# Should Comorbidities be Considered in the Decision to Discharge COVID-19 Patients From Hospital? A Case Series

**Bahar Saberzadeh-Ardestani, Majid Sorouri, Bardia Khosravi, Ali Reza Sima, Reza Malekzadeh**

*Department of Gastroenterology, Digestive Disease Research Center, Digestive Disease Research Institute, Tehran University of Medical Sciences, Tehran, Iran*

***Received: 12 Apr. 2021; Accepted: 21 Oct. 2021***

**Abstract-** An outbreak of COVID-19 started in December 2019 in the city of Wuhan and is now rapidly spreading across the world. We report two cases of confirmed COVID-19 with pre-existing comorbidities who were discharged from the hospital with a good clinical condition and in concordance with interim discharge protocols. However, they were readmitted and died on the discharge day. Here we discuss the importance of patient demographics in clinical management vs. the resolution of the pulmonary disease alone and raise a question about the impact of comorbidities on discharge protocols.
© 2021 Tehran University of Medical Sciences. All rights reserved.
*Acta Med Iran* 2021;59(11):675-680.

**Keywords:** Coronavirus disease 2019 (COVID-19); Comorbidity; Discharge protocol; Outcome assessment; Health care

## Introduction

A rapid outbreak of COVID-19 started in December 2019 in the city of Wuhan and now spreads across the world (1). Up to the date of April 30, 2020, more than three million confirmed cases and 208000 deaths had been reported from 213 countries (1). Du *et al*., have shown factors such as old age, cardiovascular or cerebrovascular diseases, low lymphocyte count, and high cardiac troponin I as predictors of mortality among these patients (2,3). Other studies have emphasized the impact of comorbidities on patient outcomes (4,5). Multiple studies have suggested an association between cardiovascular diseases, diabetes, and kidney disease and clinical outcomes (5-9). Although studies have shown an association between comorbidities and disease severity, there may also be an association between comorbidities and patient outcomes after recovery.

## Case Report

### Case 1

On March 14, 2020, a 76-year-old man presented to the emergency room of Shariati Hospital, Tehran, Iran, with subjective signs and symptoms of fever, dry cough, and dyspnea for six days after a close contact with a suspected COVID-19 case. The patient had a history of hypertension, ischemic heart disease, kidney stone, and Lewy body dementia, and had been treated with aspirin, losartan, donepezil, citalopram. On admission to the hospital, the physical exam revealed the absence of orientation to time and place, a body temperature of 37.8° C, a blood pressure of 104/72 mm Hg, a pulse of 101 beats per min, a blood oxygen saturation of 91%, and a respiratory rate of 19 breaths per min. The patient had no crackles or rales on lung auscultation. The spiral lung CT scan revealed crazy paving and ground-glass opacities in both lungs (Figure 1).

The patient's oropharyngeal swab tested positive for SARS-CoV-2 by real-time reverse-transcriptase–polymerase-chain-reaction (rRT-PCR) assay. Laboratory results showed mild thrombocytopenia and alterations in hepatic function measures (Table 1).

The patient was treated with antibiotics, hydroxychloroquine, oseltamivir, lopinavir/ritonavir, and prophylaxis anticoagulation. The patient became

**Corresponding Author:** A.R. Sima
Department of Gastroenterology, Digestive Disease Research Center, Digestive Disease Research Institute, Tehran University of Medical Sciences, Tehran, Iran
Tel: +98 9155137188, Fax: +98 2182415000, E-mail address: simaalireza@gmail.com

Copyright © 2021 Tehran University of Medical Sciences. Published by Tehran University of Medical Sciences
This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International license (https://creativecommons.org/licenses/by-nc/4.0/). Non-commercial uses of the work are permitted, provided the original work is properly cited

gradually alert after the second day. During hospitalization, the patient's mean blood pressure was between 103-124 mmHg and was tachycardic during the first six days with heart rates ranging between 96-120, requiring adjustment of his antihypertensive drugs. His ECGs obtained on multiple occasions did not show significant changes, and the troponin level did not rise. After recovery on hospital day seven, the patient was discharged with a body temperature of 36° C, blood pressure of 140/70 mm Hg, a pulse of 90 beats per min, blood oxygen saturation of 93%, a respiratory rate of 19 breaths per min, in a good general condition. The patient lost consciousness while getting in the car to leave the hospital. The patient was brought to the emergency room in cardiogenic shock and respiratory arrest, with a blood pressure of 90/70 mm Hg and a pulse of 90 beats per min. He was intubated and 15 minutes later suffered a cardiopulmonary arrest. Cardiopulmonary resuscitation was initiated but was unsuccessful

**Table 1. Laboratory findings in cases 1 and 2 during hospitalization.**

| | | Case 1 | | | Case 2 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Reference Range** | **Hospital day 1** | **Hospital day 3** | **Hospital day 7** | **Hospital day 1** | **Hospital day 4** | **Hospital day 8** | **Hospital day 12** | **Hospital day 14 (before discharge)** | **Hospital day 14 (after readmission)** | **Hospital day 17** |
| **White-cell count (per µl)** | 4500-11000 | 5000 | | 5400 | 6120 | 5020 | 5870 | 8040 | 10690 | 16100* | 10900 |
| **Red-cell count (per µl)** | 4.7-6.1 | 4.92 | | 5.03 | 3.97* | 4.05* | 3.45* | 3.45* | 3.25* | 3.37* | 3.64* |
| **Absolute neutrophil count (per µl)** | 1500-8000 | 3550 | | 3996 | 3182 | 2816 | 3522 | 4261 | | 11592* | |
| **Absolute lymphocyte count (per µl)** | 1000-4800 | 950* | | 972* | 2448 | 1506 | 1174 | 1366 | | 3059 | |
| **Platelet count (per µl)** | 150000-450000 | 111000* | | 80000* | 129000* | 127000* | 233000 | 342000 | 445000 | 443000 | 497000* |
| **Hemoglobin (g/dl)** | 13.5-17.5 | 15.9 | | 15.5 | 10.5* | 10.5* | 9.0* | 9.1* | 8.6* | 8.9* | 9.5* |
| **Hematocrit (%)** | 45-52 | 42.6* | | 44.4* | 31.5* | 31.9* | 27* | 27.4* | 26.2* | 27.6* | 28.4* |
| **Sodium (mmol/liter)** | 135-145 | 139 | | 138 | 140 | 140 | 139 | 139 | 138 | 138 | 140 |
| **Potassium (mmol/liter)** | 3.5-5 | 4.29 | | 4.15 | 3.95 | 6.1* | 4.3 | 3.84 | 4.67 | 4.67 | 5.17* |
| **Glucose (mmol/liter)** | 80-140 | | | | 234* | | 139 | | 373* | | 148* |
| **Blood urea nitrogen (mg/dl)** | 7-20 | 26* | | 34* | 39.5* | 31.3* | 48* | 54* | 56* | 55* | 51* |
| **Creatinine (mg/dl)** | 0.6-1.2 | 1.37* | | 0.91 | 1.77* | 2.1* | 2.08* | 1.84* | 1.98* | 2.32* | 1.57* |
| **Procalcitonin (ng/ml)** | <0.15 | 0.12 | | | 0.17* | | | | | | |
| **Aspartate aminotransferase (U/liter)** | 10-40 | 49* | | | | | 24 | | 85* | | |
| **Alanine aminotransferase (U/liter)** | 7-56 | 25 | | | | | 12 | | 45 | | |

**Cont. table 1**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Alkaline phosphatase (U/liter)** | 20-140 | 93 | | | | | 251* | | |
| **Lactate dehydrogenase (U/liter)** | 140-280 | | | | 792* | | | | |
| **Creatine kinase (U/liter)** | 22-198 | | | | 95 | | | | |
| **Albumin (g/dl)** | 3.4-5.4 | | | | 3* | | | | |
| **Blood Culture** | Negative | | Negative | Negative | | | | | |
| **PT (Seconds)** | 11-13.5 | | | | 14.2* | | | 17.1* | 17.7* |
| **PTT (Seconds)** | 31.4-41.4 | | | | 26.2* | | | 31* | 24* |
| **INR** | 0.8-1.1 | | | | 1.25* | | | 1.51* | 1.40* |
| **Iron , Serum Fe (mcg/dL)** | 60-170 | | | | | 58* | | | |
| **TIBC (mcg/dL)** | 240-450 | | | | | 168* | | | |
| **Ferritin (ng/ml)** | 12-300 | | | | | 1187* | | | |
| **ESR (mm/h)** | <20 | | | | | | | 100* | |
| **CRP Titer (mg/L)** | <3 | | | | | | | 59* | |
| **Urine analysis** | protein: -, blood: -, Glucose:-, RBC:0-2, WBC:0-3, Bacteria:- | | protein: 1+*, blood: 2+*, RBC: 22-25*, | protein: 2+*, blood: 3+*, RBC: 30-35*, | | | | protein: 1+*, blood: 1+*, Glucose: trace*, RBC:10-12* , WBC:12-15*, Bacteria: many* | |
| **Urine Culture** | Negative | | Negative | | | | | | |
| **Troponin I (ng/dL)** | <34.2 | | 15.7-17.6 | | | | | | |
| **BNP (pg/ml)** | <120 | | | | | | | 3412* | |

* Abnormal values

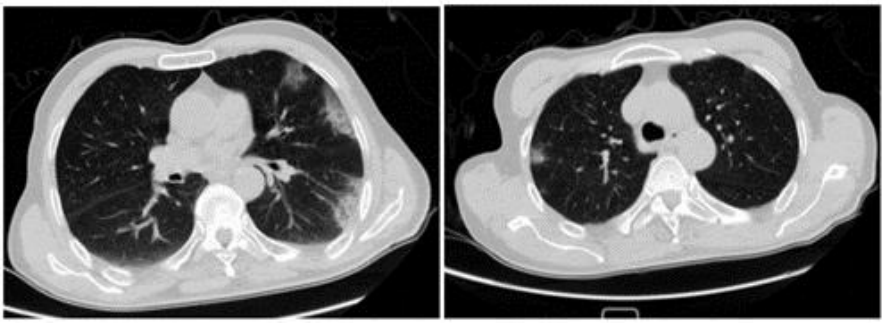

**Figure 1.** First case axial lung chest CT scan on hospital day 1
Crazy paving and ground-glass opacities in both lungs are shown

## Case 2

On March 10, 2020, A 66-year-old man presented to the emergency room of Shariati Hospital, Tehran, Iran, with reported obtundation for two days and subjective signs and symptoms of respiratory disease, including fever, dry cough, and dyspnea for three days. The patient had a past medical history of type 2 diabetes, hypertension, ischemic heart disease, ischemic

cardiomyopathy, CVA, pulmonary embolism, bilateral below-the-knee amputation, right eye blindness, and cured tuberculosis. His outpatient medications included aspirin, methohexital, clopidogrel, nitroglycerin, losartan, furosemide, spironolactone, atorvastatin, gabapentin, sertraline, Sodium valproate, rivastigmine, pantoprazole, and insulin. On admission to the hospital, his physical exam revealed a disoriented person with tachypnea and respiratory rate of 22 breaths per min and hypoxia with a blood oxygen saturation of 91% but otherwise relatively normal vital signs, including a body temperature of 37.4° C, a blood pressure of 114/61 mm Hg, a pulse of 66 beats per min. The patient had fine rales on the right lung auscultation. The spiral lung CT scan revealed ground-glass opacities in the right lung (Figure 2), and the brain CT scan showed multiple old infarcts in the left hemisphere and a low-density area in the right occipital lobe.

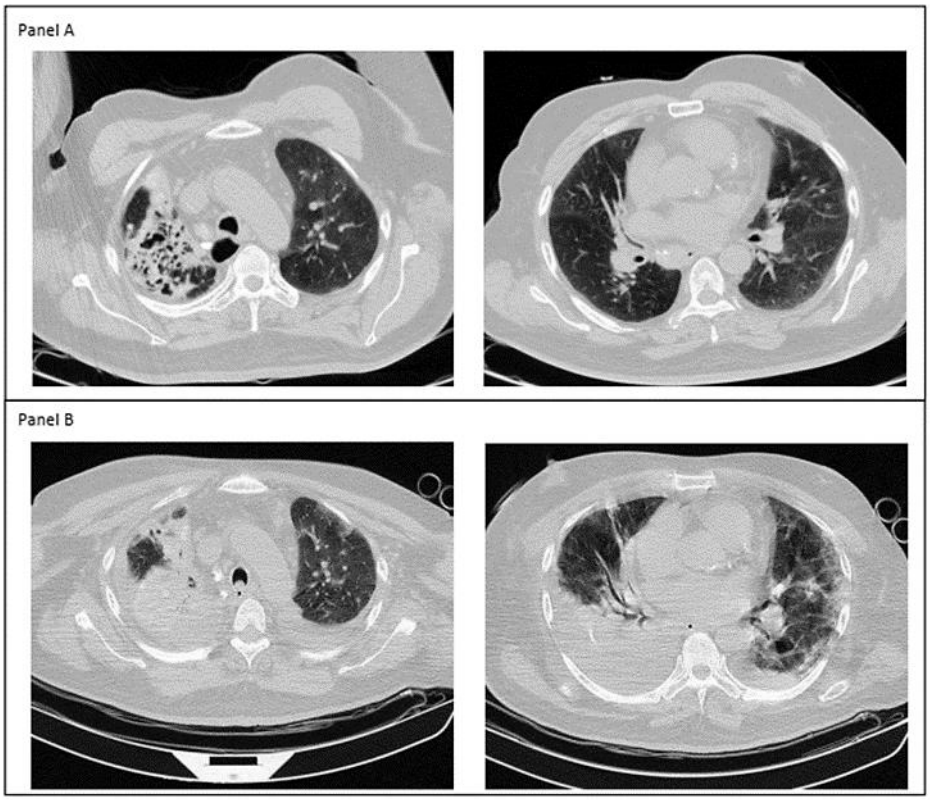


**Figure 2.** Second case lung chest CT scan on hospital day one and day 14

Panel A shows ground-glass opacities in the right lung on the first hospital day. Panel B shows Bilateral multifocal dominantly peripheral patchy ground-glass opacities, moderate bilateral pleural effusion, multiple enlarged mediastinal lymph nodes in multiple levels, collapsed right upper lobe, and contained multiple calcified granulomas on the hospital day 14.

The patient's oropharyngeal swab tested positive for SARS-CoV-2 by real-time reverse-transcriptase–polymerase-chain-reaction (rRT-PCR) assay. The patient was treated with antibiotics, hydroxychloroquine, oseltamivir, lopinavir/ritonavir, and prophylactic anticoagulant. Laboratory results showed anemia and mild thrombocytopenia (Table 1). No MRI was performed per isolation policies. The clinical diagnosis of thromboembolic embolic stroke was made. The cardiac echocardiographic examination showed depressed left ventricular function with an ejection fraction of 30%, an estimated pulmonary artery pressure (PAP) of 29, and the absence of thrombus. There was no evidence for atrial fibrillation by EKG or cardiac monitoring. Therefore, treatment with enoxaparin and carvedilol was initiated. On hospital day six, the patient's dyspnea resolved, and on hospital day seven, the thrombocyte count raised from 106000 to above 150000 platelets per microliter of blood. After completion of his treatments on hospital day fourteen, the patient was discharged with a body temperature of 36°C, blood pressure of 120/70 mm Hg, a pulse of 80 beats per min, blood oxygen saturation of 96%, a respiratory rate of 16 breaths per min, and good

general condition.

The patient lost consciousness while getting in the car to leave the hospital and was presented to the emergency room with cardiopulmonary arrest. The patient was immediately intubated, and cardiopulmonary resuscitation was initiated successfully. There were no significant changes in the ECG. However, the cardiac echocardiography examination revealed an ejection fraction of 20% and an estimated PAP of 35 mmHg. The blood test was only significant for leukocytosis (16000 WBC per microliter of blood), although the patient was discharged with a WBC count of 10690 per microliter of blood. The spiral lung CT scan revealed bilateral multifocal dominantly peripheral patchy ground-glass opacities, moderate bilateral pleural effusion, enlarged mediastinal lymph nodes at multiple levels, multiple calcified granulomas, and collapsed right upper lobe (Figure 2). The Brain CT scan showed multiple old infarcts in the left hemisphere. Treatment with antibiotics, anticoagulants, antiepileptics, and antiarrhythmic was initiated. On the fourth day of readmission, the patient suffered a cardiopulmonary arrest; however, the cardiopulmonary resuscitation failed.

## Discussion

We present two cases of confirmed COVID-19 with cardiac arrest shortly after the discharge in stable condition. At the beginning of the pandemic, COVID-19 was considered merely a pulmonary disease. As time has passed, the clinical experience has shown the effect of this virus on different organ systems (10-12). Endothelial damage has been suggested as a major consequence of the viral infection, leading to cardiac arrest and stroke (13). Therefore, multiorgan monitoring is vital in managing COVID-19 cases. Both cases here had major comorbidities. The impact of COVID-19 on a patient's pre-existing conditions is not clearly understood. The discharge protocols have focused on respiratory features, and the importance of comorbidities has been neglected (14-17). The Ministero della salute, Consiglio Superiore di Sanità (Italy) (15), the Chinese CDC (China) (18), The National Centre for Infectious Diseases (Singapore) (16), and CDC (USA) use pulmonary signs and symptoms, and viral test results as the major criteria in their discharge protocols (14). These protocols are simplified to facilitate the discharge of the patients. After fulfilling the following criteria: 1) the resolution of dyspnea with a respiratory rate under 20, 2) a blood oxygen saturation ≥93% without supplementary oxygen, 3) a pulse rate <90 per min, 4) afebrile with stable blood pressure, and 5) normal urine output, our two cases were discharged based on the decision of discharge committee consisted of the patient's physician, an infectologist and a pulmonologist. Yet, they suffered from cardiac arrest while being discharged from the hospital. Therefore, we suggest That the comorbidities should be taken into account in discharge planning as they affect immediate morbidity and mortality. Even though some patients may recover from initial COVID-19 symptoms, they could require a continuation of care due to their underlying disease. We propose that further examination of the discharge criteria with the consideration of comorbidities is needed to prevent unwanted outcomes in those who have recovered from the initial symptoms. We know the association between comorbidities and disease severity, but can comorbidities affect patients' outcomes after initial recovery? Maybe it's time to reconsider the discharge protocols.

## References


1. World Health Organization. Coronavirus disease 2019: World Health Organization; 2020 (Accessed at https://www.who.int/emergencies/diseases/novel-coronavirus-2019.)
2. Du RH, Liang LR, Yang CQ, Wang W, Cao TZ, Li M, et al. Predictors of Mortality for Patients with COVID-19 Pneumonia Caused by SARS-CoV-2: A Prospective Cohort Study. Eur Respir J 2020;55:2000524.
3. Valizadeh R, Moghaddam-Tabrizi F, Omidi T, Mahdi-Akhgar M, Bahadori R, Farrokh-Eslamlou H. Identification of Risk Factors Associated With Mortality Among Patients With COVID-19 Using Random Forest Model: A Historical Cohort Study. Acta Med Iran 2021;59:457-65.
4. Guan WJ, Liang WH, Zhao Y, Liang HR, Chen ZS, Li YM, et al. Comorbidity and its impact on 1590 patients with Covid-19 in China: A Nationwide Analysis. Eur Respir J 2020;55:2000547.
5. Guo T, Fan Y, Chen M, Wu X, Zhang L, He T, et al. Cardiovascular Implications of Fatal Outcomes of Patients With Coronavirus Disease 2019 (COVID-19). JAMA Cardiol 2020;5:811-8.
6. Shi S, Qin M, Shen B, Cai Y, Liu T, Yang F, et al. Association of Cardiac Injury With Mortality in Hospitalized Patients With COVID-19 in Wuhan, China. JAMA Cardiol 2020,5:802-10.
7. Li B, Yang J, Zhao F, Zhi L, Wang X, Liu L, et al. Prevalence and impact of cardiovascular metabolic diseases on COVID-19 in China. Clin Res Cardiol 2020;109:531-8.

8. 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:e3319.
9. Cheng Y, Luo R, Wang K, Zhang M, Wang Z, Dong L, et al. Kidney disease is associated with in-hospital death of patients with COVID-19. Kidney Int 2020;97:829-38.
10. 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;323:1061-9.
11. Dong N, Cai J, Zhou Y, Liu J, Li F. End-stage Heart Failure with COVID-19: Strong Evidence of Myocardial Injury by 2019-nCoV. JACC Heart Fail 2020;8:515-7.
12. Li T, Lu H, Zhang W. Clinical observation and management of COVID-19 patients. Emerg Microbes Infect 2020;9:687-90.
13. Sardu CG, Morelli J, Morelli MB, Wang X, Marfella R, Santulli G. Is COVID-19 an Endothelial Disease? Clinical and Basic Evidence. Preprints 2020.
14. CDC. Discontinuation of Transmission-Based Precautions and Disposition of Patients with COVID-19 in Healthcare Settings (Interim Guidance), 2020.
15. ECDC. Discharge criteria for confirmed COVID-19 cases - When is it safe to discharge COVID-19 cases from the hospital or end home isolation? (Accessed at https://www.ecdc.europa.eu/sites/default/files/documents/COVID-19-Discharge-criteria.pdf2020.)
16. Tay JY, Lim PL, Marimuthu K, Sadarangani SP, Ling LM, Ang BSP, et al. De-isolating COVID-19 Suspect Cases: A Continuing Challenge. Clin Infect Dis 2020;71:883-4.
17. Kakodkar P, Kaka N, Baig MN. A Comprehensive Literature Review on the Clinical Presentation, and Management of the Pandemic Coronavirus Disease 2019 (COVID-19). Cureus 2020;12:e7560.
18. CDC C. Diagnosis and treatment protocol for COVID-19 patients (trial version 7, revised) (Accessed at http://www.chinacdc.cn/en/COVID19/2020.)