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Original Article

Clinical and Epidemiological Characteristics of Hospitalized COVID-19 Patients in Hormozgan, Iran: A Retrospective, Multicenter Study

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Abstract

Background: To better manage the COVID-19 pandemic, it is necessary to carefully study information about patients with COVID-19.

Objective: To report clinical and epidemiological characteristics of COVID-19 patients in southern Iran.

Methods: This cross-sectional retrospective study was conducted based on data extracted from the COVID-19 registry of Hormozgan. Data from patients with confirmed COVID-19 based on CT-scan results or real-time reverse transcriptase–polymerase chain reaction (RT-PCR) results until September 25, 2020, were analyzed for this study (2351 inpatients). We reported demographics, signs and symptoms on admission, comorbidities, and treatments, as well as clinical outcomes, hospital stay, and intensive care unit (ICU) admission.

Results: Most of patients were men (1235/2351; 52.5%) and the most common signs and symptoms included cough (1343/2351; 57.1%), shortness of breath (1224/2351; 52.1%) and fever. The most common comorbidities included hypertension (410/2351 (17.4%), diabetes (343/2351; 14.6%) and chronic cardiac disease (282/2351; 12%). Also, 228 patients (9.7%) were hospitalized in the ICU. The mortality rate was 12.5% (295/2351) among all patients and 64.5% (147/228) in ICU wards, respectively. The number of cases with comorbidities including hypertension, chronic cardiac disease, diabetes, chronic neurological disorders, chronic kidney disease, chronic hematologic disease, malignant neoplasm, moderate or severe liver disease, dementia and fauvism in the ICU was significantly higher than the general wards.

Conclusion: Most characteristics of our patients were similar to those reported in other studies; however, our patients were younger and suffered from a less severe disease. The mortality rate in the ICU was higher than other studies.

Keywords: COVID-19, Epidemiology, Hormozgan, Iran

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Introduction

A series of pneumonia cases with unknown etiology appeared in Wuhan, China, in December 2019. The clinical symptoms were very similar to those of viral pneumonia.[1] However, more precise research studying the lower respiratory tract led to the discovery of a new virus, later named coronavirus 2019.[2] Being highly contagious for the human-to-human infection and the rapid spread of the virus attracted global attention. Soon enough, the World Health Organization (WHO) declared the coronavirus 2019 disease (COVID-19) as an emergency for public health and international concern.[3,4]

Iran is one of the countries with the highest cases of COVID-19. As of October 6, 2020, there have been 479 000 confirmed cases and 27 000 deaths.[5] To manage COVID-19 data, Hormozgan University of Medical Sciences (HUMS), Iran, established a regional registry program (RCovidRH) in March 2020[6] and started to collect the related data. Although the number of studies addressing COVID-19 is increasing in the world, these studies are mainly from China, the US, and European countries,[7-16] few studies from developing countries such as Iran have also reported the clinical and epidemiological features of the disease. In the present report of RCovidRH,[6] we characterized the features of patients with COVID-19 admitted to hospitals affiliated to HUMS in the Hormozgan province.

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Materials and Methods

Study Design and Population

This retrospective study was carried out based on the data obtained from the RCovidRH.[6] This registry has been collecting data related to patients with a definite or suspected diagnosis of COVID-19 for both outpatients and hospitalized patients referring to 20 hospitals and healthcare facilities throughout Hormozgan province in southern Iran since March 25, 2020. There are 14 cities in Hormozgan in which more than 1,750,627 people live. RCovidRH has already collected the data from more than 5000 patients. We extracted the data related to hospitalized patients with a definite diagnosis of COVID-19 according to CT-scan or real-time reverse transcriptase–polymerase chain reaction (RT-PCR) results until September 25, 2020.

Data Collection

RCovidRH collects data both prospectively and retrospectively. The variables collected in the RCovidRH were selected based on the International Severe Acute Respiratory and Emerging Infection Consortium (ISARIC), the US Center for Disease Prevention and Control (CDC), and WHO case reporting forms.[17-19] The registry extracts the required data from patients' medical records as well as PCR lab test results from the reference laboratory of the province assigned for the diagnosis of COVID-19. Two trained nurses supervised by an infectious diseases specialist review the medical records, and subsequently fill out the data extraction forms, and finally register them in a web-based software. Quality control staff in the registry control the quality of the data continuously and provide required feedback for the collection of shortcomings and completion of data. More details were provided in an earlier study.[6] For this study, we extracted data of 2393 hospitalized patients with a definite diagnosis of COVID-19 from the registry. There were 42 re-admissions. For this study, the researchers solely considered the admission leading to the worst outcome (death); otherwise, the first admission was considered for the analysis. Finally, we analyzed the data from 2351 inpatients.

Outcomes

The main outcome was intensive care unit (ICU) admission. We also reported demographics, signs and symptoms on admission, comorbidities, treatments, clinical outcomes (recovery/death), and length of hospital stay.

Data Analysis

We used frequency and percentage for non-numerical data, and mean, median, and interquartile range (IQR) for numerical variables. Age categories were made based on previous studies.[9,20] We used the Pearson Chi-Square or Fisher's Exact Test for non-numerical variables, and the t-test or Mann-Whitney for numerical variables for the normally distributed data. Normality of distribution was tested with the Kolmogorov-Smirnov test. The analyses were carried out using SPSS software (edition 25) and $P<0.05$ was considered as the level of significance.

Results

Demographic and Social Characteristics

Table 1 shows the demographic and social characteristics of the 2351 patients. The mean age was 47.02 ± 20.4 years (Min-Max: below 1 year and 99 years). Most of the patients were men (52.5%). A total of 228 patients (9.7%) were hospitalized in the ICU. There was a history of traveling 14 days before initiation of symptoms in 2% of patients. The percentage of healthcare staff infected by the disease was 2.7%.

Clinical Characteristics

The most common comorbidities included hypertension (17.4%), chronic cardiac disease (12%), diabetes with or without complications (14.6%), and asthma (5.1%). Moreover, most patients did not have any history of smoking, using alcohol, or drug addiction. ICU patients suffered from significantly more comorbidities including hypertension (28.5% vs. 16.3%), chronic cardiac disease (21.9% vs. 10.9%), diabetes with complications (14% vs. 8%), diabetes without complications (14.5% vs. 5.1%), chronic neurological disorders (9.6% vs. 3.8%), chronic kidney disease (7.5% vs. 3%), chronic hematologic disease (3.9% vs. 1.9%), malignant neoplasm (4.8% vs. 1.8%), moderate or severe liver disease (3.9% vs. 1.1%), dementia (1.3% vs. 0.2%) and fauvism (2.6% vs. 0.7%). Other comorbidities were not significantly different between ICU and non-ICU patients.

The most common symptoms on admission included cough (57.1%), fever (45.1%), shortness of breath (52.1%), fatigue (18.1%), muscle aches (17.7%) and chills (11.3%). Although there was no significant difference for most symptoms between ICU and non-ICU patients, cough, seizure, shortness of breath, fever, fatigue, headache, lost sense (of smell or taste), and vertigo were significantly different between ICU and non-ICU patients (Table 2, Figures 1 and 2).

Vital Signs and Laboratory Results

According to the available vital signs and laboratory results, the values of temperature, blood pressure, platelets, APTT, sodium and potassium did not show any significant difference between ICU and non-ICU patients. The levels of hematocrit, hemoglobin, lymphocyte, and oxygen saturation of ICU patients were significantly lower than non-ICU patients while the reverse was true for other laboratory and vital sign values (Table 3).

Treatments

In total, 47.1% of the patients underwent oxygen therapy. Moreover, this procedure was applied for 95.6% of ICU patients ($P<0.0001$). Non-invasive and invasive ventilation were respectively used for 4.5% and 6.8% of

Table 1. Demographics and Social Characteristics of Hospitalized Patients Infected With COVID-19

Variables	ICU Patients (n = 228; 9.7%)	Non-ICU Patients (n = 2123; 90.3%)	Total Patients (n = 2351)	*P* Value
	No. (%)	No. (%)	No. (%)	
Age				
<10	20 (8.8)	79 (3.7)	99 (4.2)	
10–19	5 (2.2)	80 (3.8)	85 (3.6)	
20–29	11 (4.8)	250 (11.8)	261 (11.1)	
30–39	28 (12.3)	448 (21.1)	476 (20.2)	<0.001*
40–49	26 (11.4)	359 (16.9)	385 (16.4)	
50–59	30 (13.2)	302 (14.2)	332 (14.1)	
60–69	43 (18.9)	339 (16)	382 (16.2)	
≥70	65 (28.5)	265 (12.5)	330 (14)	
Mean (± SD), (y)	53.12 ± 24.4	46.37 ± 19.8	47.02 ± 20.4	<0.001*
Median (Q1, Q3)	58.5 (38, 72)	45 (32, 61)	46 (33, 62)	<0.001*
Min, Max	<1, 99	<1, 94	<1, 99	—
Sex, Male	136 (59.6)	1099 (51.8)	1235 (52.5)	0.024*
Pregnant	8 (3.5)	65 (3.1)	73 (3.1)	0.069
Travel (14ds before symptom), Yes	3 (1.3)	44 (2.1)	47 (2.0)	0.001*
Animal contact, Yes	2 (0.9)	18 (0.8)	20 (0.9)	0.004*
Health care worker, Yes	7 (3.1)	56 (2.6)	63 (2.7)	0.701

*Significant difference

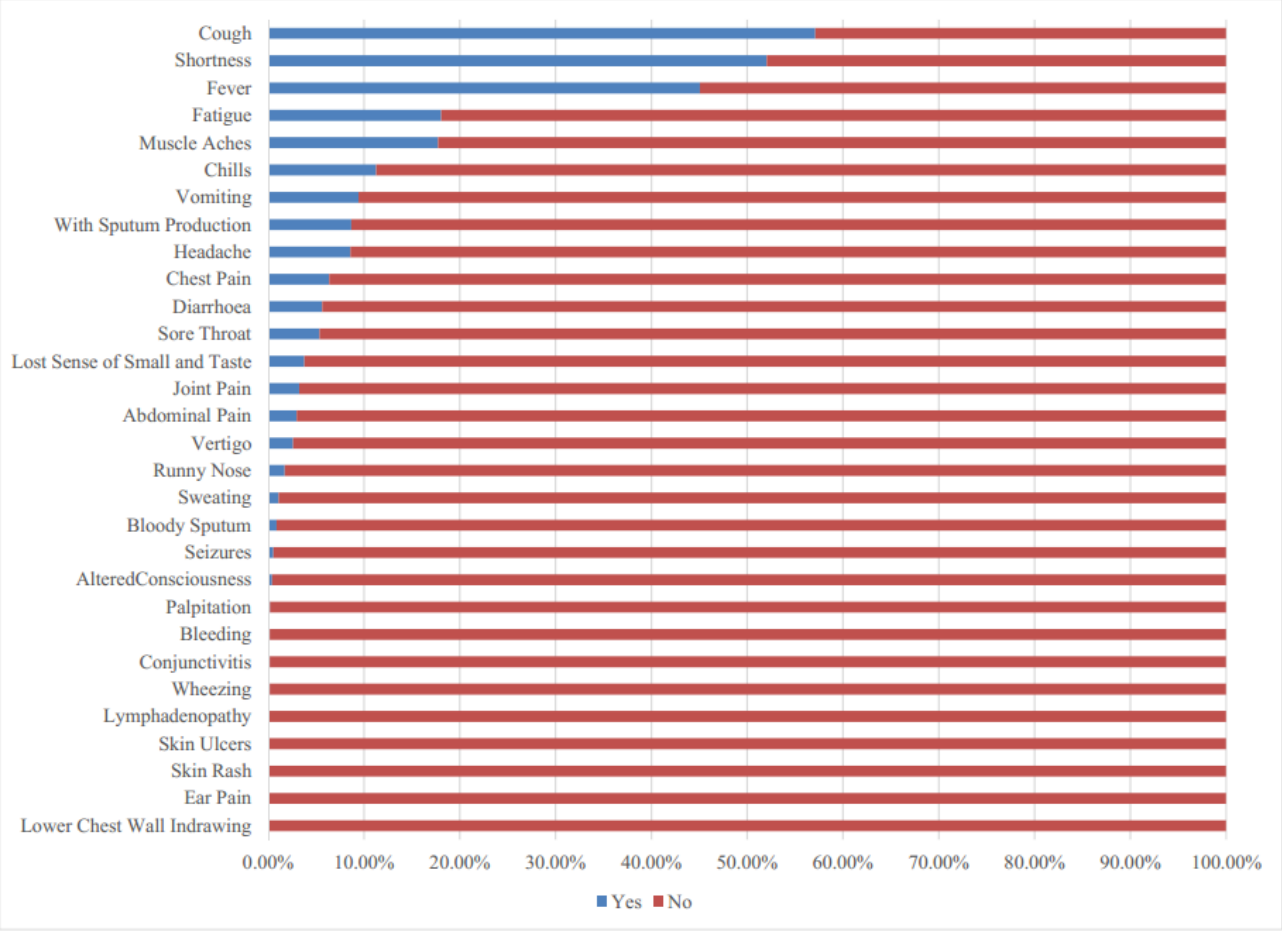

Figure 1. Distribution of Symptoms among Patients.

Table 2. Clinical Characteristics of Hospitalized Patients Infected With COVID-19

Variables	ICU Patients (n = 228)	Non-ICU Patients (n = 2123)	Total Patients (n = 2351)	*P* Value
	No. (%)	No. (%)	No. (%)	
Comorbidities				
Hypertension	65 (28.5)	345 (16.3)	410 (17.4)	<0.0001*
Chronic cardiac disease	50 (21.9)	232 (10.9)	282 (12.0)	<0.0001*
Diabetes with complications	32 (14)	171 (8.1)	203 (8.6)	0.002*
Diabetes without complications	33 (14.5)	109 (5.1)	142 (6)	<0.001*
Asthma	12 (5.3)	107 (5)	119 (5.1)	0.884
Chronic neurological disorder	22 (9.6)	81 (3.8)	103 (4.4)	<0.001*
Hyperlipidemia	4 (1.8)	92 (4.3)	96 (4.1)	0.061
Chronic kidney disease	17 (7.5)	63 (3)	80 (3.4)	<0.001*
Chronic pulmonary disease	11 (4.8)	57 (42.7)	68 (2.9)	0.067
Chronic hematologic disease	9 (3.9)	40 (1.9)	49 (2.1)	0.038*
Malignant neoplasm	11 (4.8)	38 (1.8)	49 (2.1)	0.002*
Hypothyroid	6 (2.6)	43 (2)	49 (2.1)	0.543
Rheumatologic disorder	5 (2.2)	27 (1.3)	32 (1.4)	0.254
Moderate or severe liver disease	9 (3.9)	23 (1.1)	32 (1.4)	<0.001*
Fauvism	6 (2.6)	15 (0.7)	21 (0.9)	0.0031*
Obesity	2 (0.9)	5 (0.2)	7 (0.3)	0.091
Hyperthyroid	1 (0.4)	4 (0.2)	5 (0.2)	0.436
HIV/AIDS	2 (0.9)	4 (0.2)	6 (0.3)	0.05
Dementia	3 (1.3)	4 (0.2)	7 (0.3)	0.003*
Mild liver disease	—	4 (0.2)	4 (0.2)	0.665
Malnutrition	—	—	—	—
Smoking, Yes	17 (7.5)	111 (5.2)	128 (5.4)	0.159
Opium, Yes	10 (4.4)	48 (2.3)	58 (2.5)	0.049*
Hookah, Yes	4 (1.8)	33 (1.6)	37 (1.6)	0.818
Alcohol, Yes	1 (0.4)	7 (0.3)	8 (0.3)	0.788
Methadone, Yes	4 (1.8)	16 (0.8)	20 (0.9)	0.118
Other relevant risk factors	45 (19.7)	193 (9.1)	238 (10.1)	<0.001*
Sign and symptoms				
Cough	88 (38.6)	1255 (59.1)	1343 (57.1)	0.001*
With sputum	10 (4.4)	194 (9.1)	204 (8.7)	0.015 *
Bloody sputum	1 (0.4)	20 (0.9)	21 (0.9)	0.443
Shortness of breath	138 (60.5)	1086 (51.2)	1224 (52.1)	0.007*
Fever	82 (36)	978 (46.1)	1060 (45.1)	0.004 *
Fatigue	61 (26.8)	364 (17.1)	425 (18.1)	<0.0001 *
Muscle aches	35 (15.4)	382 (18)	417 (17.7)	0.321
Chills	19 (8.3)	246 (11.6)	265 (11.3)	0.14
Vomiting	18 (7.9)	204 (9.6)	222 (9.4)	0.4
Headache	9 (3.9)	193 (9.1)	202 (8.6)	0.008 *
Chest pain	10 (4.4)	140 (6.6)	150 (6.4)	0.195
Diarrhea	11 (4.8)	122 (5.7)	133 (5.7)	0.567
Sore throat	9 (3.9)	117 (5.5)	126 (5.4)	0.319
Joint pain	3 (1.3)	73 (3.4)	76 (3.2)	0.085
Lost sense (smell or taste)	1 (0.4)	88 (4.1)	89 (3.8)	0.005*
Abdominal pain	9 (3.9)	61 (2.9)	70 (3)	0.365
Vertigo	1 (0.4)	60 (2.8)	61 (2.6)	0.031*

Table 2. Continues.

Variables	ICU Patients (n = 228)	Non-ICU Patients (n = 2123)	Total Patients (n = 2351)	*P* Value
	No. (%)	No. (%)	No. (%)	
Runny nose	3 (1.3)	38 (1.8)	41 (1.7)	0.603
Sweating	4 (1.8)	22 (1)	26 (1.1)	0.324
Seizures	8 (3.5)	5 (0.2)	13 (0.6)	0.001*
Altered consciousness	2 (0.9)	8 (0.4)	10 (0.4)	0.270
Wheezing	—	4 (0.2)	4 (0.2)	0.665
Conjunctivitis	—	4 (0.2)	4 (0.2)	0.665
Palpitation	—	5 (0.2)	5 (0.2)	0.6
Bleeding	—	4 (0.2)	4 (0.2)	0.665
Lymphadenopathy	—	2 (0.1)	2 (0.1)	0.815
Skin rash	—	1 (0)	1 (0)	0.903
Skin ulcers	—	1 (0)	1 (0)	0.903
Ear pain	—	1 (0)	—	.903
Lower chest wall in-drawing	—	—	—	—

*Significant difference

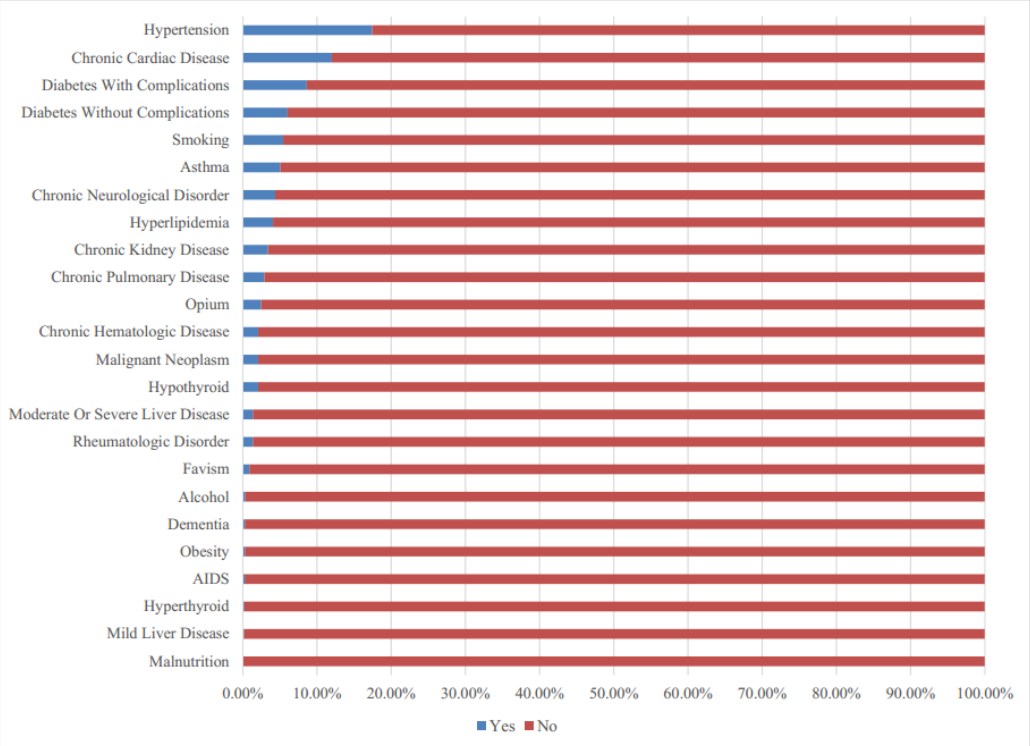

Figure 2. Distribution of Comorbidities among Patients.

patients. These procedures were respectively provided for 40.8% and 54.8% of ICU patients ($P < 0.05$). The duration of ventilation was 4.33 days on the average (1.79 days for non-ICU, and 5 days for ICU patients). The most common medications were antibiotics (80.1%), and antiviral agents (82.5%). The most frequently prescribed antiviral agents were hydroxychloroquine (63%), lopinavir/ritonavir (24%), and oseltamivir (18.2%). Corticosteroids were used for 58.8% of ICU patients, but 19.4% of non-ICU patients ($P < 0.0001$) (Table 4).

Outcomes

Totally, 87.5% of the patients were discharged from the hospitals in good conditions and 12.5% passed away. Comparing ICU and non-ICU patients in terms of outcome showed that 35.5% of ICU patients were discharged while 64.5% of them passed away, both of which were significant compared to non-ICU patients ($P < 0.0001$). Non-ICU

Table 3. Vital Signs and Laboratory Results on Admission of Hospitalized Patients Infected With COVID-19

		ICU Patients (*n* = 228)	Non-ICU Patients (*n* = 2123)	Total Patients (*n* = 2351)	*P* Value
Temperature	Mean ± SD	37.21 ± 0.86	37.27 ± 0.78	37.27 ± 0.79	0.118
	Median	37.0	37.0	37.0	0.102
HR	Mean ± SD	89.67 ± 24.28	83.98 ± 16.46	84.53 ± 17.44	0.008*
	Median	84.5	82.0	82.0	0.119
RR	Mean ± SD	23.44 ± 11.96	19.88 ± 5.45	20.24 ± 6.50	<0.0001*
	Median	20.0	19.0	19.0	<0.0001*
Systolic BP	Mean ± SD	121.7 ± 24.43	118.89 ± 18.87	119.18 ± 19.52	0.221
	Median	120.0	120.0	120.0	0.001*
Diastolic BP	Mean ± SD	74.39 ± 13.77	74.56 ± 11.49	74.55 ± 11.69	0.859
	Median	71.0	75.0	75.0	0.811
Oxygen Saturation	Mean ± SD	88.18 ± 11.96	94.85 ± 4.91	94.17 ± 6.36	<0.0001*
	Median	91.0	96.00	96.0	<0.0001*
Lab tests					
Hemoglobin	Mean ± SD	11.28 ± 2.32	12.25 ± 2.16	12.15 ± 2.198	<0.0001*
	Median	11.1	12.3	12.2	<0.0001*
WBC	Mean ± SD	10.96 ± 9.01	7.48 ± 4.92	7.86 ± 5.61	<0.0001*
	Median	9.25	6.5	6.7	<0.0001*
Lymphocyte	Mean ± SD	16.22 ± 12.95	24.87 ± 13.04	23.97 ± 13.29	<0.0001*
	Median	12.3	23.3	22	<0.0001*
Neutrophil	Mean ± SD	77.10 ± 15.79	66.9 ± 15.39	68 ± 15.75	<0.0001*
	Median	82.0	68.2	69.8	<0.0001*
Hematocrit	Mean ± SD	35.21 ± 6.86	37.52 ± 17.11	37.28 ± 16.34	<0.0001*
	Median	35.2	37.2	37	0.003*
Platelets	Mean ± SD	223.21 ± 119.94	230.20 ± 99.89	229.46 ± 102.19	0.10
	Median	200.5	211.0	210	0.101
APTT	Mean ± SD	36.46 ± 14.66	34.10 ± 10.0	34.37 ± 10.67	0.151
	Median	34.0	33.0	33	0.277
PT	Mean ± SD	15.15 ± 5.89	13.59 ± 2.73	13.81 ± 3.42	<0.0001*
	Median	13.20	13.0	13.0	0.003 *
INR	Mean ± SD	1.29 ± 0.7	1.11 ± 0.41	1.14 ± 0.47	0.001 *
	Median	1.05	1.0	1.0	0.205
ALT	Mean ± SD	64.80 ± 102.04	45.08 ± 99.12	47.36 ± 99.62	0.015*
	Median	34.0	31.0	32.0	0.065
Total Bilirubin	Mean ± SD	2.39 ± 4.19	1.37 ± 2.74	1.51 ± 2.99	<0.0001*
	Median	1.1	0.7	0.8	<0.0001*
AST	Mean ± SD	94.41 ± 179.96	57.73 ± 316.8	61.95 ± 304.39	<0.001 *
	Median	75.0	33.0	34	<0.0001*
Glucose	Mean ± SD	170.47 ± 115.28	124.13 ± 72.02	130.75 ± 81.23	<0.001 *
	Median	138.0	103.0	105	<0.0001*
Blood Urea Nitrogen	Mean ± SD	45.25 ± 40.58	27.01 ± 25.68	29.08 ± 28.38	<0.0001*
	Median	30.0	21.0	22	<0.0001*
Creatinine	Mean ± SD	1.49 ± 1.70	1.071.04	1.12 ± 1.15	<0.0001*
	Median	1.0	0.9	0.9	<0.0001*
LDH	Mean ± SD	793.15 ± 854.57	459.71 ± 599.43	492.75 ± 636.76	<0.001 *
	Median	529.0	373.0	385.5	<0.0001*
Sodium	Mean ± SD	138.89 ± 7.72	138.15 ± 5.75	138.23 ± 6.01	0.628
	Median	138.0	138.0	138.0	0.656

Table 3. Continues.

		ICU Patients (*n* = 228)	Non-ICU Patients (*n* = 2123)	Total Patients (*n* = 2351)	*P* Value
Potassium	Mean ± SD	4.27 ± 0.71	4.23 ± 1.68	4.24 ± 1.59	0.227
	Median	4.10	4.10	4.10	0.517
Troponin	Mean ± SD	250.12 ± 724.17	40.21 ± 320.103	70.31 ± 409.64	<0.0001*
	Median	14.0	2.0	3.0	<0.0001*
Mg	Mean ± SD	2.30 ± 0.72	1.94 ± 0.25	2.03 ± 0.44	<0.0001*
	Median	2.1	2.0	2.0	0.001*
ESR	Mean ± SD	41.2 7 ± 30.55	35.02 ± 27.04	35.61 ± 27.44	0.043*
	Median	37.0	29.0	30.0	<0.0001*

*Significant difference

Table 4. Treatments and Medications for Hospitalized Patients Infected with COVID-19

Variables	ICU Patients (n = 228)	Non-ICU Patients (n = 2123)	Total Patients (n = 2351)	*P* Value
	No. (%)	No. (%)	No. (%)	
Oxygen therapy	218 (95.6)	890 (41.9)	1108 (47.1)	<0.001*
Noninvasive ventilation	93 (40.8)	12 (0.6)	105 (4.5)	0.001*
Invasive ventilation	125 (54.8)	34 (1.6)	159 (6.8)	<0.001*
Invasive ventilation duration				
Mean (± SD), Day	5.01 ± 5.6	1.79 ± 1.75	4.33 ± 5.23	<0.001*
Median (Q1, Q3)	3 (1.25, 7)	1 (1, 1.5)	2 (1, 5)	—
Min, Max	1, 40	1, 8	1, 40	—
Medications				
Any antibiotics	213 (93.4)	1669 (78.6)	1882 (80.1)	0.007*
Any antiviral agent	205 (89.9)	1734 (81.7)	1939 (82.5)	0.001*
Hydroxychloroquine	129 (56.6)	1352 (63.7)	1481 (63)	<0.001*
Lopinavir/Ritonavir	105 (46.1)	460 (21.7)	565 (24.0)	<0.001*
Oseltamivir	14 (14)	395 (18.6)	427 (18.2)	0.003 *
Interferon Beta	78 (34.2)	303 (14.3)	381 (16.2)	<0.001*
Atazanavir	49 (21.5)	192 (9)	241 (10.3)	<0.001*
Ribavirin	11 (4.8)	21 (1)	32 (1.4)	<0.001*
Remdesivir	9 (3.9)	3 (0.1)	12 (0.5)	<0.001*
Albumin	15 (6.6)	1 (0)	16 (0.7)	<0.001*
Corticosteroid	134 (58.8)	411 (19.4)	545 (23.2)	<0.001*
Plasma exchange	22 (9.6)	6 (0.3)	28 (1.2)	<0.001*
IVIg	33 (14.5)	22 (1)	55 (2.3)	<0.001*

*Significant difference

Table 5. Clinical Outcomes of Hospitalized Patients Infected with COVID-19

Variables	ICU patients (n = 228)	Non-ICU Patients (n = 2123)	Total Patients (n = 2351)	*P* Value
	No. (%)	No. (%)	No. (%)	
Discharged alive	81 (35.5)	1975 (93)	2056 (87.5)	<0.001*
Death	147 (64.5)	148 (7)	295 (12.5)	
LOS, day				
Mean (± SD)	8.51 ± 6.97	4.03 ± 3.46	4.47 ± 4.17	<0.001*
Median (Q1, Q3)	7 (3.25, 11.75)	3 (2, 5)	3 (2, 6)	<0.001*
Min, Max	1, 43	1, 39	1, 43	—

*Significant difference

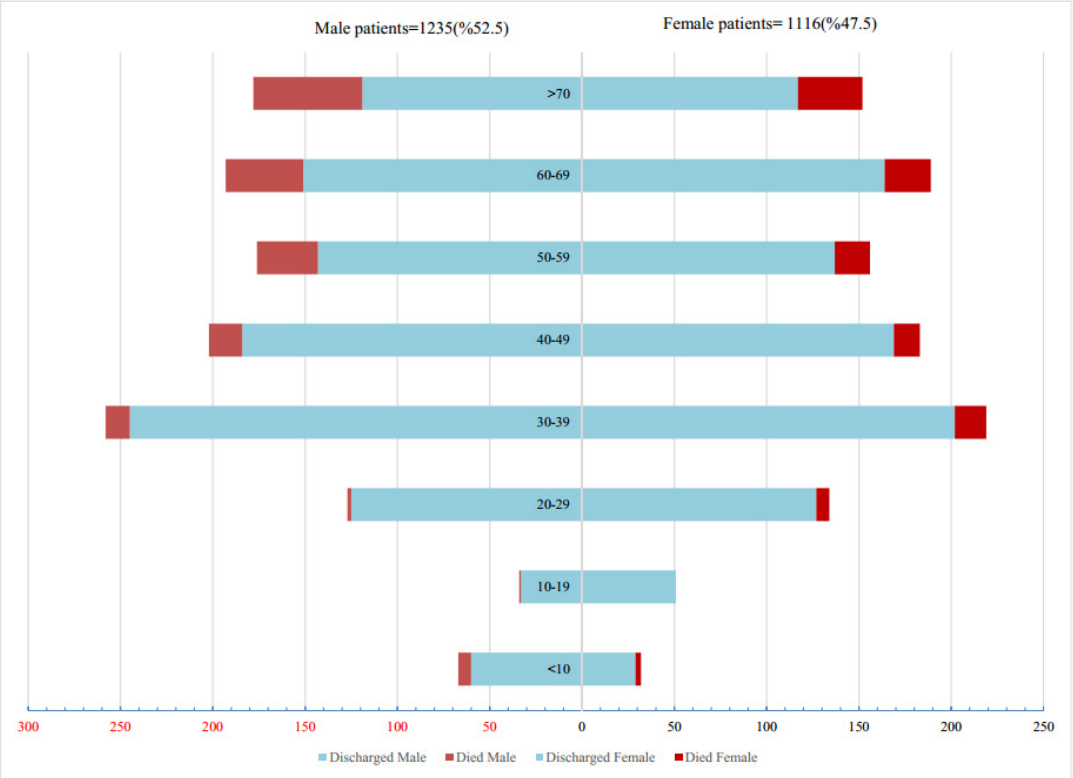

Figure 3. Distribution of Outcomes between Men and Women Classified by Age Groups.

patients were hospitalized for 4 days on the average while it was 8.5 days for ICU patients. The average ICU length of stay was 6.35 (± 6.2) days (Min = 1, Max = 43, Median = 4, Q1 = 2, Q3 = 8) (Table 5). Figure 3 shows the distribution of outcomes (discharge and death) between male and female patients classified by age groups. As is shown, in both sexes, more deaths occurred among patients in the age groups of more than 70, 60–69, and 50–59 years, in decreasing order of frequency.

Discussion

The present study is the first descriptive study addressing clinical and epidemiological characteristics of COVID-19 in southern Iran. The mean and median age for our patients was 47 and 46 years, respectively. In a study from China, the mean age and the most frequent age groups were 55.5, and 50–59 years (30%), respectively.[10] Studies from the UK, Germany and Italy reported median age values of 73, 73 and 71 years, respectively.[7-8,15] A study in Tehran, Iran, showed that the mean age was 55.5, and the majority of patients were in the age group of 50–70 years.[21] This indicates that our patients are younger. Our ICU patients were significantly older than non-ICU patients (53 vs. 46 years). Another study showed that there was no difference between ICU and non-ICU patients in terms of patients' age[12] and another reported that ICU patients were older.[22] We found that this disease infected men more than women. Furthermore, male patients were hospitalized in the ICU more than women. Other studies have reported similar results.[7-8,10,21] Some studies have suggested that this might be related to the X chromosome and sex hormones as factors for stimulating adaptive immunity.[10]

Most of our cases suffered from comorbidities including hypertension, chronic cardiac diseases, diabetes, and asthma. Our findings confirm earlier studies.[8,21,23-24] A study from China reported cardiovascular and cerebrovascular diseases (40%), endocrine system diseases such as diabetes (13%), and digestive system disease (11%) as common comorbidities.[10] A UK study reported that the most common comorbidities were chronic cardiac disease (30.9%), diabetes without complications (20.7%), chronic pulmonary disease excluding asthma (17.7%), chronic kidney disease (16.2%), and asthma (14.5%), which was almost similar to our study in terms of common comorbidities. However, our patients suffered from fewer comorbidities than the UK report.[7] A systematic review on 10 articles and 76,993 patients indicated that hypertension (16.37%), cardiovascular disease (12.11%), smoking history (7.63%), and diabetes (7.87%) were the most common comorbidities in people infected with COVID-19. Chronic obstructive pulmonary disease (COPD), malignancy, and chronic kidney disease were other common comorbidities.[25] Another systematic review shows that hypertension (15.6%), diabetes (7.7%), cardiovascular disease (4.7%), malignancy (1.2%) were the most prevalent comorbidities.[26] These studies confirm our findings.

We found that hypertension, chronic cardiac disease, diabetes, chronic neurological disorders, chronic kidney disease, chronic hematologic disease, malignant neoplasm,

moderate or severe liver disease, dementia and fauvism were more common in ICU patients than non-ICU patients. Another study showed that diabetes, hypertension and cardiovascular disease were the most common comorbidities and there were no differences between ICU and non-ICU patients in this respect[12]; however, a study reported that hypertension, cardiovascular disease, diabetes, and cerebrovascular disease were significantly more common in ICU patients.[22]

In our patients, the most common reported symptoms were cough, shortness of breath, fever, fatigue, and muscle aches. Chen reported fever (83%), cough (82%), shortness of breath (31%), and muscle ache (11%) as common symptoms of patients in China.[10] A recent UK study confirms our findings and presents cough (68.9%), fever (71.6), and shortness of breath (71.2%) as the most common symptoms.[7] A systematic review analyzed 43 studies involving 3600 patients found that fever (83.3%), cough (60.3%), and fatigue (38.0%) were the most common clinical symptoms.[27] Another systematic review indicated that fever (85.6%), cough (65.7%), fatigue (42.4%), and dyspnea (21.4%) were the most common symptoms.[26] A systematic review also showed that fever (88.7%), cough (57.6%), and dyspnea (45.6%) were the most common symptoms.[28] These studies are almost similar to our study.

We also found that only cough, seizure, shortness of breath, fever, fatigue, headache, lost sense (of smell or taste), and vertigo were significantly different between ICU and non-ICU patients. According to a study, only dyspnea was significantly more common in ICU patients[12]; however, another study reported significantly higher anorexia, dyspnea, pharyngalgia, dizziness, and abdominal pain among ICU patients.[22]

In our study, 47.1% of the patients (95.6% of ICU patients) received oxygen therapy. Only 4.5% and 6.8% of patients received non-invasive and invasive ventilation, respectively. Antibiotics (80.1%) and antiviral agents (82.5%) were common medications. In the UK, 55% received high flow oxygen, while 16%, and 10% received non-invasive and invasive ventilation, respectively.[7] Similarly, 76% of patients reported in a Chinese study received oxygen therapy. Non-invasive and invasive ventilation were used for 13% and 4%, respectively. Also, 71% and 76% of patients received antibiotics and antiviral treatment, respectively.[10] The use of antibiotic therapy (100%) and antiviral therapy (93%) reported in another study is similar to our findings. The authors also reported the use of non-invasive ventilation (24%) or invasive mechanical ventilation (5%) among Chinese patients.[12] Prescribing antibiotics for our patients was similar to an Italian study.[8]

In our study, 9.7% of patients were hospitalized in ICU. It was lower than New York (14.2%),[13] the UK (17%),[7] France (31%),[14] Italy (20.5%)[8] and Germany (21%).[15] According to a systematic review, 20.3% of patients required ICU services.[28] This study may indicate that our patients were infected with a less severe disease. Additionally, the mortality rate was 12.5% among all patients and 64.5% among ICU patients. Mortality was higher among older male patients. The mortality was reported at 11% and 15% in Chinese studies,[10,12] 20% in France,[14] 26% in the UK[7], 43.6% in Italy[8] and 16.6% in Germany.[15] A systematic review indicates that 13.9% of hospitalized patients have fatal outcomes and the case fatality rate is >13%.[28] In a study from Tehran, the case fatality rate was 8.06% among hospitalized patients and most deceased patients were ≥60 years of age (mean=65.38). Additionally, the fatality rate was 8.54% and 7.13% for men and women, respectively.[21] Although the age of patients who died was almost similar in our and the UK[7] and Tehran[21] studies, mortality was lower in our population. Conversely, in the UK, 32% of patients who received a high level of care such as ICU services died, while this rate was 64.5% in our population, which was higher than the UK[7], Italy (26%),[29] China (38%)[12] and Germany (29%).[15]

This study had some strengths. The data was extracted from a multi-center registry with considerable quality control. This registry is currently enrolling patients and enables us to analyze more patients in the future and compare the trends. Furthermore, this registry applied ISARIC case report form that improved the comparability of findings. Despite these strengths, some limitations should be considered. Our analysis did not include home-quarantined cases and outpatients. Although we collected data regarding outpatients, these data were not complete and were under the quality improvement process. Therefore, we excluded these patients from the study.

In conclusion, this study is the first epidemiologic investigation with quite a high sample size in southern Iran. It shows that hypertension, chronic cardiac disease, diabetes, and asthma are the most prevalent comorbidities, and cough, shortness of breath, fever, fatigue, and muscle aches are the most common signs and symptoms. ICU and non-ICU patients are different in terms of some comorbidities and symptoms. The mortality rate is 12.5% in general and 64.5% in ICU patients and is higher in older men. These findings may play a major role in healthcare policy-making for this disease.

Authors' Contributions

MH: Conceptualization, data curation, methodology, writing-the original draft, validation, writing - review and editing, project administration, resources, supervision. FK: Conceptualization, data curation, methodology, software, visualization, writing-the original draft, validation, writing - review and editing, project administration, resources, supervision. MK, GM and NA: Data curation; Methodology; Writing - review and editing. MS and ND: Methodology; Writing- the original draft; Writing - review and editing. AS: Conceptualization, formal analysis, methodology, software, writing- the original draft, validation, writing - review and editing, supervision.

Conflict of Interest Disclosures

There are no conflicts of interest.

Ethical Statement

This study received ethical approval from the Ethics Committee of Hormozgan University of Medical Sciences (HUMS. REC.1398.482).

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