

Original/Research Paper

COVID-19 among heart failure patients: A retrospective study of 294 patients at a referral cardiac center in northern Iran

Samad Karkhah ^{a, b}  | Arsalan Salari ^c  | Zahra Ahmadnia ^c  | Mohammad Javad Ghazanfari ^d  | Nazila Javadi-Pashaki ^{e, f*} 

- a. Department of Medical-Surgical Nursing, School of Nursing and Midwifery, Guilan University of Medical Sciences, Rasht, Iran
- b. Burn and Regenerative Medicine Research Center, Guilan University of Medical Sciences, Rasht, Iran
- c. Department of Cardiology, Cardiovascular Diseases Research Center, Heshmat Hospital, School of Medicine, Guilan University of Medical Sciences, Rasht, Iran
- d. Department of Medical-Surgical Nursing, School of Nursing and Midwifery, Shahid Beheshti University of Medical Sciences, Tehran, Iran
- e. Department of Nursing, Cardiovascular Diseases Research Center, School of Nursing and Midwifery, Guilan University of Medical Sciences, Rasht, Iran
- f. Social Determinants of Health Research Center (SDHRC), Guilan University of Medical Sciences, Rasht, Iran

***Corresponding author(s):** Nazila Javadi-Pashaki (PhD), Department of Nursing, Cardiovascular Diseases Research Center, School of Nursing and Midwifery, Guilan University of Medical Sciences, Rasht, Iran.

Email: n.javadip@gmail.com

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Abstract

Cardiovascular disease, especially heart failure (HF), is the most important comorbidity that increases the risk of death in COVID-19 patients. This study aimed to assess and compare demographic characteristics, clinical features, and clinical outcomes in HF patients with and without COVID-19. Using a retrospective research, 294 patients with HF referred to a cardiac center in Guilan province, northern Iran were enrolled. Data were collected using census sampling from August 2020 to 2021. In this study, the medical records of all patients with HF were assessed. In this research, 294 HF patients were enrolled. Also, 26.53% of HF patients had COVID-19. Mean EF, blood pressure, and HF duration in HF patients with COVID-19 were 25.83 (SD=12.31), 126.65 (SD=24.67) mmHg, and 3.79 (SD=2.10) years, respectively. The most common symptoms in HF patients with COVID-19 were cough (52.56%), headache (44.87%), and gastrointestinal problems (43.59%), respectively. Finally, 55.13% of HF patients with COVID-19 died. The mean age of HF patients with COVID-19 was higher than in HF patients without COVID-19 (66.02 vs. 62.79 years; $P=0.031$). Hyperlipidemia was higher in HF patients with COVID-19 than in HF patients without COVID-19 (25.64% vs. 13.89%; $P=0.018$). Also, in-hospital mortality was higher in HF patients with COVID-19 than in HF patients without COVID-19 (55.13% vs. 16.20%; $P<0.001$). Overall, HF patients with COVID-19 are at particular risk for severe complications and high mortality. Therefore, it is recommended to pay special attention to HF patients with COVID-19.

Keywords: COVID-19, Heart Failure, Mortality, Cardiovascular Diseases.

1 | Introduction

Since December 2019, COVID-19 led to a health problem in the world. Although the full spectrum of this infection in humans has not been fully identified, it is progressing rapidly [1-7]. Based on the World Health Organization, a total of 470,839,745 confirmed cases of COVID-19 had been identified around the world by March 22, 2022, out of which 6,092,933 died. In Iran, a total of 7,142,289 confirmed cases of COVID-19 had been identified

around the world by March 22, 2022, out of which 139,662 died [8]. Comorbidity has been introduced as a basic predictor of death among COVID-19 patients [1-7]. Previous evidence has shown that cardiovascular disease, especially heart failure (HF), is the most important comorbidity that increases the risk of death among COVID-19 patients [1, 9]. A study [9] found that 16% of patients who died from COVID-19 had cardiac symptoms. Also, an observational study [10] on 8,910 COVID-19 patients found

that in-hospital death risk was higher in COVID-19 patients with HF compared with COVID-19 patients without HF (15.3% vs. 5.6%). Therefore, HF is known as an independent predictor of death in patients with COVID-19 [10]. Overall, HF patients are at particular risk for severe complications and high mortality due to weakened immune systems and decreased hemodynamic ability to fight infections. Production of more TNF- α monocytes and less IL-10 than in healthy individuals, which in combination with the extensive inflammatory response associated with COVID-19 infection, increases the need for cardiac function. However, HF patients usually do not have adequate cardiac output [1, 11].

Although the COVID-19 pandemic is almost over and a lot of information is known about this disease, narrow gaps in our understanding of the disease among HF patients, and thus, aid decision-making by health care providers and administrators, more evidence is needed on the prevention, control, and treatment of COVID-19 among HF patients. Due to the importance of this issue, this research aimed to assess and compare demographic characteristics, clinical features, and clinical outcomes in HF patients with and without COVID-19.

2 | Methods

2.1 | Study design and subjects

Using a retrospective study, 294 HF patients referred to a cardiac center in Guilan province, northern Iran were enrolled. Data were collected using census sampling from August 2020 to 2021. In this study, the medical records of all HF patients were assessed. HF patients over the age of 18 years with a duration of HF over three months were included in the research. Also, patients with incomplete medical records were excluded from the present study. The Research Ethics Committee of Guilan University of Medical Sciences confirmed this research (IR.GUMS.REC.1399.023).

2.2 | Data collection

Data collection was conducted via a researcher-made checklist including demographic characteristics (age, sex, active smoking, a history of hospitalization due to heart problems, and body mass index [BMI]), clinical features (infection with COVID-19, ejection fraction [EF], duration of HF, blood pressure, symptoms [fever, tremor, cough, body pain, gastrointestinal problems, sore throat, loss of olfactory sense, loss of the sense of taste, and headache], comorbidities [diabetes mellitus, myocardial infarction, angioplasty, valve diseases, hyperlipidemia, and hypertension/hypotension], and pharmacological treatment [anti-platelets, nitrates, beta blockers, multivitamin, anti-lipids, angiotensin-

converting-enzyme inhibitors, angiotensin receptor blockers, antidiabetics, diuretics, antipsychotics, proton-pump inhibitors, and calcium channel blockers]), and clinical outcome (in-hospital mortality).

2.3 | Statistical analysis

Data analysis were conducted via SPSS.V.16.0. Study variables were showed using mean (standard deviation) and number (percentage), respectively. The relationship between study variables was assessed via Chi-square and t-tests. $P < 0.05$ was considered as a significant level.

3 | Results

3.1 | Participants

In this research, 294 HF patients were enrolled. Of the participants, 55.78% were male, 23.13% were active smokers, 12.59% had a history of hospitalization due to heart problems during the COVID-19 pandemic, 50.34% had a BMI of 25 to 30 kg/m², and 66.67% had hypertension/hypotension. Mean age, EF, blood pressure, and duration of HF in patients with HF were 63.65 (SD=12.86) years, 24.67 (SD=11.85), 126.90 (SD=25.42) mmHg, and 3.86 (SD=2.28) years, respectively. Also, 26.53% of HF patients had COVID-19 (Tables 1 & 2).

3.2 | Demographic characteristics, clinical features, and clinical outcomes in HF patients with COVID-19

Of the HF patients with COVID-19, 50.00% were male, 26.92% were active smokers, 12.82% had a history of hospitalization due to heart problems during the COVID-19 pandemic, 56.41% had a BMI of 25 to 30 kg/m², and 74.36% had hypertension/hypotension. Mean age, EF, blood pressure, and HF duration in HF patients with COVID-19 were 66.02 (SD=12.05) years, 25.83 (SD=12.31), 126.65 (SD=24.67) mmHg, and 3.79 (SD=2.10) years, respectively. The most common symptoms in HF patients with COVID-19 were cough (52.56%), headache (44.87%), and gastrointestinal problems (43.59%), respectively. Finally, 55.13% of HF patients with COVID-19 died (Tables 1 & 2).

3.3 | Comparison of demographic characteristics, clinical features, and clinical outcomes in HF patients with and without COVID-19

The mean age of HF patients with COVID-19 was higher than in HF patients without COVID-19 (66.02 vs. 62.79 years; $P=0.031$) (Table 1). Hyperlipidemia was higher in HF patients with COVID-19 than in HF patients without COVID-19 (25.64% vs. 13.89%; $P=0.018$). Also, in-hospital mortality was higher in HF

patients with COVID-19 than in HF patients without COVID-19 (55.13% vs. 16.20%; $P<0.001$) (Table 2).

Table 1. Demographic characteristics of HF patients with or without COVID-19.

	Total (n=294)	HF patients		P-value
		COVID-19 (n=78)	Non-COVID-19 (n=216)	
Age (years)	63.65 (SD=12.86)	66.02 (SD=12.05)	62.79 (SD=13.05)	0.031
Sex				
Male	164 (55.78)	39 (50.00)	125 (57.87)	0.230
Female	130 (44.22)	39 (50.00)	91 (42.13)	
Active smoking				
Yes	68 (23.13)	21 (26.92)	47 (21.76)	0.354
No	226 (76.87)	57 (73.08)	169 (78.24)	
History of hospitalization due to heart problems				
Yes	37 (12.59)	10 (12.82)	27 (12.50)	0.541
No	257 (87.41)	68 (87.18)	189 (87.50)	
BMI (kg/m²)				
18.5-24.9	116 (39.46)	27 (34.62)	89 (41.20)	0.457
25-30	148 (50.34)	44 (56.41)	104 (48.15)	
>30	30 (10.20)	7 (8.97)	23 (10.65)	

Table 2. Clinical features and outcomes of HF patients with or without COVID-19.

	Total (n=294)	HF patients		P-value
		COVID-19 (n=78)	Non-COVID-19 (n=216)	
<i>Clinical features</i>				
EF	24.67 (SD=11.85)	25.83 (SD=12.31)	24.24 (SD=11.67)	0.364
Duration of HF (years)	3.86 (SD=2.28)	3.79 (SD=2.10)	3.87 (SD=2.35)	0.771
Blood pressure (mmHg)	126.90 (SD=25.42)	126.65 (SD=24.67)	126.99 (SD=25.73)	0.748
Symptoms				
Fever	32 (10.88)	26 (33.33)	6 (2.78)	<0.001
Tremor	37 (12.58)	33 (42.31)	4 (1.85)	
Cough	46 (15.65)	41 (52.56)	5 (2.31)	
Body pain	35 (11.90)	29 (37.18)	6 (2.78)	
Gastrointestinal problems	39 (13.27)	34 (43.59)	5 (2.31)	
Sore throat	31 (10.54)	27 (34.62)	4 (1.85)	
Loss of olfactory sense	36 (12.24)	31 (39.74)	5 (2.31)	
Loss of the sense of taste	31 (10.54)	26 (33.33)	5 (2.31)	
Headache	42 (14.29)	35 (44.87)	7 (3.24)	
Comorbidities				
Diabetes mellitus				
Yes	132 (44.90)	41 (52.56)	91 (42.13)	0.073
No	162 (55.10)	37 (47.44)	125 (57.87)	
Myocardial infarction				
Yes	29 (9.86)	7 (8.97)	22 (10.19)	0.759
No	265 (90.14)	71 (91.03)	194 (89.81)	
Angioplasty				
Yes	84 (28.57)	24 (30.77)	60 (27.78)	0.616
No	210 (71.43)	54 (69.23)	156 (72.22)	
Valve diseases				
Yes	53 (18.03)	13 (16.67)	40 (18.52)	0.715
No	241 (81.97)	65 (83.33)	176 (81.48)	
Hyperlipidemia				
Yes	50 (17.01)	20 (25.64)	30 (13.89)	0.018
No	244 (82.99)	58 (74.36)	186 (86.11)	
Hypertension/Hypotension				
Yes	196 (66.67)	58 (74.36)	138 (63.89)	0.060

	Total (n=294)	HF patients		P-value
		COVID-19 (n=78)	Non-COVID-19 (n=216)	
No	98 (33.33)	20 (25.64)	78 (36.11)	
Pharmacological treatment				
Anti-platelets	291 (98.98)	77 (98.72)	214 (99.07)	
Nitrates	283 (96.26)	75 (96.15)	208 (96.30)	
Beta blockers	244 (82.99)	66 (84.61)	178 (82.41)	
Multivitamin	260 (88.43)	67 (85.90)	193 (89.35)	
Anti-lipids	279 (94.90)	73 (93.59)	206 (95.37)	
Angiotensin-converting-enzyme inhibitors	257 (87.41)	65 (83.33)	192 (88.89)	0.206
Angiotensin receptor blockers	274 (93.20)	74 (94.87)	200 (92.59)	
Antidiabetics	168 (57.14)	49 (62.82)	119 (55.09)	
Diuretics	279 (94.90)	72 (92.31)	207 (95.83)	
Antipsychotics	22 (7.48)	8 (10.26)	14 (6.48)	
Proton-pump inhibitors	258 (87.75)	68 (87.18)	190 (87.96)	
Calcium channel blockers	13 (4.42)	5 (6.41)	8 (3.70)	
<u>Clinical outcomes</u>				
In-hospital Mortality				
Yes	78 (26.53)	43 (55.13)	35 (16.20)	<0.001
No	216 (73.47)	35 (44.87)	181 (83.80)	

4 | Discussion

Demographic findings vary based on variables such as the type of population studied, different characteristics of the studied samples, the number of comorbidities, and the conditions of different patients in different studies [12-15]. A study in the USA [15] found that 6.3% of HF patients had COVID-19. Hyperlipidemia in HF patients with COVID-19 may be due to the nature of cardiac disease and its side effects. Hypertension and hyperlipidemia are common in these patients, which can be the cause of negative outcomes in these patients [10, 16].

In the research, the most common symptoms in HF patients with COVID-19 were cough (52.56%), headache (44.87%), and gastrointestinal problems (43.59%), respectively. Consistent with this finding, a study in Spain [17] found that cough is the most common symptom in HF patients with COVID-19. A notable point in the present study was the presence of headache and gastrointestinal symptoms in HF patients with COVID-19. Although headache and gastrointestinal symptoms were present in COVID-19 patients [5, 18-22], it is unclear whether these symptoms are present in HF patients with COVID-19. Thus, more evidence is required to confirm the present finding. Headache and gastrointestinal complications in HF patients with COVID-19 can be due to the side effects of some drugs used in these patients [23-25]. However, patients' atypical symptoms such as headache and gastrointestinal symptoms can not be ignored.

This research found that 55.13% of HF patients with COVID-19 died. Also, in-hospital mortality was higher in HF patients with COVID-19 than in HF patients without COVID-19. A systematic review and meta-analysis [26] showed that HF was

associated with higher hospitalization, morbidity, and mortality in COVID-19 patients. Consistent with the present study, a study in the USA [15] showed that the mortality rate was higher in HF patients with COVID-19 than in COVID-19 patients without HF (24.2% vs. 14.2%). Therefore, HF patients with COVID-19 are at particular risk for severe complications and high mortality. Hence, it is suggested that future researchers assess HF as an important predictor of mortality for COVID-19.

4.1 | Limitations

Some COVID-19 patients were not included in the present research due to incomplete and non-electronic records. Also, in the present study, the length of stay in the hospital was not collected as an important indicator to evaluate the clinical consequences of the participants.

5 | Conclusions

Overall, HF patients with COVID-19 are at particular risk for severe complications and high mortality. Therefore, it is recommended to pay special attention to HF patients with COVID-19.

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Authors' contributions

Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work: SK, AS, ZA, MJG, NJP; Drafting the work or revising it critically for important intellectual content: SK, AS, ZA, MJG, NJP; Final

approval of the version to be published: SK, AS, ZA, MJG, NJP; Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved: SK, AS, ZA, MJG, NJP.

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Ethics approval and consent to participate

The Research Ethics Committee of Guilan University of Medical Sciences confirmed this research (IR.GUMS.REC.1399.023). After obtaining permission from the hospital administration, the researchers visited the hospital. Verbal informed consent was obtained from participants.

Competing interests

We do not have potential conflicts of interest with respect to the research, authorship, and publication of this article.

Availability of data and materials

The datasets used during the current study are available from the corresponding author on request.

Using artificial intelligent chatbots

None.

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