

Scientific Foundation SPIROSKI, Skopje, Republic of Macedonia  
 Open Access Macedonian Journal of Medical Sciences. 2020 Sep 20; 8(T1):144-149.  
<https://doi.org/10.3889/oamjms.2020.5013>  
 eISSN: 1857-9655  
**Category:** T1 - Thematic Issue "Coronavirus Disease (COVID-19)"  
**Section:** Infective Diseases



# Clinical and Demographic Characteristics of Patients with COVID-19 Who Died in Modarres Hospital

Sara Besharat<sup>1</sup>, Nasser Malekpour Alamdari<sup>2</sup>, Nahid Dadashzadeh<sup>3</sup>, Ramin Talaie<sup>4</sup>, Seyed Shahram Mousavi<sup>3</sup>, Abdolrazagh Barzegar<sup>3</sup>, Sasan Tavana<sup>5</sup>, Rohollah Valizadeh<sup>6,7</sup>, Mehdi Frouzesh<sup>3\*</sup>

<sup>1</sup>Clinical Research and Development Center, Department of Radiology, Shahid Modarres Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran; <sup>2</sup>Department of Surgery, Critical Care Quality Improvement Research Center at Shahid Modarres Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran; <sup>3</sup>Department of Forensic Medicine, Legal Medicine Research Center, Iranian Legal Medicine Organization, Tehran, Iran; <sup>4</sup>Department of Gastroenterology and Hepatology, School of Medicine, Shahid Modarres Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran; <sup>5</sup>Department of Pulmonary Disease, School of Medicine, Shahid Modarres Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran; <sup>6</sup>Department of Epidemiology, Student Research Committee, School of Public Health, Iran University of Medical Sciences, Tehran, Iran

## Abstract

**BACKGROUND:** Novel coronavirus disease (COVID-19) is caused by severe acute respiratory syndrome-CoV2 as a century concern affecting public health.

**AIM:** This study aimed to find the clinical and demographic characteristics of the patients died following COVID-19 development at Modarres Hospital, Tehran, Iran.

**METHODS:** In this descriptive-analytical cross-sectional study, 62 patients died following COVID-19 were studied in terms of age, gender, body mass index, comorbidity, symptoms, liver profile, lipid profile, hemoglobin, platelet, white blood cell, lymphocytes, neutrophils, C-reaction protein, polymerase chain reaction (PCR), creatine phosphokinase, creatinine, blood urea nitrogen (BUN), potassium, magnesium, and sodium.

**RESULTS:** The results showed that 71% of patients were male and 69.4% had positive PCR test indicating low sensitivity of the test; 90.3% of patients were above 60 years old; 56.5 of patients had lymphocytopenia; the mean age was 67.62 ± 15.07 years; with symptoms lasting 6.24 days. The mean serum creatinine and BUN were 3.18 g/dl and 125.9 mg/dl, respectively, indicating renal involvement. All patients had pulmonary involvement accompanied by other organ involvements. Regarding symptoms, 72% of patients showed fever. Some affected patients had diarrhea, lethargy, and fatigue. A comparison of comorbidities by gender showed no significant differences.

**CONCLUSION:** According to our results, the majority of patients were overweight. In people who are more than 60 years, multi-organ failure was notable. Fever, cough, and shortness of breath were dominant symptoms like other studies, but neurological complications following COVID-19 as meningoencephalitis is possible that can be used as a differential diagnosis. We did not find differences between male and female regarding comorbidity, symptoms, and mortality rate.

**Edited by:** Ksenija Bogoeva-Kostovska  
**Citation:** Besharat S, Alamdari NM, Dadashzadeh N, Talaie R, Mousavi SS, Barzegar A, Tavana S, Valizadeh R, Frouzesh M. Clinical and Demographic Characteristics of Patients with COVID-19 Who Died in Modarres Hospital. Open Access Maced J Med Sci. 2020 Sep 20; 8(T1):144-149. <https://doi.org/10.3889/oamjms.2020.5013>  
**Keywords:** Clinical display; Coronavirus Disease-19; Novel coronavirus  
**\*Correspondence:** Mehdi Frouzesh, No. 108, Taleghani St., Tehran, Iran. E-mail: [m.frouzesh.forensic@gmail.com](mailto:m.frouzesh.forensic@gmail.com)  
**Received:** 28-May-2020  
**Revised:** 11-Jul-2020  
**Accepted:** 09-Sep-2020  
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**Funding:** Publication of this article was financially supported by the Scientific Foundation SPIROSKI, Skopje, Republic of Macedonia  
**Competing Interests:** The authors have declared that no competing interests  
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## Introduction

Novel coronavirus (CoV) disease (COVID-19) is caused by severe acute respiratory syndrome (SARS)-CoV2 and is a causative agent of a potentially lethal disease resulting in widespread concern in the global public health. CoV is one of the largest pathogens that mainly target the human respiratory tract. Previous outbreaks of CoV have included SARS and Middle East respiratory syndrome, which have long been known to be very threatening to public health. In late December 2019, a number of patients were admitted to hospitals whose initial diagnosis was a side effect of an unknown cause. The affected cases were associated with a wholesale market for seafood and wet animals in Wuhan, Hubei Province, China [1], [2]. Indeed, COVID-19 is a novel zoonotic disease caused by a novel

CoV that started from China and bat is the reservoir hosts of novel CoVs [3]. Epidemiological studies of primary cases of CoV pneumoniae-2019 showed that many cases were exposed to the seafood market in Wuhan, China [4]. The basic reproduction number of COVID-19 was reported from 2.24 to 3.58 [5].

The first official COVID-19 case in Iran was announced on February 19, 2020. On March 16, 2020, 4 weeks later, the daily situation report on COVID-19 showed about 5000 confirmed cases [6]. According to the World Health Organization (WHO), total confirmed cases of COVID-19 in Iran are 93,657 cases and show a decline slope so that in the last report, 80 deaths occurred on 30 April 2020 [7].

A study by Wang *et al.* showed that from January 10 to 24, 2019, the number of people infected

with the novel coronavirus-2019 in China increased 31.4 times. They estimated the mortality rate of 2.84% for COVID-19. They also found that the male-to-female mortality ratio was 3.25 to 1; the median age of death was 75 years; the median time from the first symptoms to death was 14 days, and the median time from the initial symptoms to death in people aged 70 years and older (11 days) was shorter than people under 70 years (20 days) [8]. A study by Li *et al.* revealed that the mean age of 425 patients infected with novel CoV was 59 years, of which 56% were men; the mean incubation period was 5.2 days, and almost half of the adult patients were 60 years and older. The incubation period for COVID-19 was 14 days after exposure, in which lots of cases occur approximately 4–5 days after exposure [9].

Detection of COVID-19 in most cases is not easy because most patients have mild or moderate syndrome with a strong prognosis. However, it may be necessary to identify an etiological factor in epidemiological studies, especially during epidemic outbreaks. Since the new CoV-2019 has not been found in humans before, no specific vaccine or treatment has been provided. Furthermore, drug therapy did not show optimum results in multiple organ failures [10], [11], [12], [13].

Renal involvement is prominent in this regard and it is recommended to check renal factors such as creatinine at admission [14], [15]. There is more need to conduct further studies in different conditions, for example, pregnant women, because the data of these conditions are sparse. Regarding that, many factors influence the development of any disease, special groups should be careful more [16], [17], [18], [19]. It is important to diagnose all suspected cases as soon as possible and to treat them quickly, to cut off the source of the infection. Conventional diagnostic testing methods, such as assessment to detect antiviral antibodies or viral antigens, have been clinically developed and used. New diagnostic solutions, including real-time polymerase chain reaction (RT-PCR) and microscopic-based measurements, may be effective in monitoring epidemiological measures, along with preventive measures [20], [21].

Like other CoVs, COVID-19 nucleic acids can be detected in samples such as nasopharyngeal swabs, sputum, lower respiratory tract secretions, blood, and feces. Clinical signs and graphic findings provide an acceptable diagnosis. It is showed that fever (78.9%) and cough (67.7%) were the most common symptoms. Diarrhea (3.7%) and vomiting (5%) were rare. Abnormalities in computed tomography (CT) images of the chest were observed in 96% of patients infected with novel CoV, and in 82.1% of them, lymphopenia was recorded [22]. In Italy and Bulgaria, the same clinical characteristics of COVID-19 were reported [23], [24], [25]. Furthermore, the mortality of the COVID-19 varies country by country and sometimes city by city [26], [27].

Due to the high mortality of COVID and the WHO's announcement of a pandemic on February

2020, further studies are needed to identify disease symptoms, prognosis, graphical, and paraclinical findings for definitive diagnosis and subsequent treatment. In this study, the clinical and demographic characteristics of the dead patients following COVID-19 development were evaluated.

## Methods

In this descriptive-analytical cross-sectional study performed as a retrospective, the total numbers of patients died due to COVID-19 ( $n = 62$ ) were studied in Modarres Hospital, Tehran. The existing records of patients who died following COVID-19 were examined through census sampling and the variables of age, gender, body mass index (BMI), comorbidity, symptoms, liver profile, lipid profile, hemoglobin, platelet, white blood cell (WBC), lymphocytes, neutrophils, C-reaction protein (CRP), RT-PCR (for partial diagnosis), creatine phosphokinase (CPK), creatinine, blood urea nitrogen, potassium, magnesium, and sodium were examined.

Inclusion criteria were the patients with approved COVID-19 died within April 2020. Exclusion criterion was the illegible file of the patients. Indeed, the method of sampling was census. Regarding the case definition, the approved COVID-19 case was considered as a patient with a positive respiratory sample performed by PCR method (nasopharyngeal swab RT-PCR) with a sensitivity and specificity of 78.2% and 98.8%, respectively [28].

There were 430 hospitalized patients at Modarres Hospital in April 2020, and 62 of whom died this month. The diagnosis was based on radiological chest X-ray, CT scan, PCR test, and initial symptoms of COVID-19 (evidence of extensive pulmonary involvement with tachycardia and respiratory rate above 25 or higher, fever, myalgia, and cough).  $O_2$  saturation was below 93%, requiring hospitalization at the intensive care unit at the beginning of the visit or short-term after admission. These patients underwent treatment protocols based on the respiratory pattern and clinical findings and pulmonary scintigraphy in the middle and severe groups of COVID-19, including hydroxychloroquine with or without Kaletra® (Lopinavir+Ritonavir) and sometimes oseltamivir. Some patients were given antibiotics and corticosteroids, intravenous immunoglobulin, and Vitamin C ampoules. Depending on the patient's respiratory progression or progression of the disease to acute respiratory distress syndrome ( $PI_{O_2}/FI_{O_2} < 300$ ) or acute lung injury ( $PI_{O_2}/FI_{O_2} < 200$ ), or suffering from respiratory distress or severe decrease of  $O_2$  saturation, they needed intubation and mechanical ventilation.

### Statistical analysis

Descriptive statistics (frequency, mean, and standard deviation) and analytical statistics were used to analyze the data analysis. All the analysis was conducted using SPSS. The Kolmogorov–Smirnov statistical test demonstrated that the data did not have a normal distribution. Thus, the nonparametric tests were used in order to analyze the data.  $p < 0.05$  was considered statistically significant.

### Ethical consideration

This research was performed according to the Declaration of Helsinki. Informed written consent was obtained from the patients, and the study was approved by the Ethics Committee of Shahid Beheshti University of Medical Sciences (ethical code: IR.SBMU.RETECH.REC.1399.034, available at: <http://ethics.research.ac.ir/IR.SBMU.RETECH.REC.1399.034>).

## Results

In this study, 62 patients who died due to confirmed COVID-19 in Modarres Hospital in Tehran. Regarding gender, 71% of patients were male and 69.4% had positive PCR test results, indicating low sensitivity of the test. Regarding age as an effective factor, 90.3% of patients had above 60 years old. Regarding lymphocytopenia, 56.5 of patients had lymphocytopenia. Indeed we used absolute lymphocyte count formula for calculating lymphocytopenia [29]. Thrombocytopenia is divided into three groups: mild (100,000–150,000 platelets/ $\mu\text{L}$ ), moderate (50,000–100,000 platelets/ $\mu\text{L}$ ), and severe ( $<50,000$  platelets/ $\mu\text{L}$ ) (Table 1). In terms of clinical and paraclinical characteristics, patients had a mean BMI of  $28.34 \text{ kg/m}^2$  (overweight class). The mean age was 67.62 years, with symptoms lasting 6.24 days, length

**Table 1: The number of patients by lymphocytopenia, PCR, BMI, age, gender, and platelet patients with COVID-19**

| Variable                | Number of patients | Percent |
|-------------------------|--------------------|---------|
| Gender                  |                    |         |
| Female                  | 18                 | 29.0    |
| Male                    | 44                 | 71.0    |
| PCR test                |                    |         |
| Positive                | 43                 | 69.4    |
| Negative                | 19                 | 30.6    |
| Lymphocytopenia         |                    |         |
| Yes                     | 35                 | 56.5    |
| No                      | 26                 | 41.9    |
| BMI ( $\text{kg/m}^2$ ) |                    |         |
| 18.5–24.9               | 7                  | 22.6    |
| 25–29.9                 | 15                 | 48.4    |
| 30–39.9                 | 9                  | 29.0    |
| Platelet (Count per mL) |                    |         |
| 100–150                 | 24                 | 40.0    |
| 50–100                  | 8                  | 13.3    |
| $<50$                   | 2                  | 3.3     |
| Age (year)              |                    |         |
| 28–40                   | 1                  | 1.6     |
| 41–60                   | 5                  | 8.1     |
| $>60$                   | 56                 | 90.3    |

BMI: Body mass index, PCR: Polymerase chain reaction.

of hospital stay 6.64 days, and staying in the intensive care unit for 4.70 days. The mean serum creatinine and blood urea were 3.18 g/dl and 125.9 mg/dl, respectively, indicating renal involvement. Other laboratory variables are listed in Table 2. Regarding involvement of organs, 33.9% of patients had solely pulmonary involvement, which was often associated with cardiac involvement and systemic infection (17.7%). However, all patients had pulmonary involvement accompanied by other organ involvements. In 16.16% of cases, pulmonary involvement was associated with renal involvement and

**Table 2: Clinical and paraclinical characteristics of patients with COVID-19**

| Variable                                   | Minimum | Maximum | Mean    | Standard deviation | Reference range                    |
|--|---------|---------|---------|--------------------|------------------------------------|
| Age (year)                                 | 28.00   | 95.00   | 67.62   | 15.07              | -                                  |
| BMI ( $\text{kg/m}^2$ )                    | 21.40   | 39.50   | 28.34   | 4.13               | -                                  |
| Duration of sign (Day)                     | 1.00    | 20.00   | 6.24    | 4.14               | -                                  |
| Duration of admission sign (Day)           | 1.00    | 20.00   | 6.48    | 4.64               | -                                  |
| Stay in the intensive care unit sign (Day) | 1.00    | 17.00   | 4.70    | 4.39               | -                                  |
| Duration of intubation sign (Day)          | 1.00    | 17.00   | 4.34    | 4.25               | -                                  |
| WBC (Count per microliter)                 | 2,700   | 177,000 | 15,470  | 22,330             | 4500–11,000                        |
| Lym (Count per microliter)                 | 2,800   | 90,000  | 11,610  | 15,460             | 800–5000                           |
| Neut (Count per microliter)                | 5,900   | 96,000  | 82,260  | 18,070             | 5000–10,000                        |
| Plt (Count per microliter)                 | 22,000  | 249,000 | 208,230 | 312,130            | 150,000–450,000                    |
| Hb (mg/dl)                                 | 6.60    | 128.00  | 15.52   | 20.64              | Male: 13.5–17.5<br>Female: 12–15.5 |
| CRP (mg/L)                                 | 1.00    | 3.00    | 2.32    | 0.70               | $<10$                              |
| AST (mg/dl)                                | 27.00   | 4680.00 | 237.10  | 715.77             | 8–48                               |
| ALT (mg/dl)                                | 21.00   | 2800.00 | 146.78  | 393.07             | 7–55                               |
| ALP (mg/dl)                                | 91.00   | 453.00  | 217.21  | 91.25              | 40–129                             |
| Urea (mg/dl)                               | 31.00   | 370.00  | 125.96  | 84.31              | 7–20                               |
| Creatinine (mg/dl)                         | 0.96    | 14.80   | 3.18    | 2.94               | 0.84–1.21                          |
| LDH (U/L)                                  | 2.50    | 3408.00 | 1167.65 | 681.31             | 140–280                            |
| CPK (mcg/L)                                | 33.00   | 1507.00 | 459.65  | 387.01             | 10–120                             |
| SpO <sub>2</sub> (%)                       | 50.00   | 92.50   | 78.62   | 8.59               | 95–100                             |

BMI: Body mass index, WBC: White blood cell, CRP: C-reaction protein, CPK: Creatine phosphokinase.

ALT: Aspartate aminotransferase.

11 patients undergone hemodialysis and 18 patients developed acute kidney injury. One person developed meningoencephalitis (Table 3). Regarding comorbidities, 24.4% of patients had hypertension and heart disease. Some affected patients had diabetes, gastrointestinal diseases, and cancer (Table 4). Regarding symptoms, 19% of patients had fever, cough, and shortness of breath together. However, 72% of patients showed fever. Some affected patients had diarrhea, lethargy, and fatigue (Table 5). A comparison of comorbidities by gender showed no significant differences (Table 6). In patients more than 60 years, the frequency of organ failures was significantly different and 10 patients were involved with renal failure, 13 patients with heart disease, and six patients with systematic infection. Approximately

**Table 3: The number of organs affected following novel coronavirus infection**

| Involved organ                                | Number of patients | Percent |
|---|--------------------|---------|
| Lung  | 21                 | 33.9    |
| Lung and kidney                               | 10                 | 16.1    |
| Lung, systematic infection                    | 5                  | 8.1     |
| Lung, kidney, and systematic infection        | 4                  | 6.5     |
| Lung, systematic infection and heart          | 11                 | 17.7    |
| Lung, kidney, and heart                       | 5                  | 8.1     |
| Lung, kidney, heart, and systematic infection | 4                  | 6.5     |
| Lung and heart                                | 2                  | 3.2     |
| Total   | 62                 | 100.0   |

**Table 4: The number of comorbidities in patients with COVID-19**

| Comorbidity                | Number of patients | Percent |
|----------------------------|--------------------|---------|
| Hypertension               | 5                  | 11.1    |
| Heart                      | 4                  | 8.9     |
| Diabetes                   | 3                  | 6.7     |
| Gastrointestinal           | 2                  | 4.4     |
| Cancer                     | 6                  | 13.3    |
| Heart and diabetes         | 6                  | 13.3    |
| Heart and gastrointestinal | 2                  | 4.4     |
| Hypertension and heart     | 11                 | 24.4    |
| Hypertension and diabetes  | 3                  | 6.7     |
| Hypertension and cancer    | 1                  | 2.2     |
| History of surgery         | 1                  | 2.2     |
| Cerebrovascular accident   | 1                  | 2.2     |

all patients were involved with pulmonary disease (Table 7). Table 8 presents some predictive factors increasing the chance of mortality following COVID-19 including shortness of breath (odds ratio: 1.821, p: 0.011), age more than 60 years (odds ratio: 4.022,

**Table 5: The number of symptoms in patients with COVID-19**

| Symptoms                                 | Number of patients | Percent |
|--|--------------------|---------|
| Fever                                    | 1                  | 1.6     |
| Cough                                    | 2                  | 3.3     |
| Shortness of breath                      | 8                  | 13.1    |
| Diarrhea                                 | 1                  | 1.6     |
| Fatigue                                  | 3                  | 4.9     |
| Lethargy                                 | 1                  | 1.6     |
| Fever and shortness of breath            | 10                 | 16.4    |
| Fever, cough, and shortness of breath    | 19                 | 31.1    |
| Fever and lethargy                       | 1                  | 1.6     |
| Diarrhea, cough, and shortness of breath | 2                  | 3.3     |
| Fever, cough, and lethargy               | 3                  | 4.9     |
| Fever, shortness of breath, and fatigue  | 10                 | 16.4    |

p: 0.001), hypertension (odds ratio: 1.944, p: 0.036), diabetes (odds ratio: 2.085, p: 0.002), and cancer (odds ratio: 3.902, p: 0.012). The results of multiple regression showed that age can be one of the main predictive factors. It should be noted that other factors were not significant in univariate regression.

**Table 6: Comparison of comorbidities by gender**

| Comorbidity                | Gender (%) |          | Statistics                   |
|----------------------------|------------|----------|------------------------------|
|                            | Female     | Male     |                              |
| Hypertension               | 1 (7.1)    | 4 (12.9) | X2 Fisher = 10.769 p = 0.444 |
| Heart                      | 2 (14.3)   | 2 (6.5)  |                              |
| Diabetes                   | 1 (7.1)    | 2 (6.5)  |                              |
| Gastrointestinal           | 0 (0)      | 2 (6.5)  |                              |
| Cancer                     | 0 (0)      | 6 (19.4) |                              |
| Heart and diabetes         | 2 (14.3)   | 4 (12.9) |                              |
| Heart and gastrointestinal | 0 (0)      | 2 (6.5)  |                              |
| Hypertension and heart     | 6 (42.9)   | 5 (16.1) |                              |
| Hypertension and diabetes  | 2 (14.3)   | 1 (3.2)  |                              |
| Hypertension and cancer    | 0 (0)      | 1 (3.2)  |                              |
| History of surgery         | 0 (0)      | 1 (3.2)  |                              |
| Cerebrovascular accident   | 0 (0)      | 1 (3.2)  |                              |

## Discussion

Due to the emergence of COVID and the WHO's announcement of a pandemic in and finally, the need for identifying the clinical and demographic characteristics of COVID-19, we conducted this study. In summary, our study showed that among 62 dead people due to COVID-19, 71% of patients were male and 69.4% had positive PCR test results, indicating low sensitivity of the test; 90.3% of patients had above 60 years old; 56.5 of patients had lymphocytopenia;

**Table 7: The number of organ failures in patients with COVID-19**

| Organ                                  | Age more than 60 years | Age less than 60 years | p-value | $\chi^2$ |
|--|------------------------|------------------------|---------|----------|
| Lung                                   | 17                     | 4                      | 0.018   | 16.956   |
| Lung and kidney                        | 10                     | 0                      |         |          |
| Lung + systematic infection            | 4                      | 5                      |         |          |
| Lung and kidney + systematic infection | 4                      | 0                      |         |          |
| Lung + systematic infection + heart    | 9                      | 2                      |         |          |
| Lung and kidney + heart                | 4                      | 1                      |         |          |
| Lung and heart                         | 0                      | 2                      |         |          |

the mean age was 67.62 years; with symptoms lasting 6.24 days. The mean serum creatinine and blood urea were 3.18 g/dl and 125.9 mg/dl, respectively, indicating renal involvement. All patients had pulmonary involvement accompanied by other organ involvements. Regarding symptoms, 19% of patients had fever, cough, and shortness of breath together. However, 72% of patients showed fever. Some affected patients had diarrhea, lethargy, and fatigue. A comparison of comorbidities by gender showed no significant differences. Regarding age, the frequency of patients died following COVID-19 <60 was low and it

**Table 8: Logistic regression to predict the binary outcome (death following COVID-19)**

| Variable               | B      | SE    | p-value | Odds ratio | 95% CI |        |
|------------------------|--------|-------|---------|------------|--------|--------|
|                        |        |       |         |            | Lower  | Upper  |
| Shortness of breath    | 0.599  | 0.140 | 0.011   | 1.821      | 1.112  | 1.928  |
| HB                     | -0.994 | 1.011 | 0.098   | 0.370      | 0.211  | 2.344  |
| LDH                    | -1.084 | 1.141 | 0.599   | 0.338      | 0.138  | 12.112 |
| Neut                   | 0.0009 | 0.411 | 0.813   | 1.001      | 0.872  | 4.371  |
| Lymph                  | 0.207  | 1.057 | 0.342   | 1.230      | 0.239  | 15.091 |
| Cough                  | 1.099  | 0.982 | 0.067   | 3.003      | 0.919  | 43.310 |
| Age more than 60 years | 1.391  | 0.156 | 0.001   | 4.022      | 2.471  | 4.560  |
| Hypertension           | 0.664  | 0.131 | 0.036   | 1.944      | 1.331  | 2.229  |
| Diabetes               | 0.734  | 0.027 | 0.002   | 2.085      | 1.989  | 2.215  |
| Cancer                 | 1.361  | 0.141 | 0.012   | 3.902      | 2.656  | 4.625  |

makes bias in interpretation. We should know that the majority of our study population consisted of patients who were above 60 years and this finding should not ignore the risk of mortality in younger patients. It is declared that some groups of people are more prone to develop COVID-19, including pregnant women and elderlies, in which older people are predisposed to this disease (age >55 years) [30]. The median age of patients with COVID-19 in a study by Richardson *et al.* was 63 years and 39.7% were female, while these results were consistent with our results [31].

Huang *et al.* found that 98% of patients with COVID-19 had a fever. They reported that patients referred with cough (76%), fatigue and muscle pain (44%), dyspnea (55%), sputum expectoration (28%), headache (8%), hemoptysis (5%), and diarrhea (3%). Laboratory tests showed that 25% of infected patients had leukopenia and 64% had lymphocytopenia. Aspartate aminotransferase levels are elevated in 37% of patients. Myocarditis was diagnosed in 12% of patients, and very sensitive troponin I levels were significantly increased in these patients. Abnormalities in chest CT images were observed in 100% of patients [32]. According to Table 7, our study declared that COVID-19 is a multi-organ disease; in such a way

that single-organ failure (lung) was shown in just 21 patients. In 10 patients, lung and kidney were involved together. Renal involvement was detected in 18 patients, accompanied by lung and heart involvement.

In a study entitled "Presenting characteristics, comorbidities, and outcomes among 5700 patients hospitalized with COVID-19 in the New York City area" done by Richardson *et al.*, the results indicated 3.2% of patients were treated by renal dialysis. Richardson *et al.* reported hypertension as the most common comorbidity consistent with our study because heart disease, especially hypertension, was observed a lot in patients [31].

Zhao *et al.* revealed that Asian men were more likely to develop CoV infection in 2019 [5]. Guan *et al.* reported 1099 cases of the new CoV-2019 infection. They found that fever (78.9%) and cough (67.7%) were the most common symptoms. Diarrhea (3.7%) and vomiting (5%) were rare. Abnormalities in CT images of the chest were observed in 96% of patients infected with COVID-19, and in 82.1% of them, lymphopenia was recorded [22]. These results were consistent with our results. Approximately the reported symptoms and organ failure were recorded for the dead cases. There were no notable differences between the reviewed studies and the results of our study. The display of COVID-19 in Asian people is the same. While in a study by Richardson *et al.*, 30.7% was febrile, that's why the display of symptoms can be changed by geographical differences [31]. Our study found more fertile patients compared to the Richardson *et al.* study.

## Conclusion

According to our results, the majority of died people affected by COVID-19 were overweight and more than 60 years old. In people who were more than 60 years, multi-organ failure was notable. Fever, cough, and shortness of breath were dominant symptoms like other studies but neurological complications following COVID-19 as meningoencephalitis is possible that can be used as a differential diagnosis. COVID-19 in people more than 60 years rings a dreadful bell to medical staff. Lung is always involved in both genders. We did not found differences between male and female regarding comorbidity, symptoms, and mortality rate.

## Acknowledgments

We would like to thank the Vice-Chancellor for Research and Technology of Shahid Beheshti University of Medical Sciences and also the director of Modarres Hospital in Tehran Province for their

cooperation in conducting this research (ethical code: IR.SBMU.RETECH.REC.1399.034).

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