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Case Report

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Concomitant pulmonary embolism and renal infarction associated with COVID-19 infection

Abstract

The incidence of thromboembolic events has increased in COVID-19 patients. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection is recognized as a provoking factor for acute pulmonary embolism. Concomitant arterial embolism should be kept in mind in cases with pulmonary embolism and COVID-19. Renal infarction should be suspected in a COVID-19 patients presenting with an unexpected symptom such as abdominal pain. In addition, thrombophilia screening should be considered in patients with thrombosis involving multiple organs without the existence of any risk factors.

Keywords: COVID-19, Pulmonary embolism, Renal infarction

INTRODUCTION

Coronavirus disease 2019 (COVID-19) gives rise to hypoxia, excessive inflammation, platelet activation, endothelial dysfunction and stasis, which may predispose the patients to arterial and venous thromboembolic events, such as acute pulmonary embolism (PE), deep vein thrombosis, ischemic stroke, myocardial infarction and systemic arterial embolism (1). The incidence of COVID-19-related PE has been reported as 17.9% in the emergency department, 23.9% in the general services, and 48.6% in the intensive care unit (2). Although rare, COVID-19-related renal infarction has also been reported (3). In this context, in this case report, a young patient who did not have any comorbidities, yet developed both PE and renal infarction on the basis of COVID-19 infection is presented.

CASE REPORT

A 22-year-old male patient presented to the emergency department with complaints of fever, fatigue, and joint pain, and with shortness of breath, abdominal pain, nausea and vomiting. He had the relevant examinations and tests, including the reverse transcription-polymerase chain reaction (RT-PCR) test conducted using a nasal swab specimen. Consequentially, he was diagnosed with COVID-19 and started on Favipiravir treatment. He was discharged with the recommendation to stay isolated at home. It was learned that the patient received a single dose of COVID-19 mRNA vaccine about 1 month ago. He was not smoking and had no known comorbidities. Patient was not on any medication and also had no cancer or blood disorders in his familial history or any other feature.

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His general condition was moderate. He was conscious, cooperative and oriented. Body mass index (BMI) was calculated as 24.8kg/m². The measurement of vital signs revealed the following results; blood pressure: 130/75mmHg, pulse: 105 beats/min, respiratory rate: 22/min., fever: 38.3°C and oxygen saturation in room air: 94%. Cardiovascular and respiratory system examination were normal. In the abdominal examination, there was tenderness with palpation in the left upper and lower quadrants. Left costovertebral angle tenderness was evident. There was no sign of peritoneal irritation. Electrocardiography revealed sinus tachycardia. There was S1Q3T3 finding (Figure-1) The laboratory tests revealed the following results; WBC (white blood cell count): 8.63×109/L, Hgb (hemoglobin): 16.00g/dl, PLT (platelet count): 192.00×109/L, BUN (blood urea nitrogen): 19.63mg/dl, and Creatinine: 1.6 mg/dl. Procalcitonin, ferritin, IL-6 (interleukin 6), CRP , D-dimer and fibrinogen values were increased. NT-proBNP level was slightly elevated and HS-Tn-I was negative. Arterial blood gas reading indicated hypocarbia. O2 saturation was %95.8. Transthoracic echocardiography indicated that left ventricular systolic functions were normal, whereas right heart was slightly dilated. There was mild-to-moderate tricuspid regurgitation and estimated systolic pulmonary artery pressure was 50 mmHg. The bilateral lower extremity venous Doppler sonography did not reveal anything unusual. Computed tomography pulmonary angiography indicated a filling defect compatible with acute stage thrombus allowing flow in the right main pulmonary artery. In addition, filling defect compatible with thrombus was observed in the right and left pulmonary arteries, allowing flow at the segmental level (Figure-2). Renal color Doppler sonography was performed given the left costovertebral angle tenderness. A hypoechoic area with no blood supply was detected in the upper pole of the left kidney. The right renal blood flow was typical. The left renal artery appeared open in the contrast-enhanced abdominal computed tomography. However, there was a patchy hypodense area in the cortical area in the upper pole of the left kidney, which was interpreted by the radiology department as partial renal infarction (Figure-3). The patient had developed both PE and renal infarction after contracting COVID-19. He was hospitalized and started on low-molecular-weight heparin (LMWH). The Favipiravir treatment was continued. Since he had no known risk factor or comorbidity, thrombophilia was considered. The results of the rheumatological examinations however were normal. There was no systemic lupus erythematosus or vasculitis. He tested negative for antiphospholipid antibodies, that is, he did not have antiphospholipid syndrome. Von Willebrand antigen and AT (antithrombin)-III levels were normal, but he had protein C and protein S deficiencies. In addition, genetic tests revealed heterozygous mutations in Factor V H 1299R, MTHFR C677T, MTHFR A1298C and PAI-1 4G>5G genes. The transthoracic echocardiography performed after discharge did not reveal anything abnormal in his left heart functions. Right heart chambers were within normal limits. There was mild tricuspid regurgitation and his estimated systolic pulmonary artery pressure was 28mmHg. No shunt was observed in transesophageal echocardiography. He was prescribed a therapeutic dose of LWMH for 3 months after discharge, and an indefinitely extended oral anticoagulant treatment was planned thereafter.

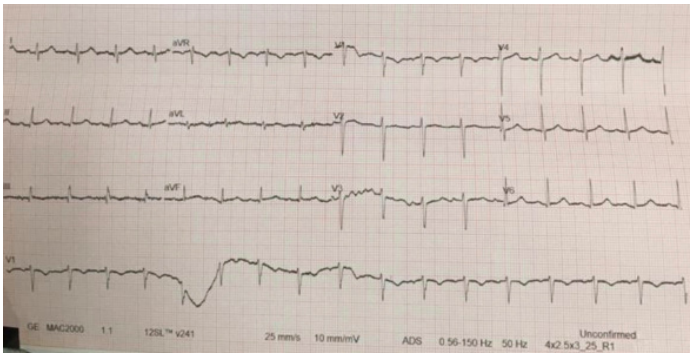

Figure 1. ECG shows sinus tachycardia and S1Q3T3 sign

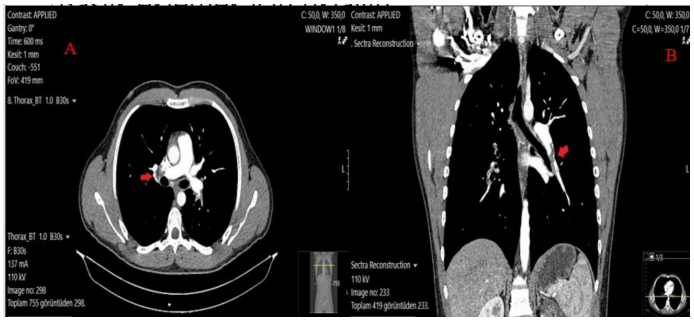

Figure 2. Computed tomography pulmonary angiography indicated a filling defect compatible with acute stage thrombus allowing flow in the right main pulmonary artery. (A) filling defect compatible with thrombus was observed in the right and left pulmonary arteries at the segmental level (B)

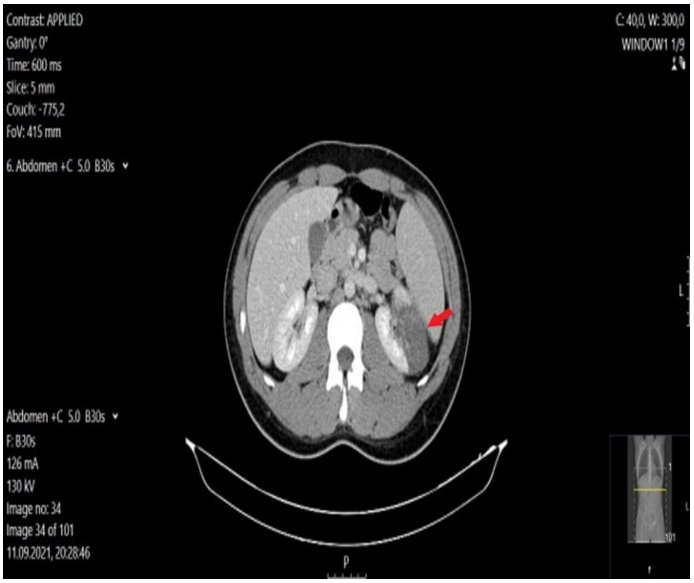

Figure 3. Contrast-enhanced abdominal computed tomography shows a patchy hypodense area in the cortical area in the upper pole of the left kidney

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DISCUSSION

SARS-CoV-2 infection was named as the coronavirus disease 2019 (COVID-19) by the World Health Organization (WHO). WHO declared COVID- 19 a pandemic on March 11th, 2020 (4). Many observational and retrospective studies have demonstrated that the incidence of thromboembolic events in patients with COVID-19 pneumonia is higher than the general population. The COVID-19-related local and systemic inflammation, activation of coagulation, hypoxemia and immobilization have been blamed for the said higher incidence of thromboembolic events (5,6).

As a matter of fact, acute PE was reported as the most commonly observed COVID-19-related thrombotic complication in many studies (7). COVID-19 reportedly contributes to the development of immobilization-related venous thromboembolism and infection-related immunothrombosis PE particularly in intensive care patients (8,9). In a retrospective study on COVID-19 patients admitted to the emergency department, it was shown that PE increased 9 times in the presence of COVID-19. In addition, it was reported that the PE, which was developed in the presence of COVID-19, was often present in the segmental and subsegmental pulmonary arteries (10).

Renal infarction is an arterial vascular emergency pathology that causes damage to kidney tissues. Its etiology includes thromboembolism, thrombus originating from the heart or aorta, renal artery damage, and prothrombotic conditions (11). Renal infarction, an uncommon finding of COVID-19, is an extremely rare cause of admission in COVID-19 patients (12). The kidneys are susceptible to thrombosis. Evidence of thrombus at the glomerular capillary level was found in postmortem pathological examinations of patients with severe COVID-19 (13). In the same study, it was also reported that thrombotic microangiopathy caused acute kidney injury in patients.

Interestingly, some studies reported elevated thrombophilia parameters in patients with COVID-19 (14). The clinical significance of this finding has not yet been elucidated. The role played by the elevated thrombophilia parameters in coagulopathy associated with COVID-19 is also controversial. Therefore, routine screening for thrombophilia in patients with COVID-19 is not recommended in general. However, thrombophilia panel may be recommended in specific cases, such as the case presented herein, where thromboembolic events develop in more than one organ in a young patient with no risk factors for thrombosis. As a reason, the detection of thrombophilia will change the treatment management. Early and recurrent thrombosis may be associated with congenital thrombophilia. Severe thrombophilic defects such as protein C and protein S deficiencies and mild prothrombotic polymorphisms increase the risk of thrombosis in the presence of additional risk factors. Accordingly, hereditary thrombophilia may contribute to the increased risk of thrombosis in patients with COVID-19 (15).

The case presented herein did not have COVID-19 pneumonia, that is, the infection was not severe. Nevertheless, he had developed both PE and renal infarction. The analysis of the thrombophilia panel did not indicate antiphospholipid antibody syndrome, yet he had protein C and protein S deficiencies. In addition, heterozygous mutations were observed in Factor V H 1299R, MTHFR C677T, MTHFR A1298C and PAI-1 4G>5G genes. It is possible that the said deficiencies and heterozygous mutations may have triggered thrombosis in more than one organ along with COVID-19-related coagulopathy in case presented herein. This study is the first study to date where a case who developed both PE and renal infarction following COVID-19, was concurrently diagnosed with thrombophilia was presented. PAI-1 4G/5G is a prothrombotic inherited mutation, which has previously been shown to increase intravascular coagulation and cause thrombosis in coronavirus infections (16). In another study, it was reported that PAI-1 was high in all four patients with severe pneumonia associated with COVID-19, and that three of these four patients also had protein C and S deficiencies (17). These findings indicate an increased risk for thromboembolic events, as was the case for the patient presented in this case report.

The European Society of Cardiology (ESC) guideline recommends administration of anticoagulant therapy at standard prophylactic dose to all patients admitted to the hospital with COVID-19 infection. On the other hand, in the case of critically ill patients presented with COVID-19 pneumonia, it has been stated that more intensive anticoagulation may be indicated at moderate or even therapeutic doses. Then again, patients with COVID-19 pneumonia have been shown to develop acute PE even while receiving full-dose anticoagulation (18). The SARS-CoV-2 spike S1 protein receptor binding domain interacts with LMWHs. In addition, LMWHs have anti-inflammatory and immunomodulatory effects (19). Therefore, the patient presented herein was first started on LMWH treatment. Oral anticoagulant therapy was continued after discharge, and indefinitely extended oral anticoagulation treatment was planned given that he had a persistent risk factor.

CONCLUSION

In conclusion, it should be kept in mind that thromboembolism may occur in both arterial and venous systems in patients with COVID-19. An underlying thrombophilic condition may be considered especially if the patient is young and has no comorbidities.

Competing interests: The authors declare that they have no competing interest.

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Data Availability Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Patient informed consent: Patient consent was obtained for the publication of this article.

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