

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

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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.

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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

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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

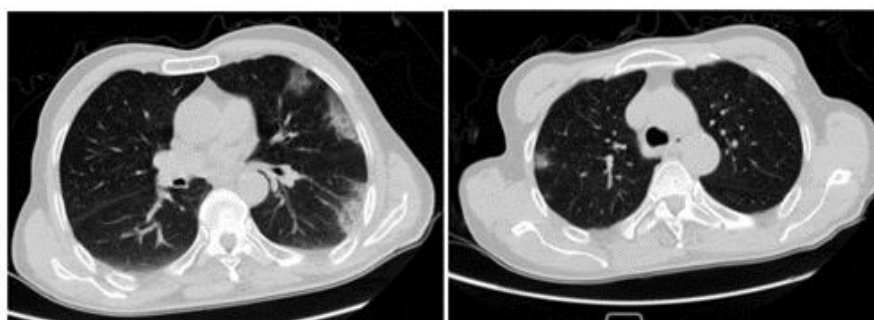


Figure 1. First case axial lung chest CT scan on hospital day 1
Crazy paving and ground-glass opacities in both lungs are shown

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

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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.

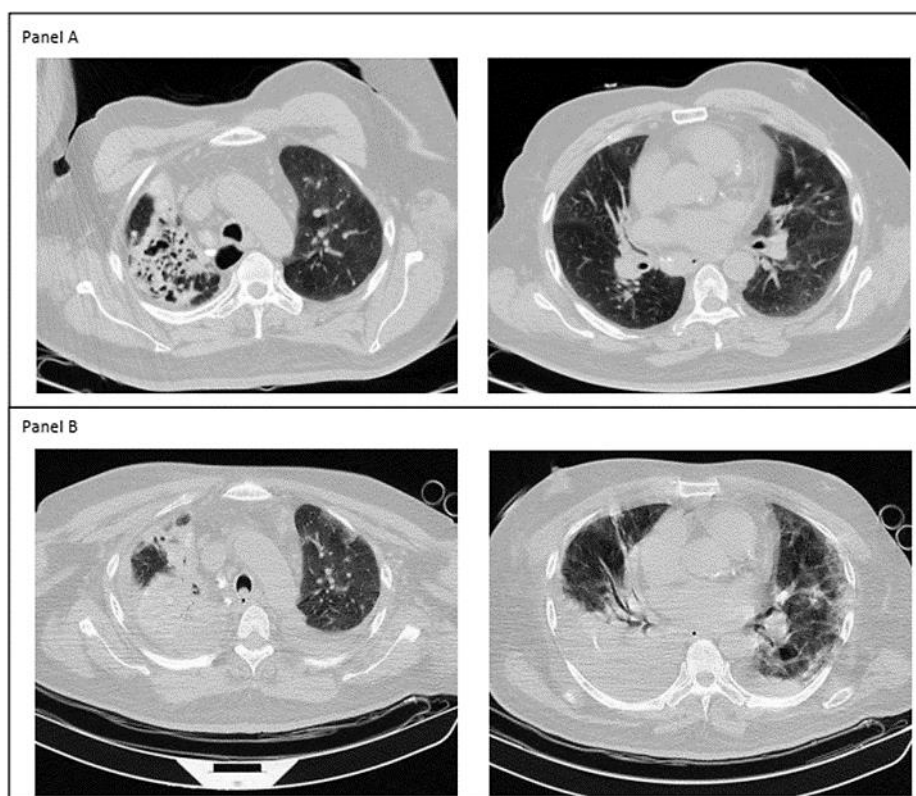


Figure 2. Second case lung chest CT scan on hospital day one and day 14

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 $\geq 93\%$ 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.

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