Iranian Journal of Virology 2021;15 (2): 88-94
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Short communication

Epidemiologic and Clinical Characteristics of 186 Hospitalized Patients with Covid-19 in Tehran, Iran: A Retrospective, multi-Center Case Series

Papizadeh S[1], Moradi P[2], Havasi Mehr M[3], Amerkani S[1], Farhadi Nezhad R[4], Saadati H[5], Shahani T[6], Mohammadian M[7], Sadooghi N[8], Mehrabi M[9], Farzi R[10], Azarash Z[10], Tavakoli A[11,12*], Ranjbar R[13*], Ghorbani S[11,14*]

1. Department of Medical Microbiology, Kerman University of Medical Sciences, Kerman, Iran
2. Department of Virology, Faculty of Medical sciences, Tarbiat Modares University, Tehran, Iran
3. Department of Physiology, Iran University of Medical Sciences, Tehran, Iran
4. Abadan Faculty of Medical Sciences, Abadan, Iran
5. Department of Epidemiology and Biostatistics, School of Health, North Khorasan University of Medical Sciences, Bojnurd, Iran
6. Department of Virology, School of Medicine, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
7. Zanjan University of Medical Science, Mousavi Hospital, Zanjan, Iran
8. Department of Pathobiology and Laboratory Science, North Khorasan University of Medical Science, Bojnurd, Iran
9. Department of Microbiology, Karaj Branch, Islamic Azad University, Karaj, Iran
10. Department of Virology, Faculty of Medicine, Shiraz University of Medical Science, Shiraz, Iran
11. Department of Medical Virology, Faculty of Medicine, Iran University of Medical Science, Tehran, Iran
12. Research Center of Pediatric Infectious Diseases, Institute of Immunology and Infectious Diseases, Iran University of Medical Sciences, Tehran, Iran
13. Molecular Biology Research Center, Systems Biology and Poisonings Institute, Baqiyatallah University of Medical Sciences, Tehran, Iran
14. Student Research Committee, Iran University of Medical Sciences, Tehran, Iran

Abstract

The objective of this case series was to compare the clinical characteristics, radiologic features, and laboratory findings between COVID-19 severe patients admitted to the intensive care unit (ICU) to those with non-severe patients who were not admitted to the ICU. From September 1, 2020, to October 30, 2020, a total of 186 laboratory-confirmed patients with COVID-19 were included in this study. Among 186 patients, 48 (25.8%) were admitted to the ICU. Patients admitted to the ICU were older and had also more underlying comorbidities compared to patients admitted to the non-ICU ward ($P<0.05$). The levels of LDH, CRP, ALT, AST, and neutrophil count were higher in patients admitted to the ICU compared to patients who were not admitted to the ICU ($P<0.05$). Among the chest X-ray findings, consolidation was only a significant difference between patients admitted to the ICU and non-ICU patients ($P<0.05$). Among 48 patients admitted to the ICU, 6 patients (12.5%) were still in the ICU, 26 patients (54.1%) were discharged, and 16 patients (33.3%) died as of April 15, 2020. Our study showed that older age, male sex, and having underlying diseases are strongly associated with increased risk of severe disease and death in patients with COVID-19. Therefore, more attention should be paid to elderly male patients who have an underlying disease.

Keywords: COVID-19; SARS-CoV-2, clinical characteristics

Introduction

In December 2019, the new Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-Cov-2) was recognized as a cause of respiratory illness named coronavirus disease 2019 (COVID-19). The first reports of pneumonia were originated in the Huanan Seafood Wholesale market in Wuhan, Hubei Province of China raising concerns about a

Corresponding authors:
Reza Ranjbar (ranjbar@bmsu.ac.ir);
Saied Ghorbani (Vet.S.ghorbani@gmail.com);
Ahmad Tavakoli (Tavakoli.a@iums.ac.ir).

zoonotic viral infection (1, 2). Phylogenetic analysis showed that the SARS-Cov-2 belongs to the betacoronavirus genus of the Corornaviridae family (3). Epidemiological studies have shown that the virus is easily transmitted via aerosol, droplets, and infected surfaces (4, 5). The rapid spread and high transmission ability of the SARS-CoV-2 among humans have allowed the disease to become pandemic in a short span of time. According to the last report of the World Health Organization (WHO), published on April 13, 2021, there were 135,057,587 confirmed cases of COVID-19 and 2,919,932 confirmed deaths around the world.

The first studies by Huang et al. on 41 patients and Chen et al. on 99 patients showed close contact and history of travel to endemic areas of the disease were observed in patients (6, 7).

The two studies have been reported that the most common clinical symptoms in these patients are fever, cough, shortness of breath, and fatigue. These studies have also shown radiological findings of pneumonia and lung involvement (8-10). Organ dysfunction such as acute respiratory distress syndrome (ARDS) has been observed in dead patients (7, 11).

Several studies have shown that in most patients, the disease is asymptomatic or associated with mild symptoms, while in older cases, those with underlying disease, and individuals with defective immune systems, the symptoms are more severe and are more likely to result in death (4, 10, 12).

However, information on differences in clinical characteristics between severe and non-severe cases is relatively limited in some countries including Iran.

The objective of this case series was to describe the clinical characteristics of patients with confirmed COVID-19 infection admitted to major hospitals in Tehran. Moreover, clinical characteristics of severe cases admitted to the intensive care unit (ICU) and non-severe cases who did not admit to the ICU were compared.

Methods

Study design and participants: We performed a retrospective, multicenter (three hospitals affiliated to Iran University of Medical Sciences [Firoozgar, Fayyazbakhsh, and Rasoul akram]) study on the epidemiological history, clinical records, laboratory results, chest radiological features, and outcome of 186 laboratory-confirmed patients with COVID-19. All patients were included between September 1, 2020, to October 30, 2020, and were hospitalized. The clinical manifestations, radiographic presentations, and the disease outcomes were recorded up to October 15th, 2020, the final date of follow-up.

Data collection: The researchers analyzed the clinical data on epidemiology (history of travel or close contact with confirmed COVID-19 patients), signs and symptoms (fever and cough), underlying disease (hypertension and diabetes), laboratory finding, the radiological manifestation, and outcomes (discharged, death or in hospital). Data were retrospectively obtained from electronic medical records. The real-time reverse transcriptase polymerase-chain-reaction (RT-PCR) test was performed using nasal and pharyngeal swab specimens. Laboratory parameters including white blood cell (WBC) count, neutrophil count, lymphocyte count, albumin, platelet, hemoglobin, C-reactive protein (CRP), alanine aminotransferase (ALT), aspartate aminotransferase (AST), and lactate dehydrogenase (LDH) were evaluated. Additionally, computed tomography (CT) was used as a diagnostic technique to assess lung involvement.

Statistical analysis: Demographic and clinical characteristics as categorical variables were presented as numbers and percentages, while continuous variables were presented as medians and interquartile ranges (IQR).

Intergroup differences in the characteristics were tested by using Pearson's $\chi 2$ test or Fisher's exact test for categorical variables, and by using the Ranksum test for continuous variables with the non-parametric distribution. All analyses were conducted using Stata version 13.1 (StataCorp, College Station, TX, USA).

Table 1. Demographics, baseline characteristics, underlying medical conditions, and clinical outcomes of patients with confirmed COVID-19.				
	Total (186)	**ICU (48)**	**Non-ICU (138)**	**p-value**
Age, median (IQR)	47(33-62)	62.5(44-75)	42(30-52)	<0.0001
Sex/male	98 (52.63)	34 (70.8)	64 (46.38)	0.001
Contact history				
Travel history/contact with patients	130 (69.8)	33 (68.7)	97 (70.2)	0.84
Healthcare worker	40 (21.5)	7 (14.5)	33 (23.9)	0.175
Comorbidities				
Hypertension	54 (29.0)	24 (50.0)	30 (21.7)	<0.0001
Diabetes	34 (18.2)	8 (16.6)	26 (18.8)	0.737
Malignancy	13 (6.9)	2 (4.1)	11 (7.9)	0.520
Respiratory disease	43 (23.1)	22 (45.8)	21 (15.2)	<0.001
Chronic kidney disease	2 (1.0)	2 (4.1)	0 (0)	0.066
Chronic liver disease	10 (5.3)	2 (4.1)	8 (5.8)	0.666
Current smoker	9 (4.8)	4 (8.3)	5 (3.6)	0.240
ARDS	43 (23.1)	22 (45.8)	21 (15.2)	<0.001
Sign and symptom				
Shortness of breath	161 (86.5)	40 (83.3)	121 (12.3)	0.447
Fever	95 (51.0)	27 (56.2)	68 (19.2)	0.405
Cough	123 (66.1)	25 (52.0)	98 (71.0)	0.017
Fatigue	116 (62.3)	36 (75)	80 (57.9)	0.036
Chest pain	111 (59.6)	32 (66.6)	79 (57.2)	0.252
Bone pain	66 (35.4)	22 (45.8)	44 (31.8)	0.082
Chill	61 (32.8)	13 (27.0)	48 (34.7)	0.328
Nose capping	63 (33.8)	11 (22.9)	52 (37.6)	0.063
Loss of sense of smell	44 (23.6)	23 (47.9)	21 (15.2)	<0.0001
Myalgia	138 (74.1)	30 (62.5)	108 (78.2)	0.032
Sputum production	25 (13.4)	7 (14.5)	18 (13.0)	0.80
Diarrhea	17 (9.1)	7 (14.5)	10 (7.2)	0.149
Confused	44 (23.6)	18 (37.5)	26 (18.8)	0.009
Nausea and vomiting	35 (18.8)	10 (20.8)	25 (18.1)	0.678
Headache	73 (39.2)	23 (47.9)	50 (36.2)	0.153
Runny nose	61 (32.8)	10 (20.8)	51 (36.9)	0.040
Outcome				
Hospitalized	33 (17.8)	6 (12.5)	27 (19.7)	0.017
Discharged	116 (62.7)	26 (54.1)	90 (56.6)	
Death	36 (19.9)	16 (33.3)	20 (14.6)	

Intensive care unit (ICU), interquartile range (IQR)

Results

Demographic features: A total of 186 hospitalized patients with confirmed COVID-19 infection, including 76 patients from Firoozgar hospital, 60 patients from Fayyaz-bakhsh hospital, and 50 patients from Rasoul Akram hospital were recruited. The median age of all patients was 47 years (range, 33-62). The median age of patients admitted to the ICU was 62.5 years, which was higher than those patients admitted to the non-ICU ward (42 years), showing that the disease is more severe in elderly patients. Among 186 patients, 88 (47.3%) were female and 98 (52.6%) were male.

Of these patients, 48 (25.8%) were admitted to the ICU, of whom 34 (70.8%) were male and 14 (29.2%) were female, indicating that the disease is more severe in men (Table 1).

Table 2. Laboratory finding of patients infected with Sars-Cov-2					
	Normal range	**Median IQR**			**p-value**
		Total (186)	**ICU (48)**	**Non-ICU (138)**	
White blood cell count × 10^9 L	3.5-9.5	8.7 (5.8-11.8)	9.55 (4.7-13.6)	8.7 (5.8-10.6)	0.216
Neutrophil count × 10^9 L	1.8-6.3	6.3 (4.2-9)	8.45 (5.01-12.1)	5.7 (4.2-7.56)	0.002
Neutrophil increased (n)		94	32	62	
Lymphocyte count × 10^9 L	1.1-3.2	1.49 (0.8-2.2)	0.95 (0.32-1.49)	1.7 (1-2.4)	0.0001
Lymphocyte decreased (n)		61	25	36	
Platelet × 10^9 L	125-350	189 (142-241)	152.5 (105-188)	196 (153- 248)	0.0001
LDH	125-243	323.5 (216-640)	688 (328.5-917)	256 (198-420)	<0.0001
CRP, mg/L	0-5	30 (22-64)	42 (33.5-64)	28 (17-39)	<0.0001
Hemoglobin g/dl	13.5-17.5	12.2 (10.7-13.3)	11.7 (10.5-12.8)	12.4 (10.8-13.8)	0.026
Albumin g/L	3.5-5	3.7 (3.5-3.9)	3.5 (3.1-3.9)	3.7 (3.5-3.9)	0.055
ALT	<40 U/L	25 (17-41)	37.5 (22.5-46)	23 (16-35)	0.0001
AST	<40 U/L	24 (17-31)	29 (23.5-48)	22 (15-30)	<0.0001

Lactate dehydrogenase (LDH), C-reactive protein (CRP), Alanine transaminase (ALT), Aspartate transaminase (AST)

Among 186 patients, 40 (21.5%) were healthcare workers, 130 (69.8%) had a travel history or close contact with COVID-19 patients, 83 (44.6%) had one or more underlying medical comorbidities including hypertension (29.0%), respiratory disease (23.1%), diabetes (18.2%), malignancy (6.9%), chronic liver disease (5.3%), and chronic kidney disease (1.0%), and 9 (4.84%) were current smokers. The most common clinical symptoms were shortness of breath (86.5%), myalgia (74.1%), and cough (66.1%), followed by fatigue (62.3%), chest pain (59.6%), fever (51.0%), headache (39.2%), bone pain (35.4%), nose capping (33.8%), chill (32.8%), runny nose (32.8%), confused (23.6%), nausea and vomiting (18.8%), sputum production (13.4%), and diarrhea (9.1%) (Table 1).

Patients who were admitted to the ICU (n=48) were significantly older (median age, 62.5 years [IQR44-75]) than patients who were not admitted to the ICU (n=138) (median age, 42 years [IQR 30-52]) (P<0.0001), and had also more underlying comorbidities (Table 1).

Laboratory findings: Regarding the laboratory parameters, there were significant differences between patients admitted to the ICU and non-ICU patients. The levels of LDH, CRP, ALT, AST, and neutrophil count were higher in patients admitted to the ICU compared to patients who did not admit to the ICU **(**P<0.05). More details on the differences between these two patients groups are given in Table 2.

Chest X-ray: Out of 186 enrolled patients, 180 (96. 7%) showed chest abnormalities, 170 (91.4%) had lung bilateral abnormalities, 68 (36.5%) had consolidations and 123 (66.1%) had ground-glass opacities (GGOs) in their lungs on CT imaging, and 10 (5.3%) had unilateral lung abnormality. About 98% of patients admitted to the ICU had bilateral lung involvement, while 89% of non-ICU patients had bilateral lung involvement. Consolidation and GGO were observed in 52% and 56% of ICU patients, respectively, while 31% and 69% of non-ICU patients had consolidation and GGO, respectively.

Among the chest X-ray findings, consolidation was only a significant difference between patients admitted to the ICU and non-ICU patients (P<0.05) (Table 3).

Outcome: As of April 15, 2020, 33 patients (17.8%) were still hospitalized, 116 patients (62.7%) were discharged, and 36 patients (19.94 %) died.

Table 3. Chest X-ray and CT scan findings in patients with confirmed COVID-19.				
	Total (n=186)	**ICU (n=48)**	**Non-ICU (n=138)**	**p-value**
Chest abnormality	180 (96.77)	47 (97.92)	133 (96.37)	0.057
Bilateral abnormality	170 (91.40)	47 (97.92)	123 (89.13)	0.075
Consolidation	68 (36.56)	25 (52.08)	43 (31.16)	0.010
Ground-glass opacity (GGO)	123 (66.13)	27 (56.25)	96 (69.57)	0.093
Unilateral abnormality	10 (5.37)	0 (0)	10 (7.97)	0.072

Computerized tomography scan (CT scan), Ground-glass opacity (GGO)

Among 48 patients admitted to the ICU, 6 patients (12.5%) were still in the ICU, 26 patients (54.1%) were discharged, and 16 patients (33.3%) died.

Discussion

To date, there are limited studies that compare clinical symptoms, laboratory findings, radiological results, and outcomes between COVID-19 severe patients admitted to the ICU and non-severe patients who did not admit to the ICU. In the current study, a total of 186 patients have entered the study, of whom 48 have been admitted to the ICU. As of April 15, 2020, 116 people were discharged, 33 were hospitalized, and 36 died. The median age of patients admitted to the ICU was 62.5 years, and the median age of patients admitted to the non-ICU ward was 42 years. The average age of the deceased was 59 years, indicating that the disease was more severe in adults and was associated with higher mortality.

In this context, a meta-analysis study conducted by Ali showed that the case fatality rate (CFR) in COVID-19 patients less than 15 years old and more than 15 years old were 0.6 and 39.5%, respectively (13).

The present study showed that 70.8% of ICU patients and 46.3% of non-ICU patients had male sex. We conclude that COVID-19 is more severe in men than women and more men are admitted to the ICU. Therefore, special attention should be paid to male and elderly patients. Previous studies have also shown that the risk of disease and mortality rates are higher in men compared to women. Besides, the CFR was 8.5% and 7.1% for men and women, respectively (14).

Similarly, Dawei Wang reported that 61.1% of COVID-19 patients admitted to the ICU were males [12]. The patients admitted to the ICU were elderly men and had a greater number of underlying diseases than those who were not admitted to the ICU. This suggests that age, sex, and comorbidity may be risk factors for poor outcomes.

Our results showed that shortness of breath, myalgia, and cough were the most common clinical symptoms in COVID-19 patients. In studies performed by Dawei Wang and Chaolin Huang, fever was observed in 98% of patients, while in our study it was observed in 51%. Also, ARDS was 17% in Chen's study, whereas it was 23.1% in our study (6, 7, 12). Compared with symptoms in non-ICU patients, symptoms were more common in ICU patients, including cough, fatigue, and loss of sense of smell, myalgia, confused and runny nose.

Patients admitted to the ICU were significantly older than patients who were not admitted to the ICU. Also, hypertension, ARDS and respiratory diseases were higher among ICU admitted patients in comparison to non-ICU admitted patients. This indicates that underlying diseases can affect the severity of COVID-19 disease. Some studies have shown that patients with underlying heart disease(15), kidney disease (16), diabetes (17), and hypertension (18) have a higher mortality rate.

Among COVID-19 patients, lymphopenia and increased levels of LDH and CRP were the most important laboratory findings. Among laboratory findings, LDH, ALT, and AST and neutrophil count were higher among ICU admitted patients in comparison to non-ICU patients, while lymphocyte count, albumin, and platelets were lower among ICU patients in

comparison to non-ICU admitted patients. The most important complications in hospitalized patients were hypertension and ARDS. In previous studies, Shock and ARDS had been reported as two common complications (12).

ARDS was observed in 45.8% of patients admitted to the ICU and in 100% of dead patients. This indicates that in addition to age, ARDS also contributes to substantial mortality (19-21). Hypertension, respiratory disease, and ARDS were common comorbidity conditions among ICU patients in compression to non-ICU patients. Underlying respiratory disease and ARDS are associated with poor prognosis and may increase mortality in COVID-19 patients(22). Lymphopenia has been previously observed in SARS and MERS coronavirus infections. Lymphopenia was also observed in COVID-19 patients. This suggests that coronavirus infection may be associated with lymphopenia (4, 23).

According to the radiological findings, about 96.7% of our patients showed pulmonary involvement, which was bilateral involvement. GGO was also more common than unilateral involvement and consolidation. In Chaolin Huang's study(6), lung involvement was 98%, and in the present study, 96.77% of patients showed pulmonary involvement in the CT scans. Consolidation was significantly different between ICU and non-ICU patients. No significant difference was observed in other radiological findings. The study also found that about 69.8% of patients had a history of travel to endemic areas or had close contacts with infected persons, indicating contact with infected patients plays a vital role in the spread of infection (24).

In this study, the RT-PCR test was performed only on throat swab samples and we did not have access to the bronchoalveolar lavage (BAL) samples. Besides, several patients were still hospitalized, and the outcome of their illness could affect the outcome of the study, which can be considered as the main limitations of this study.

Conclusion

Our study showed that older age, male sex, and existence of underlying diseases were strongly associated with an increased risk of severe disease and death among COVID-19 patients. Therefore, more attention should be given to elderly male patients with underlying diseases.

Acknowledgment

None.

Conflict of interest

The authors declare that they have no competing interests.

Funding

None.

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