

Research Paper

Relationship Between Comorbidity, Chronic Diseases, ICU Hospitalization, and Death Rate in the Elderly With Coronavirus Infection



Hamed Akhavadegan^{1,2}, Mahmood Aghaziarati¹, Mohammad Ghasem Roshanfekar Balalemi¹, Zahra Arman Broujeni², Fatemeh Taghizadeh¹, Isa Akbarzadeh Arab³, *Majid Janani³

1. Department of Urology, Baharloo Hospital, Tehran University of Medical Sciences, Tehran, Iran.
2. Department of Research, Baharloo Hospital, Tehran University of Medical Sciences, Tehran, Iran.
3. Department of Epidemiology and Biostatistics, School of Health, Tehran University of Medical Sciences, Tehran, Iran.



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ABSTRACT

Objectives The association of comorbidity diseases, such as diabetes and hypertension with the severity of Coronavirus Disease 2019 (COVID-19) has been repeatedly assessed. However, less research has specifically addressed the elderly. This study aimed to describe the demographic and clinical characteristics and evaluate the relationship between comorbidities, and the rates of Intensive Care Unit (ICU) hospitalization and death due to COVID-19 in the elderly.

Methods & Materials This retrospective study was conducted in elderly patients with COVID-19 admitted to Baharloo Hospital. Demographic information, types of underlying diseases, and need for hospitalization in the ICU or death in hospital among the hospitalized patients from March 2020 to July 2020 was extracted from the COVID-19 hospital database. The logistic regression model was used to estimate the Odds Ratio (OR), as a separate measure of the association between the research variables' outcomes (death & hospitalization outcomes in the ICU).

Results A total of 522 elderly patients were included in the study. Approximately 77% (n=422) of the elderly survived and 23% (n=100) died. The study participants' mean±SD age was 72.55±8.44 years. Besides, and about 54% (n=281) were males. Logistic regression model results suggested that the odds of death in the study participants with ≥2 underlying diseases equaled 1.69 (OR=1.69, 95%CI: 0.97-2.91, P=0.04). Moreover, the odds of ICU hospitalization in them was 2.26 (OR=2.26, 95%CI: 1.34-3.81, P=0.002) time higher than their counterparts who did not have underlying diseases, i.e., statistically significant.

Conclusion Our results are expected to impact preventive interventions and take a more targeted approach to prioritize older patients with risk factors, rather than adopting calendar age policies as a general indicator for risk assessment.

Extended Abstract

1. Introduction

T

he rapid spread of Coronavirus Disease 2019 (COVID-19) worldwide was consid-

ered a pandemic [1, 2]. Numerous deaths occurred globally due to this disease [3]. Although the COVID-19 is fatal in all ages, it is much severe in elderly patients [4, 5].

Aging is among the critical risk factors for increased disease severity and mortality in patients with COVID-19 [6].

* **Corresponding Author:**

Majid Janani

Address: Department of Epidemiology and Biostatistics, School of Health, Tehran University of Medical Sciences, Tehran, Iran.

Tel: +98 (99) 81461046

E-mail: majid.jananiiii@gmail.com

Comorbidity of a condition with chronic diseases in the elderly is a common health problem worldwide [7], especially in countries with higher life expectancy [8, 9].

Triage, patient prioritization, and reducing COVID-19-induced mortality are major challenges; thus, numerous studies have focused on the risk factors associated with COVID-19 outcomes in patients; however, data in elderly patients remains limited. Therefore, this study was performed to describe the demographic and clinical characteristics and to investigate the relationship between comorbidity and COVID-19 outcomes in the elderly.

2. Materials and Methods

This retrospective cohort study was conducted in patients aged ≥ 60 years with COVID-19, hospitalized in Baharloo Hospital. All included patients were diagnosed with COVID-19 as per a positive Polymerase Chain Reaction (PCR) test, a typical view of COVID-19 on Computer Tomography (CT) scan, or radiography data.

The research participants' demographic data, including age, gender, Body Mass Index (BMI), disease severity,

comorbidity with chronic diseases, and outcome variables, including the duration of hospitalization, a history of Intensive Care Unit (ICU) hospitalization, and disease outcome (death/alive) were collected from the admission records.

An Independent Samples t-test was used to compare the mean scores of the quantitative data between the dead and surviving groups. Besides, the Chi-squared test was used to investigate the relationship between qualitative variables and the death or survival of the explored patients. Analysis of Variance (ANOVA) was also used to compare the mean values of the quantitative variables in groups with one, ≥ 2 , and without comorbidities. The logistic regression model was used to investigate the relationship between comorbidity and outcomes. The Kaplan–Meier and Logrank tests were used to report survival and compare survival in the elderly with/without underlying disease. STATA was used for data analysis; the significance level of <0.05 was bilaterally considered in all analyzes.

3. Results

Overall, 522 elderly patients admitted to Baharloo Hospital were included in the present study. Approximately

Table 1. The demographic characteristics and symptoms of the elderly with COVID-19 at the time of hospitalization by underlying disease subgroups

Characteristic	Mean \pm SD/ No. (%)				P
	Total (n=522)	Without Comorbidity (n = 152)	With One Underlying Disease (n=157)	With two or More Underlying Diseases (n=213)	
Age	72.55 \pm 8.44	70.30 \pm 8.46	73.43 \pm 8.76	73.49 \pm 7.90	<0.001
BMI, kg/m ²	26.56 \pm 4.21	26.52 \pm 3.74	25.58 \pm 4.54	27.01 \pm 4.13	0.067
Gender (male)	281 (53.8)	87 (57.2)	87 (55.4)	107 (50.2)	0.372
female	241 (46.2)	65 (42.8)	70 (44.6)	106 (49.8)	
Symptoms					
Fever	267 (51.1)	71 (46.7)	90 (57.3)	106 (49.8)	0.153
Chills	144 (27.6)	30 (19.7)	51 (32.5)	63 (29.6)	0.030
Myalgia	138 (26.4)	36 (23.7)	42 (26.8)	60 (28.2)	0.629
Cough	319 (61.1)	106 (69.7)	86 (54.8)	127 (59.6)	0.022
Dyspnea	363 (69.5)	94 (61.8)	111 (70.7)	158 (74.2)	0.038
Hospitalization duration (days)*	6 (6.7)	4.5 (8)	6 (7)	7 (5.5)	0.007
ICU admission	147 (28.2)	26 (17.1)	46 (29.3)	75 (35.2)	<0.001
Death	121 (23.2)	24 (15.8)	39 (24.8)	58 (27.2)	0.032

*Median and interquartile range has been reported.

Table 2. The ORs of underlying diseases by each disease and the combination of underlying diseases to cause death or hospitalization

Comorbidity	Outcome: Death		Outcome: ICU Hospitalization	
	OR (95%CI)	P	OR (95%CI)	P
Cardiovascular disease	1.07 (1.04-1.09)	<0.001	1.64 (1.05-2.55)	0.027
Respiratory diseases	0.72 (0.24-1.55)	0.303	1.32 (0.61-2.84)	0.303
Renal Diseases	1.23 (0.48-3.13)	0.651	1.70 (0.71-4.05)	-
Hypertension	1.21 (0.79-3.13)	0.373	1.41 (0.95-2.10)	0.86
Diabetes	1.30 (0.85-2.01)	0.222	1.70 (1.13-2.56)	0.10
Stroke (brain)	0.90 (0.45-1.18)	0.780	2.13 (1.14-3.97)	0.017
Thyroid disease	0.89 (0.22-2.38)	0.852	1.48 (0.45-4.83)	0.516
Rheumatic diseases	2.14 (0.75-8.23)	0.136	1.26 (0.36-4.41)	0.709
Without underlying disease	1	-	1	-
With one underlying disease	1.46 (0.82-2.63)	0.199	1.68 (0.95-2.95)	0.071
With two or more underlying diseases	1.69 (0.97-2.91)	0.040	2.26 (1.34-3.81)	0.002

77% (n=422) of the hospitalized elderly survived the disease, and 23% died. The Mean±SD age of the study participants was 72.55±8.44 years, and about 54%(281) of them were males. The age of the elderly who expired due to COVID-19 (76.31±8.66 y) was older than that in the surviving elderly (71.41±08.04 y), i.e., statistically significant (P<0.001) (Table 1).

Furthermore, a significantly higher proportion of the expired elderly patients had cardiovascular diseases, compared to the rest (P=0.011). Additionally, the mortality rate in the elderly with one or more underlying diseases was significantly higher than that in the elderly without such conditions (24.8% vs. 15.8%; P=0.032) (Table 2).

Logistic regression analysis suggested that having cardiovascular disease increases the odds of death in the elderly by 1.07 (OR=1.07, 95%CI: 1.04-1.09); also, the odds of death in participants who had ≥2 underlying diseases was 1.69 (OR=1.69, 95%CI: 0.97-2.91, P=0.04) times higher than that in the elderly without such conditions, i.e., significant (Table 2). Moreover, the regression results for each outcome are presented in Table 2.

As shown in Figure 1, the survival rate of the patients without underlying diseases was higher than that in the patients with underlying diseases (Figure 1B). Besides, the

frequencies of death and ICU hospitalization were directly related to the underlying diseases. Additionally, the elderly with a higher frequency of underlying diseases generated a higher mortality rate and ICU hospitalization (Figure 1C).

4. Discussion and Conclusion

This study described the demographic and clinical characteristics and investigated the association between underlying diseases and the severity of COVID-19 in the elderly. Numerous studies suggested that the mortality rate in the elderly with COVID-19 is much higher than that in the young population [4, 5, 10]. The obtained results also signified that approximately 23% of the elderly with COVID-19 expired, i.e., higher than the mortality rate in China, Korea, and Italy [4, 11].

Patients with COVID-19 usually die from various causes, including multiple organ failure, shock, respiratory failure, heart failure, arrhythmias, and renal failure [12, 13]. Previous studies indicated that a higher age can cause an inadequate response of the immune system to pathogens, the dysfunction of organs [14-17], and accelerated inflammation; eventually leading to multiple organ failure and death, and death in the ICU [18, 19].

Previous studies reported that comorbidity with other diseases may lead to a weakened immune system and

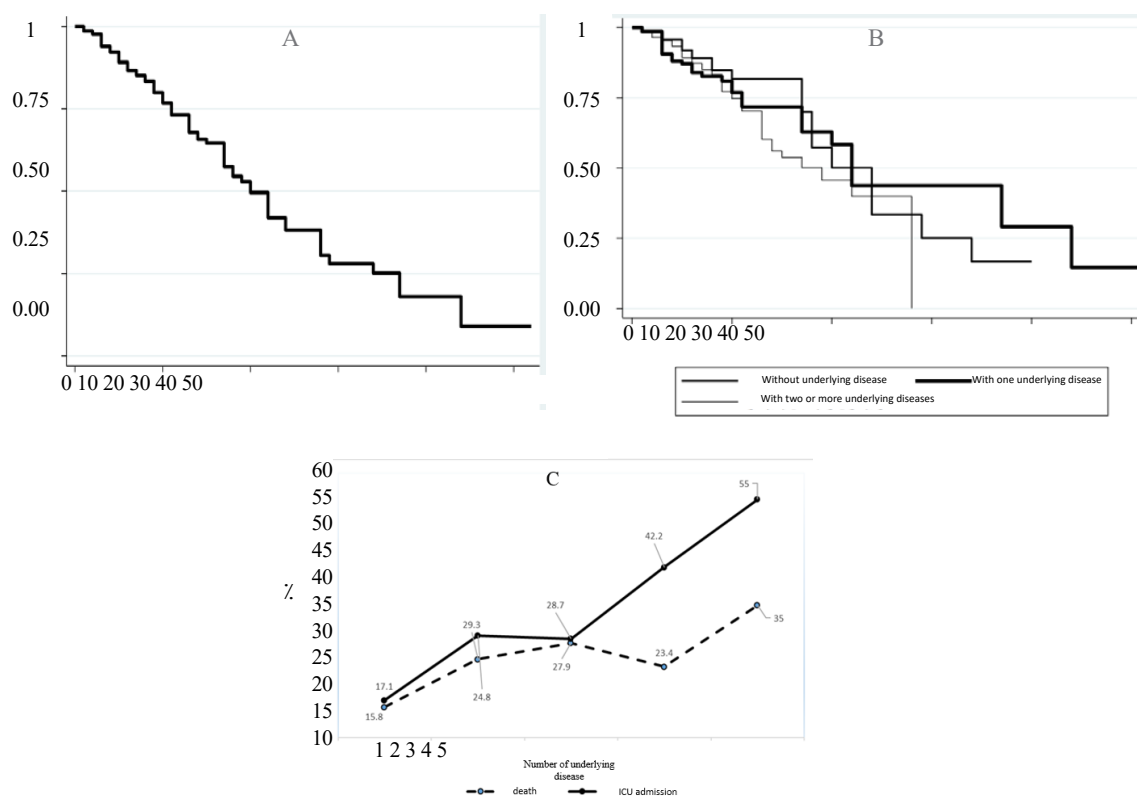


Figure 1. Kaplan–Meier survival odds chart in the studied elderly studied

A: in general; B: underlying diseases subgroup, and C: shows the association between the number of underlying diseases and death/ ICU admission.

the dysfunction of the body; thus, this condition presents higher adverse impacts in the elderly patient, compared to the young patients with COVID-19 [16, 17, 20, 21]. Previous studies, specified cardiovascular disease, obstructive pulmonary disease, hypertension, and diabetes as the most critical risk factors for the severity and mortality of COVID-19 [22].

Sun et al. examined 3400 patients and reported similar results to ours [45]. Ruan et al. also explored 150 patients with COVID-19 and concluded that cardiovascular disease and hypertension were higher in patients who expired due to the disease, compared to the patients who were discharged (43% vs. 19%; $P < 0.001$) [46]. A systematic review and meta-analysis study included 16 studies and 3994 patients; accordingly, the relevant data demonstrated that hypertension ($OR = 2.95$), diabetes ($OR = 3.07$), cardiovascular disease ($OR = 4.58$), and chronic kidney disease ($OR = 5.32$) generated a higher risk of mortality or undesirable outcomes in this group [47].

Finally, our results suggested that mortality is very high in the elderly with COVID-19. Chronic disease aggravates

the prognosis in the elderly. Our results are expected to impact preventive interventions and take a more appropriate approach to prioritize older patients with risk factors, rather than adopting calendar age policies as a general indicator of risk. Furthermore, it seems that more care should be provided for the elderly with COVID-19 and underlying disease.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the Ethics Committee of the Tehran University of Medical Sciences (Code: IR.TUMS.VCR.REC.1399.148). All ethical principles are considered in this article. The participants were informed about the purpose of the research and its implementation stages. They were also assured about the confidentiality of their information and were free to leave the study whenever they wished, and if desired, the research results would be available to them.

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Authors' contributions

Research of texts: Hamed Akhavizadegan and Mohammad Ghasem Roshanfekar Balalemi; Drafting of the article: Hamed Akhavizadegan, Mahmoud Aghaziarti and Zahra Boroujeni; Completion and correction of the draft article: Majid Janani and Fatemeh Taghizadeh; Data analysis: Issa Akbarzadeh Arab and Majid Janani; Editing, completion and final approval: All authors.

Conflicts of interest

The authors declared no conflict of interest.

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