

## Case Report

# Massive Pulmonary Embolism and Thrombus-in-Transit in COVID Negative Female during COVID Pandemic

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Thrombus-in-transit is a rare condition, and it associates with massive pulmonary embolism with high mortality. During the Coronavirus Disease-2019 (COVID) pandemic, the number of thromboembolic events increased, and COVID infection is found to trigger hypercoagulability. We experienced a rare case during this COVID pandemic who presented with shortness of breath. Her COVID test was negative. She was found to have a massive pulmonary embolism and thrombus-in-transit. She was placed on venoarterial extracorporeal membrane oxygenation (VA ECMO) upon which she was to receive thrombectomy. However, on repeat echocardiography, the entire thrombus was no longer visualized in the right heart. The right heart was enlarged with severely decreased function. She was instead treated with thrombolytic therapy. Four days later, VA ECMO was successfully removed. A follow-up echocardiography revealed that both left and right ventricular sizes and function had returned to normal. This condition carries a high mortality regardless of the treatment approaches used, and this case highlights potentially significant morbidity and mortality in non-COVID individuals during the pandemic. Timely diagnosis and tailoring therapy most suitable for individual case is the key to favorable outcome.

**Keywords:** Thrombus-in-transit; Pulmonary embolism; Venoarterial extracorporeal membrane oxygenation; Echocardiography; Pandemic**Abbreviations**

COVID-19: Coronavirus Disease-2019; LV: Left Ventricle; PE: Pulmonary Embolism; POCUS: Point-of-Care Ultrasound; RV: Right Ventricle; tPA: Tissue Plasminogen Activator; VA ECMO: Venoarterial Extracorporeal Membrane Oxygenation

**Introduction**

A stay-at-home-order during COVID-19 pandemic has restricted social and cultural activities for millions of inhabitants in New York City. A 3-month postpartum female presented with acute deep vein thrombosis and thrombus-in-transit which led to massive PE. This report highlights potentially significant morbidity and mortality in non-COVID individuals during the pandemic.

**Presentation**

A 33-year-old African American female who was 3 month postpartum and living sedentary lifestyle due to Coronavirus Disease-2019 (COVID-19) pandemic presented to the emergency department with worsening shortness of breath and palpitations for 2 days. She also complained of a two-week history of right calf tenderness.

The patient was hypoxic with peripheral capillary oxygen saturation of 84% on room air which improved to > 92 % with supplemental oxygen, her respiratory rate was at 22 per minute, and she was tachycardiac at 144 beats/min. Her blood pressure was 126/86 mmHg. There was no fever or cough.

**Medical History**

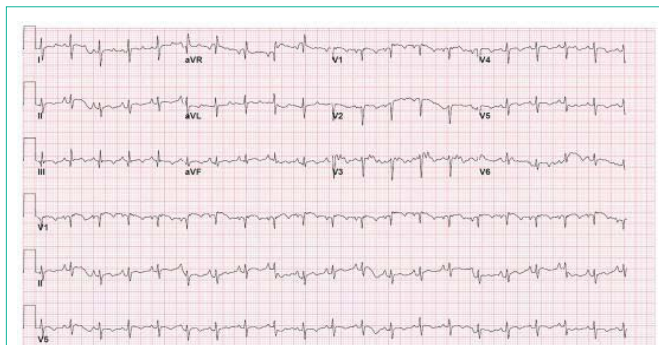
Past medical history included human immunodeficiency virus (not on antiretroviral therapy, undetectable viral load, CD4 of 551cells/mm<sup>3</sup>), sickle cell trait, and varicose veins. She was taking oral contraceptive pill, however stopped taking it one week prior to the presentation for unclear reason.

**Differential Diagnosis**

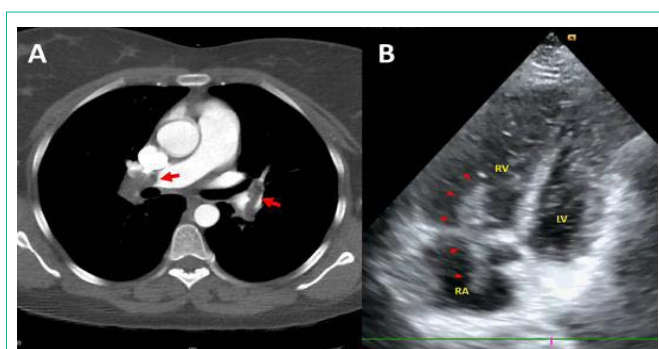
The differential diagnosis included COVID-19, Pulmonary Embolism (PE), post-partum cardiomyopathy, and myocarditis.

**Investigations**

Electrocardiogram revealed sinus tachycardia, right atrial enlargement, right axis deviation, with deep S wave in lead I, Q waves and inverted T waves in Lead III, which was the classic McGinn-White Sign (Figure 1). This was indicative of right heart strain. A diagnosis of PE was therefore entertained. Her chest X-ray was unremarkable. Laboratory studies showed mild leukocytosis (10.9 k/mL) without left shift, elevated lactic dehydrogenase (509 U/L), D-dimer (13.0 mg/mL), N-terminal-pro hormone B-type natriuretic peptide (5,160 pg/mL), and C-reactive protein (5.2 mg/dL). Troponin T was normal. The COVID-19 test result was negative. A computed tomography angiogram of the chest revealed multiple pulmonary emboli involving bilateral main pulmonary arteries extending into the branches of all lobes (Figure 2A). On echocardiography, the right ventricle (RV) was dilated and hypokinetic. There was a multilobular mobile mass in the right atrium prolapsing across the tricuspid valve into the right ventricle, consistent with a thrombus-in-transit (Figure



**Figure 1:** Electrocardiogram on admission showing typical 'S1Q3T3' pattern pathognomonic for pulmonary embolism.



**Figure 2:** (A) Computed tomography angiogram showing thrombus involvement of the right and left main pulmonary arteries. (B) Echocardiography showing multilobular mobile mass in the right atrium prolapsing across the tricuspid valve into the right ventricle, consistent with a thrombus-in-transit.

2B, Movie 1). The Left Ventricular (LV) function was normal. Venous duplex Doppler confirmed acute occlusive deep vein thrombosis in the left proximal femoral vein and bilateral gastrocnemius veins.

## Management

Therapeutic dose of unfractionated heparin infusion was initiated, and hemodynamics were closely monitored in the surgical intensive care unit. The patient remained tachycardiac at heart rate of 120 – 130 beats/min as well as labile blood pressure. Four hours after the initial echocardiography, a bedside point-of-care ultrasound (POCUS) revealed worsening RV dilation and hypokinesis, and a newly developed LV dysfunction with ejection fraction of 30%. Based on the evidence of the large thrombus-in-transit with RV strain as well as LV failure, venoarterial extracorporeal membrane oxygenation (VA ECMO) was inserted to avoid catastrophic cardiogenic shock. Seven hours after the initial echocardiography, POCUS failed to visualize the mobile thrombus in the heart (Movie 2). It was considered another massive PE event occurred after VA ECMO insertion under a therapeutic dose of unfractionated heparin use, therefore systemic tissue plasminogen activator (tPA) was initiated. Mechanical thrombectomy was deferred because the thrombus-in-transit no longer existed. The clinical course was complicated by severe menstrual bleeding requiring packed red-blood-cell transfusion. The patient improved clinically, and POCUS showed improvement of LV function and RV afterload (improved RV dilatation and severity of tricuspid regurgitation). The VA ECMO was successfully

decannulated after four days. A follow-up echocardiography eight days later showed normalized biventricular size and function (Movie 3).

## Discussion

The rapid global spread of COVID-19 with a devastating number of deaths has brought a worldwide lockdown. Stay-at-home orders were issued by nearly all the states in the United States and at least 316 million people were urged to stay home. The stress of confinement was especially pronounced in New York City – the epicenter of the COVID-19 pandemic – due to the typically small and expensive living spaces. This has led to more sedentary lifestyle for the millions of inhabitants in a city known for its many social and cultural activities.

Underlying hypercoagulable condition predisposes patients to developing potentially life-threatening thromboembolic disorders such as deep vein thrombosis and pulmonary embolism. African American ethnicity [1] and HIV status [2] predispose patients to hypercoagulability. In addition, PE is one of the leading cause of death during and after pregnancy. There is a prospective study evaluating consecutive patients with first diagnosis of venous thrombosis recruited from six anticoagulation clinics. Partners of patients and a random digit dialing group without recent history of venous thrombosis, oral contraceptives or hormone replacement therapy, or malignancy were included as control subjects. Within this study cohort, comparing pregnant to non-pregnant subjects, the risk of PE was reported to be 2-fold higher during pregnancy and 34-fold higher during postpartum period [3]. It is not clear how far this heightened risk extends beyond the conventionally defined six week postpartum period. Kamel et al. showed that an elevated risk persists up to 12 weeks after delivery, although this is less commonly seen [4].

Thrombus-in-transit is rare. When it is seen, nearly all patients had developed significant PE [5]. These floating thrombi are in transit from the legs to the pulmonary arteries and hence can embolize at any time, thus necessitating emergency treatment [6]. Echocardiography demonstrates signs of cor pulmonale: right ventricular overload, paradoxical septal motion, and pulmonary hypertension. Thrombus is typically shown to resemble “sausage-link” that reflects the origin from lower extremity veins with venous valves. Mortality is high regardless of the chosen therapeutic option: 100% without therapy, 29% with anticoagulation therapy, 24% with surgical embolectomy, and 11% with thrombolysis [7]. When patients survived, post discharge outcomes are usually favorable [5].

Management of this condition is not straightforward needing individualized approach [8]. Thrombolysis may be a faster and more readily available, reserving interventional techniques for those who may have contraindications to surgery or lytic therapy [5]. Thrombolysis carries theoretical advantages, as it accelerates lysis of the thrombus, and foster pulmonary reperfusion, also reducing pulmonary hypertension. In light of ventricular interdependence, the improvement of right ventricular function helps to improve biventricular output, reversing cardiogenic shock [9]. Additionally, thrombolytic agents result in the simultaneous resolution of the intracardiac, intrapulmonary, or deep venous thrombus [10].

## Follow-up

The patient's symptoms resolved and her hemodynamics stayed

stable after removal of VA ECMO. She was discharged home on apixaban to follow up with our Vascular Surgery Clinic.

## Conclusions

Many city dwellers are vulnerable to developing deep vein thrombosis due to sedentary lifestyle during COVID pandemic. We present a rare case of massive PE with thrombus-in-transit in the right heart. VA ECMO and systemic thrombolytic therapy were utilized. Her cardiac function recovered to normal. This case highlights potentially significant morbidity and mortality in non-COVID individuals during the pandemic. Timely diagnosis and management is the key to success.

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