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CASE REPORT
Other

COVID-19 infection complicated with acute pulmonary embolism treated with percutaneous pulmonary artery thrombectomy: a case report

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Background Coronavirus disease 2019 (COVID-19) disease is a highly prothrombotic state. Deep vein thrombosis (DVT) and pulmonary embolism (PE) are observed with increased incidence in patients infected with the severe acute respiratory syndrome coronavirus 2 virus.

Case summary A 57-year-old male patient with a recent COVID-19 infection complained of leg swelling shortly after his COVID ward discharge. A few days later he was hospitalized with acute massive PE and DVT of his left leg was diagnosed. In another facility, as the first line of treatment, the PE was managed with catheter-directed therapy (CDT) using thrombus defragmentation via 5F (French) Pigtail catheter and supraselective application of 40 mg alteplase. Following the procedure, in addition, 50 mg alteplase was also applied as a 1 hour systemic infusion. Despite the haemodynamic stabilization of the patient, he remained persistently symptomatic and tachycardic. Three days later—in our institution, a second computed tomography pulmoangiography revealed massive thrombotic masses mainly in the left pulmonary artery. Successful percutaneous thrombus aspiration was conducted. The procedure was uneventful with an immediate drop of systolic pulmonary artery pressure from 68 to 47 mmHg and relief of the patient's symptoms.

Discussion In the era of the COVID-19 pandemic, physicians have to remain vigilant of its potential thrombotic complications, the most commonly observed being DVT and PE. We demonstrated the efficacy of percutaneous thrombus aspiration in a patient with acute COVID-19-associated PE, after initial CDT with thrombus defragmentation and high-dose tissue plasminogen activator was implemented with a suboptimal result.

Keywords COVID-19 • Pulmonary embolism • Deep vein thrombosis • Percutaneous thrombectomy • Case report

ESC Curriculum 9.5 Pulmonary thromboembolism • 9.6 Pulmonary hypertension

Learning points

- Coronavirus disease 2019 is a hypercoagulable state, and physicians should remain vigilant of thrombotic complications, especially deep vein thrombosis and pulmonary embolism (PE).
- Acute PE is a heterogenic condition with various treatment methods available.
- While guidelines direct management of acute PE in the general population, an individualized approach should be considered for every patient, considering all treatment options.

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Introduction

Since the first registered case of the Coronavirus disease 2019 (COVID-19) pandemic in December 2019, the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) caused the death of more than 1 million people worldwide.[1] The virus affects predominantly the respiratory system where the local inflammation and thrombotic microangiopathy disrupt haemostasis and 'unlock' a cascade of systemic prothrombotic interactions, causing thromboembolic complications in various vascular beds.[2,3] Venous thromboembolism (VTE) is the most common thrombotic complication of COVID-19. The registered incidence was 31.3% in a meta-analysis, with 19.8% for deep vein thrombosis (DVT) and 18.9% for pulmonary embolism (PE).[4] For patients admitted in ICU, vascular complications are especially high. Notably, in a study, the cumulative incidence of VTE (at 7, 14, and 21 days), was 26%, 47%, and 59% for ICU patients compared with 5.8%, 9.2%, and 9.2% for patients hospitalized on the wards.[5] In another cohort of patients, the incidence of VTE in ICU patients, who received thromboprophylaxis, was 27%, with 81% of the cases being PE.[6] Similar results were observed in 26 ICU patients treated with at least a prophylactic anticoagulant dose, with a cumulative rate of VTE of 69%.[7]

Timeline

Date	Events
19 February–10 March 2021	• COVID-19 infection with acute respiratory distress syndrome and bilateral pneumonia
20 March 2021	• Painful swelling of the left leg
22–25 March 2021	• Sudden-onset dyspnoea, pre-syncope, haemodynamic instability • CT pulmoangiography showing massive bilateral thrombotic masses in the pulmonary artery • Acute massive pulmonary embolism treated with catheter-directed thrombus defragmentation and supraselective thrombolysis (40 mg tPA) followed by systemic fibrinolysis (50 mg tPA)
25–30 March 2021	• The patient is with persistent dyspnoea and tachycardia • Control CT pulmoangiography demonstrates massive thrombotic masses with a 'saddle' thrombus at the bifurcation of the left pulmonary artery • Successful percutaneous pulmonary artery thrombectomy

Case report

A 57-year-old men with known obesity (weight 110 kg; BMI 38.1 kg/m2) and hypertension suffered from COVID-19 infection, which presented with acute respiratory distress syndrome and bilateral pneumonia. He was treated in a hospital for 20 days (7 days in the ICU). Treatment included high-volume oxygen supplementation, corticosteroids, remdesivir, supportive care, and low-molecular-weight heparin (LMWH)—enoxaparin 60 mg/subcutaneously (s.c.) two times daily while he was hospitalized. After discharge, he continued applying enoxaparin 60 mg/s.c./daily, recommended for 1 month. However, he started feeling a painful swelling in his left calf 10 days after his COVID ward discharge and was again admitted to the hospital 2 days later due to sudden onset dyspnoea, pre-syncope, and was hypotensive, with blood pressure (BP) of 90/60 mmHg. A computed tomography (CT) pulmoangiography showed bilateral massive thrombotic defects in the pulmonary artery. Echo-Doppler revealed DVT of the femoral and popliteal veins of his left leg. *Ad hoc*, per institution and operator discretion, catheter-directed therapy (CDT) was performed with bilateral mechanical thrombus defragmentation, using a 5 French (F) Pigtail catheter, and supraselective bolus application of 40 mg tissue plasminogen activator (tPA), in the form of alteplase. After the procedure was completed, in addition, 50 mg alteplase was applied as a 1 h systemic infusion. Continuous infusion with unfractionated heparin (UFH) was then started, uninterrupted for the remaining of his hospitalization. The patient stabilized haemodynamically, but in the next few days was persistently dyspnoic and tachycardic at rest, with a heart rate (HR) of 110–120 beats per minute (bpm). Three days after the procedure, the patient was transferred to our facility. Physical examination revealed bilateral lung crackles, muffled heart sounds with no murmurs, and swelling of the left calf. Vital signs were as follows: a BP of 120/70 mmHg, HR of 115 bpm, respiratory rate of 32 per minute, and saturation of 88% at room air. The electrocardiography (ECG) showed the S1Q3T3 pattern and negative T waves in V1–V3. Echocardiography (EchoCG) examination revealed preserved left ventricle (LV) size and systolic function, dilated right ventricle (RV) with RV/LV ratio >0.9, and indirectly measured systolic pulmonary artery pressure (SPAP) of 50–55 mmHg. Laboratory results were as follows: white blood cells—5.72 $\times$ 10^9, haemoglobin—128 G/l, platelets—303 $\times$ 10^9, creatinine–1.15 mmg/dL, hsTroponin I—163.1 mng/l (reference range 4.0–60.0), NT-proBNP—1183 pg/ml (35-125), D-dimer—14.3 (0–0.5 μg/ml), CRP—35.5 mg/l (0–5), arterial blood gas analysis–partial pressure of oxygen (O2)—30.5 mmHg, partial pressure of carbon dioxide—71 mmHg, O2 Saturation—87%. Computed tomography pulmoangiography (*Figure 1*) revealed persistent bilateral thrombotic defects with a massive 'saddle' thrombus at the bifurcation of the left pulmonary artery. After a multidisciplinary discussion, a decision was made to perform percutaneous thrombectomy using the Aspirex thrombectomy system (Straub Medical, Switzerland). The right common femoral vein was cannulated and a 10F introducer was used for the placement of the 10F Aspirex aspirational catheter in the left pulmonary artery (*Figure 2*). Several runs of thrombus aspiration were performed successfully, evacuating massive thrombotic masses (*Figure 3*). The procedure was uneventful

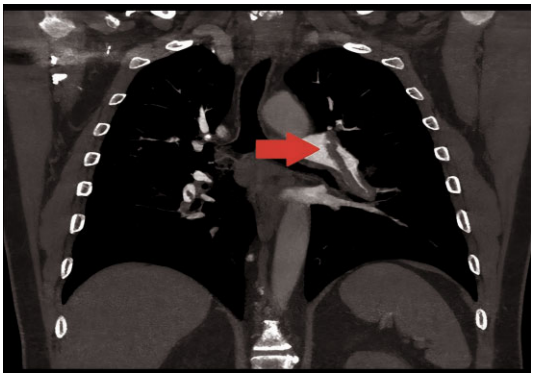

Figure 1 Computed tomography pulmoangiography showing bilateral thrombotic masses with massive 'saddle' thrombus (red arrow) at the bifurcation of the left pulmonary artery.

with an 'on the table' drop of the invasively measured SPAP from 68 to 47 mmHg, a decrease of the heart rate from 100 to 88 bpm, and immediate reduction of the patient's complaints of dyspnoea. The patient was treated with UFH for the first 24 h after the procedure, followed by rivaroxaban 15 mg two times daily for 21 days, and 20 mg/daily, recommended for a total of 6 months. He was discharged without any complications 5 days later. Three months after the incident, the patient is feeling well, his ECG shows no abnormalities, the EchoCG revealed an RV with normal size and function, and indirectly measured SPAP of 30 mmHg.

Discussion

The SARS-CoV-2 virus leads to severe pulmonary alveolar inflammation, local microangiopathy, and thrombosis. This may trigger a systemic hypercoagulable state, through complex inflammatory-thrombotic interactions, leading to thromboembolic events in different vascular basins, most commonly DVT and PE.[2–4] That is why

Figure 3 Thrombotic masses aspirated from the left pulmonary artery.

thromboprophylaxis is recommended for all hospitalized COVID-19 patients, mainly via LMWH.[8] Nevertheless, thrombotic complications remain high in patients treated with prophylactic and even therapeutic LMWH doses.[6,7] Most current recommendations do not support the continuation of the anticoagulant treatment after COVID ward discharge.[8] However, some patients, with high thrombotic risk, may continue theirs out of the hospital anticoagulant treatment with either a prophylactic dose of LMWH or 10 mg rivaroxaban daily.[8,9] Present-day PE management guidelines dictate using systemic fibrinolysis for the treatment of patients with high-risk PE, while intermediate

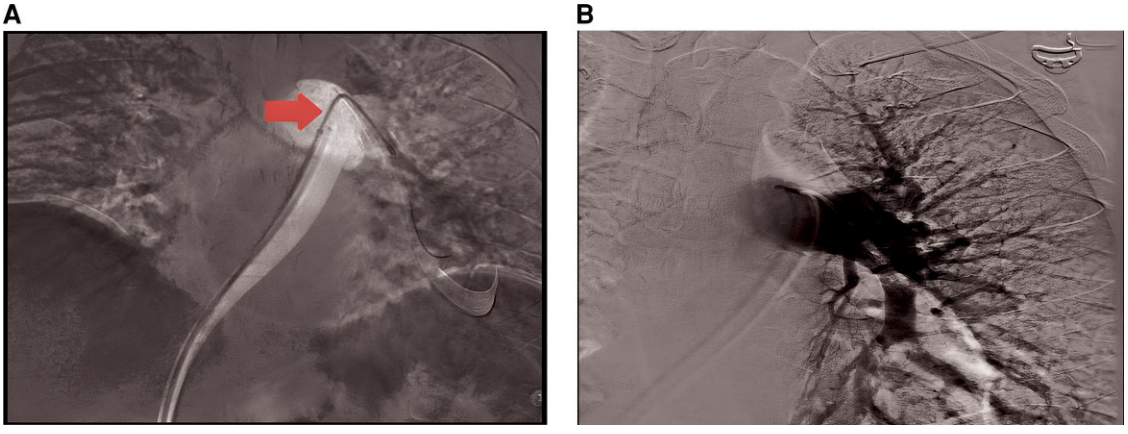

Figure 2 (*A*) Left-sided pulmonary artery thrombus aspiration using 10F Aspirex catheter. (*B*) Control pulmoangiography after several runs with the 10F thrombus aspiration catheter Aspirex—patent blood flow in the left pulmonary artery.

and low-risk patients are managed with anticoagulation only.[10] Still, a vast armamentarium of interventional devices is left as a second-line of treatment options, being recommended mostly when systemic thrombolysis fails or is contraindicated.[10,11] In terms of PE severity staging, our patient would fall in the intermediate–high-risk group (haemodynamically stable, positive laboratory and an instrumental constellation of RV dysfunction, Pulmonary Embolism Severity Index = 127) and anticoagulation treatment alone is supposed to be sufficient.[10] Nevertheless, with the patient having persistent complaints of dyspnoea and clear signs of right ventricular strain, our team felt that a more aggressive approach should be followed. Early in the discussion of the different management options systemic fibrinolysis was dismissed, because a high-dose tPA treatment was already applied with a suboptimal result. A decision was made to use the Aspirex percutaneous thrombectomy catheter, which was readily available and was successfully used to aspirate large thrombotic masses from the pulmonary vasculature, which led to stabilization of the patient's haemodynamics and reduction in the pulmonary artery pressure. This device was previously used in a single-centre experience for the treatment of 16 patients with acute massive PE with excellent results.[12] Our decision derived additional confidence from contemporary clinical trials data demonstrating the efficacy of various percutaneous thrombus aspiration devices for the management of patients with acute intermediate-risk PE.[13] In addition, other authors have already shared their experience with successful treatment of COVID-19-associated acute PE via percutaneous mechanical thrombectomy.[14,15]

Conclusions

COVID-19 is a highly prothrombotic state, with the most common vascular complications being DVT and PE. We demonstrated the efficacy of percutaneous pulmonary artery thrombectomy in a patient with acute COVID-19 associated PE.

Lead author biography

Professor Ivo Petrov is the Head of the Cardiology and Angiology Department of Acibadem City Clinic—Cardiovascular Center, Sofia, Bulgaria. Interested in all fields of interventional medicine—coronary heart disease, structural heart disease, peripheral artery disease, cerebrovascular disease, endovascular treatment of pulmonary embolism, and deep vein thrombosis.

Supplementary material

Supplementary material is available at European Heart Journal – Case Reports.

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Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as Supplementary data.

Consent: The authors confirm that written consent for submission of the case report including images and associated text has been obtained from the patient in line with COPE guidance.

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