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Comparison of chronic diseases in deceased and survived patients with COVID-19 admitted to the hospital

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Original Article

Abstract

BACKGROUND: Assessing the prevalence of chronic diseases is necessary to reduce complications and mortality rates in patients infected with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). This study aimed to evaluate the chronic diseases in patients with coronavirus disease 2019 (COVID-19) and describe the clinical course of symptoms and changes in laboratory findings during the hospitalization of these patients.

METHODS: This cross-sectional and retrospective study investigated the frequency of various chronic diseases in hospitalized patients with COVID-19, and compared them to deceased and improved patients in Razi Teaching Hospital, Ghaemshahr, Mazandaran Province, the northern part of Iran, during the March to September 2020. Data analysis was performed by SPSS -21 using mean and standard deviation (SD) and chi-square test.

RESULTS: 1000 patients were evaluated for chronic diseases. The most common chronic disease in patients with COVID-19 was diabetes (30.3%), followed by hypertension (HTN) (28.8%), and ischemic heart disease (IHD) (14.7%). Other chronic illnesses were less than the mentioned diseases including hypothyroidism (4.9%), heart failure (HF) (4.3%), renal failure (4.3%), obesity (2.3%), and corticosteroid consumption (2.1%).

CONCLUSION: According to the results, chronic diseases such as diabetes, HTN, and cardiovascular disorders can increase the risk of mortality from COVID-19. The mortality rate in the present study was similar to the majority of studies in this field. However, the difference in mortality rates with other studies may be because patients who required advanced medical care in the hospital and had an advanced stage of the disease were examined in our study.

KEYWORDS: COVID-19; Chronic Disease; SARS-CoV-2; Pandemic

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Introduction

Clinical practice has demonstrated that severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) can affect the hematological, cardiovascular, renal, gastrointestinal, hepatic, endocrine, and nervous systems.[1] Studies showed that chronic diseases in people with coronavirus disease 2019 (COVID-19) might significantly increase the associated mortality rate.[2,3] The Chinese Center for Disease Control and Prevention study on 44672 (1023 deaths) patients with COVID-19 reported that these patients had an increased risk of cardiovascular disease (CVD), high blood pressure (BP), diabetes, respiratory disease, and cancer.[4] A British cross-sectional study on 16749 hospitalized patients with COVID-19 also found that patients with heart, lung, and kidney disease and cancer, dementia, and obesity had a higher risk of death.[5] A cohort study in the intensive care unit (ICU) in France (n = 124) showed that obesity exacerbated the

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disease and increased the need for medical care.[6] Subsequently, the findings of a study on 138 COVID-19 cases indicated that 64 (46.4%) of them had comorbidities with underlying disease. Importantly, patients admitted to the ICU (72.2%) had higher comorbidity than patients not admitted to the ICU (37.3%),[7] which suggests that underlying and chronic diseases may cause adverse outcomes in patients with COVID-19 and even increase mortality in these patients.[8] Studies struggled to find the mechanism of action of underlying diseases in increased morbidity and mortality in these patients. Several specific factors are responsible for the increased risk and severity of SARS-CoV-2 infection in diabetes.

In the mice with diabetes, angiotensin-converting enzyme 2 (ACE-2) expression was increased in the renal cortex, liver, and pancreas but not in the lungs.[9] Recently, a randomized study showed that diabetes was causally associated with ACE-2 expression.[10] Diabetes is associated with increased furin, a type 1 membrane-bound protease from the proprotein convertase subtilisin/kexin (PCSK) family. It is involved in the entry of coronaviruses into cells. An increase in furin in diabetes may facilitate virus replication.[11] Significant changes in T lymphocytes have also been reported in animal models with Middle East respiratory syndrome (MERS).[12] Chronic liver disease can also weaken the immune system, which may increase the risk of developing severe COVID-19 disease. In addition, having severe COVID-19 and taking medications to treat this disease may adversely affect the liver. Understanding the hepatic effects of SARS-CoV-2 requires a combination of experimental and clinical models. Laboratory cell models have demonstrated the role of receptors such as high-density lipoprotein (HDL) receptor and Scavenger receptor class B type 1 (SR-B1) along with ACE-2 for cell entry. In addition, research has shown that both biliary and hepatic organoid models express the necessary viral entry receptors and increase SARS-CoV-2 infection.[13] Sickle cell anemia is another condition that increases the risk of developing severe symptoms of COVID-19. ACE inhibitors and angiotensin receptor blockers (ARBs) are among the most commonly prescribed drugs to treat high BP. These drugs might be potential factors in increasing the prevalence of COVID-19 in people with hypertension (HTN) because coronavirus attaches to the ACE-2 receptor located in lung and heart tissue. People who use ACE and ARB inhibitors produce more of these receptors, increasing the chances of developing COVID-19.[14] Assessing the prevalence of chronic diseases is necessary to reduce complications and mortality rates in patients infected with SARS-CoV-2.

Methods

This was a cross-sectional study investigating the prevalence of various chronic diseases in patients admitted with COVID-19 diagnosis and comparing them in patients who deceased and survived in Razi Teaching Hospital in Ghaemshahr, Mazandaran Province, the northern part of Iran, from March to September 2020. Patients' personal information was kept confidential to researchers, and only information related to this research was used. 1000 participants signed the informed written consent.

The population of this study included all patients whose COVID-19 disease was confirmed by a physician using a computed tomography (CT) scan or reverse transcription polymerase chain reaction (RT-PCR). Radiological examinations are essential in the initial diagnosis and management of the disease. The diagnostic confirmation test is usually RT-PCR, which identifies the ribonucleic acid (RNA) genome of the virus. Diagnosis of COVID-19 is by testing positive for molecular detection on one of the significant respiratory specimens (nasopharyngeal swab, sputum, or lower

respiratory tract aspiration).[1] Those patients who were not diagnosed with any of the abovementioned were excluded from the study. 1000 patients were monitored in the timeline of the study. Because all patients enrolled in the study were selected by census method, no patients were excluded from the study. Alcoholic subjects and regular cigarette smokers were excluded from the study as confounding variables. The existence of chronic diseases in patients was evaluated by the past medical history recorded in patients' medical profiles.

Demographic information, clinical findings, laboratory findings, and radiographic images of 1000 patients were collected based on a questionnaire. Follow-ups and determination of outcomes were done by researchers (specialists, doctors) in the research. Patient's demographic information, including age, sex, height, weight, marital status, residence (city/village), occupation, etc., were recorded. Other characteristics of the disease including having a chronic disease [diabetes, HTN, ischemic heart disease (IHD), hypothyroidism, heart failure (HF), and chronic kidney disease], vital signs of patients at the time of referral [oxygen saturation (SPO_2), pulse rate (PR), respiratory rate (RR), BP], patients' clinical signs, finally possible complications central nervous system (CNS), myocarditis, pneumothorax), and death chart of patients [cardiac arrest, respiratory arrest, multiple organ failure (MOF)] were examined. This study was first presented to the Ethics Committee of Mazandaran University of Medical Sciences, Sari, Iran, and started after approval (IR.MAZUMS.REC.1399.843).

Data were analyzed using SPSS software (version 21, IBM Corporation, Armonk, NY, USA). Mean and standard deviation (SD) were used to describe quantitative variables. The chi-square test was used to evaluate the relationship between qualitative variables. P-value < 0.05 was considered a significant level.

Results

In this study, 1000 patients were evaluated for chronic diseases. The frequency of chronic diseases in people with COVID-19 is reported in table 1. The most common chronic disease in patients with COVID-19 was diabetes (30.3%), followed by HTN (28.8%) and IHD (14.7%). Other chronic illnesses were less than the mentioned diseases, including hypothyroidism (4.9%), HF (4.3%), renal failure (4.3%), and obesity (2.3%). 153 (15.3%) of the subjects expired due to COVID-19, and 847 (84.7%) recovered. 37.9% of those who died and 28.9% of those who recovered had diabetes.

The difference in recovery and death was statistically significant (P = 0.026), which indicates that diabetes increases the incidence of death in patients. The study results showed that 13.1% of the deceased and 2.7% of the recovered had HF, and the difference in their recovery and death was statistically significant (P < 0.001). This result suggests that HF increases the incidence of death in patients with 13.1% of the deceased and 15% of the recovered patients having IHD, but the difference in recovery and death was not statistically significant (P = 0.537). 39.2% of the deceased and 26.9% of the recovered patients had HTN. The difference in recovery and death was statistically significant (P = 0.002). It has been found that high BP increases the incidence of death in patients with 4.6% of the deceased and 1.7% of the cured people. 3.9% of those who died and 4.4% of those who recovered had kidney failure, but the difference in their recovery and mortality was not statistically significant (P = 0.802). 2% of expired and 2.4% of recovered patients were obese. However, the difference between their recovery and death was not statistically significant (P = 0.761). Finally, based on a review of patient records, it was found that 6.54% of those who died and 4.61% of those who recovered had hypothyroidism, but the difference in their recovery and death was not statistically significant (P = 0.381).

Table 1. The prevalence of chronic diseases in recovered and deceased patients with coronavirus disease 2019 (COVID-19)

Chronic disease		Results of hospitalization [n (%)]			P*
		Expired	Recovered	Total	
Diabetes	No	95 (62.1)	602 (71.1)	697 (69.7)	0.036
	Yes	58 (37.9)	245 (28.9)	303 (30.3)	
Hypertension	No	93 (60.8)	619 (73.1)	712 (71.2)	0.002
	Yes	60 (39.3)	228 (26.9)	288 (28.8)	
Ischemic heart disease	No	133 (86.9)	720 (85.0)	853 (85.3)	0.537
	Yes	30 (13.0)	137 (15.0)	147 (14.7)	
Hypothyroidism	No	143 (93.4)	808 (95.3)	951 (95.1)	0.381
	Yes	10 (6.5)	39 (4.6)	49 (4.9)	
Heart failure	No	133 (86.9)	824 (97.3)	657 (95.7)	< 0.001
	Yes	20 (13.1)	23 (2.7)	43 (4.3)	
Renal failure	No	147 (96.1)	810 (95.6)	957 (95.7)	0.802
	Yes	6 (3.9)	37 (4.4)	43 (4.3)	
Obesity	No	150 (98.0)	827 (97.6)	977 (97.7)	0.381
	Yes	3 (2.0)	20 (2.4)	23 (3.3)	

*Chi-square test

Discussion

The main purpose of the study was to compare hospitalized chronic diseases in patients with COVID-19 admitted to the hospital. This article investigates the details of 1000 patients admitted to Razi Teaching Hospital, with COVID-19 confirmed by polymerase chain reaction (PCR) by laboratory and specific clinical outcomes (death or discharge) from March to September 2020, to study the chronic diseases in these patients. The global spread of COVID-19 has prompted health researchers to take swift action to control the epidemic, and various studies have begun since its outbreak. Due to the recent COVID-19 global pandemic, its high prevalence in Iran (Mazandaran Province) and the mortality of patients with chronic diseases, there is a significant need to analyze the causes of mortality related to underlying diseases.

The present study aimed to compare the underlying diseases in patients who died and recovered from COVID-19 and showed that patients with diabetes, HTN, CVD, IHD, and hypothyroidism had a higher risk and were more likely to die from COVID-19 than other patients. These findings seem similar to the other studies on the prevalence of COVID-19 patients with underlying chronic illnesses. High BP is usually associated with other risk factors such as CVD and diabetes, increasing the risk of COVID-19. Diabetes can also be considered a risk factor for the severity and progression of COVID-19.[1] In the present study, the most common underlying disease in patients with COVID-19 was diabetes (30.3%), HTN (28.8%), and other underlying diseases that had a lower frequency. 153 (15.3%) of the patients died due to COVID-19, and 847 (84.7%) recovered.

Previous studies have shown that diabetes and CVD increase the risk of severe acute respiratory syndrome (SARS) and MERS, which, like COVID-19, are acute respiratory syndromes. They increase the risk of death by SARS by 11% and 8%, respectively, and more than 50% of people with MERS have underlying diseases such as diabetes and HTN, and more than 30% of them suffer from CVD. Diabetes can increase the risk of immune disorders. Many studies have shown that diabetes can disrupt the immune system by impairing its function and disrupting neutrophil chemotaxis and the antibacterial activity of monocytes and phagocytosis, which leads to an increase in infection.[15] 16% of

patients classified with severe COVID-19 in China had underlying diabetes, and 24% had HTN.[16] This study also showed that 28.8% of people with COVID-19 had a history of HTN, 30.3% had diabetes, and 19.0% had CVD. The present study also showed that 37.9% of the deceased and 28.9% of the recovered people had diabetes and the difference in recovery and death was statistically significant. Besides, 13.1% of the deceased and 2.7% of the recovered had HF. The difference in recovery and death rates was statistically significant, which showed that HF increased the incidence of death in patients with COVID-19. In a study conducted by Talebi et al. to compare the clinical and epidemiological features of patients with fatal and improved COVID-19, it was shown that of 178 patients, 85.4% improved, and 14% of patients died. 43.8% of all patients and 71.9% of deceased patients had at least one underlying chronic disease. Elevated white blood cell (WBC) counts, decreased lymphocytes, and increased neutrophils were significantly higher in deceased patients.[17] This study was similar to the present study in terms of death and improvement rates, and the present study showed that underlying diseases led to more deaths in people with COVID-19.

Pathology tests are essential factors that have not been investigated in the present study; therefore, it is suggested that future studies examine the clinical and pathological features of patients with COVID-19 who have died and improved. In a study by Yang et al., the mortality rate was 4.3% among 138 hospitalized patients.[18] However, in the study of Chen et al., this rate was 14.1%,[19] which is consistent with our study. Talebi et al. conducted a study similar to the subject of our study in comparing the clinical and epidemiological characteristics of death and recovery of patients with COVID-19 referred to the educational and medical center of Sabzevar, Iran. In this study, about 14% of the 178 patients died, which was approximately equal to the mortality rate in our study.[17] The difference in mortality of patients with COVID-19 may be due to the fact that patients who required advanced medical care in the hospital and experienced an advanced stage of the disease were examined in our study.

In the present study, most of the expired patients had a history of diabetes. Most patients, especially those who died, had at least one underlying chronic disease, consistent with the results of other evidence. Underlying diseases such as HTN, heart disease, and diabetes were common in deceased patients. In the study by Li et al., all patients who died had an underlying disease. Older people are more prone to mortality since chronic diseases are more prevalent in these patients, which increases the risk of death among the studied samples.[20] The present study was performed in March to September, 2020, around the second wave of the outbreak in Iran. According to a study conducted at Babol University of Medical Sciences, Babol, Iran, in the first wave of the disease, 8% of patients, and in comparison with the second wave, 23% of patients died.[21] While in our study, the mortality rate (15%) was higher than the first wave and lower than the second wave. Compared to the first wave, this significant increase could be due to non-compliance with health protocols and increased virus prevalence in the second wave. Moreover, in a similar study conducted by Babamahmoodi et al. in Mazandaran, from March 2020 to May 2020 (first wave), it was found that the mortality rate was 14.3%,[22] which was approximately similar to the current study.

The limitations of this study include the lack of access to more study samples, the lack of review of multiple treatment centers in different cities, and the lack of patients' gender, age, symptoms during hospitalization, and pathology tests. It is suggested that more attention be paid to the observance of health

protocols for people with the underlying disease, and if a vaccine for this disease is available, people with the underlying disease should be given priority. Gender, age, symptoms of COVID-19 during hospitalization, and pathology tests of patients are essential factors that have not been studied in the present study; therefore, it is suggested that future studies examine the clinical and pathological features of patients with COVID-19 who have died and improved.

Conclusion

Chronic diseases such as diabetes, HTN, and cardiovascular disorders can increase the risk of death from COVID-19. The mortality rate in the present study was similar to the majority of studies in this field. However, the difference in mortality rates with other studies may be because patients who required advanced medical care in the hospital and had an advanced stage of the disease were examined in our study. More attention is suggested to the observance of public health protocols for people with chronic illnesses.

Conflict of Interests

Authors have no conflict of interests.

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References

1. Gupta A, Madhavan MV, Sehgal K, Nair N, Mahajan S, Sehrawat TS, et al. Extrapulmonary manifestations of COVID-19. Nat Med. 2020; 26(7): 1017-32.
2. Momtazmanesh S, Samieefar N, Uddin LQ, Ulrichs T, Kelishadi R, Roudenok V, et al. Socialization during the COVID-19 pandemic: The role of social and scientific networks during social distancing. Adv Exp Med Biol. 2021; 1318: 911-21.
3. Khazeei Tabari MA, Iranpanah A, Bahramsoltani R, Rahimi R. Flavonoids as promising antiviral agents against sars-cov-2 infection: A mechanistic review. Molecules. 2021; 26(13).
4. Deng G, Yin M, Chen X, Zeng F. Clinical determinants for fatality of 44,672 patients with COVID-19. Crit Care. 2020; 24(1): 179.
5. Docherty AB, Harrison EM, Green CA, Hardwick HE, Pius R, Norman L, et al. Features of 20 133 UK patients in hospital with covid-19 using the ISARIC WHO Clinical Characterisation Protocol: Prospective observational cohort study. BMJ. 2020; 369: m1985.
6. Simonnet A, Chetboun M, Poissy J, Raverdy V, Noulette J, Duhamel A, et al. High prevalence of obesity in severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) requiring invasive mechanical ventilation. Obesity (Silver Spring). 2020; 28(7): 1195-9.
7. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. JAMA. 2020; 323(11): 1061-9.
8. Yang J, Zheng Y, Gou X, Pu K, Chen Z, Guo Q, et al. Prevalence of comorbidities and its effects in patients infected with SARS-CoV-2: A systematic review and meta-analysis. Int J Infect Dis. 2020; 94: 91-5.
9. Roca-Ho H, Riera M, Palau V, Pascual J, Soler MJ. Characterization of ACE and ACE2 expression within different organs of the NOD mouse. Int J Mol Sci. 2017; 18(3).
10. Rao S, Lau A, So HC. exploring diseases/traits and blood proteins causally related to expression of ACE2, the putative receptor of SARS-CoV-2: A Mendelian randomization analysis highlights tentative relevance of diabetes-related traits. Diabetes Care. 2020; 43(7): 1416-26.
11. Fernandez C, Rysa J, Almgren P, Nilsson J, Engstrom G, Orho-Melander M, et al. Plasma levels of the proprotein convertase furin and incidence of diabetes and mortality. J Intern Med. 2018; 284(4): 377-87.
12. Maddaloni E, Buzzetti R. Covid-19 and diabetes mellitus: unveiling the interaction of two pandemics. Diabetes Metab Res Rev. 2020; 36(7): e33213321.
13. Marjot T, Webb GJ, Barritt AS, Moon AM, Stamataki Z, Wong VW, et al. COVID-19 and liver disease: Mechanistic and clinical perspectives. Nat Rev Gastroenterol Hepatol. 2021; 18(5): 348-64.
14. Rossi GP, Sanga V, Barton M. Potential harmful effects of discontinuing ACE-inhibitors and ARBs in COVID-19 patients. Elife. 2020; 9.

15. Park JE, Jung S, Kim A, Park JE. MERS transmission and risk factors: A systematic review. BMC Public Health. 2018; 18(1): 574.
16. Guo W, Li M, Dong Y, Zhou H, Zhang Z, Tian C, et al. Diabetes is a risk factor for the progression and prognosis of COVID-19. Diabetes Metab Res Rev. 2020; 36(7): e3319.
17. Talebi S, Nematshahi M, Tajabadi A, Khosrogerdi A. Comparison of clinical and epidemiological characteristics of deceased and recovered patients with COVID-19 in Sabzevar, Iran. J Mil Med. 2020; 22(6): 509-16.
18. Yang W, Cao Q, Qin L, Wang X, Cheng Z, Pan A, et al. Clinical characteristics and imaging manifestations of the 2019 novel coronavirus disease (COVID-19): A multi-center study in Wenzhou city, Zhejiang, China. J Infect. 2020; 80(4): 388-93.
19. Chen X, Hu W, Ling J, Mo P, Zhang Y, Jiang Q, et al. Hypertension and diabetes delay the viral clearance in COVID-19 patients. MedRxiv. 2020.
20. Li X, Wang L, Yan S, Yang F, Xiang L, Zhu J, et al. Clinical characteristics of 25 death cases with COVID-19: A retrospective review of medical records in a single medical center, Wuhan, China. Int J Infect Dis. 2020; 94: 128-32.
21. Jalali SF, Ghassemzadeh M, Mouodi S, Javanian M, Akbari KM, Ghadimi R, et al. Epidemiologic comparison of the first and second waves of coronavirus disease in Babol, North of Iran. Caspian J Intern Med. 2020; 11(Suppl 1): 544-50.
22. Babamahmoodi F, Ahangarkani F, Yazdani charati J, Alikhani A, Hatami M, Delavaryan L, et al. Comparing clinical and para-clinical findings and risk factors among COVID-19 survived and deceased patients in North of Iran, 2019-2020. J Mazandaran Univ Med Sci. 2021; 31(201): 70-82.