Epidemiological and Clinical Features of 2019 Novel Coronavirus Diseases (COVID-19) in the South of Iran

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Abstract

Background

In March 2020, WHO has declared pandemic on COVID-19. Although the number of infected cases is increasing, information about its clinical characteristics in the Middle East especially in Iran, a country which is considered as one of the most important foci of the disease in the world is lacking. Till date, there is no available literature on the clinical data on COVID-19 patients in Iran.

Method and Material:

In this multicenter retrospectively registered study, 113 hospitalized confirmed cases of COVID-19 admitted in university affiliated hospitals in Shiraz, Iran in from February 20 to March 20 were enrolled.

Results

The median age was 53 years and 71 (62.8%) were males. The most common symptoms at onset were fatigue (75: 66.4%), cough (73: 64.6%), and fever (67: 59.3%). Laboratory data revealed significant correlation between lymphocyte count, partial thromboplastin time, international normalized ratio with the severity of the disease (P value = 0.003, 0.000, 0.000, respectively). The most common abnormality in chest CT scan was ground-glass opacity (77: 93.9%), followed by consolidation (48: 58.5%). Our results revealed an overall 8% (9 out of 113 cases) mortality rate among the patients, in which the majority was among the ICU admitted patients (5: 55.6%). Also, 68 (60.2%) of our patients achieved total recovery and 7 (6.2%) were discharged with follow-up and home isolation.

Conclusion

In this multi-center study which included 113 hospitalized patients with diagnosis of COVID-19, 9.7% of cases were transferred to ICU and mortality rate was 8%. Furthermore, finding the source of infection and studying the behavior of COVID-19 is crucial for understanding the pandemic.

1. Background

In late December 2019, China reported an outbreak of viral pneumonia in Wuhan, Hubei Province, China, which spread rapidly to other areas [1, 2]. It revealed that the causative agent of the cluster of acute respiratory illness was an RNA enveloped beta coronavirus from the sarbecovirus subgenus of *Coronaviridae's* family, which was termed the novel coronavirus disease 2019 (COVID-19) [3–6]. COVID-19 counts as the third outbreak of betacoronaviruses in the 21st century, causing a public health crisis of global concern [7, 8]. Previous outbreaks of this viral family have been described in 2002 and 2012. The former was a respiratory disease identified as Severe Acute Respiratory Syndrome Coronavirus (SARS-

CoV), involving 37 countries, and the latter known as Middle East Respiratory Syndrome Coronavirus (MERS-CoV) affecting 27 countries. The overall mortality rate of these two epidemics of SARS-CoV and MERS-CoV was 10% and 37%, respectively [4, 9–12].

COVID-19 is a global concern and has become a significant health problem since the number of infected cases and affected countries has escalated rapidly [13]. On March 11, 2020, the World Health Organization (WHO) confirmed COVID-19 a pandemic. As of March 31, 2020, over 800,000 cases of COVID have been reported with a death toll of over 39,000 patients and only around 141,000 recovered cases in 199 countries and territories worldwide. Among the top-ranking countries, Iran has placed in the seventh position with over 35,000 confirmed cases and over 2,500 deaths, and only around 11,600 recovered cases [14, 15]. However, the actual number of cases might be much higher because of challenges in confirming the cases due to the limited PCR diagnostic test kits and available staff in the hospitals.

Based on the literature, the incubation period of the disease could be up to 14 days [16]. Most cases can have mild symptoms of fever, cough, sore throat, and myalgia. However, some cases can present with severe conditions such as multiple organ failure, acute respiratory distress syndrome, pulmonary edema, and pneumonia [17–19]. Based on radiological findings in previous studies, the most frequent CT findings included bilateral pulmonary parenchymal ground-glass and consolidative pulmonary opacities, occasionally with a rounded morphology and a peripheral lung distribution [20, 21]. In respect to laboratory data, a decrease in the absolute value of lymphocytes in most patients can be found [22], indicating that the virus might mainly act on lymphocytes, especially T-cells. Damage to T lymphocytes can be a primary factor resulting in exacerbations of patients [23]. In clinical practice, a low absolute value of lymphocytes could assist as a reference index in diagnosing new cases of coronavirus infections. Due to the severity of the disease, with over 20% critical patients and mortality about 3%, COVID-19 is a global health emergency [24]. Therefore, early detection and appropriate treatment of critical cases are of essential importance.

At present, there is lacking information regarding the epidemiology and clinical features of COVID-19 patients in the Middle East, especially Iran, a country which is considered as one of the most important foci of the disease in the world. Therefore this study is conducted to evaluate the clinical features of COVID-19 patients in Fars province, southern Iran.

2. Patients And Methods

2.1 Study Design

The center for control and prevention of 2019 novel Coronavirus Disease (*COVID-19*) *was* established on February 20, 2020, to monitor the spread of *the* COVID-*19* in Fars Province,, the Iran's fourth most populated province. These centers included and provide services for five university affiliated, Shiraz University of Medical Sciences, hospitals. The approach to the disease was based on Iran national

guidelines, adapted from WHO guidelines, and latest studies on *COVID-19* [25]. The incubation period of COVID-19 defined as the time from exposure to the onset of illness, which, based on reports from China and all over the world, was assumed between 3 to 14 days. A patient with symptoms of fever, rhinorrhea, cough, sore throat, and possibly respiratory distress was defined as suspected to COVID-19, especially if there was a positive history of close contact with a highly suspected or confirmed COVID-19 patient, or having a history of travel to a COVID-19 affected countries or cities [26]. Confirmed COVID-19 cases were admitted and quarantined in intended centers for COVID-19 diagnosis and management of Shiraz University of Medical Sciences.

The severity of disease was based on the American Thoracic Society guidelines for community-acquired pneumonia as severe and non-severe, similar to other studies [27, 28], which in our research was the reference for ICU or non-ICU admission.

2.2 Data collection

The epidemiological and clinical (including clinical records, laboratory data, as well as data regarding the chest HRCT scans) data of all confirmed COVID-19 patients from February 20, 2020, to March 20, 2020, in intended centers for COVID-19 diagnosis and management of Shiraz University of Medical Sciences were collected. All physical examination was performed by a single treating physician. Also, the primary chest CT scan was reviewed independently by a single trained specialized radiologists who was blind to the primary impression, clinical symptoms and the patient's outcome.

2.3 Laboratory Confirmation of COVID-19

Real-time reverse transcriptase-polymerase chain reaction (RT-PCR) was used to confirm suspected cases. RT-PCR assays performed following the protocol established by the WHO [25]. Nasopharyngeal and oropharyngeal swab samples were collected and tested for SARS-CoV-2 for each patient. Under a biosafety cabinet and according to laboratory biosafety guidelines, the RNAs were extracted, using QIAamp™ viral RNA mini kit from Qiagen™ according to the manufacturer's instructions. With E-gene and Rdrp-gene probe/primer and superscript ^{TM} III platinum, one-step qRT-PCR kit of Invitrogen company mixtures was prepared. The mixtures transferred to Roche Light cycler™ 96 and Applied Biosystem ABI step one plus™ real time thermal cyclers with positive control and no template control (NTC) as well as an internal control. After 45 cycles the produced graphs observed, any rise after the noise and before cycle 32 considered as positive for SARS-COV 2 [29, 30].

2.4 Statistical Analysis

The collected data was summarized as means (± SD) or medians (with interquartile ranges). For particular variables, the percentage of patients in each group was calculated. Unpaired Student's t-test, chi-square test, or Fisher's exact test was used to compare the clinical characteristics of COVID-19 patients as appropriate. A P. value of less than 0.05 considered indicating statistical significance. All the statistical analyses was performed by the Statistical Package for Social Sciences (SPSS Inc., Chicago, Illinois, USA) version 26.0.

3. Results

3.1 Presenting Characteristics

The study population consisted of 113 confirmed COVID-19 cases, with a median age of 53 years (IQR 40.5–64; range 20–99). The patients consisted of 71 (62.8%) males and 42 (37.2%) females. Among the patients in our study, 11 (9.7%) were admitted to intensive care units due to the severity of their disease. The average time between the initiations of symptoms till hospital admission was 5.63 days, and the average duration of hospitalization was 6.20 days. The average days from the start of symptoms till development of dyspnea, and progression to ARDS were 5.63, 0.5, and 2 days, respectively. Among the patients in our study 44 (38.9%) had one or more coexisting medical condition alongside COVID-19, the most frequent were hypertension (22: 19.5%), diabetes (16: 14.2%), and cardiovascular diseases (16: 14.2%) (Table 1).

Among the hospitalized patients, the most common symptoms at onset of disease were fatigue (66:4%), cough (64.6%), and fever (59.3%); while the less common were hemoptysis (6.2%), and conjunctival congestion (15%) (Table 1).

3.2 Vital Signs and Physical Examination

Based on the patients' vital signs on admission, 77 (68.1%) of our patients had no fever. Also, 12 (10.6%) had elevated heart rates (> 100/min), 2 (1.8%) had elevated respiratory rate (> 24/min), and 7 (6.3%) had elevated blood pressures on admission. These values did not differ between severe and non-severe patients and were all lower among the deceased patients, although not significant. The oxygen saturation of the patients was also measured on admission, which showed 39 (34.5%) of the patients had an O_2 saturation of less than 90%. Also, the mean saturation of O_2 was significantly lower among the ICU admitted patients ($P = 0.001$) and was also significantly lower among the deceased patients ($P < 0.05$).

In term of lung examination, only seven patients (25.9%) had significant rales, which were significantly correlated with the severity of the disease. Among the other signs of infection, the most common were throat congestion (17: 15%), and swelling of the tonsils (8:7.1%) (Table 1).

3.3 Laboratory findings

Numerous variations in laboratory findings were seen among the severe and non-severe, as well as the deceased and living patients (Table 3). ICU admitted patients had significantly higher lymphocyte count then non-ICU patients, although this correlation was not significant with the mortality of the patients in our study. The severe group and the deceased group had higher levels of white blood cell and neutrophil count. Still, lower levels of hemoglobin, hematocrit, and platelet count were detected compared to the non-severe and alive groups, although these differences were not statistically significant. Based on coagulation tests, there were significantly higher international normalized ratio (INR) levels and prolonged partial thromboplastin time (PTT) among the severe and non-severe group ($P < 0.001$); however, the significance of this finding among the deceased group was only valid for INR ($P < 0.001$).

Among the biochemical tests, the severe group showed higher blood urea nitrogen (BUN), creatinine, aspartate aminotransferase, C reactive protein, and erythrocyte sedimentation rate (ESR) compared to the non-severe group, although not significant (Table 3).

The neutrophil to lymphocyte ratio (NLR) was calculated and compared based on the severity and mortality in the patients in our study. Results showed a significantly higher NLR among the ICU admitted group (severe group) and the expired group (P = 0.007 and 0.01, respectively). This difference was also significant among patients above 50 years of age (P = 0.023 and 0.021). However, the average NLR among patients above 50 years with ICU admission was 11.46 compared to 4.92 for above 50 years without ICU admission. For patients below 50 years of age, an average of 5.82 vs. 3.46 was calculated for death and living, respectively (P > 0.05).

3.4 Radiological findings

Radiological evaluation revealed 4 (4.9%) patients with normal CT scans, none of which were among the severe or mortality group. These patients were dominantly male (75%) and under 50 years of age, although no significant correlation was achieved among gender and age with normal CT finding. The most common abnormality was ground-glass opacity (77: 93.9%), followed by consolidation (48: 58.5%). Also, radiological findings of crazy paving were significantly more frequent in non-severe and living patients (P < 0.05) (Table 4).

3.5 Interventions

The main treatments initiated for the patients consisted of antiviral therapy (113: 100%), antibiotic therapy (112: 99.1%), and corticosteroid (5: 4.4%). Also, based on oxygen support administered for the patients, the majority of non-severe patients used nasal cannula (96.8%). Still, for severe cases, other modalities such as invasive mechanical ventilation, non-invasive ventilation, or high flow masks were used according to condition of patients in our study. Patients using invasive mechanical ventilation had significantly higher mortality in our study (P < 0.01) (Table 1).

3.6 Outcome

Based on the prognosis of the disease, an overall 8% mortality rate was documented among the patients in our study, in which the majority was among the ICU admitted patients (5: 55.6%). Also, 68 (60.2%) of our patients achieved total recovery, and 7 (6.2%) were discharged with follow-up and home isolation.

4. Discussion

Based on the results of this study till March 30, 2020, a total number of 113 patients have been admitted to Shiraz hospitals, the capital of Fars province, Iran, with the diagnosis of COVID-19. The mean age of hospitalized patients was 53 years old, with a male to female ratio of 1.6:1. Of these patients, 29 (25.7%) were still hospitalized, 68 (60.2%) were discharged, 7 (6.2%) were discharged with outpatients' treatment and 9 (8%) died. 11 (9.7%) cases have been admitted to ICU due to the severity of the disease

Virological findings indicate that some of the Asian populations may potentially be more susceptible to Covid-19 than other races [31–33]. Chan et al. confirmed the person-to-person transmission of the virus [16]. Our results showed that COVID-19 infects men more than women; this findings is consistent with the findings of the previous studies [1, 4, 34, 35]. In early reports in China, the susceptibility of men contracting the disease was believed to have a relationship with their link to the seafood market (the origin of the disease) as most workers there were men [34]. Nevertheless, as the disease spread to other countries throughout the world, this theory was weakened as men were also more susceptible to disease in other countries. Several theories have been proposed in this manner; Li et al. reported that this male to female ratio can be attributed to the role of sex hormones and protection of the X chromosome, which plays an essential role in adaptive and innate immunity [4]. However, it may be assumed that due to Iranian culture, men tend to have more person to person contact as they work outside the house rather than women who usually stay at home and do the household tasks.

Considering the patients' age, most patients with severe conditions had aged more than 50 years old. They had comorbid diseases such as hypertension and diabetes, which is aligned with the data that have been previously reported [34, 36]. Fang et al. described a theory that since the coronavirus binds to its target through angiotensin-converting enzyme 2 (ACE-2) expressed by epithelial cells in kidney, lung and blood vessels, the infection can be facilitated the risk of developing severe COVID-19 may be increased in individuals who take ACE inhibitors and angiotensin II Type-I receptor blockers (ARBs) and also among diabetic patients as they tend to have an increase in ACE-2 expression [37–39].

Putting aside the typical symptoms such as fever, cough, and myalgia [6, 40, 41], our data revealed that many patients presented with atypical symptoms such as abdominal pain, diarrhea, nausea, vomiting, and vertigo. These data suggest that aside from the focus on typical symptoms, we must keep in mind atypical presentations of the disease as most of our patients developed with gastrointestinal symptoms to achieve earlier diagnosis and prevent the spread of the disease.

Based on our data, those who had lower O_2 saturation on admission and presented with rales on physical examination were significantly associated with being severely ill and poorer prognosis. Furthermore, those who were severely ill had lower heart rates and blood pressure. This finding can be explained by the theory that coronavirus affects not only the respiratory system but also the cardiovascular system. Based on published studies, COVID-19 patients have had high levels of myocardial injury biomarkers in their blood samples [4, 34]. Furthermore, Zheng et al. stated that this myocardial injury might be related to ACE2 which is widely expressed in the cardiovascular system as well as the respiratory system [42].

In terms of laboratory data, abnormalities included leukocytosis in 10.8%, lymphopenia in 12.6%, thrombocytopenia in 15.6%, PT and PTT in 77.9% and 45.8% were seen in the patients. Patients with severe conditions had higher increases in C - reactive protein and ESR levels, and those who died had higher levels of lactate dehydrogenase. Furthermore, severe cases of COVID-19 had more laboratory abnormalities than those who were admitted in general wards. The same results have been reported in

previous studies, except for the fact that the number of cases with lymphopenia in our study was lower than other studies [1, 34, 43–45].

It is worth mentioning that in our study, the NLR ratio was significantly higher in those who were admitted to ICU and those who died, but the average level of NLR in most patients was higher than 3.13. Therefore we assume that a higher cut off in approach to COVID-19 patients based on the NLR ratio might be beneficial as Lie et al. reported the appropriate cutoff of 3.13 [46]. The overall results of lab data suggest that the novel coronavirus infection is associated with the activation of immune system responses with an impact on lymphocytes and the activation of the coagulation cascade. Thus further studies in this area can be beneficial in the treatment of COVID-19.

Based on our data, 4 (4.9%) of our patients had normal chest CT scans, which were under 50 years old and were not severely ill. Hu et al. also reported that 29.2% of the younger asymptomatic patients in his study had normal radiologic findings [47]. Most abnormal radiologic findings consisted of ground-glass opacities, consolidation, and crazy paving present mostly in both lungs and peripheral areas. These data which is consistent with other publications, suggest that CT scan can play a crucial role in the diagnosis and evaluation of the severity of the disease [34, 40, 44, 48].

The fatality rate of patients included in the current study was 8%, which is almost near to the national mortality rate in Iran that has been reported to be 7% based on documented COVID-19 patients but was significantly higher compared to most studies from China [34, 49, 50], yet some of which reported higher or equal mortality rate in the hospitalized patients [4, 41]. Given that China had a history of SARS outbreak in 2003, they were able to successfully control the disease with the help of their previous experience and appropriate leadership. Inadequate awareness towards the disease at early stages, lack of medical protection, high infectivity of the virus, and lack of treatment measures in Iran has led to a rapid increase in the number of patients and mortality rates [51]. Moreover, since those who develop with mild symptoms do not seek medical treatment, the actual mortality rate in the society might be even lower.

Controlling the source of infection, taking preventive measures, early diagnosis, isolation of suspicious cases, and supportive care have been taken into consideration to cease the spread of the virus. Although many randomized controlled trials have been initiated around the world, no specific treatment or vaccine has been proposed for COVID-19. Antiviral and antibiotic therapies have been used to treat COVID-19; however, none of them were found to be properly beneficial [34, 45]. In our study, all of the patients received antiviral therapy, all except one received antibiotic treatment, and 5 cases (4.4%) received corticosteroids.

As with any hospital-based study, this study has its own limitations. Firstly, we encountered some missing data as there were variations in patients' documents in two hospitals given the limited time and shortage of trained medical staff. Secondly, some patients were still admitted to the hospital in the time of manuscript writing, which can affect the outcome results. Thirdly, due to the limited number of patients and given the fact that most patients with mild symptoms were not hospitalized and were not included in

the study, further community-based studies are justified to explore different clarify the different aspects of this disease in Iran, as one of the most important foci of the disease.

5. Conclusion

In this multicenter case series of 113 hospitalized patients, we reported an 8% mortality rate for the COVID-19 patients in south of Iran. Some patients developed with atypical symptoms in the time of admission which makes the diagnosis difficult. Finding the source of infection and studying the behavior of COVID-19 is crucial for understanding the pandemic. Also, early diagnosis, improving the detection methods, timely isolation, and proper treatment are the key factors in fighting this infection.

6. Declarations

Ethics approval and consent to participate

The ethics committee of Shiraz University of Medical Sciences approved this study with the ethical code number: IR.SUMS.REC.1398.1378. Patients' information was de-identified prior to data analysis and confidentiality of patient information was guaranteed and protected by recording only birth date, gender, marital status, occupation, comorbid disease.

Consent for publication

Not applicable.

Availability of data and materials

SPSS data of the participant can be requested from the authors. Please write to the corresponding author if you are interested in such data.

Competing interests

The authors declare that they have no competing interests.

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None.

Authors' contributions

RS, MM, ZK, ML, AD designed the study, HH collected the clinical data, YE and ML collected the radiological data, and BS carried out the laboratory evaluation. AM, AH, ME carried out the statistical analysis. AE and KR drafted the manuscript while RS and MM edited and prepared the final version of the article. All author proofread and approved the final version of the manuscript.

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Tables

Table 1. Clinical and demographic features of COVID-19 patients in Shiraz, South of Iran

Variable	Total (%) *n= 113*	Severe *n=11*	Non-severe *n=102*	P.value	Death *n=9*	Live *n=104*	P.value
Age (years)							
20-34	13 (11.5)	1 (7.7)	12 (92.3)	0.750	1 (7.7)	12 (92.3)	0.899
35-49	36 (31.9)	2 (5.6)	34 (94.4)		2 (5.6)	34 (94.4)	
50-64	36 (31.9)	5 (13.9)	31 (86.1)		3 (8.3)	33 (91.7)	
65-74	14 (12.4)	2 (14.3)	12 (85.7)		1 (7.1)	13 (92.9)	
≥75	14 (12.4)	1 (7.1)	13 (92.9)		2 (14.3)	12 (85.7)	
Sex							
Male	71 (62.8)	7 (9.9)	64 (90.1)	0.750	5 (7)	66 (93)	0.725
Female	42 (37.2)	4 (9.5)	38 (90.5)		4 (9.5)	38 (90.5)	
Occupation							
Healthcare worker	3 (2.8)	0 (0)	3 (100)	1.000	0 (0)	3 (100)	1.000
Non-healthcare worker	103 (97.2)	9 (8.7)	94 (91.3)		9 (8.7)	94 (91.3)	
History of Contact with infected cases	19 (16.8)	0 (0)	19 (100)	0.206	0 (0)	19 (100)	0.353
History of travelling	30 (26.5)	3 (10)	27 (90)	1.000	2 (6.7)	28 (93.3)	1.000
Comorbid Disease							
Hypertension	22 (19.5)	5 (22.7)	17 (77.3)	0.037	2 (9.1)	20 (90.9)	1.000
Diabetes	16 (14.2)	3 (18.8)	13 (81.3)	0.188	2 (12.5)	14 (87.5)	0.613
Cardiovascular disease	16 (14.2)	4 (25)	12 (75)	0.049	2 (12.5)	14 (87.5)	0.613
Malignancy	1 (0.9)	0 (0)	1 (100)	1.000	0 (0)	1 (100)	1.000
Asthma	7 (6.2)	1 (14.3)	6 (85.7)	0.522	1 (14.3)	6 (85.7)	0.450
Chronic obstructive Pulmonary disease	9 (8.0)	1 (11.1)	8 (88.9)	1.000	1 (11.1)	8 (88.9)	0.540
Chronic kidney disease	6 (5.3)	0 (0)	6 (100)	1.000	0 (0)	6 (100)	1.000
Other Immunosuppressive diseases	2 (1.8)	0 (0)	2 (100)	1.000	0 (0)	2 (100)	1.000
Symptoms at onset of illness							
Fever	67 (59.3)	5 (7.5)	62 (92.5)	0.350	3 (4.5)	64 (95.5)	0.156
Cough	73 (64.6)	5 (6.8)	68 (93.2)	0.193	5 (6.8)	68 (93.2)	0.718
Fatigue	75 (66.4)	10 (13.3)	65 (86.7)	0.096	8 (10.7)	67 (89.3)	0.268
Sputum production	24 (21.4)	2 (8.3)	22 (91.7)	1.000	4 (16.7)	20 (83.3)	0.097
Dyspnea	58 (51.3)	8 (13.8)	50 (86.2)	0.205	4 (6.9)	54 (93.1)	0.738
Chest pain	43 (38.1)	6 (14)	37 (86)	0.328	3 (7)	40 (93)	1.000
Chills	67 (59.3)	4 (6)	63 (94)	0.114	3 (4.5)	64 (95.5)	0.153
Hemoptysis	7 (6.2)	0 (0)	7 (100)	1.000	0 (0)	7 (100)	1.000
Rhinorrhea	26 (23.0)	1 (3.8)	25 (96.2)	0.452	2 (7.7)	24 (92.3)	1.000
Sore throat	36 (31.9)	3 (8.3)	33 (91.7)	1.000	2 (5.6)	34 (94.4)	0.716
Abdominal pain	24 (21.2)	2 (8.3)	22 (91.7)	1.000	2 (8.3)	22 (91.7)	1.000

Diarrhea	25 (22.1)	1 (4)	24 (96)	0.451	2 (8)	23 (92)	1.000
Nausea	48 (42.5)	5 (10.4)	43 (89.6)	1.000	5 (10.4)	43 (89.6)	0.491
Vomiting	29 (25.7)	2 (6.9)	27 (93.1)	0.725	4 (13.8)	25 (86.2)	0.234
Anorexia	75 (66.4)	9 (12)	66 (88)	0.329	8 (10.7)	67 (89.3)	0.268
Myalgia /Arthralgia	69 (61.1)	7 (10.1)	62 (89.9)	1.000	5 (7.2)	64 (92.8)	0.734
Headache	60 (53.1)	5 (8.3)	55 (91.7)	0.753	6 (10)	54 (90)	0.498
Dizziness/ Vertigo	45 (39.8)	7 (15.6)	38 (84.4)	0.111	6 (13.3)	39 (86.7)	0.152
Conjunctival congestion	17 (15.0)	2 (11.8)	15 (88.2)	0.670	2 (11.8)	15 (88.2)	0.622
Physical exam on admission							
Temperature							
<37.3	77 (68.1)	8 (10.4)	69 (89.6)	0.005	6 (7.8)	71 (92.2)	0.002
37.3-38	24 (21.2)	0 (0)	24 (100)		0 (0)	24 (100)	
38.1-39	11 (9.7)	2 (18.2)	9 (81.8)		2 (18.2)	9 (81.8)	
>39	1 (0.9)	1 (0.9)	0 (0)		1 (100)	0 (0)	
Heart Rate							
>100 (beats/min)	12 (10.6)	1 (7.7)	12 (92.3)	1.000	1 (7.7)	12 (92.3)	1.000
Respiratory Rate							
>24(breaths/min)	2 (1.8)	1 (50)	1 (50)	0.186	1 (50)	1 (50)	0.154
Blood Pressure							
Normal	36 (32.4)	4 (11.1)	32 (88.9)	0.738	4 (11.1)	32 (88.9)	0.617
Elevated	7 (6.3)	7 (10)	63 (90)		5 (7.1)	65 (92.9)	
Saturation of O_2							
<90	39 (34.5)	7 (17.9)	32 (82.1)	0.046*	4 (5.4)	70 (94.6)	0.271
≥90	74 (65.5)	4 (5.4)	70 (94.6)		5 (12.8)	34 (87.2)	
Lung Auscultation							
Respiratory Rales	27 (23.9)	7 (25.9)	20 (74.1)	0.004*	3 (11.1)	24.(88.9)	0.444
Respiratory Wheeze	8 (7.1)	0 (0)	8 (100)	1.000	0 (0)	8 (100)	1.000
Respiratory Stridor	10 (8.8)	1 (10)	9 (90)	1.000	1 (10)	9 (90)	0.580
Other Infection Signs							
Throat Congestion	17 (15.0)	4 (23.5)	13 (76.5)	0.060	1 (5.9)	16 (94.1)	1.000
Swelling of tonsils	8 (7.1)	1 (12.5)	7 (87.5)	0.571	0 (0)	8 (100)	1.000
Lymphadenopathy	3 (2.7)	1 (33.3)	2 (66.7)	0.267	0 (0)	3 (100)	1.000
Rash	6 (5.3)	0 (0)	6 (100)	1.000	1 (16.7)	5 (83.3)	0.377
Treatment							
Anti-Viral therapy	113 (100.0)	11 (9.7)	102 (90.3)	NA	9 (8)	104 (92)	NA
Antibiotic therapy	112 (99.1)	11 (9.8)	101 (90.2)	1.000	9 (8)	103 (92)	1.000
Use of Corticosteroid	5 (4.4)	2 (40)	3 (60)	0.074	1 (20)	4 (80)	0.345
Oxygen support							
Nasal cannula	31 (27.4)	1 (3.2)	30 (96.8)	0.285	1 (3.2)	30 (96.8)	0.440

	Noninvasive ventilation or high flow mask	11 (9.8)	6 (54.5)	5 (45.5)	0.000*	1 (9.1)	10 (90.9)	1.000
	Invasive mechanical ventilation	2 (1.8)	2 (100)	0.000	0.009*	2 (100)	0 (0)	0.006*
Prognosis								
	Hospitalization	29 (25.7)	2 (6.9)	27 (93.1)	0.000*	0 (0)	29 (100)	0.000*
	Discharge with continued OPD treatment	7 (6.2)	1 (14.3)	6 (85.7)		0 (0)	7 (100)	
	Total Recovery	68 (60.2)	3 (4.4)	65 (95.6)		0 (0)	68 (100)	
	Death in course of Hospitalization	9 (8)	5 (55.6)	4 (44.4)		9 (100)	0 (0)	

NA: Not applicable

* indicator of significant correlation

Table 2. Vital signs at admission of COVID-19 patients in Shiraz, South of Iran

Vital signs on admission	Total (±SD) *n=113*	Mean (±SD)		P.value	Mean (±SD)		P.value
		Severe *n=102*	Non-Severe *n=11*		Death *n=9*	Live *n=104*	
Systole Blood Pressure (mmHg)	129.74 (±95.50)	116.91 (±13.94)	131 (±100.42)	0.641	117.44 (±15.05)	130.82 (±99.46)	0.689
Diastole Blood Pressure (mmHg)	74.56 (±10.68)	77.00 (±13.12)	74.29 (±10.42)	0.427	74 (±12.28)	74.61 (±10.58)	0.871
O2 Saturation	90.12 (±5.66)	84.64 (±8.91)	90.71 (±4.90)	0.001*	86.00 (±7.58)	90.47 (±5.363)	0.022*
Respiratory rate	18.99 (±12.88)	19.18 (±2.994)	18.97 (±7.02)	0.922	18.89 (±2.759)	19 (±6.979)	0.962
Heart rate	85.21 (±12.88)	84.60 (±13.53)	85.27 (±12.89)	0.875	79.88 (±16.47)	85.63 (±12.57)	0.226
Temperature	36.90 (±3.56)	37.34 (±1.06)	36.86 (±3.73)	0.673	37.47 (±1.138)	36.85 (±3.698)	0.623

* indicator of significant correlation

Table 3. Laboratory features of COVID-19 patients in Shiraz, South of Iran

Laboratory Findings	Normal Value	All patients *n=113*	Sever *n=11*	Not Sever *n=102*	P.value	Dead *n=9*	Live *n=104*	P.value
White blood cell count	3.5 – 9.5	6.06 (±2.50)	6.62 (±2.68)	6.00 (±2.49)	0.438	6.83 (±2.94)	6.00 (±2.47)	0.341
Leukopenia		10 (9)	0 (0)	10 (100)	0.424	1 (10)	9 (90)	0.484
Normal		89 (80.2)	9 (10.1)	80 (89.9)		6 (6.7)	83 (93.3)	
Leukocytosis		12 (10.8)	2 (16.7)	10 (83.3)		2 (16.7)	10 (83.3)	
Neutrophil count (* 10^9/L)	1.8 – 6.3	4.60 (±2.2)	10.33 (±0)	4.37 (± 1.93)	0.006	6.49 (± 3.47)	4.26 (± 1.83)	0.064
1.8 – 6.3		20 (76.9)	0 (0)	20 (100)	0.231	2 (10)	18 (90)	0.218
>6.3		6 (23.1)	1 (16.7)	5 (83.3)		2 (33.3)	4 (66.7)	
Lymphocyte count (* 10^9/L)	1.1 – 3.2	1.16 (±0.66)	1.37 (± 0.62)	1.14 (± 0.66)	0.386	1.09 (±0.64)	1.16 (±0.66)	0.791
<1500		14 (12.6)	4 (28.6)	10 (71.4)	0.030*	3 (21.4)	11 (78.6)	0.141
1.5 – 3.2		71 (64)	4 (5.6)	53 (94.4)		4 (5.6)	67 (94.4)	
>3.2		26 (23.4)	3 (11.5)	23 (88.5)		2 (7.7)	24 (92.3)	
Monocyte count (* 10^9/L)	0.1 – 0.6	0.49 (±0.34)	0.46 (± 0)	0.50 (±0.38)	0.939	0.46 (± 0)	0.50 (± 0.38)	0.939
Normal		5 (83.3)	1 (20)	4 (80)	1.000	1 (20)	4 (80)	1.000
Increase Monocyte count		1 (16.6)	0 (0)	1 (100)		0 (0)	1 (100)	
Hemoglobin (g/L)	12 – 17.5	13.54 (±2.39)	13.28 (±1.53)	13.57 (±2.47)	0.706	13.02 (±2.26)	13.58 (±2.41)	0.500
Hematocrit (%)	36 - 54	40.42 (±4.69)	37.05 (±10.81)	40.66 (±4.29)	0.301	40.02 (±6.6)	40.50 (± 4.3)	0.838
Platelet count	150 - 450	220.92 (±105.66)	220 (±108.82)	220.98 (±105.87)	0.985	199.55 (±104.24)	222.85 (±106.09)	0.791
Thrombocytopenia		17 (15.6)	2 (11.8)	15 (88.2)	0.676	1 (5.9)	16 (94.1)	0.927
Normal		80 (73.4)	7 (8.8)	73 (91.3)		7 (8.8)	73 (91.3)	
Thrombocytosis		12 (11.0)	2 (16.7)	10 (83.3)		1 (8.3)	11 (91.7)	
Prothrombin Time (S)	9.4-13.5	15.35 (±2.38)	16.30 (±2.39)	15.25 (±2.37)	0.167	16.70 (± 1.54)	15.23 (± 2.41)	0.077
Normal		25 (22.1)	2 (8)	23 (92)	0.796	0 (0)	25 (100)	0.249
Prolonged		88 (77.9)	9 (10.2)	79 (89.8)		9 (10.2)	79 (89.8)	
Partial Thromboplastin Time (S)	25-36.5	37.61 (±8.49)	37.81 (±12.36)	37.59 (±8.02)	0.934	35.11 (± 10.48)	37.84 (± 8.31)	0.357
Decreased		1 (0.9)	2 (100)	0 (0)	0.000*	1 (50)	1 (50)	0.100
Normal		57 (53.3)	2 (3.6)	54 (96.4)		4 (7.1)	52 (92.9)	
Prolonged		49 (45.8)	7 (14.3)	42 (85.7)		4 (8.2)	45 (91.8)	
International Normalized Ratio	0 – 1.1	1.32 (±0.23)	1.85 (±0.49)	1.28 (±0.15)	0.000*	1.64 (± 0.32)	1.25 (± 0.13)	0.000*
Blood urea nitrogen (mg/dL)	7 - 20	16.80 (±5.81)	17.34 (±6.57)	16.75 (±5.76)	0.762	17.67 (± 16.73)	16.73 (± 5.68)	0.663
≤20		82 (76.6)	8 (9.8)	74 (90.2)	1.000	6 (7.3)	76 (92.7)	1.000

>20		25 (23.4)	2 (8)	23 (92)		2 (8)	23 (92)	
Creatinine (mg/dL)	0.6 – 1.2	1.13 (±0.35)	1.22 (±0.38)	1.12 (±0.35)	0.418	1.02 (±0.29)	1.14 (±0.36)	0.386
≤1.2		69 (64.5)	6 (8.7)	63 (91.3)	0.741	6 (8.7)	63 (91.3)	0.709
>1.2		38 (35.5)	4 (10.5)	34 (89.5)		2 (5.3)	36 (94.7)	
Sodium (mmol/L)	135 - 145	137.7(±5.12)	137.13 (±4.53)	137.73 (±5.21)	0.717	138.91 (±5.74)	137.56 (±5.09)	0.478
Potassium (mmol/L)	3.5 - 5	4.1(±0.6)	3.84 (±0.46)	4.08 (±0.57)	0.195	4.34 (± 0.68)	4.04 (0.56)	0.478
Lactate dehydrogenase (U/L)	0 - 250	686.23 (±509.39)	-	686.23 (± 509.39)	NA	1116.5 (± 1059.95)	628.86 (± 431.66)	0.214
Aspartate aminotransferase (U/L)	15 - 40	47.00 (±30.86)	49.00 (± 0)	47.00 (± 33.33)	1.000	47 (± 0)	47 (± 33.33)	1.000
Alanine aminotransferase (U/L)	9 - 50	35.87 (±36.48)	32.00 (± 0)	36.42 (± 39.36)	0.920	32.00 (± 0)	36.42 (±39.36)	0.920
Albumin (g/L)	3.4 – 5.4	3.90 (±0.46)	3.90 (±0)	3.90 (±0.47)	0.986	3.90 (±0.20)	3.90 (± 0.49)	0.974
Total bilirubin (mmol/L)	0 – 1.4	0.69 (±0.30)	0.64 (±0)	0.69 (±0.31)	0.866	0.38 (±0.21)	0.73 (± 0.29)	0.063
Direct Bilirubin (mmol/L)	0 – 0.3	0.34 (±0.16)	0.31(± 0)	0.34 (±0.16)	0.846	0.23 (± 0.10)	0.35 (±0.16)	0.333
C reactive Protein (mg/L)	0 - 8	34.32 (±20.40)	44.00 (±24.74)	33.33 (±19.79)	0.116	35.00 (± 25.27)	34.28 (±20.23)	0.934
<8		9 (8.3)	0 (0)	9 (100)	0.127	0 (0)	9 (100)	0.616
8-50		72 (66.7)	5 (6.9)	67 (93.1)		5 (6.9)	67 (93.1)	
≥ 50		27 (25)	5 (18.5)	22 (81.5)		1 (3.7)	26 (96.3)	
Erythrocyte sedimentation rate (mm/h)	0 - 20	45.05 (±21.93)	45.66 (±22.39)	34 (±0)	0.619	41.50 (± 24.89)	46.00 (± 21.93)	0.726
<20		1 (0.9)	0 (0)	1 (100)	1.000	0 (0)	1 (100)	1.000
≥20		18 (15.9)	1 (5.6)	17 (94.4)		4 (22.2)	14 (77.8)	
PH	7.35 – 7.45	7.35 (0.29)	7.41 (±0.05)	7.33 (±0.32)	0.567			
Acidosis		8 (7.1)	1 (16.7)	5 (83.3)	0.727	0 (0)	6 (100)	0.394
Normal		28 (24.8)	5 (17.9)	23 (82.1)		5 (17.9)	23 (82.1)	
Alkaline		3 (2.7)	0 (0)	3 (100)		1 (33.3)	2 (66.7)	
Arterial Blood Gas								
PCO2	35 - 48	44.08 (±10.73)	42.45 (± 6.61)	44.26 (± 11.11)	0.615	46.20 (± 15.27)	43.89 (± 10.33)	0.563
PO2	40	31.24(±13.74)	38.88 (±17.50)	30.35 (±13.06)	0.051	47.40 (± 27.23)	29.73 (10.83)	0.000*
HCO3	35 - 48	25.62 (±3.58)	25.91 (±3.25)	25.58 (±3.63)	0.789	25.82 (± 4.35)	25.60 (± 3.53)	0.868

NA: Not applicable

* indicator of significant correlation

Table 4. Radiological findings of CT-scan of COVID-19 Patients in Shiraz, Fars

Variable	Total (%) *n= 113*	Severe *n=11*	Non-severe *n=102*	P.value	Death *n=9*	Live *n=104*	P.value
Involvement							
Normal	4 (4.9)	0 (0)	4 (100)	0.519	0 (0)	4 (100)	0.728
Unilateral	8 (9.8)	0 (0)	8 (100)		1 (12.5)	7 (87.5)	
Bilateral	70 (85.4)	7 (10)	63 (90)		5 (7.1)	65 (92.9)	
Distribution							
Diffuse	9 (11)	3 (33.3)	6 (66.7)	0.019*	4 (44.4)	5 (55.6)	0.000*
Random (Peripheral and peribronchial)	18 (22)	3 (16.7)	15 (83.3)		1 (5.6)	17 (94.4)	
Peripheral	50 (61)	1 (2)	49 (98)		1 (2)	49 (98)	
Peribronchial	1 (1.2)	0 (0)	1 (100)		0 (0)	1 (100)	
Ground Glass Opacity	77 (93.9)	7 (9.1)	70 (90.9)	1.000	6 (7.8)	71 (92.2)	1.000
Crazy Paving	40 (48.8)	7 (17.5)	33 (82.5)	0.005*	6 (15)	34 (85)	0.011*
Reverse halo	10 (12.2)	0 (0)	10 (100)	0.589	1 (10)	9 (90)	0.554
Reticular opacity	8 (9.8)	1 (12.5)	7 (87.5)	0.527	0 (0)	8 (100)	1.000
Consolidation	48 (58.5)	4 (8.3)	44 (91.7)	1.000	3 (6.3)	45 (93.8)	0.688
Centrilobular nodule	2 (2.4)	0 (0)	2 (100)	1.000	0 (0)	2 (100)	1.000
Solid Nodule	9 (11)	0 (0)	9 (100)	1.000	0 (0)	9 (100)	1.000

Figures

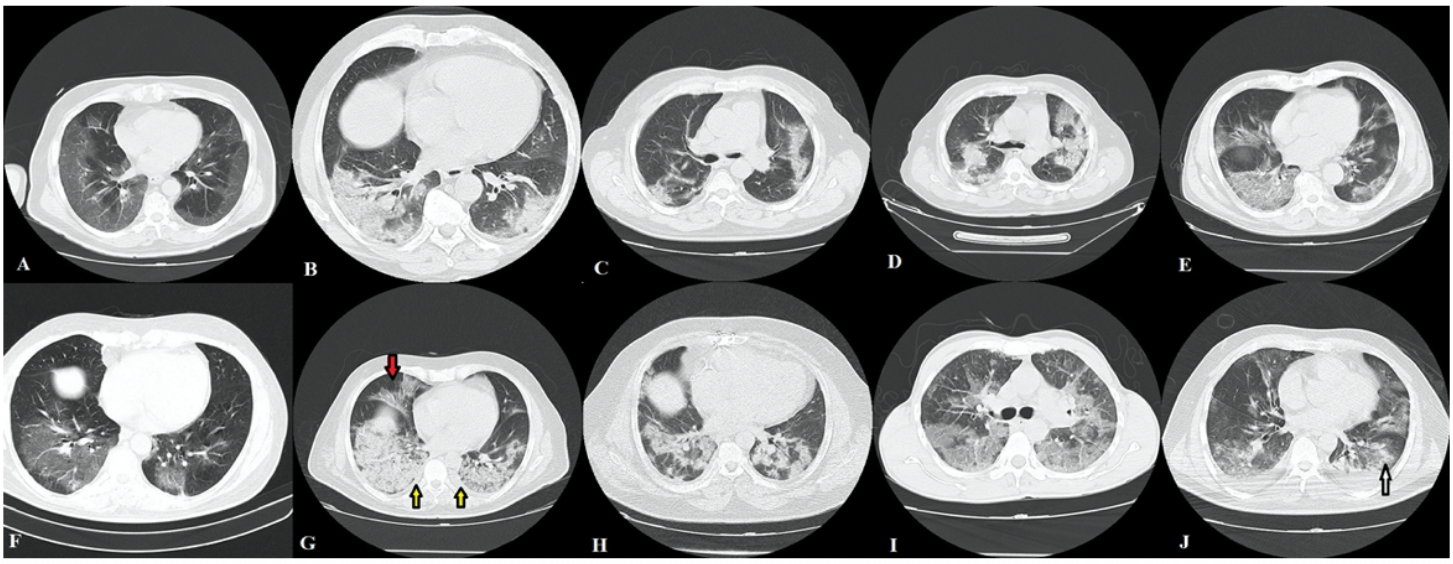

Figure 1

(A) Axial CT scans from an above 60 year-old male; Selected cut from non-contrast chest CT of lung window. Sub pleural crescent-shaped Ground-glass opacities as well as smooth interlobular septal thickening can be seen in both lungs, involving mostly peripheral zone; (B) Axial CT scans from an above 60 year-old male; selected image from non-contrast chest CT scans, lung window. Extensive consolidation with can be seen in both lower lobes with air bronchograms; (C and D) Axial CT scans from an above 50 year-old male at the level of carina; (C) Day 5 after symptom onset: patchy consolidation affecting the bilateral, peripheral lung parenchyma and (D) Day 7: expansion of consolidation in both lungs, as well as ground glass opacities in right side; (E) Axial CT scans from an above 60 year-old male; selected image from non-contrast chest CT scans, lung window. Mixed consolidation and ground glass opacities can be seen in both lower lobes, right middle lobe and lingula of left upper lobe; (F and G) Axial CT scans from an above 50 year-old male ; selected image from non-contrast chest CT scans, lung window, (F) Day 3 after symptom onset: ground glass opacities in both lower lobe associated with mal focus of consolidation and (G) Day 7: expansion of consolidation in both lungs, as well as GGO in right middle lobe(Black arrow) ; Mild pleural effusion is seen bilaterally (yellow arrows); (H) Axial CT scans from an above 50-year old female; selected image from non-contrast chest CT scans, lung window. Multiple patchy consolidation in both lower lobe; (I) Axial CT scans from an under 50 year-old male; selected image from non-contrast chest CT scans, lung window. Crazy-paving pattern (GGO with superimposed inter- and intralobular septal thickening) are seen bilaterally; (J) Axial CT scans from an above 50 year-old male; selected image from non-contrast chest CT scans, lung window. Ground-glass opacities affecting the bilateral lung field, reverse halo sign (ground-glass opacity surrounded by denser consolidation of crescentic shape) in left lower lobe (arrow), Pleural effusion is seen bilaterally.