

Influencing demographic characteristics, comorbidities disease, and radiologic finding on mortality due to Covid-19 in Iran

Farshad Gharebakhshi¹, Purya Haghjoo², Akram Sabkara³, Roya Rahmani³, Parisa Raji⁴, Razieh Mousapour¹, Sara Ghaseminejad Kermani⁵, Zaynab Tavafizadeh⁶, Alireza Fazeli⁷

Departments of ¹Radiology and ⁵Emergency Medicine, Imam Hossein Hospital, School of Medicine, Shahid Beheshti University of Medical Sciences, Tehran, ²Urology Research Center, Razi Hospital, School of Medicine, Guilan University of Medical Sciences, Rasht, Departments of ³Infection and Tropical Disease and ⁴Anesthesiology, School of Medicine, Shahid Beheshti University of Medical Sciences, Tehran, ⁶Department of Radiology, School of Medicine, Iran University of Medical Sciences, Tehran, ⁷Department of Medical Education, Medical Education Research Center, Isfahan University of Medical Sciences, Isfahan, Iran

ABSTRACT

Introduction: Recognition of death risk factors is urgently needed, not only to identify the defining clinical and epidemiological characteristics with greater precision but also to facilitate the appropriate supportive care and prompt access to the intensive care unit (ICU) if necessary. This study aimed to investigate the influencing demographic characteristics, comorbidities disease, and radiologic finding on COVID-19 death. **Method:** Descriptive cross-sectional study included adult patients with COVID-19 from Imam Hossein. Demographic characteristics, comorbidities disease, chest CT scan findings, and outcome (death/survive) data were extracted from information health system (HIS), by using a data collection check list. To explore the influencing factors on mortality, logistic regression method was used. **Result:** Result demonstrated that most patients who died because of Covid-19 were men (63.4%), more than 60 years (86.4%), married (95.8%), and self-employed (37.1%) with a mean age of 72.1 ± 15.46 years ranging from 22 to 93 years. Having comorbidities disease such as cancer, cardiac disease, diabetes, age, and pathologic chest CT findings was associated with death. In contrast, gender, marital, job, cerebral vascular disease, and HTN were not correlated. **Conclusion:** Identification of demographic characteristics, comorbidities disease, and radiographic finding correlated with death of COVID-19 can help clinicians in order to with rapid diagnose and triages of high-risk patients to have a better plan for the care of these patients.

Keywords: Covid-19, mortality, comorbidities disease, radiologic finding

Address for correspondence: Mr. Alireza Fazeli,

Department of Medical Education, Medical Education Research Center, Isfahan University of Medical Sciences, Isfahan, Iran.

E-mail: Alirezafazeli68@yahoo.com

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Introduction

In December 2019, a viral disease was found for the first time from Wuhan, China with an unknown cause.^[1] On February 12, 2020, the International Committee on Taxonomy of Viruses announced that the official name of the coronavirus is

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severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). This is a novel member of human coronavirus, identified recently. World Health Organization pronounces that the official name of the disease caused by the virus is coronavirus disease 2019 (COVID-19).^[2] The main symptoms and signs of COVID-19 patients are fever, dry cough, dyspnea, fatigue, and lymphopenia. In severe and critical patients, SARS-CoV-2 infections caused by viral pneumonia may lead to severe acute respiratory syndrome and even death.^[3-5] After the first patient was reported in December 2019 in Wuhan City, Hubei Province, China, this infecting disease broke out quickly, spread around all over the world, and was persistently evolving so far.^[6] COVID-19, or the disease caused by the SARS-CoV-2 coronavirus, has caused a pandemic that has affected patients in more than 188 countries and territories worldwide.^[7]

Identification of risk factors for critical conditions is urgently needed, not only to identify the defining clinical and epidemiological characteristics with greater precision but also to facilitate the appropriate supportive care and prompt access to the intensive care unit (ICU) if necessary.^[8] Knowledge on the association between demographic factors and clinical findings and different severity stages of COVID-19 such as infection, severe disease, ICU admission, and death may provide insight into the comorbidities pathophysiological mechanisms (immunity, coagulopathy, and comorbidities). This knowledge may also guide clinical decision-making, especially when there is an impending shortage in healthcare resources such as ICU beds. Additionally, exploring demographic and clinical findings influencing COVID-19 outcomes may guide policymakers in, for instance, the prioritization of pharmaceutical and nonpharmaceutical interventions and screening.^[9] These demographic factors and the clinical findings may also be necessary for the design and interpretation of clinical trials on the efficacy of treatments as they could potentially be strong confounders.^[10]

The present study aimed to analyze risk factors correlated with patients' definite death due to COVID-19. We show that if older age, gender, pathologic chest Ct finding, and comorbidities disease are death risk factors of COVID-19 patients. We also indicated for the first time if symptoms and vital signs on admission are correlated with death.

Method and Material

Study design and participants

This descriptive cross-sectional study included adult hospitalized patients (≥ 18 years old) from Imam Hossein hospital (Tehran, Iran). All adult patients who were diagnosed with COVID-19 base of reverse transcriptase-polymerase chain reaction (RT-PCR) Covid-19 and chest CT scan were screened, and those who died or hospitalized in the ICU or general ward were included in our study and followed to outcome as a death or recovery. This hospital was one of the biggest hospitals designated for transferring patients with COVID-19 in Tehran, Iran.

Inclusion and exclusion criteria

Inclusions criteria were including age more than 18 years old, definite diagnose of COVID-19 base of positive RT_PCR or chest CT-scan, patient satisfaction to participate in the study, and exclusion criteria were including the death of the patient for any cause other than Covid-19 and patient satisfaction no to participate in the research.

Data collection

Demographic characteristics, pathologic chest CT findings, comorbidities disease, and outcome (death/survive) data were extracted from information health system (HIS), by using a data collection check list. All data were checked by one emergency medicine specialist, two radiologists, two infectious and tropical disease specialists, an anesthesiologist, and an educated nurse. Patients were followed by an educated nurse to outcome as a death or recovery.

Clinical finding

Patient pharyngeal swab specimens were collected for the SARS-CoV-2 viral nucleic acid detection using a real-time RT-PCR assay. The viral nucleic acid testing for all patients was performed by the clinical laboratory from Imam Hossein Hospital of Shahid Beheshti University of medical science in Iran. The detailed protocol was described somewhere else.^[4]

Radiographic findings, including the chest CT scan, were done for each patient. All radiographic finding was generated by the clinical radiographic of Imam Hossein Hospital. The radiographic and comorbidities disease data for some patients were missing.

Statistical analysis

Descriptive statistics such as mean, standard deviation, and percentage were used to present the data. Chi-square test to assess the correlation between causes of death with different clusters of variables such as age, gender, and pathologic chest CT findings was used. We used the Mann-Whitney U-test, χ^2 -test, independent *t*-test, and Fisher's exact test to compare differences between the cluster of variables such as age, gender, pathologic, and chest CT findings, of survivors and nonsurvivors where appropriate. To explore the risk factors correlated with in-hospital death, logistic regression method was used.^[11-13] A *P* value less than 0.05 was considered significant. Data analysis was performed by using the software SPSS v26.

Result

The result showed that the total participants were 940 (653 recovered and 287 deaths). Most patients were hospitalized because of Covid-19 were men (59.7%), more than 60 years (58.1%), married (93.7%), and self-employed (40.4%) with a mean age of 61.93 ± 17.92 years, ranging from 18 to 93 years. Also, the result showed that most patients who died because of Covid-19 were men (63.4%), more than 60 years (86.4%), married (95.8%), and self-employed (37.1%)

with a mean age of 72.1 ± 15.46 years ranging from 22 to 93 years [Table 1].

Logistic regression showed that gender, marital, and job were not correlated with death, while age was correlated [Table 2].

Results showed that the most frequent comorbidities disease and radiologic findings in all patients was diabetic (21.1%), heart disease (10.6%), hypertension (7.4%), cancer (2.7%), cerebral vascular disease (CVA) (2.6), and pathologic CT findings (92.4.3%) [Table 3].

Logistic regression showed that the comorbidities disease such as hypertension and CVA were not correlated with death, while cancer, cardiac disease, diabetic, and CT findings were correlated [Table 4].

Table 1: Demographic characteristics of COVID-19 patients

Variables	Recovery case frequency (Percent) n=653	Death cases frequency (Percent) n=287	Total cases frequency (Percent) n=940	P
Gender				
Male	379 (58)	182 (63.4)	561 (59.7)	P=0.134
Female	274 (42)	105 (36.6)	379 (40.3)	
Total	653 (69.5)	287 (30.5)	940 (100)	
Age				
<30 years	46 (7)	8 (2.8)	54 (5.7)	P<0.001
30-59 years	309 (47.3)	31 (10.8)	340 (36.2)	
>60 years	298 (45.6)	248 (86.4)	546 (58.1)	
Age Mean				
Year	57.46±17.09	72.1±15.46	61.93±17.92	P<0.001
Marital				
Single	47 (7.2)	12 (4.2)	59 (6.3)	P=0.079
Married	606 (82.8)	275 (95.8)	881 (93.7)	
Job				
Employee	46 (7)	8 (2.8)	54 (5.7)	P=0.081
Self-employed	272 (41.7)	108 (37.6)	380 (40.4)	
Housewife	252 (38.6)	105 (36.6)	357 (38)	
Retired	83 (12.7)	66 (23)	149 (15.9)	

Discussion

This study aimed to investigate the influencing demographic and clinical factors of definite mortality due to Covid-19 in Iran. In this study, there was no association between gender and mortality of COVID-19 patients, while higher age was correlated; in a mixed group of patients with COVID-19 and SARS, Jin *et al.*^[8] found that increased age and sex were correlated with more severe disease and mortality. Maraqa *et al.*^[11] found that males had a greater risk of death and females more likely to contract the disease, but males more likely to die as did those 60 years of age and older. A meta-analysis review study by Pijls *et al.*^[10] showed that men and patients aged 70 and above have a higher risk for COVID-19 infection, severe disease, ICU admission, and death Panthee *et al.*^[14] found that nearly half of the deaths were among people less than 50 years of age and being female increased the risk of death. In this study, older patients (>60 years old) were correlated with the severity and death of COVID-19 patients; this finding was confirmed by previous studies.^[3,5,15-17] The immune system changes with increasing of age.^[18] Aging is also correlated with a high prevalence of comorbidities and decreased reserve capacity of vital organs, which may lead to increased frailty, together with an aged immune system; this may put elderly individuals at risk of a poor outcome and higher risk of mortality when infected with COVID-19.^[10] Also, the result in this study showed that gender is not a risk factor for higher severity and mortality in patients with COVID-19, consistent with our research; previous studies have confirmed this finding; Lin Fu *et al.*^[12] found that gender is not risk factor for death of COVID-19 patients. Regarding there are no sex differences in the immune response and no differences between men and women in responsibility and daily activity including household, goes to work, cares for the sick and elderly patient in family, and shopping both men and women are equal to be exposed to COVID-19; thus, there were no significant differences in gender in this study.

In our study, we found that comorbidities diseases including diabetes, cancer, and cardiac disease are risk factors for death

Table 2: Logistic regression between demographic characteristics and death risk of COVID-19 patients

Variables	Total cases frequency n=940	Death cases frequency (Percent) n=287	B	S.E.	Logistic Wald	Regression 95%CI	P
Gender							
Male	561	182 (32.44)	-0.226	0.146	2.390	0.59-1.06	0.112
Female	379	105 (27.7)					
Age							
<30 years	54	8 (14.81)					
30-59 years	340	31 (9.11)	1.688	0.164	105.470	3.91-7.46	<0.001
>60 years	546	248 (45.42)					
Marital							
Single	59	12 (20.33)	0.575	0.332	3.010	0.92-3.40	0.083
Married	881	275 (31.21)					
Job							
Employee	583	182 (31.21)	-0.86	0.147	0.340	0.68-1.22	0.560
Not-employed	357	105 (29.41)					

of patients due to COVID-19, while CVA and hypertension were not associated with death risk, consistent with our study; previous studies have confirmed this finding; Fu *et al.*^[12] found that hypertension is not the risking factor for COVID-19 patient's death. Panthee *et al.*^[14] found that most deaths were correlated with cardiovascular diseases and diabetes. Nikpouraghdam *et al.*^[19] declared having comorbidities diseases was significantly correlated with mortality. Chang *et al.*^[20] demonstrated that the presence of diabetes was significantly correlated with predicting the progression to the severe stage of COVID-19. A study in

Rhode Island declared that diabetes is a risk factor for the severity and mortality of COVID-19 patients.^[18] The higher incidence of cardiovascular disease and diabetes among COVID-19 deaths in this study is similar to those reported in the previous studies.^[21-23] Some studies said that COVID-19 patients with comorbidities were at an increased death risk.^[3,5] While some studies were in contrast with our investigation and noted that diabetes and cardiac disease are not risking factors for death because of COVID-19.^[12] Having comorbidities diseases such as diabetes and cardiac disease reduces tissue blood flow and cell nutrition, and thus reduces the repair of damaging tissue due to infection caused by COVID-19, and in patients with comorbidities diseases such as cancer, the immune system is weakened due to receiving chemotherapy drugs; thus, all of these cause patients to the severity and increase their mortality.

The result of the present study showed that pathologic chest CT findings were correlated with mortality of COVID-19 patients. Consistent with our study, previous studies have confirmed this finding. Chang *et al.*^[20] declared chest X-ray findings were related to the severe stage and mortality of COVID-19 patients. Lung haziness or consolidation on chest CT indicated the significant effects of COVID-19. Pathologic chest CT findings indicate a severe stage of the disease which shows the necessary opportunity to start timely medication and care for patients.

Conclusion

Identification of demographic characteristics, comorbidities disease, and radiographic finding correlated with mortality of COVID-19 can help clinicians in order to with early identification and triages of high-risk patients to have a better plan for the care of these patients.

Table 3: Comorbidities disease frequently of COVID-19 patients

Variables	Recovery case frequency (Percent) n=653	Death cases frequency (Percent) n=287	Total cases frequency (Percent) n=940	P
Cancer				
No	644 (98.6)	271 (94.4)	915 (97.3)	P<0.001
Yes	9 (1.4)	16 (5.4)	25 (2.7)	
Heart				
No	608 (93.1)	232 (80.8)	840 (89.4)	P<0.001
Yes	45 (6.9)	55 (19.2)	100 (10.6)	
CVA				
No	635 (97.2)	281 (97.9)	916 (97.4)	P=0.551
Yes	18 (2.8)	6 (2.1)	24 (2.6)	
Diabetic				
No	532 (81.5)	210 (73.2)	742 (78.9)	P=0.004
Yes	121 (18.5)	77 (26.8)	198 (21.1)	
Hypertension				
No	608 (93.1)	262 (91.3)	870 (92.6)	P=0.328
Yes	45 (6.9)	25 (8.7)	70 (7.4)	
Chest CT findings				
Yes	584 (89.4)	285 (99.3)	869 (92.4)	P<0.001
No	69 (10.6)	2 (0.7)	71 (7.6)	

Table 4: Logistic regression between comorbidities disease and death risk of COVID-19 patients

Variables	Total cases frequency n=940	Death cases frequency (Percent) n=287	B	S.E.	Logistic Wald	Regression 95%CI	P
Cancer							
No	915	271 (29.61)	1.441	0.423	11.609	1.84-9.67	0.001
Yes	25	16 (64)					
Cardiac							
No	840	232 (27.61)	1.164	0.215	29.232	2.1-4.88	<0.001
Yes	100	55 (55)					
CVA							
No	916	281 (30.67)	-0.283	0.477	0.353	0.29-1.91	0.552
Yes	24	6 (25)					
Diabetic							
No	742	210 (28.3)	0.478	0.167	8.17	1.162-2.23	0.004
Yes	198	77 (38.88)					
Hypertension							
No	870	262 (30.11)	0.254	0.260	0.954	0.77-2.14	0.329
Yes	70	25 (35.71)					
Chest CT Finding							
Yes	869	285 (32.79)	-2.824	0.721	15.34	0.01-0.24	<0.001
No	71	2 (2.81)					

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Conflicts of interest

There are no conflicts of interest.

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