Received: 6 September 2021 | Accepted: 22 September 2021

DOI: 10.1002/rcr2.861

CASE REPORT

Respirology Case Reports OPEN ACCESS APSR WILEY

A case of massive saddle pulmonary embolism and benign tracheal stenosis in a patient with COVID-19 infection

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Associate Editor: Semra Bilaceroglu

Abstract

Since December 2019, the novel coronavirus disease 2019 (COVID-19) outbreak that started in Wuhan, China, has become a global pandemic affecting millions of people around the globe. These patients are prone to a number of complications either related to their disease or to the different treatment modalities. Pulmonary embolism (PE) and benign post-intubation tracheal stenosis (BTS) are among these complications. In this study, we report the case of a patient with a recent COVID-19 infection that got complicated by a massive PE as well as a BTS.

KEYWORDS

COVID-19, infection, pulmonary embolism, saddle, tracheal stenosis

INTRODUCTION

Since December 2019, the novel coronavirus disease 2019 (COVID-19) outbreak that started in Wuhan, China, has become a pandemic affecting millions of people around the globe. These patients are prone to a number of complications either related to their disease or to the different treatment modalities. Pulmonary embolism (PE) and benign post-intubation tracheal stenosis (BTS) are among these complications. In this study, we report the case of a patient with a recent COVID-19 infection that got complicated by a massive PE as well as a BTS.

CASE REPORT

A 56-year-old non-smoker female patient with a body mass index (BMI) of 31.25 kg/m^2 presented to our medical centre in respiratory failure after 14 days of being diagnosed with a COVID-19 infection. On admission, the patient was in respiratory distress, using her accessory respiratory muscles. Her oxygen saturation was 60%–62% on room air. Otherwise, she was haemodynamically stable.

After being put on supplemental oxygen via a heated high-flow nasal cannula with an fraction of inspired oxygen (FiO_2) of 90% and a flow of 60 L/min, an urgent high-dose contrast-enhanced computed tomography (CT) showed the following: (1) A saddle PE involving the right and left main pulmonary arteries with multiple large filling defects involving the right upper, right middle, right lower and left lower pulmonary arteries and their segmental branches (Figure 1). (2) Bilateral multilobar patchy ground-glass opacities and consolidations, typical for COVID-19 pneumonia.

She then became haemodynamically unstable and more hypoxic. An urgent, difficult intubation was done and an invasive mechanical ventilation and vasopressors were started. The patient received one dose of intravenous alteplase 100 mg, was started on enoxaparin 1 mg/kg twice daily subcutaneously and was transferred to the intensive care unit (ICU). Her ICU stay was complicated by a ventilator-associated pneumonia due to a sensitive *Serratia marcescens*. She was successfully extubated after 10 days of mechanical ventilation.

Two days later, the patient developed a new dyspnoea and stridor without desaturation or signs of respiratory distress. A flexible bronchoscopy was done to investigate the symptoms. The procedure showed a necrotic tracheal mucosal flap occluding approximately 90% of the lumen with traumatic abrasion of the anterior tracheal mucosa (Figure 2). The traumatic area started around 2.5 cm below the vocal cords and extended to a length of 3.5 cm downwards. The necrotic mucosa was completely removed using the cryoprobe as well as the biopsy forceps (Figure 3). The reminder of the trachea-bronchial tree

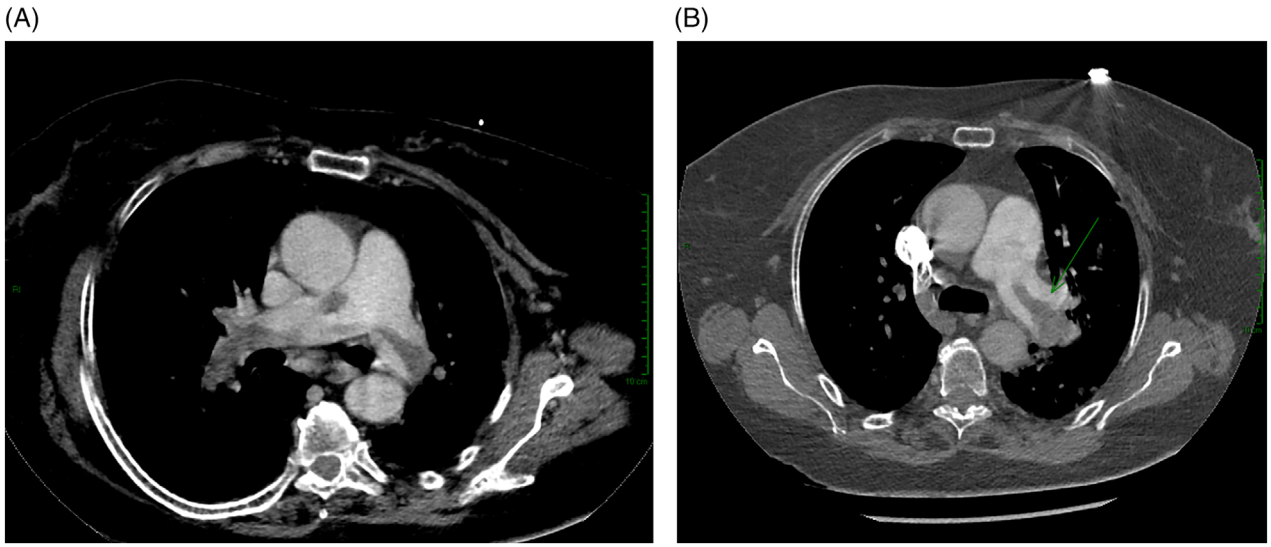

FIGURE 1 (A) Axial contrast-enhanced computed tomography (CECT) image showing a saddle pulmonary embolism in the right and left pulmonary arteries and seen extending into the right interlobar and segmental arteries. (B) Axial CECT showing a large filling defect in the left main pulmonary artery (indicated by the arrow)

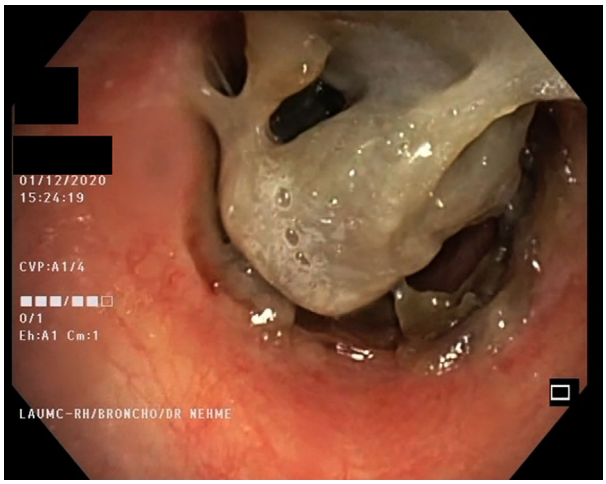

FIGURE 2 Necrotic tracheal mucosal flap occluding approximately 90% of the tracheal lumen

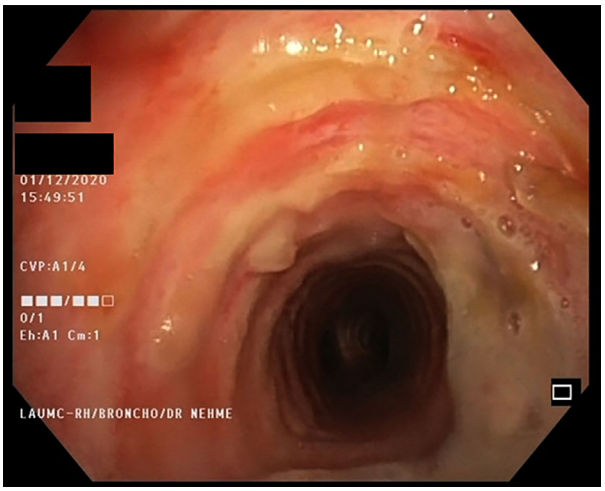

FIGURE 3 Normal tracheal lumen diameter at the end of the procedure

was normal. The procedure was very well tolerated by the patient and the stridor disappeared afterwards. She was successfully discharged from the hospital on room air a few days later while being completely asymptomatic.

DISCUSSION

Millions of people have been affected by the COVID-19 pandemic. Reports suggest that among those infected with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), up to 20% develop severe disease requiring hospitalization.[1–3] Almost one quarter of them might require ICU admission, representing approximately 5%–8% of the total patient population.[3] These patients are prone to a number of complications including, but not limited to, acute respiratory distress syndrome, PE and post-intubation BTS. To the best of our knowledge, this is the first case in the literature of a COVID-19 patient complicated by a massive PE followed by a post-intubation traumatic BTS during the same admission.

Patients with SARS-CoV-2 infection often have hypercoagulable states that lead to different types of coagulation problems. Although its pathogenesis is not fully understood, it is clear that these patients have multiple derangements in Virchow's triad. First, an elevated level of circulating prothrombotic factors such as factor VIII, fibrinogen, circulating prothrombotic microparticles and neutrophil extracellular traps

has been reported in multiple studies.[4,5] Second, endothelial injury occurs via direct invasion by the virus of endothelial cells, cytokines like interleukin-6 and intravascular venous and arterial catheters.[6,7] Lastly, being confined to bed favours stasis, as is the state of all hospitalized critically ill patients. These factors contribute to the microvascular as well as the thromboembolic events seen in SARS-CoV-2 patients. Taking into consideration the relatively high incidence of PE especially in patients requiring ICU admission, CT pulmonary angiogram and/or lower limbs Doppler ultrasonography are frequently used during the initial assessment of these severe patients,[8] which was the diagnostic approach taken in our patient when her clinical state deteriorated. As with any patient presenting with a massive PE, COVID-19 pneumonia patients complicated by massive PE are managed with thrombolytics followed by a therapeutic anticoagulation for an approximate 3-month period.[9]

BTS is defined as a non-malignant disease process resulting in narrowing of the trachea and main stem bronchi. The narrowing of the airway can occur either through intraluminal obstruction of the airway, by extrinsic compression of the airway, or because of malacia. Intraluminal benign stenosis is divided into simple stenosis consisting of web-like often circumferential process measuring less than 1 cm; complex stenosis with irregular shape measuring longer than 1 cm; and finally as in our patient, pseudomembranous stenosis often resulting from an acute direct trauma to the tracheal mucosa during an intubation attempt. BTS usually occurs 1–6 weeks after extubation, and presents with symptoms such as stridor, dyspnoea, cough, cyanosis and recurrent pneumonia.[10] Stridor manifests at approximately 25%–30% narrowing of the tracheal diameter, while dyspnoea occurs at 50% of narrowing. The incidence rate of post-intubation BTS is estimated to range between 4.6% and 21%.[11,12] Intubated patients with COVID-19 pneumonias have almost double the risk of developing tracheal damage and respiratory complications compared to non-COVID-19 ICU patients.[13] Risk factors for BTS include traumatic endotracheal intubation, prolonged intubation attempt for more than 10 min, excessive airway manipulation, a prolonged intubation period and use of low-volume high-pressure cuff endotracheal tube. Patient-based risk factors are female gender, overweight plus category (BMI ≥ 26.5 kg/m^2), known airway deformities or anatomical variances (e.g., a high Mallampati class), trauma patients and self-extubation.[14–17] It has been shown that in patients with difficult intubation, following a set of guidelines, such as the presence of a trained airway team, a shared mental model and planning and communication throughout airway management, reduces the incidence of intubation-related complications.[18] Our patient has five of these risk factors by being an obese female and having a Mallampati class 3, a difficult traumatic intubation attempt and a prolonged intubation period of 10 days.

Bronchoscopy's role in the management of BTS is of high importance especially due to its relatively low invasiveness in comparison to surgical interventions. In addition to its therapeutic role, it is also used for confirming the diagnosis as well as ruling out other diseases such as tracheomalacia and vocal cord palsy.[19] Mechanical debulking with removal of the occluding tissue and/or mechanical dilatation using the rigid bronchoscope or a dilatation balloon are initially used as a therapeutic approach. Other therapeutic techniques such as argon plasma coagulation, laser therapy and cryotherapy can also be useful for re-establishing the tracheal lumen. Risks of airway perforation leading to pneumothorax or pneumomediastinum, along with injury to intrathoracic blood vessels, remain the major complications. Removable stent implantation is also one of the therapeutic options. Silicone stents are preferred over metallic stents for being easy to manipulate and relatively inexpensive. Metallic stents usage for benign tracheal stenosis is controversial because they can be more difficult to remove once they get imbedded into the tracheal mucosa. When endoscopic treatments fail, a surgical approach like tracheal sleeve resection with end-to-end anastomosis is used. In our patient, mechanical debulking was done using the cryoprobe and the biopsy forceps with successful removal of the necrotic pseudomembrane forming tracheal mucosa and successful restoration of the tracheal lumen. In cases of pseudomembrane-related tracheal stenosis, removal of the pseudomembranes often achieves a good result without the need for stent placement.

CONFLICT OF INTEREST

None declared.

AUTHOR CONTRIBUTION

Ralph Nehme (pulmonary and critical care physician) was the patient's attending physician. Mohamad Fleifel (internal medicine resident, co-author of the article) was part of the team taking care of the patient during her admission. Melissa Abou Khalil and Ali Al Dailaty (internal medicine residents) were part of the team taking care of the patient during her admission and were involved in the writing and editing of the article.

ETHICS STATEMENT

The authors declare that appropriate written informed consent was obtained for the publication of this case report and accompanying images.

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How to cite this article: Nehme R, Fleifel M, Abou Khalil M, Al Dailaty A. A case of massive saddle pulmonary embolism and benign tracheal stenosis in a patient with COVID-19 infection. Respirology Case Reports. 2021;9:e0861. https://doi.org/10.1002/rcr2.861