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COVID-19 in Intensive Care Unit Admitted Patients: A Cross-Sectional Study

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ABSTRACT

The ongoing COVID-19 pandemic has posed significant challenges to healthcare systems worldwide, particularly in intensive care units (ICUs), where critically ill patients are treated. This cross-sectional study aimed to investigate the demographic characteristics, comorbidities, and mortality factors associated with COVID-19 patients admitted to the ICU of Imam Reza Hospital in Mashhad, Iran, to optimize patient management and improve outcomes. A total of 409 ICU patients were included in the study with a confirmed COVID-19 diagnosis based on RT-PCR tests, 61.5% of whom were males, with a mean age of 56.32 ± 15.92 years. The most common presenting symptom was dyspnea (95.6%), followed by weakness (82.7%), chest discomfort (77.8%), headache (66.1%), fever (65.4%), and cough (47.8%). Hypertension (52.4%) and diabetes (50.2%) were the most prevalent comorbidities among the participants. The overall mortality rate was 55.9%. Factors significantly associated with higher mortality included older age ($p<0.001$), confusion at admission ($p<0.001$), diabetes ($p=0.006$), hypertension ($p<0.001$), ischemic heart disease ($p=0.014$), higher heart rate ($p<0.001$), respiratory rate ($p<0.001$), and lower SPO2 ($p<0.001$). Deceased patients also had significantly higher blood glucose ($p<0.001$), urea ($p<0.001$), creatinine ($p<0.001$), CRP ($p=0.017$), INR ($p=0.026$), and CT scores ($p<0.001$) compared to survivors. The findings underscored the importance of identifying high-risk COVID-19 patients at the time of ICU admission. These results suggested that patients exhibiting these characteristics require close monitoring and early, aggressive interventions from the onset of hospitalization to improve their clinical status and reduce the risk of mortality.

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Introduction

In late December 2019, a pneumonia associated with a novel coronavirus emerged in Wuhan, China, which subsequently attracted global attention (1-3). On January 7th, the novel coronavirus was isolated, and on January 12th, it was officially named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) or 2019-nCoV. Its complete genome sequence was shared with the World Health Organization (WHO) on the same day (1). Coronaviruses are RNA viruses associated with acute respiratory infections in humans; however, their ability to infect hosts from other species and

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cause a variety of diseases has made them complex pathogens (4). This virus has evolved into two major strains, L and S, with the L strain being more common and aggressive, while the S strain is considered an older, or ancestral, version (5). SARS-CoV-2 binds to angiotensin-converting enzyme 2 (ACE2) and utilizes transmembrane protease serine 2 (TMPRSS2) for cell entry (6). Sequence analysis revealed that the bat SARS-like coronavirus is the closest virus to SARS-CoV-2, with an 88% nucleotide similarity, classifying it as a new member of the beta coronavirus family (7, 8). SARS-CoV-2 also invades host cells through the spike glycoprotein and the CD147 receptor (9, 10). To confirm this binding in vitro, an anti-CD147 antibody, meplazumab, was used, which significantly inhibited viral invasion of host cells (9). Coronavirus transmission occurs primarily through respiratory droplets and less frequently via aerosols (suspended solid or liquid particles in gas) and fomites (transmission of infectious diseases via objects) (11).

The pathogenesis of SARS, MERS, and SARS-CoV-2 is not limited to the lungs (12), as the ACE2 receptor is also expressed in tissues such as the heart, kidney tubules, the luminal surface of the small intestine, and blood vessels (13-16). The severe consequences of these diseases include respiratory failure, acute respiratory distress syndrome (ARDS), pneumonia, and heart damage (17-19). Patients whose COVID-19 diagnosis was confirmed by real-time RT-PCR and next-generation sequencing (NGS) (20) often had underlying conditions, including diabetes, hypertension, and cardiovascular disease. They exhibited symptoms such as fever, cough, and fatigue, along with less common symptoms like sputum production, headache, and diarrhea (17). There is also evidence suggesting that COVID-19 can directly damage pancreatic beta cells (21). Based on studies, the gut and fecal microbiome composition correlates with COVID-19 severity and plasma concentrations of several inflammatory cytokines and hematologic markers, indicating tissue damage. These changes in the microbiome persist even after the clearance of SARS-CoV-2 (22).

The most common clinical symptoms of COVID-19 have been fever, cough, muscle aches, or fatigue, while laboratory findings have included abnormal lymphocyte counts and elevated C-reactive protein (CRP) levels (23). Studies have shown that patients over 60 years old exhibited more pronounced symptoms, including lymphopenia, thrombocytopenia, and elevated CRP and lactate dehydrogenase levels (24). Further examinations revealed increased CRP and erythrocyte sedimentation rate (ESR), as well as CT scan findings such as ground-glass opacities (GGO), fibrotic streaks, and subpleural transparent lines (25). Studies also found that at least one-third of COVID-19 cases are asymptomatic. Additionally, nearly three-fourths of individuals who were asymptomatic at the time of PCR testing remained asymptomatic at follow-up (26). Overall, the most commonly reported symptoms in COVID-19 patients include fever or chills, headache, muscle or body aches, dry cough, fatigue, shortness of breath, decreased white blood cell count, and radiographic evidence of pneumonia. Less commonly reported symptoms include diarrhea, runny nose, liver damage, kidney damage, nausea, vomiting, and signs of lymphopenia and thrombocytopenia. Symptoms typically appear 2 to 14 days after exposure to the virus (17, 27-30).

This virus has been identified in clinical specimens using NGS, real-time RT-PCR, cell culture, and electron microscopy (18, 31). Although RT-qPCR is suitable for detection, it can sometimes yield false-negative results due to sample contamination or technical flaws, which cannot be overlooked given the serious consequences of misdiagnosis in the context of COVID-19 (32, 33). Detecting viral RNA outside the respiratory tract does not necessarily indicate the presence of viable viruses, and the diagnostic significance of detecting this virus outside the respiratory tract remains unclear (34). Since patients typically experience pneumonia symptoms in the early stages of infection (35), CT chest scans have higher sensitivity for diagnosing COVID-19 infection compared to RT-qPCR (36). To diagnose current infection or past exposure to SARS-CoV-2, IgM and IgG antibodies are assessed (37). Individuals with mild COVID-19 symptoms were found to have virus-specific memory T cells, B cells, specific IgG antibodies, and neutralizing plasma against COVID-19 three months after symptom onset (38).

Severe complications and symptoms from COVID-19 can occur at any age, including in patients without comorbidities, but the most severe cases are typically observed in older patients or those with underlying conditions such as cardiovascular disease, diabetes, hypertension, chronic lung disease, cancer (particularly hematological, lung, and metastatic), chronic kidney disease, and obesity (39). In older patients with comorbidities, COVID-19 often progresses to severe stages (39).

The US Centers for Disease Control and Prevention (CDC) has also identified immunosuppressed states and liver disease as risk factors for severe illness (40), although available data on these conditions remain limited.

Given the varied results of studies on the characteristics of hospitalized ICU COVID-19 patients and factors influencing their outcomes, the present study was designed to investigate the demographic characteristics, as well as morbidity and mortality factors, of COVID-19 patients admitted to the internal ICU of Imam Reza Hospital in Mashhad. The goal was to use the findings to improve the management of hospitalized COVID-19 ICU patients.

Materials and methods

Study Implementation Steps

The present study is a cross-sectional study conducted by collecting data from patients with a confirmed diagnosis of COVID-19 based on RT-PCR tests, who were hospitalized in the ICU of Imam Reza (AS) Hospital, Mashhad University of Medical Sciences, Mashhad, Iran. Patients who were directly transferred from the emergency department to the ICU or were transferred to the ICU within the first 72 hours of hospitalization in the wards were included in the study.

The study population included individuals whose records were registered at Imam Reza Hospital in Mashhad and who were diagnosed with COVID-19 based on RT-PCR tests. However, it should be noted that during the early stages of the disease, PCR testing was not available for all patients, and diagnoses were made based on CT scans and clinical symptoms.

Sampling was performed using a census approach; for this purpose, the records of patients admitted to Imam Reza (AS) Hospital in Mashhad from April 1, 2020, to September 22, 2021, were reviewed, and the required information was extracted.

Information recorded and evaluated in this study included:

1- A demographic questionnaire was used to collect information on the following: gender, age, admission date, discharge date, length of stay, interval between onset of symptoms and referral to the hospital, outcome of hospitalization (whether hospitalization led to death), underlying diseases (such as diabetes, hypertension, cardiovascular diseases, pulmonary diseases, malignancies, liver diseases, renal diseases, HIV, autoimmune diseases, history of organ transplantation, hematological diseases, rheumatological diseases, obesity based on BMI over 35, infectious diseases, neurological diseases, and other similar conditions), smoking history, history of drug abuse, alcohol use history, exposure to an individual with COVID-19, travel history, influenza vaccination history, and use of medications such as antihypertensive drugs, ACE inhibitors/ARBs, antidiabetic drugs, chemotherapy, corticosteroids, NSAIDs, immunosuppressive drugs, and other similar treatments.

2- Vital signs of the patient, including: oxygen saturation level, heart rate (beats per minute), respiratory rate (breaths per minute), and systolic and diastolic blood pressure.

3- Patient physical and clinical symptoms, including: fever, cough, fatigue, headache, hemoptysis, diarrhea, vomiting, nausea, shortness of breath, hypertension, sputum production, rhinorrhea, abdominal pain, conjunctivitis, myalgia, weakness, sore throat, anemia, and other similar conditions.

4- Laboratory findings, including: CBC parameters, random blood sugar, urea, creatinine (Cr), plasma mineral levels, inflammatory markers, coagulation factors, and liver enzymes. It should be noted that only the first laboratory test taken at the time of admission was recorded, and laboratory tests conducted during the patient's hospital stay were not investigated.

5- Imaging findings, including the extent of lung involvement and the observed findings on CT scan.

6- Treatment performed for the patient.

Statistical methods and sample size

After data collection, the information was entered into SPSS 24 software and analyzed using descriptive statistics, independent t-test, one-way ANOVA, Tukey's post hoc test, and Pearson correlation coefficient, with an alpha level set at 0.05. Since the study was conducted as a census, there was no need to calculate the sample size.

Ethical Considerations

All stages of the study adhered to the ethical principles outlined in the Helsinki Declaration and were approved by the Ethics Committee of Mashhad University of Medical Sciences. This study was submitted to the Institutional Ethics Committee of Mashhad University of Medical Sciences on December 21, 2021, under the title

"Investigation of Demographic Characteristics, Comorbidities, and Mortality Factors of COVID-19 Patients Hospitalized in the Internal ICU of Imam Reza (AS) Hospital," with code 4001130, and was approved under code IR.MUMS.MEDICAL.REC.1400.649.

Results

A total of 409 patients were hospitalized in the ICU during the study period and included in the analysis. Of these, 252 patients (61.5%) were male, and the remaining 157 were female. The mean age of the patients was 56.32 ± 15.92 years. The symptoms and signs of the patients are presented in Table 1. As shown, the most common symptom observed was shortness of breath, reported by 392 patients (95.6%). The underlying diseases of the patients are also evaluated. As shown, the most common underlying disease was hypertension, present in 52.4% of the participants. The medications used by the patients are also assessed. As observed, the most commonly used medication was antihypertensive drugs, taken by 53.9% of the patients.

Table 1. Signs and symptoms, past medical history, and medications used by the studied patients

Characteristic	Frequency	Percent
Fever	268	65.4
Cough	196	47.8
Dyspnea	392	95.6
Sputum production	33	8
Chest discomfort	319	77.8
Nausea	117	28.5
Vomiting	119	29
Diarrhea	34	8.3
Rhinorrhea	1	0.2
Headache	271	66.1
Abdominal pain	38	9.3
Myalgia	178	43.4
Arthralgia	95	23.2
Weakness	339	82.7
Fatigue	157	38.3
Confusion	72	17.6
Anemia	4	1
Dysgeusia	2	0.5
Diabetes	206	50.2
Hypertension	215	52.4
Asthma	3	0.7
IHD (Ischemic heart disease)	128	31.2
Autoimmune diseases	5	1.2
Chronic kidney disease	35	8.5
Organ transplant	14	3.4
Malignancy	9	2.2
COPD	34	8.3
Smoking	146	35.6
Illicit drug use	55	13.4
ACEI/ARB use	204	49.8
Antihypertensives	221	53.9
Antidiabetics	193	47.1
Chemotherapy	3	0.7
Corticosteroids	21	5.1
Immunosuppressants	19	4.6
Lipid-lowering drugs	3	0.7

Of the total patients included in the study, 229 patients (55.9%) died. Table 5 compares the demographic characteristics of deceased and discharged patients. As shown, gender did not differ significantly between the two groups, but the age of deceased patients was significantly higher than that of discharged patients (p<0.001).

Table 2: Comparison of demographic characteristics between deceased and discharged patients

Characteristic		Deceased Frequency (%) or Mean±SD	Discharged Frequency (%) or Mean±SD	P-value
Gender	Male	147 (64.2)	104 (57.8)	0.186*
	Female	82 (35.8)	76 (42.2)	
Age		60.36±14.84	51.22±15.86	0.001**
Smoking		87 (38)	59 (32.6)	0.257*
Illicit drug use		29 (12.7)	26 (14.4)	0.616*

*The chi-square test was used for comparisons between groups

**Independent t-test was used for comparisons between groups

Table 3 compares the symptoms and signs at presentation between the survival and deceased groups. As shown, confusion was significantly more prevalent among deceased patients compared to discharged patients (p<0.001), while arthralgia was more common among discharged patients (p = 0.018).

Table 3: Comparison of symptoms/signs between deceased and discharged patients

Characteristic	**Deceased Frequency (%)**	**Discharged Frequency (%)**	**P-value**
Fever	157 (68.6)	111 (61.3)	0.126*
Cough	107 (46.7)	89 (49.2)	0.622*
Dyspnea	220 (96.1)	172 (95)	0.609*
Sputum	16 (7)	17 (9.4)	0.374*
Chest discomfort	177 (77.3)	142 (78.5)	0.779*
Nausea	65 (28.4)	52 (28.7)	0.939*
Vomiting	71 (31)	48 (26.5)	0.320*
Diarrhea	18 (7.9)	16 (8.6)	0.721*
Rhinorrhea	1 (0.4)	0 (0)	0.999**
Headache	147 (64.2)	124 (68.5)	0.359*
Abdominal pain	22 (9.6)	16 (8.8)	0.790*
Myalgia	94 (41)	84 (46.4)	0.277*
Arthralgia	43 (18.8)	52 (28.7)	0.018*
Weakness	194 (84.7)	145 (80.1)	0.221*
Fatigue	80 (34.9)	77 (42.5)	0.116*
Confusion	54 (23.6)	18 (9.9)	0.001>*
Anemia	2 (0.9)	2 (1.1)	0.999**
Dysgeusia	2 (0.9)	0 (0)	0.208**

*Chi-square test

**Fisher's exact test

Table 4 compares underlying diseases between deceased and discharged patients. As shown, diabetes (p=0.006), hypertension (p<0.001), and ischemic heart disease (p=0.014) were significantly more prevalent among deceased patients compared to survivors. Table 8 compares medications between the two outcome groups.

Table 4: Comparison of comorbidities between deceased and discharged patients

Characteristic	Deceased Frequency (%)	Discharged Frequency (%)	P-value
Diabetes	129 (56.3)	77 (42.5)	0.006*
Hypertension	142 (62)	73 (40.3)	0.001>*
Asthma	0 (0)	3 (1.7)	0.085**
IHD	83 (36.2)	45 (24.9)	0.014*
Autoimmune disease	4 (1.7)	1 (0.6)	0.389**
CKD	21 (9.2)	14 (7.7)	0.605**
Organ transplant	14 (6.1)	5 (2.8)	0.109*
Malignancy	6 (2.6)	3 (1.7)	0.509*
COPD	22 (9.6)	12 (6.6)	0.278*

*Chi-square test
**Fisher's exact test

Table 5: Comparison of medications between deceased and discharged patients

Characteristic	Deceased Frequency (%)	Discharged Frequency (%)	P-value
ACEI/ARB	133 (58.1)	71 (39.2)	0.001>*
Antihypertensives	146 (63.8)	75 (41.4)	0.001>*
Antidiabetics	120 (52.4)	73 (40.3)	0.015*
Chemotherapy	1 (0.4)	2 (1.1)	0.586**
Corticosteroids	14 (6.1)	7 (3.9)	0.306*
Immunosuppressants	14 (4.1)	5 (2.8)	0.109*

*Chi-square test
**Fisher's exact test

Table 6 compares vital signs at presentation between the two groups. As shown, heart rate (p<0.001), respiratory rate (p<0.001), and SpO2 (p<0.001) significantly differed between deceased and discharged patients.

Table 6: Comparison of vital signs between deceased and discharged patients

Characteristic	Deceased Mean±SD	Discharged Mean±SD	P-value*
Heart rate (bpm)	118.08±13.31	111.81±14.27	0.001>
Respiratory rate	34.25±4.16	30.35±3.60	0.001>
Systolic BP	130.45±22.47	126.84±21.23	0.102
Diastolic BP	83.85±13.59	82.23±12.42	0.221
SPO2 (%)	70.39±7.02	79.01±5.89	0.001>

*Independent t-test

Table 7 compares laboratory findings and CT scores between deceased and survival groups. As shown, blood glucose (p<0.001), urea (p<0.001), creatinine (p<0.001), CRP (p=0.017), INR (p=0.026), and CT score (p<0.001) were significantly higher in deceased patients compared to discharged patients.

Table 7: Comparison of laboratory findings and CT scores between deceased and survival groups

Characteristic	All patients Mean±SD	Deceased Mean±SD	Discharged Mean±SD	P-value*
WBC (/L109)	10.49±5.78	11.15±5.75	10.67±5.83	0.396
PMN (%)	84.38±8.49	85.09±8.51	83.48±8.41	0.057
Hemoglobin (g/dl)	12.85±2.40	12.82±2.44	12.89±2.36	0.772
Platelet (/L109)	213.56±109.48	212.43±108.96	215.01±110.42	0.814
Blood glucose (mg/dl)	183.99±11.52	142.54±71.50	165.67±98	0.001>
Urea	58.63±47.21	66.26±53.35	48.85±35.76	0.001>
Creatinine (mg/dl)	1.41±1.37	1.57±1.52	1.21±1.11	0.009
Sodium	136.05±4.64	135.83±4.93	136.33±4.26	0.274
Potassium	4.40±0.70	4.46±0.77	4.32±0.59	0.052
ESR	49.36±30.51	51.35±31.37	46.82±29.27	0.143
CRP	143.51±82.93	152.25±82.53	132.43±82.34	0.017
AST (U/L)	67.99±143.08	64.21±121.28	72.87±166.86	0.539
ALT (U/L)	60.83±115.76	53.98±64.51	69.59±158.66	0.177
ALP (U/L)	207.28±112.30	214.15±111.57	138.40±112.95	0.164
INR	1.14±0.41	1.18±0.50	1.09±0.25	0.026
PTT	33.24±24.18	35±27.86	31.06±18.41	0.089
CT score	17.22±4.39	18.05±4.13	16.15±4.48	0.001>

*Independent t-test

Discussion

The findings of this study clearly indicate that psychotherapists are exposed to multiple occupational hazards, including burnout, job stress, secondary trauma, and compassion fatigue. These hazards can have serious impacts on their mental health and professional performance. Specifically, the results demonstrate that various factors, such as the type of clients, the severity of clients' psychological issues, and the duration of therapy sessions, can influence the extent of these hazards experienced by psychotherapists.

Approximately 23% of the reviewed studies focused specifically on occupational burnout and its related factors in psychotherapists, highlighting the prevalence and significance of burnout within the profession. Work-life balance and self-compassion emerged as the strongest predictors of reduced burnout, underscoring their importance in mitigating this risk. Enhancing these factors could significantly improve the mental well-being of psychotherapists, emphasizing the need for targeted interventions.

The analysis suggests that the development and implementation of self-care programs and organizational support can help mitigate these hazards. Self-care programs may include psychological exercises, recreational and physical activities, and supportive sessions with colleagues. Organizational support could involve providing professional counseling, reducing workload, as well as creating a supportive and respectful work environment.

In addition, around 31% of the studies explored the impact of personality factors and communication In the present study, the average age of mothers in the intervention group was 26.7 years and, in the control, group was 28.3 years, and the average age of the companions in both groups was 33.5 years. In terms of demographic characteristics, education and This study investigated the demographic characteristics, comorbidities, and mortality factors of COVID-19 patients hospitalized in the ICU. Over 60% of all ICU patients were male, and the mean age of the patients was approximately 56 years. The most common symptom presented by patients was shortness of breath, which was observed in more than 95% of the cases. Other common symptoms included weakness, chest discomfort, headache, fever, and cough. Among underlying diseases, the prevalence of diabetes and hypertension was notably high, with more than half of the patients having diabetes and a similar proportion affected by hypertension. Ischemic heart disease was another prevalent comorbidity, reported in about 30% of the patients. As expected, the most commonly prescribed medications were antihypertensives and antidiabetic drugs. Unfortunately, approximately 56% of the patients included in the study succumbed to the disease. The evaluation of the association between demographic factors and patient mortality revealed that the gender of deceased patients did not significantly differ from that of discharged patients; however, the age of deceased patients

was significantly higher. Furthermore, there was no significant difference between the two groups in terms of smoking and substance abuse rates. A comparison of symptoms and signs at presentation between the survival and deceased groups indicated that the only symptom significantly associated with mortality was confusion at presentation. Approximately one-fourth of deceased patients exhibited confusion at admission, while this rate was less than 10% among discharged patients.

An interesting finding was that the prevalence of arthralgia was significantly higher in surviving patients compared to deceased ones. Based on current evidence, no specific mechanism can be identified to explain the lower prevalence of arthralgia in deceased patients, and this finding may have been incidental. The prevalence of underlying diseases was compared between deceased and discharged patients, and as expected, the prevalence of diabetes, hypertension, and ischemic heart disease was significantly higher in deceased patients. However, contrary to our expectations, the prevalence of asthma and COPD did not differ significantly between the two groups. This could be due to the minimal number of patients with asthma and COPD in the study, which may have limited the statistical power to detect significant differences. A comparison of vital signs at initial presentation between deceased and discharged patients revealed that the heart rate, respiratory rate, and SPO2 were significantly higher, faster, and lower, respectively, in deceased patients compared to those who survived. However, systolic and diastolic blood pressures did not differ significantly between the two groups. Laboratory findings were also compared between the two groups, and it was found that random blood glucose levels were significantly higher in deceased patients compared to discharged ones. Given the higher prevalence of diabetes mellitus among deceased patients, the elevated blood glucose levels are expected. Additionally, blood urea and creatinine levels were significantly higher in deceased patients. Since the rate of chronic kidney disease did not differ significantly between the two groups, this finding may suggest more severe acute kidney injury in patients who ultimately died. CRP levels were also significantly higher in deceased patients, indicating that inflammatory responses were more severe in those who died compared to survivors, as CRP is an acute-phase reactant. Finally, the INR level was significantly higher in deceased patients compared to discharged ones.

In a 2022 study by Auld et al., involving 1,686 ICU-admitted patients from four university hospitals in the United States, the in-hospital mortality rate was approximately 30%. This rate was significantly associated with older age, a higher number of comorbidities, and elevated CRP levels. These findings are consistent with those of the present study, as both studies identified older age, more comorbidities, and higher CRP levels as factors associated with increased mortality (41). In a 2022 study by Demoule et al. involving 1,166 hospitalized patients, the age of deceased patients was significantly higher than that of discharged patients, and the number of males was also higher among deceased patients. The prevalence of COPD, asthma, hypertension, diabetes mellitus, chronic heart failure, and chronic kidney disease was significantly higher in deceased patients compared to those who were discharged. Similarly, in the present study, the prevalence of hypertension and diabetes mellitus was higher in deceased patients; however, there was no significant difference between the two groups in terms of asthma and COPD prevalence, possibly due to the smaller sample size in the present study compared to that of Demoule et al. (42). In a 2021 study by Cirillo et al., 300 ICU-admitted patients in England were evaluated. The findings revealed that patients who died in the hospital were significantly older and had higher CRP and creatinine levels at presentation compared to those who were discharged, similar to the findings of the present study. However, the gender distribution, smoking rate, and prevalence of underlying diseases, including diabetes, hypertension, and coronary artery disease, were similar between the two groups, which may be attributed to the smaller sample size in the present study compared to that of Cirillo et al. (43). In a retrospective study published in 2020 by Grasselli et al., the authors enrolled 3,988 ICU-admitted, PCR-confirmed COVID-19 patients in Italy and assessed the risk factors associated with their mortality. The results showed that, overall, 53% of the patients died, and independent risk factors associated with higher mortality included older age, male gender, a history of COPD, hypercholesterolemia, and diabetes mellitus, which are consistent with the findings of the present study (44). In a 2020 study by Suleyman et al. involving 463 COVID-19 patients, the results revealed a high prevalence of underlying diseases such as hypertension,

diabetes, and chronic kidney disease among the patients. Additionally, older age and male gender were associated with an increased risk of requiring intensive care and mortality in these patients. Regarding clinical symptoms, cough, fever, and shortness of breath were among the most common symptoms at admission. However, the study did not investigate other symptoms, such as weakness, headache, and arthralgia, which were more commonly observed in survivors (45). Numerous studies have been conducted on the impact of metabolic disorders on mortality in COVID-19 patients. Overall, metabolic disorders are considered risk factors for mortality, morbidity, and the development of complications associated with COVID-19 infection. For instance, in a study conducted by Kazancioglu et al. in 2024, the results indicated that elevated levels of urea, lactate, and procalcitonin were identified as independent predictors of mortality in patients with candidemia and COVID-19. Additionally, hypotension and fever were recognized as the strongest predictive factors for candidemia in these patients (46). Early identification of risk factors could be effective in reducing the incidence and mortality associated with these infections. Further studies are necessary to investigate various aspects of this topic. The study conducted by Grasselli et al. in 2020 demonstrated that the severity of metabolic disorders and organ dysfunction could increase the risk of mortality. Additionally, the need for mechanical ventilation, older age, male gender, and the presence of underlying diseases such as diabetes and chronic obstructive pulmonary disease (COPD) were identified as independent risk factors associated with increased mortality in these patients. Furthermore, tachypnea, elevated inflammatory markers, and renal failure were significantly more prevalent in deceased patients, which is consistent with the findings of the present study (47).

In our study, hypertension emerged as the most common underlying disease among participants. This finding is consistent with global reports identifying hypertension as a prevalent comorbidity in patients hospitalized with COVID-19. The high prevalence may be attributed to the fact that hypertension is widespread in the general adult population, particularly among the elderly, who are also more likely to experience severe outcomes from COVID-19. Moreover, hypertension is often associated with other cardiovascular and metabolic conditions, which may contribute to increased vulnerability to SARS-CoV-2 infection and related complications.

Another notable finding was the significantly higher international normalized ratio (INR) observed in deceased patients compared to those who were discharged. An elevated INR indicates a prolonged prothrombin time, which may reflect liver dysfunction, coagulopathy, or disseminated intravascular coagulation (DIC)—all of which are known complications in severe COVID-19 cases. This elevation in INR may serve as a marker of systemic inflammation and multi-organ failure, both of which are associated with a poorer prognosis. Therefore, monitoring INR levels could provide prognostic value in critically ill COVID-19 patients.

Conclusion

The main finding of the present study was the identification of factors associated with in-hospital mortality in COVID-19 patients admitted to the ICU. Our results showed that older age, underlying hypertension and diabetes, hemodynamic instability at presentation, and confusion at admission were associated with higher patient mortality. Therefore, patients presenting with these characteristics require closer monitoring from the onset of hospitalization. Given the consistency of the findings in the present study with other reports, it is recommended that strategies be adopted to rapidly improve the clinical status of these patients to reduce their mortality. Additionally, to confirm or refute the influence of factors with conflicting results, further studies with larger sample sizes are suggested to obtain more reliable and accurate results.

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