OSONG PUBLIC HEALTH AND RESEARCH PERSPECTIVES

pISSN 2210-9099 eISSN 2233-6052
https://doi.org/10.24171/j.phrp.2021.0012
Osong Public Health Res Perspect 2021;12(3):169-176

Original Article

Epidemiological, imaging, laboratory, and clinical characteristics and factors related to mortality in patients with COVID-19: a single-center study

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ABSTRACT

Objectives: Coronavirus disease 2019 (COVID-19) is a novel pandemic. Considerable differences in disease severity and the mortality rate have been observed in different parts of the world. The present study investigated the characteristics and outcomes of patients hospitalized with COVID-19 in Iran.
Methods: We established a retrospective cohort to study hospitalized COVID-19 patients in Iran. Epidemiological, imaging, laboratory, and clinical characteristics and outcomes were recorded from medical documents. The chi-square test, t-test, and logistic regression models were used to analyze the data. A $p < 0.05$ was considered to indicate statistical significance.
Results: In total, 364 cases (207 males and 157 females) were analyzed. The most common symptoms were cough, fever, and dyspnea. Multifocal bilateral ground-glass opacities with peripheral distribution were the predominant imaging finding. The mean age of patients was 54.28±18.81 years. The mean age of patients who died was 71.50±14.60 years. The mortality rate was 17.6%. The total proportion of patients with a comorbidity was 47.5%, and 84.4% of patients who died had a comorbidity. Sex, history of diabetes mellitus, and dyslipidemia were not significantly associated with mortality ($p > 0.05$). However, mortality showed significant relationships with body mass index; age; history of hypertension, chronic kidney disease (CKD), ischemic heart disease, cerebrovascular accident (CVA), pulmonary disease, and cancer; and abnormal high-resolution computed tomography (HRCT) findings ($p < 0.05$ for all). Cancer had the highest odds ratio.
Conclusion: Comorbidities (especially cancer, CKD, and CVA), severe obesity, old age, and abnormal HRCT findings affected the health outcomes of patients hospitalized with COVID-19.

Keywords: COVID-19; Epidemiology; Hospitalization; Mortality

Received: January 13, 2021
Revised: March 30, 2021
Accepted: April 13, 2021

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Introduction

Coronavirus disease 2019 (COVID-19), which is caused by a novel coronavirus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was first reported in Wuhan, Hubei Province, China, in December 2019. Subsequently, COVID-19 has spread widely, affecting countries throughout the world. The first report of an outbreak in Iran was on February 29, 2020, in Birjand, the capital of the province of South Khorasan located in eastern Iran.

The incidence of COVID-19 varies by region, and considerable differences in the epidemiological and clinical characteristics, disease severity, and mortality rate of patients treated in different parts of the world have been observed [1,2]. For example, although the fatality rate of COVID-19 in China was 3.8%, the rate was 5.8% in Wuhan and only 0.7% in the rest of mainland China [3].

Early recognition of severe cases of COVID-19 is absolutely essential for timely triaging of patients. Accurate knowledge of the clinical characteristics, concurrent comorbidities, laboratory parameters, and imaging features may facilitate this assessment [4]. Despite the immensity of the problem, there are limited data available regarding the characteristics and mortality of hospitalized patients in Iran [5]. Thus, the aim of the present study was to assess the characteristics and outcomes of hospitalized patients with COVID-19 in Birjand, Iran.

Materials and Methods

In this retrospective cohort study, the study population included all patients who were admitted to Valiasr Hospital in Birjand, Iran, between February 2020 and September 2020 due to COVID-19 with a laboratory-confirmed case of COVID-19. We defined laboratory confirmation as at least one positive result after a real-time reverse transcription polymerase chain reaction (PCR) assay of a specimen collected on a nasopharyngeal swab according to World Health Organization protocols. Patients who were discharged from the hospital or died were included in the study [5]. The exclusion criteria were patients with a negative PCR test result; outpatients; patients with incomplete demographic, imaging, and clinical information (incomplete medical records); patients with undefined outcomes (discharged/dead); and patients who were still hospitalized at the end of the study [5].

The study protocol was approved by the Birjand University of Medical Sciences research council and the university ethics committee (ethics code: IR.BUMS.REC.1399.105). In all stages of the work, the principle of confidentiality of information was observed, and all data were recorded without the patient's name or identifying information.

All patients' medical records were extracted from Valiasr Hospital's medical records unit. The extracted data included patients' epidemiological and clinical characteristics, comorbidities, imaging (high-resolution computed tomography [HRCT]) features, related laboratory findings, and outcomes. In order to classify patients in terms of body mass index (BMI), the following criteria were used: underweight was classified as a BMI of less than 18.5 kg/m^2, normal weight as 18.5 to 24.9 kg/m^2, overweight as 25.0 to 29.9 kg/m^2, moderate obesity as 30.0 to 34.9 kg/m^2, and severe obesity as ≥ 35 kg/m^2 [6,7]. The target for hypertension (HTN) control during hospitalization was a systolic blood pressure (SBP)/diastolic blood pressure (DBP) <140/90 mmHg, based on the 2018 ESC/ESH guideline and the 2020 ISH guideline [8]. Patients were classified as having poor BP control if either the average in-hospital SBP was ≥140 mmHg or the average in-hospital DBP was ≥90 mmHg. Patients were classified as having good BP control if both the average in-hospital SBP was <140 mmHg and the average in-hospital DBP was <90 mmHg [8]. To calculate the average in-hospital SBP (or DBP), all data on SBP (or DBP) from a patient's documents during hospitalization were extracted, and their sum was calculated and divided by the total number of data points. The normal range for blood oxygen saturation (SpO_2) was considered 94% to 98%. SpO_2 below 94% was considered abnormal [9]. The case fatality rate (CFR) was defined as the number of confirmed deaths divided by the number of confirmed cases [10]. Severe cases with critical illness were defined as those that required invasive ventilation (by endotracheal intubation or ventilator) or intensive care unit (ICU) admission, or that resulted in death [2]. Comorbidities were defined as the presence of other underlying diseases, including a history of at least 1 of the following: HTN, diabetes mellitus (DM), ischemic heart disease (IHD), cerebrovascular accident (CVA) or stroke, dyslipidemia (DLP), chronic kidney disease (CKD), chronic pulmonary disease (asthma or chronic obstructive pulmonary disease), and cancer [2,5].

The obtained data were entered into IBM SPSS ver. 22.0 (IBM Corp., Armonk, NY, USA). Frequencies in each subcategory were calculated and comparisons were made using the chi-square and paired-sample t-tests. Adjusted logistic regression analysis was used to predict the outcome (probability of death). A p-value of <0.05 was considered to indicate statistical significance.

Results

A total of 364 patients with COVID-19 admitted to Valiasr

https://doi.org/10.24171/j.phrp.2021.0012

Hospital in Birjand were studied, of whom 157 (43.1%) were females and 207 (56.9%) were males. The mean duration of hospitalization was 8.5±4.3 days, and the mean duration between the onset of symptoms to hospital admission was 5.1±2.1 days.

The mean age of patients was 54.28±18.81 years, with a mean age of 59.87±18.40 years for females and 50.01±18.24 years for males. The mean age of patients who survived and were discharged from the hospital was 50.61±17.54 years, and the mean age of hospitalized patients who died of COVID-19 was 71.50±14.60 years. There was a significant difference between the mean age of surviving patients and patients who died ($p < 0.001$).

Table 1 shows the symptoms of hospitalized patients with COVID-19 in the present study. The most common symptom was cough, followed in descending order by fever and dyspnea. Among all patients, 213 (58.5%) had a non-productive cough and 41 (11.3%) had a productive cough.

Table 2 shows the frequency of abnormal signs of hospitalized patients with COVID-19 in the present study.

Of the 364 hospitalized patients studied, 300 (82.4%) survived (discharged) and 64 (17.6%) died. Thus, the CFR was 17.6%. Of the patients who survived and were discharged, 171 (57%) were males and 129 (43%) were females. Of the patients who died, 36 (56.3%) were males and 28 (43.8%) were females. There was no significant relationship between sex and the final outcome of patients (discharge vs. mortality) ($p = 0.912$).

There were 66 severe cases involving critical illness (18.1%). Of those cases, 38 patients (57.6%) were males and 28 (42.4%) were females. Thus, 18.3% of males and 17.8% of females had severe cases with critical illness. No significant relationship was found between sex and the severity of cases ($p = 0.56$).

Out of the 54 patients (14.8%) who were admitted to the ICU, 59.3% were males and 40.7% were females. In total, 32 male patients (15.5% of males) and 22 female patients (14.0% of females) needed to be admitted to the ICU. No significant relationship was found between sex and the need for ICU hospitalization ($p = 0.701$). Twelve (3.9%) of the 310 patients who were not admitted to the ICU died, while 52 (96.3%) of the 54 patients admitted to the ICU died. There was a significant relationship between ICU hospitalization and death ($p < 0.001$).

Endotracheal intubation was done in 56 patients (15.4%), of whom 34 (60.7%) were males and 22 cases (39.3%) were females. No significant relationship was found between sex and endotracheal intubation ($p = 0.528$). In 54 cases (14.8%), patients were connected to a ventilator. Of these, 32 (59.3%) were males and 22 (40.7%) were females. No significant

Table 1. Distribution of the frequency of symptoms in patients hospitalized with coronavirus disease 2019

Symptom	Frequency
Cough	254 (69.8)
Fever	239 (65.7)
Dyspnea	208 (57.1)
Myalgia	174 (47.8)
Chills	152 (41.8)
Weakness	123 (33.8)
Lethargy	123 (33.8)
Headache	93 (25.5)
Anorexia	68 (18.5)
Nausea	64 (17.6)
Chest pain	37 (10.2)
Vertigo	36 (9.9)
Diarrhea	36 (9.9)
Sweating	32 (8.8)
Sore throat	31 (8.5)
Vomiting	28 (7.7)
Abdominal pain	26 (7.1)
Impaired consciousness	17 (4.7)
Hyposmia	13 (3.6)
Xerostomia	13 (3.6)
Bone pain	9 (2.5)
Hypogeusia	8 (2.2)
Seizure	5 (1.4)
Rhinorrhea	6 (1.6)
Sneezing	3 (0.8)
Nasal congestion	2 (0.5)
Gastrointestinal bleeding	2 (0.5)
Faintness	2 (0.5)
Arthralgia	1 (0.3)
Otalgia	1 (0.3)
Constipation	1 (0.3)

Data are presented as *n* (%).

Table 2. Distribution of the frequency of abnormal signs of patients hospitalized with coronavirus disease 2019

Sign	Frequency
Lymphopenia	176 (48.4)
Abnormal C-reactive protein	239 (65.7)
Abnormal high-resolution computed tomography	285 (78.3)
Abnormal temperature	132 (36.3)
Abnormal systolic blood pressure	73 (20.1)
Abnormal diastolic blood pressure	67 (18.4)
Abnormal resting heart rate	107 (29.4)
Abnormal respiratory rate	44 (12.1)
Abnormal oxygen saturation	144 (39.6)

Data are presented as *n* (%).

relationship was observed between sex and the need for a ventilator ($p = 0.701$).

Out of the 364 patients admitted to the hospital, 173 (47.5%) had comorbidities, of whom 69 (39.9%) had 1 comorbidity, 40 (23.1%) had 2 comorbidities, and 64 (37.0%) had 3 or more comorbidities. Out of the 64 patients who died, 22 (34.4%) had 1 comorbidity, 10 (15.6%) had 2 comorbidities, 22 (34.4%) had 3 or more comorbidities, and 10 (15.6%) had no comorbidities. Thus, the total number of patients who died who also had a comorbidity was 54 (84.4%).

There was a significant relationship between sex and a history of HTN, DM, chronic pulmonary disease, and DLP ($p < 0.05$). There was no significant relationship between sex and a history of CKD, IHD, CVA, and cancer ($p > 0.05$) (Table 3).

There were no significant relationships between sex, history of DM, or history of DLP and mortality ($p > 0.05$) (Table 4). However, mortality showed significant relationships with BMI classification; age group; a history of HTN, CKD, IHD, CVA, chronic pulmonary disease, and cancer; and abnormal manifestations on HRCT ($p < 0.05$) (Table 4).

Table 5 shows adjusted logistic regression for age and comorbidities. Cancer, CKD, and CVA, in descending order, were the 3 factors most closely associated with mortality among hospitalized patients with COVID-19.

With respect to BMI, distribution was as follows: 33 people (9.1%) were underweight, 129 people (35.4%) had a normal weight, 103 people (28.3%) were overweight, 82 people (22.5%) had moderate obesity, and 17 people (4.7%) had severe obesity group. Among male patients, 16 people (7.7%) were underweight, 65 people (31.4%) had a normal weight, 63 people (30.4%) were overweight, 52 people (25.1%) had moderate obesity, and 11 people (5.3%) had severe obesity. Among female patients, 17 people (10.8%) were underweight, 64 people (40.8%) had a normal weight group, 40 people (25.5%) were overweight, 30 people (19.1%) had moderate obesity, and 6 people (3.8%) had severe obesity. There was no significant relationship between sex and BMI ($p = 0.216$).

There was no significant relationship between sex and abnormal findings on HRCT ($p = 0.783$). In total, 285 patients had HRCT findings indicative of COVID-19. The observed abnormalities on HRCT had a peripheral distribution in 98.9% of cases. In 243 cases (85.3%), the observed abnormalities were multifocal, while in 42 cases (14.7%), unifocal changes were observed. The frequency distribution of abnormalities observed on HRCT was as follows: bilateral ground-glass opacities (GGOs) in 226 cases (62.1%), consolidation in 84 cases (23.1%), unilateral GGOs in 41 cases (11.3%), interlobular septal thickening in 23 cases (6.3%), tree-in-bud sign or pattern in 6 cases (1.6%), air space opacities in 6 cases (1.6%), parenchymal bands in 4 cases (1.1%), and crazy-paving pattern in 4 cases (1.1%).

In total, 76 male patients (36.7%) and 68 female patients (43.3%) had SpO_2 levels below 94%. There was no significant difference between male and female patients in terms of SpO_2 ($p = 0.202$).

Discussion

In our study of hospitalized patients, the most common symptoms were cough, fever, and dyspnea. Multifocal bilateral GGOs with a peripheral distribution were the most predominant imaging finding. The mortality rate was 17.6%. In total, 84.4% of patients who died had at least 1 comorbidity. Mortality showed significant relationships with BMI; age; a history of HTN, CKD, IHD, CVA, chronic pulmonary disease, and cancer; and abnormal HRCT findings.

Consistent with other studies, cough, fever, and dyspnea were the most common presenting symptoms in our study, and comorbidities were also common among COVID-19 patients [5,11–15]. In a review study by Ge et al. [16], the reported median age of patients ranged from 41 to 57 years.

Table 3. Comparison of the distribution of frequent comorbidities among male and female hospitalized patients

Comorbidity	Male (*n* = 207)		Female (*n* = 157)		*p*-value
	Negative	Positive	Negative	Positive	
Hypertension	172 (83.1)	35 (16.9)	89 (56.7)	68 (43.3)	< 0.001
Diabetes mellitus	178 (86.0)	29 (14.0)	104 (66.2)	53 (33.8)	< 0.001
Ischemic heart disease	178 (86.0)	29 (14.0)	140 (89.2)	17 (10.8)	0.366
Cerebrovascular accident	200 (96.6)	7 (3.4)	151 (96.2)	6 (3.8)	0.823
Dyslipidemia	180 (87.0)	27 (13.0)	119 (75.8)	38 (24.2)	0.006
Chronic kidney disease	201 (97.1)	6 (2.9)	153 (97.5)	4 (2.5)	0.839
Pulmonary disease	199 (96.1)	8 (3.9)	133 (84.7)	24 (15.3)	< 0.001
Cancer	201 (97.1)	6 (2.9)	152 (96.8)	5 (3.2)	0.887

Data are presented as *n* (%).

https://doi.org/10.24171/j.phrp.2021.0012

Table 4. Evaluation of the relationships between various characteristics of hospitalized patients and outcomes

Variable	Discharge	Mortality	*p*-value
Body mass index (kg/m^2)			0.040
Underweight	31 (93.9)	2 (6.1)	
Normal weight	97 (75.2)	32 (24.8)	
Overweight	87 (84.5)	16 (15.5)	
Moderate obesity	72 (87.8)	10 (12.2)	
Severe obesity	13 (76.5)	4 (23.5)	
Sex			0.912
Male	171 (82.6)	36 (17.4)	
Female	129 (82.2)	28 (17.8)	
Age (y)			< 0.001
≤ 45	214 (93.9)	14 (6.1)	
> 45	86 (63.2)	50 (36.8)	
Hypertension			< 0.001
No	231 (88.5)	30 (11.5)	
Yes	69 (67.0)	34 (33.0)	
Diabetes mellitus			0.238
No	236 (83.7)	46 (16.3)	
Yes	64 (78.0)	18 (22.0)	
Dyslipidemia			0.355
No	249 (83.3)	50 (16.7)	
Yes	51 (78.5)	14 (21.5)	
Chronic kidney disease			< 0.001
No	296 (83.6)	58 (16.4)	
Yes	4 (40.0)	6 (60.0)	
Ischemic heart disease			< 0.001
No	274 (86.2)	44 (13.8)	
Yes	26 (56.5)	20 (43.5)	
Cerebrovascular accident			< 0.001
No	295 (84.0)	56 (16.0)	
Yes	5 (38.5)	8 (61.5)	
Chronic pulmonary disease			0.002
No	280 (84.3)	52 (15.7)	
Yes	20 (62.5)	12 (37.5)	
Cancer			< 0.001
No	295 (84.0)	56 (16.0)	
Yes	3 (27.3)	8 (72.7)	
High-resolution computed tomography			< 0.001
Negative	77 (97.5)	2 (2.5)	
Positive	223 (78.2)	62 (21.8)	
Oxygen saturation (%)			< 0.001
≥ 94	208 (94.5)	12 (5.5)	
< 94	92 (63.9)	52 (36.1)	
Smoking or hookah use			0.590
Non-smoking	284 (81.6)	64 (18.4)	
Smoking	16 (100.0)	0	
Opium addiction			0.274
No addiction	279 (81.8)	62 (18.2)	
Addiction	21 (91.3)	2 (8.7)	

Data are presented as *n* (%).

Table 5. Adjusted logistic regression for age and comorbidities

Variable	Odds ratio (95% confidence interval)
Cancer	9.21 (1.91–44.52)
Renal disease	6.31 (1.58–25.13)
Cerebrovascular accident	5.65 (1.50–21.3)
Age (>60 y)	4.54 (2.20–9.38)
Pulmonary disease	3.65 (1.42–9.39)
Ischemic heart disease	3.45 (1.54–7.71)

The majority (50%–75%) of patients were male. The results of our study are consistent with their results. A study by Wang et al. [17]—a single-center case series involving 138 patients in Wuhan, China—showed a mean age of 56 years old among hospitalized patients, 54.3% of whom were male, which are similar findings to those of our study. Those authors also reported common symptoms similar to those found in our study, with the exception that lymphopenia occurred in 70.3% of patients, which is higher than our reported rate of lymphopenia. The reason for this difference could be due to the different cut-offs used to define lymphopenia in each study. Another possible explanation may be differences in the characteristics of patients admitted to the hospitals, resulting from differences in hospitalization criteria. HRCT scans in their study showed bilateral patchy shadows or GGOs in the lungs of all patients. Although the manifestations seen on HRCT were similar in both studies, the HRCT scans in our study were not abnormal in all patients. In their study, there were probably more severe cases or cases with mostly respiratory symptoms such as cough and dyspnea, which are usually accompanied by abnormal HRCT findings. In their study, 26.1% of patients were transferred to the ICU, which is a higher proportion than found in our study. Different time intervals between the onset of symptoms and hospitalization could have affected the rates of ICU hospitalization in these studies. In both studies, patients treated in the ICU were older and were more likely to have underlying comorbidities. The overall mortality rate in their study was 4.3%, which is lower than that found in our study. This difference could be due to the fact that some patients were still hospitalized at the end of their study, and their final outcome (survival or death) was not known. If follow-up had been continued, the mortality rate in their study might have been higher. It should also be noted that death and the overall mortality rate depend on multiple variables such as hospital care, treatment, and medical staff, and these factors can result in different mortality rates in different studies. Therefore, another reason for the different results between the 2 studies in terms of mortality might be differences in the above variables and in the quality of care at the hospitals included in each study.

In a study by Gold et al. [18] of 305 hospitalized patients in Georgia, USA, the CFR was 17.1%, which is a similar result to that of our study. As in our study, mortality was significantly associated with age. In their study, 1 in 4 hospitalized patients had no recognized risk factors for severe COVID-19, which was higher than the corresponding percentage in our study (15.1%). Their study showed that 73.8% of patients had comorbidities, which is also a higher proportion than found in our study (47.5%). Their study also had a higher mean age (60 years old) than that of our study (54.28 years old). In total, 50.5% of patients in their study were female, reflecting a slightly higher proportion than in our study. The above-mentioned discrepancies could reflect population-level differences including some related to race and/or ethnicity. Their study showed a current smoking rate of 5.2% among patients, which is similar to the results of our study (4.4%). In their study, HTN, DM, IHD, and chronic pulmonary disease were documented in 67.5%, 39.7%, 25.6%, and 20.3% of patients, respectively. Although the results of the 2 studies were similar in terms of the prevalence of underlying diseases, the overall percentage of people with underlying diseases was lower among the patients in our study, which could be related to racial and ethnic differences and the overall health of the study population in the 2 countries. Severe obesity was present in 12.7% of patients, which is higher than the rate of severe obesity in our study (4.7%). Overall, the percentage of deaths among patients who received ICU care in their study (48.7%) is lower than that of our study (96.9%). In our study, ICU treatment may have been less likely to succeed because patients arrived at the hospital with more advanced disease.

The chance of death for someone hospitalized for COVID-19, according to a study by Horwitz et al. [19] conducted in New York, USA, dropped from 25.6% in March 2020 to 7.6% in August 2020. In a study by Dennis et al. [20] which analyzed survival rates in England, a similar improvement was observed. The initial mortality rate in their study is much higher than in our study. However, over time, the mortality rate in their study became lower than in our study. The initial high risk of mortality in these studies may be related to the initial lack of familiarity with the disease and relevant treatment protocols. Over time, treatment protocols evolved, and medical personnel became better able to control the mortality rate. Differences in hospitalization criteria across countries can also result in differences in mortality rates.

The mortality rate of patients hospitalized with COVID-19 in Iran, as reported by Jalili et al. [5], was 24.4%, which is

https://doi.org/10.24171/j.phrp.2021.0012

higher than the mortality rate in the present study (17.5%). This difference may reflect higher incidence and mortality rates in other parts of the country. The high CFR in their study and ours is consistent with the fact that both studies analyzed hospitalized patients, since mild cases are not likely to be admitted. In their study, the mortality rate was higher among people over 65 years old and those with a history of IHD, DM, chronic pulmonary disease, CKD, or cancer. With the exception of DM, these findings are consistent with the results of our study. In their study, the mortality rate was higher for males than females. The mortality rate for females in the present study was slightly higher than for male; however, the overall difference in mortality rates between males and females in both studies was small.

In a study by Liang et al. [2] on 1,590 cases from 575 hospitals in 31 regions in China, the mean age of patients in Hubei Province (49.7 years old) was close to that of patients in our study (54.28 years). However, outside of Hubei, the mean age (44.9 years) was noticeably lower than in our study. This discrepancy once again emphasizes the different criteria for hospitalization across regions and the possible role played by racial differences. The proportion of cases with comorbidities was higher in our study (47.5%) than in their study (32.9% in Hubei and 19.7% outside Hubei). The overall rate of severe cases and mortality in their study was 16.0% in Hubei and 3.2% outside of Hubei. The rate of severe cases in our study (18.1%) was close to that of their study, but the rate of mortality in their study was lower than that of the present study (17.5%). This could in part be due to the better management of severe cases and ICU patients and more successful treatment protocols in their hospitals than in the hospital we studied, resulting in a higher survival rate of patients with severe cases and ICU patients in their study. Furthermore, the poorer outcomes for COVID-19 patients treated in the hospital from our study might be attributed to a longer period of time between the onset of symptoms and hospitalization at our center. Another reason for this discrepancy may be related to different criteria for hospitalization of COVID-19 patients in Iran and China, and it is possible that patients with milder cases of the disease were hospitalized in China. Another factor suggesting the need for further investigation in future studies is the possible existence of specific gene polymorphisms in the Chinese population that increase resistance to COVID-19 and thus reduce mortality in China.

In a review by Park [3], fever, dry cough, and fatigue were most commonly reported as COVID-19 symptoms, whereas nasal congestion, rhinorrhea, sore throat, and myalgia were relatively rare. Occasionally, non-respiratory symptoms such as palpitation, diarrhea, or headache preceded respiratory symptoms. Although fever and dry cough were among the most common symptoms in our study, fatigue was less common and dyspnea was more common. Some symptoms that were rare in Park's study [3], such as myalgia, were common in our study. In his study, risk factors for severe pneumonia or death included being aged 60 or older and having comorbidities such as HTN, DM, IHD, chronic pulmonary disease, or cancer. This corresponds to the results of our study. Park [3] also observed that laboratory tests of confirmed COVID-19 cases often showed leukopenia, lymphopenia, and mildly elevated C-reactive protein (CRP) levels. This is consistent with our results, although lymphopenia and elevated CRP levels were not seen in all cases in our study. In another study, Velavan and Meyer [4] suggested that clinicians should consider low lymphocyte count as well as the serum levels of CRP, D-dimer, ferritin, cardiac troponin, and interleukin (IL)-6, which may be used in risk stratification to predict severe and fatal COVID-19 cases among hospitalized patients. They stated that it is more likely that the course of the disease will be unfavorable if some or all of these parameters are altered. One of the limitations of our study was the lack of results for some tests, such as IL-6 and D-dimer, in the medical records of all patients, which is why they were excluded as variables in this study.

In their review, Hani et al. [21] stated that typical computed tomography features included peripheral GGOs with a multifocal distribution, and a progressive evolution towards organizing pneumonia patterns. This also matches our results. Those authors also stated that CT may be used for prognostic purposes, with poorer outcomes in patients having more extensive disease and more consolidations.

Although this study evaluated hospitalized COVID-19 patients, it had multiple limitations. The study population was from a single city. The criteria for hospitalization vary across different cities and countries, which may make it difficult to compare mortality rates. In addition, most of the patient variables were self-reported and could not be verified.

Conclusion

Comorbidities, severe obesity, old age, and the presence of abnormal HRCT findings were associated with the final outcomes of hospitalized COVID-19 patients. Among comorbidities, a history of cancer, CKD, and CVA (in descending order of magnitude) further increased the risk of mortality. Patients with these comorbidities should receive special attention to prevent COVID-19 infection, especially if they are older, since infection and hospitalization are not likely to lead to good health outcomes in this population.

Notes

Ethics Approval

This project was approved by the ethics committee of Birjand University of Medical Sciences (ethics code: IR.BUMS.REC. 1399.105). Written Informed Consent was waived by the Board.

Conflicts of Interest

The authors have no conflicts of interest to declare.

Funding

This study was funded by the research vice-chancellor of Birjand University of Medical Sciences.

Availability of Data

All data generated or analysed during this study are included in this published article. For other data, these may be requested through the corresponding author.

Authors' Contributions

Conceptualization: all authors; Data curation: HA; Formal analysis: HS; Investigation: all author; Methodology: HS, TK, HA; Project administration: HA; Writing–original draft: HS, HA; Writing–review & editing: all authors.

Additional Contributions

The authors would like to thank the staff of the Medical Records Unit of Valiasr Hospital in Birjand, Iran, and especially Ms. Younesi, for her excellent cooperation in collecting information from patients' medical documents.

References

1. Chaibakhsh S, Pourhoseingholi A, Vahedi M. Global incidence and mortality rate of COVID-19: special focus on Iran, Italy and China. Arch Iran Med 2020;23:455–61.
2. Liang WH, Guan WJ, Li CC, et al. Clinical characteristics and outcomes of hospitalised patients with COVID-19 treated in Hubei (epicentre) and outside Hubei (non-epicentre): a nationwide analysis of China. Eur Respir J 2020;55:2000562.
3. Park SE. Epidemiology, virology, and clinical features of severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2; Coronavirus Disease-19). Clin Exp Pediatr 2020;63:119–24.
4. Velavan TP, Meyer CG. Mild versus severe COVID-19: laboratory markers. Int J Infect Dis 2020;95:304–7.
5. Jalili M, Payandemehr P, Saghaei A, et al. Characteristics and mortality of hospitalized patients with COVID-19 in Iran: a national retrospective cohort study. Ann Intern Med 2021;174:125–7.
6. Simonnet A, Chetboun M, Poissy J, et al. High prevalence of obesity in severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) requiring invasive mechanical ventilation. Obesity (Silver Spring) 2020;28:1195–9.
7. Cai Q, Chen F, Wang T, et al. Obesity and COVID-19 severity in a designated hospital in Shenzhen, China. Diabetes Care 2020;43:1392–8.
8. Ran J, Song Y, Zhuang Z, et al. Blood pressure control and adverse outcomes of COVID-19 infection in patients with concomitant hypertension in Wuhan, China. Hypertens Res 2020;43:1267–76.
9. Nicholson TW, Talbot NP, Nickol A, et al. Respiratory failure and non-invasive respiratory support during the covid-19 pandemic: an update for re-deployed hospital doctors and primary care physicians. BMJ 2020;369:m2446.
10. Li LQ, Huang T, Wang YQ, et al. COVID-19 patients' clinical characteristics, discharge rate, and fatality rate of meta-analysis. J Med Virol 2020;92:577–83.
11. Isenmann A, Isenmann S. COVID-19: variable symptoms in mild course: olfactory loss and increased resting heart rate. Dtsch Med Wochenschr 2020;145:1095–9. German.
12. Huang I, Pranata R. Lymphopenia in severe coronavirus disease-2019 (COVID-19): systematic review and meta-analysis. J Intensive Care 2020;8:36.
13. Du RH, Liang LR, Yang CQ, et al. Predictors of mortality for patients with COVID-19 pneumonia caused by SARS-CoV-2: a prospective cohort study. Eur Respir J 2020;55:2000524.
14. Zhou F, Yu T, Du R, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. Lancet 2020;395:1054–62.
15. Lian J, Jin X, Hao S, et al. Analysis of epidemiological and clinical features in older patients with coronavirus disease 2019 (COVID-19) outside Wuhan. Clin Infect Dis 2020;71:740–7.
16. Ge H, Wang X, Yuan X, et al. The epidemiology and clinical information about COVID-19. Eur J Clin Microbiol Infect Dis 2020;39:1011–9.
17. Wang D, Hu B, Hu C, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. JAMA 2020;323:1061–9.
18. Gold JA, Wong KK, Szablewski CM, et al. Characteristics and clinical outcomes of adult patients hospitalized with COVID-19 - Georgia, March 2020. MMWR Morb Mortal Wkly Rep 2020;69:545–50.
19. Horwitz LI, Jones SA, Cerfolio RJ, et al. Trends in COVID-19 risk-adjusted mortality rates. J Hosp Med 2021;16:90–2.
20. Dennis JM, McGovern AP, Vollmer SJ, et al. Improving survival of critical care patients with coronavirus disease 2019 in England: a national cohort study, March to June 2020. Crit Care Med 2021;49:209–14.
21. Hani C, Trieu NH, Saab I, et al. COVID-19 pneumonia: a review of typical CT findings and differential diagnosis. Diagn Interv Imaging 2020;101:263–8.

https://doi.org/10.24171/j.phrp.2021.0012