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Short Communication

Association of Severe Outcomes With Underlying Diseases Among Hospitalized COVID-19 Patients: A Retrospective Cohort Study

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Abstract

Predicting the outcomes of coronavirus disease 2019 (COVID-19) with comorbidities has been an interesting subject of study in the field of medicine. This study aimed to compare the clinical characteristics, radiologic features, and severe outcomes of COVID-19 among hospitalized COVID-19 patients with or without underlying comorbidity diseases. In this retrospective cohort study conducted from 1 June 2020 to 30 September 2020, 320 hospitalized cases with laboratory-confirmed COVID-19 and admitted to public hospitals in Arak, Iran, were examined. The mean $\pm$ SD age of the patients was 56.78 $\pm$ 20.06 years. The comorbidity group showed a substantially greater percentage of defined nodular pattern in chest X-ray (7.6% vs 2%, $P=0.024$) and plural effusion in CT scan findings (9% vs 0%, $P=0.004$). Intensive care unit (ICU) admission (6.9% vs. 0.6%, $P=0.003$), mechanical ventilation (5.0% vs. 0.6%, $P=0.018$), and death (6.3% vs. 0.0%, $P=0.002$) were higher in the comorbidity group. Comorbidity group had a considerably greater ratio of ICU admission, invasive ventilation, and mortality.

Keywords: Comorbidity, COVID-19, Outcomes, ICU admit, Invasive ventilation

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Introduction

Coronavirus disease 2019 (COVID-19) is a global pandemic that has become a serious public health issue worldwide.[1] This disease is a type of viral pneumonia, and is caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) belonging to the beta-coronavirus [2]. The clinical manifestations of COVID-19 are heterogeneous.[3] SARS-CoV-2 can affect any age groups and result in a wide spectrum of various clinical manifestations such as cough, sputum, diarrhea, fever, headache, and fatigue. Furthermore, the disease may cause different degrees of severity from asymptomatic carriers to fatal cases.[4,5]

Approximately 30% to 50% of COVID-19 patients have been reported to suffer from one or more comorbidities.[1] Hypertension, cardiovascular disease, diabetes, and cerebrovascular diseases are common comorbidities detected among COVID-19 patients.[4] Comorbidity has been shown to be associated with elevated risk of worse clinical outcomes in other severe acute respiratory outbreaks such as Middle East respiratory syndrome (MERS) and influenza.[1] Patients with underlying diseases, in general, suffer from more adverse outcomes than the otherwise healthy patients.[6] It is of critical importance for healthcare workers to have accurate knowledge about the prognosis of COVID-19 patients with underlying diseases;

therefore, the present study aimed to compare the clinical characteristics, radiologic features, and severe outcomes of COVID-19 among hospitalized COVID-19 patients with and without underlying comorbidity diseases.

Methods

Study Type and Population

In this retrospective cohort study carried out from 1 June 2020 to 30 September 2020, 320 hospitalized cases with laboratory-confirmed COVID-19 who had been admitted to public hospitals in Arak city, Iran, were investigated. Patients divided into two groups, each of which included 160 patients with and without underlying comorbidity diseases, were followed up while they were hospitalized, and their clinical characteristics, their chest image, as well as the severity and outcome of the disease in them were compared.

Sample Size

According to Zhou et al,[7] the risk of sever outcomes in COVID-19 patients with comorbidity was 3 to 5 times higher. Taking into account the sample size formula for comparing 2 proportions, 160 patients were needed in each group. Non-probability sampling was performed based on the inclusion criteria for hospitalized patients.

Inclusion Criteria

Inclusion criteria in this study included a definitive diagnosis of COVID-19 disease based on the positive diagnostic real time test of polymerase chain reaction (PCR), hospitalization in public hospitals in Arak (Valiasr, Khansari and Amir Al-Momenin hospitals in Arak.), and willingness to participate in the study.

Outcomes of the disease including the need for intensive care unit (ICU) care, the need for mechanical ventilation, length of hospital stay, and mortality in both groups were assessed. Patient information about clinical and laboratory symptoms was extracted from their medical records using a designed checklist, and the course of each disease was followed up.

Statistical Analysis

Statistical analyses were performed using SPSS software version 23. Continuous variables were presented as means (standard deviation, SD), and the categorical variables were presented as count (percentage). Inter-group differences in the characteristics were tested by using Pearson's χ^2 test or Fisher exact test for categorical variables, and using independent sample t test or Mann-Whitney test for continuous variables.

Results

The mean ± SD age of the patients was 56.78 ± 20.06, and 174 (54.4%) of the patients were female. hyperlipidemia (52.5%) was the most common comorbidities in COVID-19 patients followed by hypertension (46.3%), ischemic heart diseases (28.7%), and diabetes (21.9%) respectively Moreover, 63.7% of the patients had more than 1 comorbidity.

Generally, the most common clinical manifestations were fatigue (61.6%), dry cough (60.9%), and body pain (60%). Mean ± SD of age was higher in comorbidity group (65.46 ± 16.97 vs. 48.12 ± 19.19, $P < 0.001$). ICU admission (6.9% vs. 0.6%, $P = 0.003$), mechanical ventilation (5.0% vs. 0.6%, $P = 0.018$), and death (6.3% vs. 0.0%, $P = 0.002$) were all more likely in the comorbidity group relative to the group without comorbidity (Table 1).

Out of 320 enrolled patients, 240 (75%) ones showed abnormal chest CT scan findings. In addition, 115 (35.9%) ones were detected to have chest x-ray abnormality. There was no significant difference between the comorbidity and non-comorbidity groups in terms of chest abnormality based on the findings from imaging. However, defined nodular pattern in the chest x-ray finding was higher in the comorbidity group (7.6% vs 2%, $P = 0.024$), and plural effusion in CT scan abnormalities was higher in the comorbidity group (9% vs 0%, $P = 0.004$) (Table 2).

Discussion

This retrospective, cohort study was conducted from 1 June 2020 to 30 September 2020, to investigate the hospitalized cases with laboratory-confirmed COVID-19 infection and admitted to public hospitals (Valiasr, Khansari and Amir Al-Momenin hospitals) of Arak, Iran. The clinical characteristics, radiologic features, and severe outcomes of COVID-19 in COVID-19 patients with underlying comorbidity diseases and those without underlying comorbidity diseases were compared in this study.

The most common clinical symptoms of COVID-19 infection in our study patients were fatigue, dry cough, and body pain, respectively. Out of 320 COVID-19 patients, 75% showed abnormal chest CT scan and 35.9% showed chest x-ray abnormality. According to the chest x-ray finding, defined nodular pattern was higher in comorbidity group; and in chest CT scan, plural effusion in comorbidity group was higher, however; there was no significant difference between CTSSs regarding comorbidity. In a study by Raoufi et al, a significant correlation was observed among shapes of abnormality, CTSS, and mortality.[8]

According to our study results, severe outcomes of COVID-19 were more common in patients with comorbidities than those without any comorbidity. Patients with comorbidities were generally older than those without comorbidities, a finding which was consistent with the result from previous studies.[4] The most common comorbidities detected in the present study were hyperlipidemia and hypertension, followed by ischemic heart diseases and diabetes, respectively. In the study by Rastad et al, CVD and DM were discovered to be the most common comorbidities in COVID-19 patients.[9] According to the findings from a meta-analysis, hypertension, cardiovascular diseases, diabetes mellitus, chronic obstructive pulmonary disease, malignancy, and chronic kidney disease were among the most prevalent underlying diseases in order of prevalence in hospitalized COVID-19 patients.[6]

In this study, the proportions of ICU admission, mechanical ventilation, and death were higher in comorbidity group. In a study by Ye et al exploring the effects of comorbidities on COVID-19 cases, it was demonstrated that COVID-19 patients with comorbidities suffered from more adverse clinical outcomes compared to those without any comorbidity and were at risk of serious adverse outcomes.[1]

Limitations of the Study

No information was obtained by this study regarding the duration and severity of comorbidity disorders. Duration and Severity of the comorbidities are important predictors of patients' outcome. The number of deaths in our study was too small to perform subgroup analysis. Therefore, it was recommended that further studies with larger sample sizes should be carried out to investigate the role of genetic and life style in occurrence of outcomes in COVID-19 patients.

Conclusion

In sum, the comorbidity group showed a substantially greater percentage of defined nodular pattern in chest x-ray findings and plural effusion in CT scan abnormalities. In

Table 1. Demographics and Clinical Characteristics of COVID-19 Patients With or Without Comorbidities

Variable	Category	Total N (%)	Group		P Value
			With Comorbidity N (%)	Without Comorbidity N (%)	
Gender	Male	146 (45.6)	68 (42.5)	78 (48.8)	0.262
	Female	174 (54.4)	92 (57.5)	82 (51.2)	
Age	≤40	88 (27.5)	17 (10.6)	71 (44.4)	**<0.001**
	41-59	61 (19.1)	26 (16.2)	35 (21.9)	
	≥ 60	171 (53.4)	117 (73.1)	54 (33.8)	
Smoking	Yes	74 (23.1)	35 (21.9)	39 (24.4)	0.596
	No	246 (76.9)	125 (78.1)	121 (75.6)	
Addicts	Yes	31 (9.7)	17 (10.6)	14 (8.8)	0.571
	No	289 (90.3)	143 (89.4)	146 (91.3)	
Fever	Yes	160 (50.0)	79 (49.4)	81 (50.6)	0.823
	No	160 (50.0)	81 (50.6)	79 (49.4)	
Sputum	Yes	15 (4.7)	7 (4.4)	8 (5.0)	0.791
	No	305 (95.3)	153 (95.6)	152 (95.0)	
Dry cough	Yes	195 (60.9)	98 (61.2)	97 (60.6)	0.909
	No	125 (39.1)	62 (38.8)	63 (39.4)	
Dyspnea	Yes	120 (37.5)	60 (37.5)	60 (37.5)	>0.999
	No	200 (62.5)	100 (62.5)	100 (62.5)	
Body pain	Yes	192 (60.0)	97 (60.6)	95 (59.4)	0.819
	No	128 (40.0)	63 (39.4)	65 (40.6)	
Chest pain	Yes	57 (17.8)	28 (17.5)	29 (18.1)	0.884
	No	263 (82.2)	132 (82.5)	131 (81.9)	
Fatigue	Yes	197 (61.6)	98 (61.2)	99 (61.9)	0.909
	No	123 (38.4)	62 (38.8)	61 (38.1)	
Runny nose	Yes	31 (9.7)	15 (9.4)	16 (10.0)	0.850
	No	289 (90.3)	145 (90.6)	144 (90.0)	
Sore throat	Yes	65 (20.3)	32 (20.0)	33 (20.6)	0.889
	No	255 (79.7)	128 (80.0)	127 (79.4)	
Diarrhea	Yes	103 (32.4)	51 (31.9)	52 (32.5)	0.905
	No	217 (67.8)	109 (68.1)	108 (67.5)	
Nausea & vomiting	Yes	70 (21.9)	34 (21.2)	36 (22.5)	0.787
	No	250 (78.1)	126 (78.8)	124 (77.5)	
Abdominal pain	Yes	12 (3.8)	6 (3.8)	6 (3.8)	>0.999
	No	308 (96.2)	154 (96.2)	154 (96.2)	
Anorexia	Yes	136 (42.5)	71 (44.4)	65 (40.6)	0.497
	No	184 (57.5)	89 (55.6)	95 (59.4)	
Headache	Yes	65 (20.3)	30 (18.8)	35 (21.9)	0.487
	No	255 (79.7)	130 (81.2)	125 (78.1)	
Anosmia	Yes	57 (17.8)	29 (18.1)	28 (17.5)	0.884
	No	263 (82.2)	131 (81.9)	132 (82.5)	
Taste change	Yes	60 (18.8)	31 (19.4)	29 (18.1)	0.775
	No	260 (81.2)	129 (80.6)	131 (81.9)	
Dry throat	Yes	32 (10.0)	17 (10.6)	15 (9.4)	0.709
	No	288 (90.0)	143 (89.4)	145 (90.6)	
ICU	Yes	12 (3.7)	11 (6.9)	1 (0.6)	**0.003**
	No	308 (96.3)	149 (93.1)	159 (99.4)	
Ventilator	Yes	9 (2.8)	8 (5.0)	1 (0.6)	**0.018**
	No	311 (97.2)	152 (95.0)	159 (99.4)	
Length of hospitalization[1]	-	11.09 (4.94)	11.62 (5.46)	10.57 (4.35)	**0.058**
Death	Yes	10 (3.1)	10 (6.3)	0 (0)	**0.002**
	No	310 (96.9)	150 (93.8)	160 (100)	

[1]Reported as mean (SD)

Table 2. Comparing the Chest Image) Radiograph, Computed Tomography) Findings of COVID-19 Patients With or Without Comorbidities

Variable	Category	Total N (%)	Group		P Value
			With Comorbidity N (%)	Without Comorbidity N (%)	
Abnormal Chest Image					
CT scan	Yes	240 (75.0)	124 (77.5)	116 (72.5)	0.302
	No	80 (25.0)	36 (22.5)	44 (27.5)	
Radiology	Yes	115 (35.9)	58 (36.3)	57 (35.6)	0.907
	No	205 (64.1)	102 (63.7)	103 (64.4)	
Abnormal Chest X-Ray Finding					
Bilateral patchy	Yes	60 (19.6)	31 (19.6)	29 (19.6)	0.999
	No	248 (80.4)	127 (80.4)	119 (80.4)	
Peripheral consolidation	Yes	62 (20.3)	32 (20.3)	30 (20.3)	0.997
	No	244 (79.7)	126 (79.7)	118 (79.9)	
Local patchy	Yes	91 (29.7)	45 (28.5)	46 (31.1)	0.619
	No	215 (70.3)	113 (71.5)	102 (68.9)	
Hazy	Yes	56 (18.3)	27 (17.1)	29 (19.6)	0.571
	No	250 (81.7)	131 (82.9)	119 (80.4)	
Interstitial	Yes	40 (13.1)	22 (13.9)	18 (12.2)	0.648
	No	266 (86.9)	136 (86.1)	130 (87.8)	
Defined nodular	Yes	15 (4.9)	12 (7.6)	3 (2.0)	**0.024**
	No	291 (95.1)	146 (92.4)	145 (98.0)	
White lung	Yes	46 (15.0)	24 (15.2)	22 (14.9)	0.937
	No	260 (85.0)	134 (84.8)	126 (85.1)	
Negative	Yes	10 (3.3)	7 (4.4)	3 (2.0)	0.237
	No	296 (96.7)	151 (95.6)	145 (98.0)	
Chest x-ray time[1]	-	1.85 (0.62)	1.84 (0.64)	1.86 (0.61)	0.378
Abnormal Chest CT Scan Finding					
Craniocaudally distribution	Upper zone	91 (40.6)	44 (38.3)	47 (43.1)	0.345
	Middle zone	37 (16.5)	23 (20.0)	14 (12.8)	
	Lower zone	96 (42.9)	48 (41.7)	48 (44.0)	
Transverse distribution	Sub-pleural sparing	4 (1.7)	1 (0.8)	3 (2.6)	0.558
	Sub-pleural distribution	17 (7.0)	7 (5.6)	10 (8.6)	
	Central distribution	19 (7.9)	10 (7.9)	9 (7.8)	
	No transverse	202 (83.5)	108 (85.7)	94 (81.0)	
Lung region	Bilateral	185 (77.1)	100 (80.6)	85 (73.3)	0.175
	Unilateral	55 (22.9)	24 (19.4)	31 (26.7)	
Scattered distribution	Multifocal	23 (9.5)	12 (9.4)	11 (9.5)	0.963
	Focal	88 (36.2)	47 (37.0)	41 (35.3)	
	None	132 (54.3)	68 (53.5)	64 (55.2)	
Pleural effusion	Yes	9 (3.0)	9 (5.7)	0 (0)	**0.004**
	No	294 (97.0)	149 (94.3)	145 (100)	
Lymphadenopathy	Yes	3 (1.0)	3 (1.9)	0 (0)	0.249
	No	300 (99.0)	155 (98.1)	145 (100)	
Lobar CTSS[1]					
Left Lower Lobe		1.86 (0.75)	1.87 (0.75)	1.86 (0.75)	0.987
Left Upper Lobe		2.29 (0.76)	2.31 (0.76)	2.26 (0.75)	0.764
Right Lower Lobe		1.75 (0.71)	1.82 (0.77)	1.68 (0.64)	0.283
Right Middle Lobe		2.03 (0.64)	2.04 (0.70)	2.02 (0.58)	0.857
Right Upper Lobe		1.37 (0.49)	1.35 (0.48)	1.40 (0.50)	0.694
CT day[1]		1.86 (0.75)	1.87 (0.75)	1.86 (0.75)	0.987

CTSS, Computed Tomography Severity Score.

[1]Reported as mean (SD)

addition, the comorbidity group had a considerably greater ratio of ICU admission, invasive ventilation, and mortality.

Conflict of Interest Disclosures
None.

Ethical Approval
This study was approved by the ethical committee of Arak University of Medical Sciences (Ethics No. IR.ARAKMU.REC.1399.062).

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