%
	No	64	53.3%
COPD	Yes	20	16.7%
	No	100	83.3%
liver	Yes	20	16.7%
	No	100	83.3%
Renal	Yes	32	26.7%
	No	88	73.3%
IHD	Yes	52	43.3%
	No	68	56.7%
Thyroid	Yes	12	10.0%
	No	108	90.0%
Immune	Yes	8	6.7%
	No	112	93.3%
Cause	Respiratory symptoms + Others symptoms	48	40.0%
	Respiratory symptoms + GIT symptoms + Others symptoms	72	60.0%
CORADS	CORADS 3 (Indeterminate)	20	16.7%
	CORADS 4 (High)	52	43.3%
	CORADS 5 (very high)	48	40.0%

HTN: hypertension; DM: diabetes mellitus; COPD: chronic obstructive pulmonary disease; IHD: ischemic heart disease; CORADS: Corona -Dutch Radiological Society.

Table 3: Clinical characteristics of the studied patients.

		No. = 120
Age points (as it is)*	Median (IQR) Range	4 (3 – 6) 0 – 6
Chronic Health Points#	Median (IQR) Range	0 (0 – 5) 0 – 5
APACHE	Median (IQR) Range	19.5 (14 – 24) 9 – 36
Malignancy	Yes No	12 (10.0%) 108 (90.0%)
Skin	Yes No	8 (6.7%) 112 (93.3%)
Any other	Yes No	44 (36.7%) 76 (63.3%)

*Age point: 0= ≤44; 2=45-54; 3= 55-64;5=65-74;6=≥75.

#Chronic health status points: 2 points for elective postoperative patient with immunocompromise or history of severe organ insufficiency; 5 points for nonoperative patient or emergency postoperative patient with immunocompromise or severe organ insufficiency. SOFA median score is 7 ranging between 5-10, median ICU stay is 16 days ranging between 2-39 days. Readmission is detected in 3.3% only and mortality rate is 20% among the studied patients. according to table 4 and figure 28.

Table 4: Other clinical characteristics of the studied patients.

		No. = 120
SOFA	Median (IQR) Range	7 (5 – 10) 4 – 18
ICU stay	Median (IQR) Range	16 (11 – 22) 2 – 39
Re-admission	Yes No	4 (3.3%) 116 (96.7%)
Mortality	Yes No	24 (20.0%) 96 (80.0%)

Table 5: Comparison between 1st, 3rd and 7th day regarding laboratory data and vital signs among all studied patients.

		1st day	3rd day	7th day	Test value	P-value	Sig.
Temperature	Mean ± SD Range	38.10 ± 1.00 35.6 – 40.2	37.73 ± 0.61 36.2 – 38.6	37.32 ± 0.57 36.5 – 39.7	43.551•	0.000	HS
MAP	Mean ± SD Range	69.63 ± 13.92 30 – 100	74.02 ± 13.30 40 – 106	80.60 ± 12.21 60.5 – 107	21.452•	0.000	HS
HR	Mean ± SD Range	115.15 ± 20.26 60 – 159	105.90 ± 14.64 59 – 143	98.30 ± 11.90 80 – 132	75.856•	0.000	HS
RR	Mean ± SD Range	27.25 ± 4.60 10 – 40	23.87 ± 2.99 19 – 32	22.78 ± 3.56 18 – 35	84.856•	0.000	HS
Pao2	Mean ± SD Range	50.97 ± 6.45 30 – 62	54.95 ± 9.93 38 – 86	64.33 ± 9.47 46 – 85	95.216•	0.000	HS
PH	Mean ± SD Range	7.32 ± 0.09 7.07 – 7.5	7.34 ± 0.10 7.12 – 7.56	7.37 ± 0.08 7.18 – 7.53	8.528•	0.000	HS
Hco3	Mean ± SD Range	19.70 ± 5.08 9 – 31	21.25 ± 5.31 10.2 – 32	22.17 ± 4.50 14.6 – 30.5	19.053•	0.000	HS
Na	Mean ± SD Range	136.65 ± 7.89 110 – 151	139.72 ± 7.65 113 – 152	139.67 ± 5.94 128 – 153	13.181•	0.000	HS
K	Mean ± SD Range	4.20 ± 0.78 3 – 5.5	3.94 ± 0.91 2.3 – 5.9	4.12 ± 0.66 3.2 – 5.6	7.019•	0.003	HS
Create	Median (IQR) Range	1.4 (1 – 2.25) 0.5 – 5.8	1.35 (1.1 – 2.4) 0.7 – 5.9	1.4 (0.9 – 2) 0.7 – 6.5	2.851≠	0.240	NS
Hematocrit	Mean ± SD Range	35.95 ± 5.69 22.9 – 47	33.59 ± 6.37 14.1 – 45	32.58 ± 8.45 4.2 – 48.7	27.439•	0.000	HS
WBCs	Mean ± SD Range	17.58 ± 7.01 5.9 – 30.8	17.40 ± 6.54 7.6 – 30.9	14.53 ± 6.60 3.5 – 25.9	7.009•	0.003	HS
GCS	Mean ± SD Range	13.73 ± 2.30 7 – 15	13.73 ± 3.12 3 – 15	14.85 ± 0.45 13 – 15	26.256•	0.000	HS

MAP: mean arterial pressure; HR: heart rate; RR: respiratory rate; GCS: Glasgow Coma Scale; WBCs: white blood cells.
P-value > 0.05: Non-significant; P-value < 0.05: Significant; P-value < 0.01: Highly significant
•: Repeated Measures ANOVA; ≠: Friedman test

Table 6: Other laboratory measures among the studied patients at 1st, 3rd and 7th day.

		1st day	3rd day	7th day	Test value	P-value	Sig.
Lactate	Median (IQR) Range	2.4 (2.1 – 3.1) 0.9 – 9.6	2.2 (1.9 – 3.1) 1.1 – 15	1.9 (1.5 – 2.9) 1 – 4.9	42.667 ≠	0.000	HS
BUN	Median (IQR) Range	50 (40 – 70) 23 – 258	52 (40 – 65) 24 – 170	45 (39 – 59) 24 – 195	15.407≠	0.000	HS
Bands	Median (IQR) Range	7 (6 – 8) 2 – 16	7 (6 – 8.5) 4 – 23	6 (5 – 7) 0 – 19	5.810≠	0.055	NS
Lymph	Mean ± SD Range	11.05 ± 3.96 3.5 – 18	10.15 ± 3.48 2.9 – 15.2	9.87 ± 4.04 2.5 – 19.2	12.250•	0.000	HS
LDH	Mean ± SD Range	582.77 ± 245.57 280 – 1174	612.33 ± 220.59 300 – 1149	450.85 ± 169.32 249 – 850	33.019•	0.000	HS
CRP	Median (IQR) Range	89 (70 – 110) 35 – 340	85.5 (59 – 115) 24 – 354	47 (19 – 93) 3 – 280	51.852≠	0.000	HS
PCT	Median (IQR) Range	0.1 (0.1 – 0.7) 0.1 – 16	0.18 (0.1 – 0.9) 0.09 – 90.7	0.19 (0.1 – 0.4) 0.07 – 9.5	3.289≠	0.193	NS
IL6	Mean ± SD Range	36.09 ± 13.74 19.3 – 70.6	31.21 ± 10.73 19.5 – 60.1	32.70 ± 17.55 15.6 – 71.5	29.089•	0.000	HS
Ferritin	Mean ± SD Range	679.33187.89 240 – 987	636.03 ± 198.60 237 – 1145	497.70187.34 201 – 980	52.888•	0.000	HS
D-D	Mean ± SD Range	2.12 ± 0.85 0.8 – 4.3	2.22 ± 0.81 0.8 – 3.9	2.02 ± 0.79 0.7 – 3.5	2.129•	0.139	NS
PLT	Median (IQR) Range	201.5 (176 – 300) 31 – 527	178.5 (136 – 265) 38 – 598	159 (99 – 235) 48 – 617	86.519≠	0.000	HS
AST	Median (IQR) Range	46.5 (37 – 84) 24 – 121	44.5 (35 – 75) 25 – 240	42 (32 – 49) 24 – 112	44.350≠	0.000	HS
Alt	Median (IQR) Range	54.5 (40 – 81) 25 – 145	53.5 (39 – 84) 24 – 269	47 (36 – 54) 17 – 102	23.170≠	0.000	HS
pO2/ FIO2	Mean ± SD Range	164.17 ± 40.52 90 – 270	201.12 ± 51.75 85 – 320	210.00 ± 41.38 140 – 310	66.222•	0.000	HS
Bil	Mean ± SD Range	1.25 ± 0.63 0.3 – 2.6	1.25 ± 0.80 0.4 – 4.3	0.94 ± 0.31 0.4 – 2.2	21.924•	0.000	HS
UOP	Median (IQR) Range	1600 (1200 – 2400) 100 – 3800	2350 (1850 – 3350) 300 – 4900	2600 (1900 – 3000) 0 – 4800	23.379≠	0.000	HS

D-D: D-dimer; ALT: Alanine amino transferase; AST: Aspartate aminotransferase; Bil: bilirubin; PLT: platelets; IL6: interleukin-6; PCT: Procalcitonin; CRP-C-reactive protein: LDH: lactate dehydrogenase; Lymph: lymphocytes; BUN: blood urea nitrogen. UOP: urinary output; RRT: renal replacement therapy; Vaso P: vasopressorMV: mechanical ventilation.
P-value > 0.05: Non-significant; P-value < 0.05: Significant; P-value < 0.01: Highly significant
•: Repeated Measures ANOVA; ≠: Friedman test

Table 7: Distribution of patients with renal diseases and patients on mechanical ventilation at 1st, 3rd and 7th day.

		1st day		3rd day		7th day		Test value*	P-value	Sig.
		No.	%	No.	%	No.	%			
Vaso p	Yes	22	18.3%	24	20.0%	16	14.8%	1.077	0.584	NS
	No	98	81.7%	96	80.0%	92	85.2%			
RRT	Yes	8	6.7%	8	6.7%	8	7.4%	0.064	0.969	NS
	No	112	93.3%	112	93.3%	100	92.6%			
MV	Yes	60	50.0%	72	60.0%	52	48.1%	3.811	0.149	NS
	No	60	50.0%	48	40.0%	56	51.9%			
Invasive	Non invasive	96	80.0%	96	80.0%	96	88.9%	4.124	0.127	NS
	Invasive	24	20.0%	24	20.0%	12	11.1%			

Vaso P: Vasopressor; RRT: renal replacement therapy; MV: mechanical ventilation
P-value > 0.05: Non-significant; P-value < 0.05: Significant; P-value < 0.01: Highly significant
*: Chi-square test

Table 8: Relation between mortality and demographic data of the studied patients.

		Mortality		Test value	P-value	Sig.
		Yes	No			
		No. = 24	No. = 96			
Age	Mean ± SD	65.00 ± 11.41	60.63 ± 15.86	1.270•	0.207	NS
	Range	45 – 78	32 – 86			
Sex	Male	20 (83.3%)	40 (41.7%)	13.333*	0.000	HS
	Female	4 (16.7%)	56 (58.3%)			

P-value > 0.05: Non-significant; P-value < 0.05: Significant; P-value < 0.01: Highly significant
*: Chi-square test; •: Independent t-test

Table 9: Association between different chronic diseases of the patients and mortality rate.

		Mortality				Test value	P-value	Sig.
		Yes		No				
		No.	%	No.	%			
HTN	Yes	20	83.3%	52	54.2%	6.806*	0.009	HS
	No	4	16.7%	44	45.8%			
DM	Yes	12	50.0%	44	45.8%	0.134*	0.714	NS
	No	12	50.0%	52	54.2%			
COPD	Yes	0	0.0%	20	20.8%	6.000*	0.014	S
	No	24	100.0%	76	79.2%			
Liver	Yes	8	33.3%	12	12.5%	6.000*	0.014	S
	No	16	66.7%	84	87.5%			
Renal	Yes	12	50.0%	20	20.8%	8.352*	0.004	HS
	No	12	50.0%	76	79.2%			
IHD	Yes	16	66.7%	36	37.5%	6.652*	0.010	S
	No	8	33.3%	60	62.5%			
Thyroid	Yes	8	33.3%	4	4.2%	18.148*	0.000	HS
	No	16	66.7%	92	95.8%			
Immune	Yes	8	33.3%	0	0.0%	34.286*	0.000	HS
	No	16	66.7%	96	100.0%			
Cause	Respiratory symptoms + Others symptoms	16	66.7%	32	33.3%	8.889*	0.003	HS
	Respiratory symptoms + GIT symptoms + Others symptoms	8	33.3%	64	66.7%			
CORADS	CORADS 3 (Indeterminate)	4	16.7%	16	16.7%	1.442*	0.486	NS
	CORADS 4 (High)	8	33.3%	44	45.8%			
	CORADS 5 (very high)	12	50.0%	36	37.5%			

HTN: hypertension; DM: diabetes mellitus; COPD: chronic obstructive pulmonary disease; IHD: ischemic heart disease; CORADS: Corona -Dutch Radiological Society
P-value > 0.05: Non-significant; P-value < 0.05: Significant; P-value < 0.01: Highly significant
*: Chi-square test

Table 10: Association between mortality rate and different clinical characteristics of the patients at 1st day.

1st day		Mortality		Test value	P-value	Sig.
		Yes	No			
		No. = 24	No. = 96			
Temperature	Mean ± SD Range	37.51 ± 0.73 36.2 – 38.5	38.25 ± 1.00 35.6 – 40.2	-3.378•	0.001	HS
MAP	Mean ± SD Range	64.25 ± 19.29 30 – 85	70.98 ± 11.97 50 – 100	-2.149•	0.034	S
HR	Mean ± SD Range	114.92 ± 33.67 60 – 159	115.21 ± 15.48 90 – 150	-0.063•	0.950	NS
RR	Mean ± SD Range	24.25 ± 6.82 10 – 30	28.00 ± 3.53 23 – 40	-3.761•	0.000	HS
Pao2	Mean ± SD Range	47.08 ± 8.66 30 – 55	51.94 ± 5.40 40 – 62	-3.447•	0.001	HS
PH	Mean ± SD Range	7.24 ± 0.12 7.07 – 7.39	7.34 ± 0.07 7.26 – 7.5	-5.146•	0.000	HS
Hco3	Mean ± SD Range	14.43 ± 4.71 9 – 23.5	21.01 ± 4.26 14.9 – 31	-6.623•	0.000	HS
Na	Mean ± SD Range	133.25 ± 5.31 126 – 141	137.50 ± 8.22 110 – 151	-2.407•	0.018	S
K	Mean ± SD Range	4.55 ± 0.74 3.5 – 5.5	4.12 ± 0.77 3 – 5.5	2.481•	0.015	S
Create	Median (IQR) Range	2.05 (1.7 – 4.3) 0.5 – 5.8	1.3 (1 – 1.85) 0.7 – 5.4	-3.131≠	0.002	HS
Hematocrit	Mean ± SD Range	33.77 ± 4.26 27.9 – 39	36.50 ± 5.88 22.9 – 47	-2.138•	0.035	S
WBCs	Mean ± SD Range	19.57 ± 8.35 10.6 – 30	17.09 ± 6.59 5.9 – 30.8	1.559•	0.122	NS
GCS	Mean ± SD Range	10.67 ± 3.16 7 – 15	14.50 ± 1.12 10 – 15	-9.762•	0.000	HS

MAP:mean arterial pressure; HR: heart rate; RR: respiratory rate; GCS: Glasgow Coma Scale; WBCs: white blood cells.
P-value > 0.05: Non-significant; P-value < 0.05: Significant; P-value < 0.01: Highly significant
•: Independent t-test; ≠: Mann-Whitney test

Table 11: Association between mortality rate and laboratory measures at 1st day.

1st day		Mortality		Test value	P-value	Sig.
		Yes	No			
		No. = 24	No. = 96			
lactate	Median (IQR) Range	4.3 (3.1 – 4.8) 1.8 – 9.6	2.3 (2.1 – 2.9) 0.9 – 4.3	-4.962≠	0.000	HS
BUN	Median (IQR) Range	79.5 (55 – 137) 45 – 258	47 (37.5 – 64) 23 – 160	-4.369≠	0.000	HS
Bands	Median (IQR) Range	8.5 (7 – 11) 7 – 16	6 (6 – 8) 2 – 15	-4.694≠	0.000	HS
Lymph	Mean ± SD Range	9.00 ± 3.62 4.3 – 14	11.56 ± 3.90 3.5 – 18	-2.921•	0.004	HS
LDH	Mean ± SD Range	814.17 ± 183.04 665 – 1174	524.92 ± 224.77 280 – 1120	5.834•	0.000	HS
CRP	Median (IQR) Range	121 (92 – 158) 80 – 340	83 (64.5 – 90.5) 35 – 157	-4.995≠	0.000	HS
PCT	Median (IQR) Range	1.1 (0.7 – 5) 0.1 – 13.5	0.1 (0.1 – 0.15) 0.1 – 16	-5.592≠	0.000	HS
IL6	Mean ± SD Range	47.08 ± 12.39 36.2 – 69.5	33.34 ± 12.69 19.3 – 70.6	4.767•	0.000	HS
Ferritin	Mean ± SD Range	768.50 ± 119.62 569 – 970	657.04 ± 195.57 240 – 987	2.665•	0.009	HS
d-d	Mean ± SD Range	2.53 ± 0.38 2.1 – 3.2	2.01 ± 0.90 0.8 – 4.3	2.770•	0.007	HS
plt	Median (IQR) Range	181.5 (140 – 202) 133 – 213	209 (177 – 335) 31 – 527	-2.784≠	0.005	HS
Ast	Median (IQR) Range	89.5 (48 – 112) 37 – 114	45 (35 – 54.5) 24 – 121	-4.156≠	0.000	HS
Alt	Median (IQR) Range	89.5 (68 – 95) 35 – 145	50 (39.5 – 62) 25 – 131	-4.152≠	0.000	HS
pO2/ FIO2	Mean ± SD Range	128.17 ± 39.30 90 – 196	173.17 ± 35.69 120 – 270	-5.414•	0.000	HS
bil	Mean ± SD Range	1.66 ± 0.74 0.6 – 2.5	1.15 ± 0.56 0.3 – 2.6	3.739•	0.000	HS
Vaso p	Yes No	14 (58.3%) 10 (41.7%)	8 (8.3%) 88 (91.7%)	32.059*	0.000	HS
RRT	Yes No	8 (33.3%) 16 (66.7%)	0 (0.0%) 96 (100.0%)	34.286*	0.000	HS
MV	Yes No	16 (66.7%) 8 (33.3%)	44 (45.8%) 52 (54.2%)	3.333*	0.068	NS
Invasive	No Yes	0 (0.0%) 24 (100.0%)	96 (100.0%) 0 (0.0%)	120.000*	0.000	HS
uop	Median (IQR) Range	700 (400 – 1200) 300 – 2800	2050 (1400 – 2400) 100 – 3800	-2.792≠	0.005	HS

D-D: D-dimer; ALT: Alanine amino transferase; AST: Aspartate aminotransferase; Bil: bilirubin; PLT: platelets; IL6: interleukin-6; PCT: Procalcitonin; CRP-C-reactive protein: LDH: lactate dehydrogenase; Lymph: lymphocytes; BUN: blood urea nitrogen. UOP: urinary output; RRT: renal replacement therapy; Vaso P: vasopressor; MV: mechanical ventilation.
P-value > 0.05: Non-significant; P-value < 0.05: Significant; P-value < 0.01: Highly significant
*: Chi-square test; •: Independent t-test; ≠: Mann-Whitney test

Table 12: Association between mortality rate and SOFA, readmission and ICU stay.

		Mortality		Test value	P-value	Sig.
		Yes	No			
		No. = 24	No. = 96			
SOFA	Median (IQR)	11 (10 – 15)	6.5 (5 – 9)	-4.731≠	0.000	HS
	Range	5 – 18	4 – 13			
ICU stay	Median (IQR)	9.5 (2.5 – 19)	17.5 (11.5 – 22)	-2.422≠	0.015	S
	Range	2 – 39	7 – 27			
Re admission	Yes	0 (0.0%)	4 (4.2%)	1.034*	0.309	NS
	No	24 (100.0%)	92 (95.8%)			

P-value > 0.05: Non-significant; P-value < 0.05: Significant; P-value < 0.01: Highly significant
*: Chi-square test; ≠: Mann-Whitney test

Table 13: Correlation between APACHE and SOFA with other studied parameters.

	APACHE		SOFA	
	R	P-value	r	P-value
APACHE	--	--	0.291**	0.001
SOFA	0.291**	0.001	--	--
Age	0.404**	0.000	-0.008	0.929
ICU stay	0.040	0.662	-0.196*	0.032

P-value > 0.05: Non-significant; P-value < 0.05: Significant; P-value < 0.01: Highly significant Spearman correlation coefficient

Table 14: Correlation between different laboratory as well as clinical characteristics of the studied patients with APACHE II and SOFA scores at 1st day.

1st day	APACHE		SOFA	
	r	P-value	r	P-value
Temperature	-0.059	0.523	-0.151	0.101
MAP	-0.115	0.210	-0.385-**	0.000
HR	0.380**	0.000	0.000	0.997
RR	0.113	0.217	0.055	0.553
Pao2	0.064	0.489	0.140	0.129
PH	-0.208-*	0.023	-.248-**	0.006
Hco3	-0.585-**	0.000	-.516-**	0.000
Na	-0.004	0.961	-0.178	0.052
K	0.392**	0.000	0.028	0.765
Creat	0.757**	0.000	0.455**	0.000
Hematocrit	-0.556-**	0.000	-0.159	0.083
WBCs	0.172	0.060	0.383**	0.000
GCS	-0.759-**	0.000	-0.468-**	0.000
Lactate	0.397**	0.000	0.409**	0.000
BUN	0.692**	0.000	0.200*	0.029
Bands	0.358**	0.000	0.325**	0.000
Lymph	-0.223-*	0.014	-0.256-**	0.005
LDH	0.173	0.059	0.325**	0.000
CRP	0.334**	0.000	0.345**	0.000
PCT	0.539**	0.000	0.321**	0.000
IL6	-0.012	0.892	0.341**	0.000
Ferritin	-0.103	0.262	0.319**	0.000
D-D	0.009	0.919	0.449**	0.000
PLT	-0.336-**	0.000	-0.319-**	0.000
AST	0.453**	0.000	0.613**	0.000
ALT	0.476**	0.000	0.598**	0.000
PO2/ FIO2	-0.066	0.473	-.343-**	0.000
BIL	0.237**	0.009	0.430**	0.000
UOP	-.576-**	0.000	-0.483-**	0.000

D-D: D-dimer; ALT: Alanine amino transferase; AST: Aspartate aminotransferase; Bil: bilirubin; PLT: platelets; IL6: interleukin-6; PCT: Procalcitonin; CRP-C-reactive protein: LDH: lactate dehydrogenase; Lymph: lymphocytes; BUN: blood urea nitrogen. UOP: urinary output; RRT: renal replacement therapy; Vaso P: vasopressor; MV: mechanical ventilation;
P-value > 0.05: Non-significant; P-value < 0.05: Significant; P-value < 0.01: Highly significant
Spearman correlation coefficient

Whereas a significant association was detected in PLT, LDH, Lymph, and Lactate (P >0.05). Insignificant association was detected in ALT, AST, IL6, CRP, and Bands (P>0.05) at the 7th day. Similarly, Auld et al., revealed a significant association between mortality and older age, chronic renal disease, lower body mass index, SOFA, low PaO2/FIO2 ratio, high D-dimer, higher CRP, and being on MV, vasopressors, RRT, or vasodilator therapy (Auld et al., 2020). Another cohort study included 1042 patients with median age of 64 years. The study found an association between ventilation requirement and DM, dyspnea, ALT, troponin, CRP, neutrophil-lymphocyte ratio, and lactate dehydrogenase, while an association between hospitalized death and age, sex, DM, chronic statin use, albumin, CRP, neutrophil-lymphocyte ratio, mean corpuscular volume, PLT, and procalcitonin which agrees with ours (Nicholson et al., 2020).

5. Conclusions

APACHE II and SOFA scores are recommended for accurate assessment of patients during the first 24 hours of ICU admission and can predict deterioration of different laboratory parameters during COVID-19 infection.

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