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## Case Report

## Acute Cardiac Tamponade: A Case of Life-Threatening Coronavirus Disease 2019 Complication During Air Medical Transportation

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## A B S T R A C T

A 42-year-old man with coronavirus disease 2019 pneumonia was admitted to a small town hospital that did not have intensive care unit (ICU)-level resources available. Twelve hours later, the patient suddenly became agitated, and an extensive anterolateral ST-elevation myocardial infarction was detected by 12-lead electrocardiography and supported by a rise in serum cardiac enzymes. Low blood oxygen saturation (59%) and cardiac ejection fraction (ejection fraction = 20%) reflected criticality that could potentially require a catheterization laboratory, coronary artery bypass graft surgery, and ICU-level resources. After the coordination of physicians with the nearest equipped hospital and air medical crew, a Mil Mi-17 medical helicopter unit was dispatched. About 20 minutes before reaching the destination hospital, his clinical condition declined; his heart was 50 beats/min, his blood pressure was 75/40 mm Hg, and he had jugular vein distention. Muffled heart sounds, decreased electrocardiographic voltage, and the accumulation of pericardial effusion on a bedside ultrasound indicated cardiac tamponade. The air medical crew resuscitated the patient through the interventions of intubation, mechanical ventilation, administration of intravenous fluids, and initiation of an epinephrine infusion. Ultrasound-guided pericardiocentesis was performed in the helicopter, which kept him alive until pericardotomy could be performed at the destination hospital. Unfortunately, after pericardotomy and coronary artery bypass graft surgery, the patient died 7 days later in the ICU due to severe cardiopulmonary failure.

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Coronavirus disease 2019 (COVID-19) caused by the zoonotic, enveloped, single-stranded RNA betacoronavirus is a new human pathogen that was initially identified in Asia and then rapidly evolved into a pandemic. Currently, the world health care systems have been plagued by a rapid transmitted virus with few known effective treatments and recently introduced vaccine options. COVID-19 frequently affects the respiratory system, ranging from mild flulike symptoms to severe acute respiratory syndrome. Additionally, multisystemic involvement (cardiovascular, gastrointestinal, hematologic, neurologic, and so on) has also been reported.<sup>1,2</sup> COVID-19 pneumonia and the related acute respiratory distress syndrome can lead to different levels of hypoxia and potentially to death. In patients with a history of ischemic heart disease or those with very low blood oxygen saturation (such as chronic cardiopulmonary diseases), it may cause myocardial ischemia and follow infarction as a complication that has been

documented in the literature. Pericardial effusion and subsequent cardiac tamponade are recognized as infrequent complications of ST-elevation myocardial infarction (STEMI), causing hemodynamic instability and eventually death. In recent studies, tamponade has been introduced as 1 of the life-threatening complications in COVID-19 patients.<sup>3</sup>

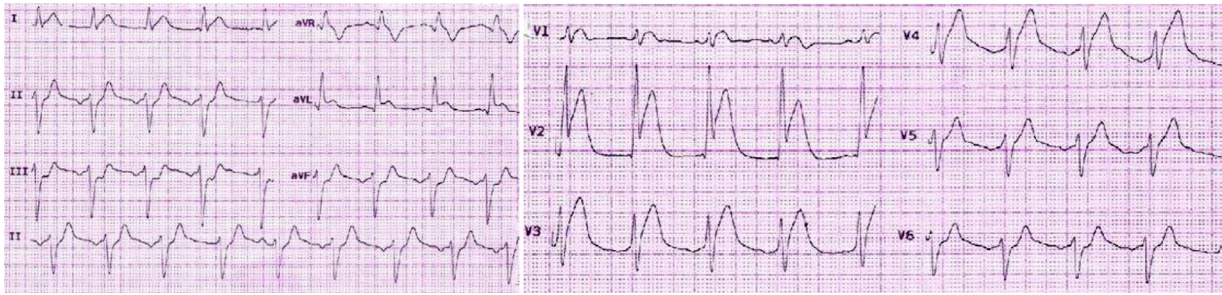
The Mil Mi-17 used in this case is a twin-engine helicopter that uses 3 flight crews and has the capacity to carry up to 24 standing and 5 supine patients. Additionally, it may be equipped with many types of medical equipment and lighting to facilitate suitable utilization as a medical helicopter.<sup>4</sup>

**Case Report**

A 42-year-old man with COVID-19 pneumonia was admitted to a small town hospital that did not have intensive care (ICU)-level resources available. Twelve hours later, the patient suddenly became agitated (with severe chest pain, cold sweating, and dyspnea exacerbation), and acute extensive anterolateral STEMI was detected by 12-lead electrocardiography and supported by a rise in serum cardiac enzymes (Fig. 1).

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**Figure 1.** Acute extensive anterolateral STEMI in the first requested 12-lead electrocardiogram.

Standard treatment was considered, but low blood oxygen saturation (59%) and cardiac ejection fraction (ejection fraction = 20%) reflected criticality that could potentially require a catheterization laboratory, coronary artery bypass graft surgery, and ICU-level resources. After 24 hours from STEMI and relative stability of the patient's clinical condition, physicians coordinated with the nearest equipped hospital and air medical crew (AMC). A Mil Mi-17 medical helicopter unit was requested, preflight assessment and preparations were performed by the AMC, and at about 58 minutes air transfer began. Within 20 minutes before reaching the destination hospital, his clinical condition declined; his heart rate was 50 beats/min, his blood pressure was 75/40 mm Hg, and he had jugular vein distention. Muffled heart sounds (which were heard with an amplified stethoscope integrated into the AMC's onboard microphone system), decreased voltage in 12-lead electrocardiography, and accumulation of pericardial effusion to a maximal depth of 2 cm on a bedside ultrasound indicated acute cardiac tamponade (Fig. 2).

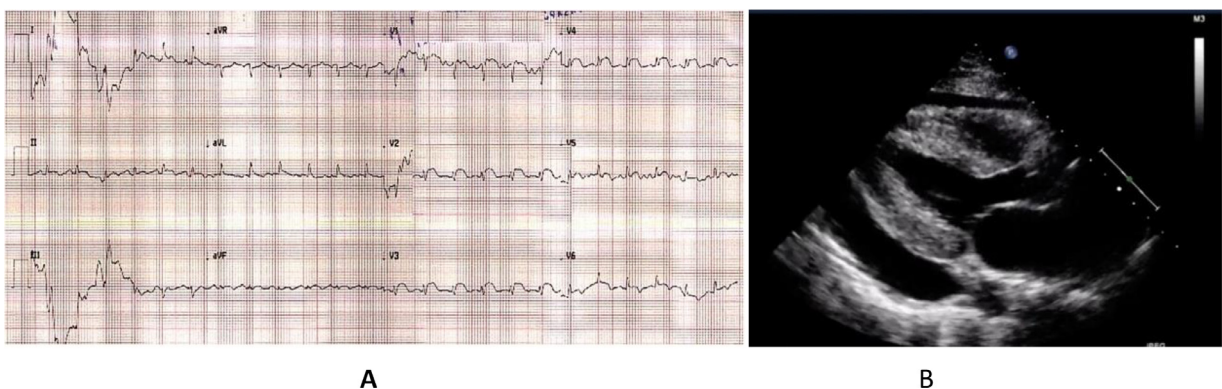
The AMC resuscitated the patient by endotracheal intubation via tube size 8, mechanical ventilation, epinephrine infusion, and intravenous fluid therapy. In-flight aspiration of 16 mL blood using an 18-G spinal needle and a 10-mL syringe by ultrasound-guided pericardiocentesis kept him alive until pericardotomy could be performed at the destination hospital. After urgent pericardotomy and coronary artery bypass graft surgery, he was admitted to the ICU with continued endotracheal intubation, mechanical ventilation, and respiratory rehabilitation. Complementary diagnostic and therapeutic interventions were requested. He received ICU care and was treated based on the national protocol for COVID-19 pneumonia. Unfortunately, despite the best efforts of the medical staff, due to the severe cardiopulmonary failure, the patient died 7 days later.

## Discussion

Cardiac tamponade is a serious medical condition in which blood or fluid fills the space between the sac that encases the heart and the

heart muscle. The most common causes include malignant disease, uremia, idiopathic pericarditis, infectious diseases (COVID-19), myocardial infarction, anticoagulation, connective tissue diseases, and Dressler or postpericardiotomy syndrome. A tension pneumothorax, which is much more common, can mimic certain aspects of acute pericardial tamponade. One should clinically suspect tamponade with the presence of 3 clinical signs (referred to as the Beck triad): low arterial blood pressure, distended neck veins, and muffled heart sounds. However, be cautious because the patient may not exhibit extended neck veins if hypovolemic. As little as 60 to 100 mL pericardial blood may produce the clinical picture of tamponade.<sup>4,5</sup> Bedside ultrasound should be performed as quickly as possible to establish a rapid, accurate, and noninvasive diagnosis. Radiographic evaluation generally is not helpful unless there is at least 200 mL blood accumulated. Many electrocardiographic changes of pericardial tamponade have been described in the literature, but few are diagnostic, and each is more likely to be observed with chronic rather than acute tamponade. Voltage reduction in all leads and electrical alternans due to swinging heart phenomenon are pathognomonic for tamponade.<sup>4,6</sup> In the prehospital setting, whenever possible, pericardiocentesis should be performed under sonographic guidance because this approach will hopefully increase the success rate and decrease the incidence of complications. Aspiration of as little as 5 to 10 mL blood may result in dramatic clinical improvement. However, it should be emphasized that pericardiocentesis is not a benign or invariably successful procedure because the blood tends to be clotted. A pigtail catheter may be introduced into the pericardial space for repeated aspirations while preparations are underway to quickly transport the patient to the operating room for pericardiotomy as definitive treatment. If left untreated or not treated quickly, it can lead to arrhythmias, cardiac arrest, and death.<sup>4-6</sup>

COVID-19 can produce different manifestations and complications. Patients with related complications or chronic underlying disease (such as diabetes mellitus, chronic renal failure, and so on) may



**Figure 2.** A, In-flight 12-lead electrocardiogram of acute cardiac tamponade with decreased voltage after acute extensive anterolateral STEMI. B, In-flight pericardial effusion on bedside ultrasound.

need ICU admission, sufficient respiratory support, mechanical ventilation, and rehabilitations. Antibacterial therapy, antiviral therapy, and conservative and adjunctive treatment may be necessary based on the national COVID-19 guidelines. Many patients who need endotracheal intubation and respiratory support will be lost. However, prompt diagnostic and therapeutic measures will play an important role in reducing their mortality and morbidity.<sup>2-4</sup>

### Conclusions

COVID-19 is associated with varied multisystem complications, which have been reported in the literature. The authors hope that by presenting this case report, 2 relevant points will be emphasized: cardiac tamponade can present as a life-threatening complication after myocardial infarction during air medical transport, and the cardiovascular system is a target that may be directly or indirectly affected in COVID-19 patients (as exemplified by myocardial infarction,

cardiac tamponade, myocarditis, cardiomyopathies, arrhythmias, and so on).

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