Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

The Journal of Emergency Medicine, Vol. 62, No. 4, pp. 566–568, 2022

0736-4679/$ - see front matter

https://doi.org/10.1016/j.jemermed.2022.01.008

Visual Diagnosis in Emergency Medicine

Right Ventricular Thrombus in Transit in a Patient With COVID-19

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□ **Keywords—COVID-19; Pulmonary Embolism; Thrombus in Transit; Echocardiography; POCUS**

Case Report

A 62-year-old man presented to our hospital with worsening respiratory distress. He had a history of uncontrolled diabetes mellitus and dyslipidemia and had received two doses of the COVID-19 adenovirus-vectored vaccine (ChAdOx1 nCoV-19) 4 months before presentation. Symptoms began 13 days before admission with headache, low-grade fever, and malaise. He had tested positive for COVID-19 and started treatment at home with supplementary oxygen and supportive measures. At day 13, he presented with worsening dyspnea and increasing oxygen requirements and was referred to our unit. During admission, he was found in respiratory distress, was intubated, and treatment with baricitinib, dexamethasone, and prophylactic low-molecular-weight heparin was started. During his first day of hospitalization, he experienced sudden hemodynamic collapse that required high doses of vasopressors. An electrocardiogram showed a right bundle branch block with an S1Q3T3 pattern. A point-of-care cardiac ultrasound (POCUS) showed preserved left ventricular ejection fraction with no evident wall motion abnormalities. The right ventricle (RV) appeared severely dilated and there was systolic D-shape visible in the parasternal short-axis view suggestive of acute right ventricular pressure overload. In the four-chamber view, the right ventricular free wall showed akinesia with preserved apical contractility (McConnell's sign). In addition, during echocardiographic evaluation, a mobile, large, right ventricular mass moving toward the main pulmonary artery, suggestive of a thrombus in transit, was detected (Figure 1 and Video 1). A high-risk acute pulmonary embolism (PE) with a thrombus in transit was diagnosed and we decided to administer i.v. thrombolysis with alteplase. After thrombolytic administration, there was visible improvement in hemodynamic status and a progressive decrease in vasopressors requirements; however, he remained critical due to the extensive lung involvement of SARS-CoV-2 infection.

Discussion

In the beginning of the pandemic, COVID-19 was considered mainly a respiratory disease, but the available evidence to date indicates that there is involvement of multiple organs and systems, and that the heart is one of the most important targets (1). In COVID-19, the RV is involved frequently, showing dilatation and subtle or overt dysfunction, which can be the result of the acute stress im-

Received: 28 September 2021; Final submission received: 23 December 2021;
Accepted: 16 January 2022

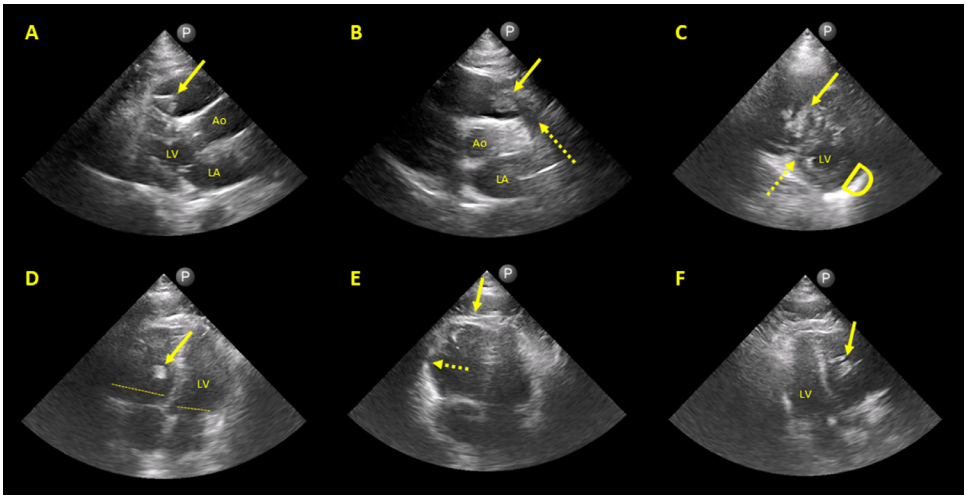

Figure 1. Point-of-care cardiac ultrasound showing a right ventricular thrombus in transit and echocardiographic signs of pulmonary embolism. (A) A parasternal long-axis view showing a severely dilated right ventricle with a thrombus (arrow). (B) A parasternal short-axis view at the level of great vessels showing a thrombus that is moving toward the main pulmonary artery (arrow), the dotted arrow is placed over the main pulmonary artery and points to the pulmonary valve. (C) A parasternal short-axis view at the level of the left ventricle showing a thrombus (arrow), the dotted arrow points to the interventricular septum that is flattened during systole and creates a D-shaped image, a sign of right ventricular pressure overload. (D) An apical four-chamber view shows a thrombus in the right ventricle (arrow), the dotted lines show how the right ventricle to left ventricle ratio is > 1 because of severe right ventricle dilatation. (E) An apical four-chamber view showing a severe dilated right ventricle, the arrow points to the right ventricular apex during systole with preserved contractility, while there is akinesia of the right ventricular free wall (McConnell's sign) (dotted arrow). (F) An apical long-axis view shows a thrombus in the right ventricle; note how the left ventricle appears collapsed with interventricular septum displacement due to right ventricular pressure overload.

posed over a thin-walled ventricle by severe lung involvement, mechanical ventilation (MV), ischemia, and myocardial damage (1,2). In addition, there is growing strong evidence that indicates that patients with COVID-19 are at increased risk of venous thromboembolism (VTE) (3,4). Recent studies have reported that symptomatic VTE was present in 1.09% of admitted patients with COVID-19, and > 85% was PE (3). Other findings suggest that VTE can be present in 3.5% of overall admitted patients with COVID-19, and in 17% of those who are screened because of high clinical suspicion. In this study, higher levels of D-dimer and need for MV were found to be strong risk factors for VTE (4). Although the mechanisms that lead to an increased risk of VTE in patients with COVID-19 are still not fully elucidated, endothelial injury, immobilization in critically ill patients, and some changes in circulating levels of prothrombotic factors might play a role in the pathogenesis.

Echocardiography has been found to be useful in the diagnostic and therapeutic process of patients with PE and hemodynamic instability (5,6). Some of the signs of RV pressure overload can be detected with 2-dimensional echocardiography without the need for M-mode or Doppler techniques; the detection of a dilated RV, McConnell's sign, and a thrombus can have a sensitivity of 80%, 97%, and 99% and a positive likelihood ratio of 4, 7.3, and 5, respectively (6). A right ventricular thrombus in transit is considered an uncommon finding and can be detected in 2–4% of patients with PE, and is far more common in those with hypotension or signs of RV dysfunction (20%) (5,6). When present, it confirms the diagnosis of PE and has a poor prognosis (5,7). A thrombus in transit has been reported previously in other patients with COVID-19 (8).]POCUS has emerged as a valuable tool in the assessment of patients that present with shock and suspicion of PE (9). It can detect with accuracy most signs of RV pressure overload, such as RV dilatation, D-shape, McConnell's sign, thrombus in transit, and inferior vena cava dilatation; and because it is portable and acquisition protocols are fast, it can shorten time from presentation to diagnosis and treatment, which is associated with better outcomes (5,10). According to guidelines and recommendations, in patients with hemodynamic instability and suspected PE, the presence of echocardiographic signs of RV pressure overload justify emergent reperfusion therapy with systemic thrombolysis because it has been found to improve RV function and prognosis (5,8).

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jemermed.2022.01.008.

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