Pulmonary artery thrombectomy – a life-saving treatment in a patient with presumed COVID-19 complicated by a massive pulmonary embolus

As new evidence emerges regarding the abnormal coagulation status in patients with novel coronavirus pneumonia (NCP), we are seeing more patients with venous thromboembolic (VTE) disease.1,2 Hypercoagulability is not solely responsible for this evolving phenomenon; the other two variables in Virchow’s triad, namely venous stasis and epithelial injury are also fulfilled as patients lie immobile for prolonged periods on the intensive care unit (ICU).3

New guidelines regarding thrombosis prevention and coagulopathy treatment have been published by Thrombosis UK to keep up with the ever changing management of patients with this unpredictable disease.4

Case report

We discuss a patient with massive pulmonary embolism (PE) and suspected coronavirus disease 2019 (COVID-19) with classic chest X-ray (CXR), computed tomography (CT)5 and clinical findings. A 58-year-old male presented to the emergency department by ambulance with a 9 day history of shortness of breath, non-productive cough and feeling generally unwell. He had been self-isolating for the last 10 days, denied foreign travel and had no known COVID-19 contacts. He lived with his wife who also reported less severe symptoms of cough and shortness of breath. He was previously fit and well and on no regular medication.

On examination he had increased work of breathing and was unable to speak in full sentences. His heart sounds were normal and his abdomen was soft. His calves were soft and he was unable to speak in full sentences. His heart sounds were normal and his abdomen was soft. His calves were soft and he was unable to speak in full sentences.

His white cell count was raised at 21 × 10⁹/l and neutrophil count of 18 × 10⁹/l with a lymphopaenia of 9 × 10⁹/l.

Hematological findings included an international normalised ratio (INR) 1.2, activated partial thromboplastin time (aPTT) 8 seconds and fibrinogen was raised at >10 g/l. His Hb was 9 g/l with a lymphopaenia of 9 × 10⁹/l.

A nasopharyngeal swab to isolate severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was negative. The patient was admitted into the ICU where he required non-invasive ventilation and a continuous infusion of 100% oxygen. On examination he had increased work of breathing and was unable to speak in full sentences. His heart sounds were normal and his abdomen was soft. His calves were soft and he was unable to speak in full sentences.

Keywords: COVID-19, paroxysmal nocturnal haemoglobinuria, complement activation, C5 inhibition

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patient had four subsequent swabs during his admission, all of which failed to detect the virus. No other respiratory viruses were isolated.

His CXR on admission (Fig 1) showed bilateral peripheral airspace opacifications, which are deemed classical findings according to British Society of Thoracic Imaging (BSTI) guidelines. The patient was intubated and ventilated and admitted to ICU.

The patient had a pulseless electrical activity cardiac arrest on ICU the next day. A bedside echocardiogram (ECG) showed dilated right cardiac chambers with intracardiac thrombus. Systemic thrombolysis was administered on ICU (100 mg of tissue plasminogen activator, tPA) failed to improve his haemodynamic status or blood oxygenation. At 20 h later, after further decline in both pulmonary gas exchange and haemodynamic stability, another ECG showed dilated right cardiac chambers and reduced radial function. He was discussed with haematology and interventional radiology, and a CT pulmonary angiogram (CTPA) was performed. This confirmed saddle embolus with large volume of clot burden within all the segmental pulmonary arteries and right heart strain (Fig 2). There were peripheral bilateral ground glass opacities, in keeping with classic COVID-19. The patient attended the interventional radiology suite for catheter-directed thrombectomy. At the start of the procedure his oxygen saturation was 93% on 100% oxygen and he had a tachycardia of 130 beats/min.

Ultrasound-guided access to the right common femoral vein was achieved. A Berenstein II catheter (Cordis, Miami, FL, USA) and hydrophilic Zipwire™ (Boston Scientific, Marlborough, MA, USA) were manipulated into the pulmonary trunk. The wire was exchanged for a 260-cm Amplatz supersoft wire and an 80-cm 10-F Flexor sheath (Cook Inc., Bloomington, IN, USA) was placed with its tip in the main pulmonary trunk. A pumped angiogram showed a saddle embolus with reduced enhancement of the peripheries of the lungs (Fig 3a). A 115-cm Penumbra Indigo® CAT8TORQ 8-F mechanical thrombectomy catheter (Penumbra Inc, Alameda, CA, USA) was then introduced into the sheath and manipulated into the lower lobe pulmonary arteries bilaterally to engage thrombus. A 60-ml luer lock syringe was attached to the end of the catheter and manual aspiration was performed several times to extract thrombus. During the procedure a bolus of 20 and 30 mg of tPA was administered into the right and left pulmonary arteries respectively.

During clot retrieval, the patient showed intermittent signs of improvement; at one point saturations improved to 95% but returned to pre-procedure levels again. Given a good angiographic result (Fig 3b) but static haemodynamic stability a decision was made to stop after 80 min. He had been on a transport ventilator for >2 h by this point and once back on ICU he was placed on a departmental ventilator and nursed in a prone position. Over the following hours and days his oxygenation and haemodynamic stability improved.

**Fig 1.** CXR showing bilateral peripheral mid and lower zone patchy airspace opacifications. These are classic COVID-19 findings according to the British Society of Thoracic Imaging.

**Fig 2.** (A) CTPA showed a saddle pulmonary embolus (arrows). Peripheral airspace consolidation is seen within the right upper lobe. There is a small right pleural effusion and some left lower lobe collapse. (B) There is bowing of the intraventricular septum (arrow heads) and a dilated right atrium, in keeping with right heart strain. (C) Complete resolution of saddle embolus. There is a small left pleural effusion and peripheral lung consolidation, in keeping with resolving NCP.
After a 14 day stay in ICU he was extubated and moved to ward-based care. A subsequent CTPA done 16 days after the procedure showed almost complete resolution of the pulmonary embolus (Fig 2).

Discussion

This case highlights the diagnosis of COVID-19 is not straightforward and confirmation cannot be relied on nasopharyngeal swab reverse transcriptase-polymerase chain reaction (RT-PCR) results alone. Although this test is very specific, the sensitivity has been reported as low as 60–70%, adding to the diagnostic challenge of NCP. During the outbreak in China, Chinese authorities broadened the official diagnostic criteria to include patients with typical findings on CT chest, indicating the importance of imaging as a diagnostic tool. We have adopted this in our institution due to the high number of false negatives.

Additionally, this case not only emphasises the increased VTE events associated with COVID-19 but also the severity of them. In both haematology and interventional radiology, our routine workload has altered and we need to be prepared to treat the complications of severe NCP alongside our intensive care colleagues. This case highlights that even if oxygen requirement or vital signs do not improve immediately after thrombectomy, it does not mean it is a futile procedure; quality of mechanical ventilation and patient positioning also have an impact on oxygenation and haemodynamic stability. In this case, percutaneous pharmaco-mechanical pulmonary artery embolectomy was a successful and life-saving treatment. We believe it should be offered to other patients with NCP-associated massive pulmonary emboli.

Take home points

- Relying solely on a positive PCR nasopharyngeal swab to diagnose COVID-19 will lead to incorrect patient management and may put members of staff at risk. Clinical and radiological features must be taken into account when diagnosing COVID-19 pneumonia.
- When standard therapies are unsuccessful in treating massive pulmonary emboli in haemodynamically unstable patients, catheter-directed thrombolysis and pulmonary artery thrombectomy can be a successful treatment in deteriorating patients and should always be considered.
- During the fight against COVID-19 clinicians need to be aware that managing these patients is complex and often requires input from multiple specialties; communication is key between intensivists, haematologists and interventional radiologists to ensure the COVID-19-positive patient is managed appropriately.

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Conflict of interest

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Immune thrombocytopenia flare with mild COVID-19 infection in pregnancy: A case report

Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) is the third zoonotic coronavirus to be identified in humans during the twenty-first century, after severe acute respiratory syndrome coronavirus (SARS-CoV) and Middle East respiratory syndrome coronavirus (MERS-CoV). The resultant disease, Coronavirus Disease 2019 (COVID-19), was first identified in December 2019 in Wuhan, Hubei province, China and rapidly evolved into a pandemic within months. In the UK, the first confirmed case was identified in late January 2020 and the first COVID-19-related death was recorded in March 2020. The clinical picture of COVID-19 ranges from asymptomatic infection to fatal pneumonia, with the latter caused by the ‘cytokine storm’ and the consequent acute respiratory distress syndrome (ARDS). Although SARS-CoV-2 affects the respiratory system primarily, gastrointestinal, genitourinary, nervous and cardiovascular systems’ affection was reported. The haematopoietic system is affected both quantitatively and qualitatively, with some of these changes, namely lymphocyte and platelet counts, bearing prognostic significance in the disease course.

Immune thrombocytopenia (ITP) is an autoimmune disease characterized by an isolated low platelet count (<100 x 10^9/l). The pathophysiology of ITP is complicated, with some aspects yet to be elucidated. Autoantibodies against platelet glycoproteins increase their destruction by macrophages and dendritic cells in the spleen and liver, and decrease their production by megakaryocytes. The initial trigger for the production of autoantibodies remains unknown and about 50% of patients lack these autoantibodies. An abnormal Th1/Th2 ratio, with skew towards the Th1 phenotype, and higher levels of Th17, Th22 and splenic follicular Th cells contribute to the autoimmunity. In addition, increased numbers of CD8 T cells and reduced numbers of Treg cells also play a role. Herein, we present a case of a pregnant patient known to have ITP, who sustained a flare after being diagnosed with COVID-19.

A 34-year-old lady, pregnant in the second trimester (20/40 weeks; gravida 2 para 1), and known to have ITP since 2013, presented to the A & E department in our hospital with a one-day history of dry cough, fever, petechiae and gum bleeding. The patient had no other comorbidities and reported no recent change in her medications. Physical examination showed no other bleeding manifestations or respiratory symptoms, with no cardiological or abdominal findings, apart from the known gestation. An initial full blood count (FBC) was remarkable for a platelet count of 9 x 10^9/l (normal range 150–450 x 10^9/l). The rest of her blood analyses, including renal and hepatic profiles, C-reactive protein, D-dimer and clotting screen (prothrombin and activated partial thromboplastin times, and fibrinogen level) were all unremarkable. A blood film did not show red cell fragments. A nasopharyngeal swab for SARS-CoV-2 PCR was taken on admission, and was later found to be positive. A working diagnosis of ITP flare was instated. Given the active bleeding, she was admitted and started on intravenous immunoglobulins (IVIG, 1 g/kg of body weight) and oral prednisolone (1 mg/kg of body weight). Respiratory symptoms and fever were managed conservatively, without the need for supplemental oxygen. On the next day of her admission (Day 1), the patient reported improvement in bleeding from her gums and no new petechiae. A repeat FBC revealed an increase in the platelet count to 34 x 10^9/l and subsequently the IVIG and prednisolone were both stopped. A drop in lymphocyte count to 1.2 x 10^9/l (normal range 1.5–4 x 10^9/l) was also noted. Day 2 showed further improvement in platelet count to 64 x 10^9/l. Based on the clinical improvement and the

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