

Pulmonary pseudoaneurysm presented as a lung nodule after recovering from Covid-19 pneumonia

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Abstract

Pulmonary pseudoaneurysms (PAPs) are an uncommon complication of severe acute respiratory syndrome coronavirus 2 infection, although they are a potentially life-threatening condition. We present this interesting condition of severe coronavirus disease 2019 (Covid-19) pneumonia. The patient presented with abnormal lung nodule and developed massive haemoptysis after recovering from Covid-19 pneumonia. PAP was diagnosed by computed tomography angiography. Endovascular embolization was performed and the bleeding was stopped.

KEYWORDS

Covid-19, embolization, haemoptysis, pulmonary pseudoaneurysm

INTRODUCTION

Pulmonary pseudoaneurysms (PAPs) are rare with a high mortality rate.¹ PAPs are defined as the focal dilatation of a segment of pulmonary artery which histologically involves only the outer layers of the arterial wall (the media and adventitia).² Common clinical presentations of PAPs include cough and haemoptysis. Massive haemoptysis may occur after the rupture of PAPs and is associated with a high mortality rate of over 50%.³ The aetiology of PAPs may be idiopathic or related to traumatic injury, fungal infections (mycotic aneurysms) and tuberculosis (Rasmussen aneurysm), primary or metastatic lung neoplasm, pulmonary hypertension or vasculitis.¹

Coronavirus disease 2019 (Covid-19) is a viral disease induced by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Covid-19 has been strongly linked to diffuse alveolar damage and associated vasculopathy, which manifests with venous or arterial thromboembolism, or vasculitis.⁴ However, massive haemoptysis and accidental finding with PAPs are uncommon manifestations of Covid-19 but constitute fatal complications. Early detection and treatment are crucial to improving outcomes.⁵⁻⁷

We presented the interesting sequelae of severe Covid-19 pneumonia. The patient presented an abnormal lung nodule after recovering from the disease. Computed

tomography (CT) angiogram was performed to confirm the diagnosis, revealing PAP. Unfortunately, the patient developed massive haemoptysis and underwent emergency embolization. Coil embolization was performed successfully to stop bleeding and completely occluded the saccular aneurysm.

CASE REPORT

A 65-year-old female with a history of hypertension and end-stage renal disease underwent intermittent haemodialysis three times weekly. She was hospitalized due to severe Covid-19 pneumonia, which was confirmed by nasopharyngeal reverse transcription-polymerase chain reaction (RT-PCR) for SARS-CoV-2. She initially presented at the emergency department with acute fever and history of close contact to patients with Covid-19. On the first day of admission, an initial chest radiography was performed without infiltration (Figure 1A). During hospitalization, she developed progressive dyspnoea and severe hypoxaemia on the seventh day of admission. Her chest radiography illustrated bilateral alveolar infiltration (Figure 1B). She was transferred to the intensive care unit (ICU) and ventilated with high-flow nasal cannula and needed fraction of inspired oxygen (FiO₂) 80% to maintain her oxygen saturation at 94%. She

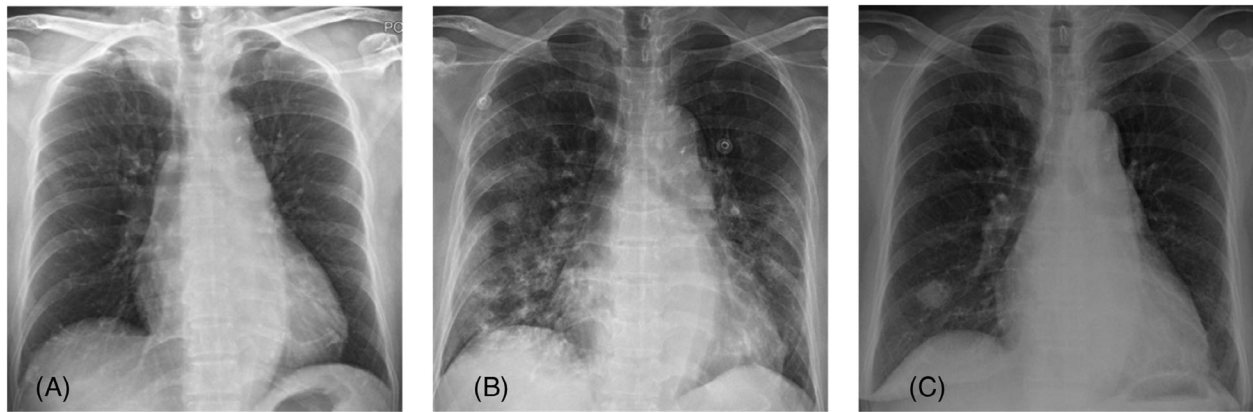


FIGURE 1 (A) On the first day of admission, initial chest radiography was performed without infiltration. (B) On the seventh day of admission, chest radiography showed bilateral alveolar infiltration, predominant at the lower and peripheral area. (C) Round circumscribed lung nodule at right lower lung area with minimal reticulation in both lungs 12 weeks after Covid-19 was detected.

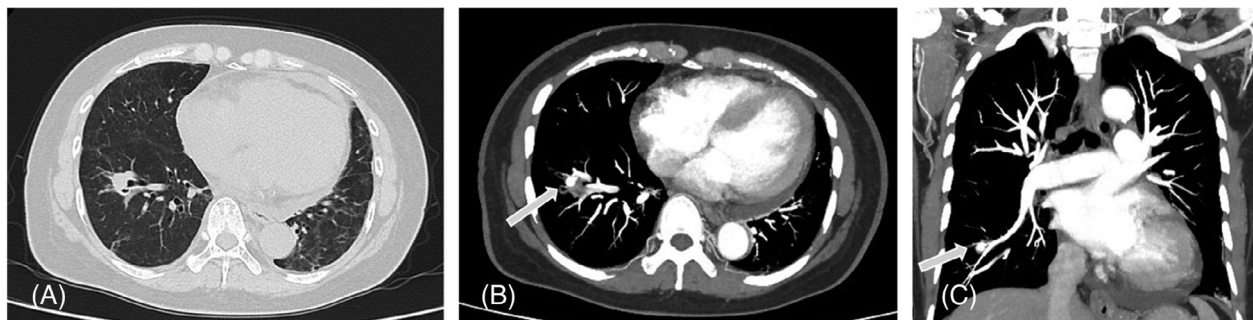


FIGURE 2 (A) Computed tomography lung window shows nodule in the right lower lung with reticular infiltration of both lungs. (B) Computed tomography angiogram (CTA) in axial view shows 1.3×2.3 cm pseudoaneurysm of anterior basal segment of the right lower lobe subsegmental pulmonary artery (arrow). (C) CTA in coronal view.

received intravenous remdesivir as an antiviral drug and was concomitantly treated with anti-inflammatory modulating agents, consisting of methylprednisolone for 3 days, and then corticosteroids, anti-interleukin 6 (tocilizumab) and haemoperfusion for cytokine removal. Subcutaneous heparin was given for thrombosis prophylaxis. After 10 days in the ICU, her clinical and oxygenation gradually improved and she was weaned off supplementary oxygen and slightly decreased steroid dosage. During the hospitalization (17 days after the virus was detected), she noticed that her right leg was gradually swelling. She received a diagnosis of acute on-top chronic deep vein thrombosis at the right superior femoral vein by CT venography and was prescribed direct oral anticoagulants (DOACs) instead of heparin. A rehabilitation programme was initiated, and she was discharged after 45 days of hospitalization with anticoagulant but without the need for additional oxygen.

Twelve weeks after the Covid-19 pneumonia, she visited the 'post Covid-19 outpatient clinic' and had marginally improved. She exhibited no previous symptoms except post-exertional malaise. RT-PCR was performed with negative result. Chest radiography follow-up illustrated a small nodule of 2.0×2.2 cm in size at the right lower lung zone

with bilateral reticulation (Figure 1C). CT angiography (CTA) was performed showing a new PAP at the antero-basal segment branch or right lower lung without lung parenchymal lesion (Figure 2). She had a thoracic CT scan 1 year ago showing no evidence of aneurysm. Moreover, other causes of vasculitis were excluded with negative results of an autoimmune panel, fungal culture and bacterial sputum culture. She had not had any history of trauma or vasculitis symptoms. DOACs were stopped at the same time. An interventional radiologist planned for endovascular embolization. Unfortunately, she developed haemoptysis and was intubated before the appointment date. She underwent emergency embolization after receiving initial resuscitation. Pulmonary artery angiography was performed using the right common femoral vein access. Selective catheterization of the right lower lung segmental branch was performed with arteriogram; following administration of contrast, it showed a saccular aneurysm at the right anterior basal segmental artery (size 8.9 mm in height, 7.9 mm in width). Our radiology team was confident that the bleeding had arisen from this pseudoaneurysm. Later, this vessel was embolized using coils. Postembolization showed complete occlusion of the

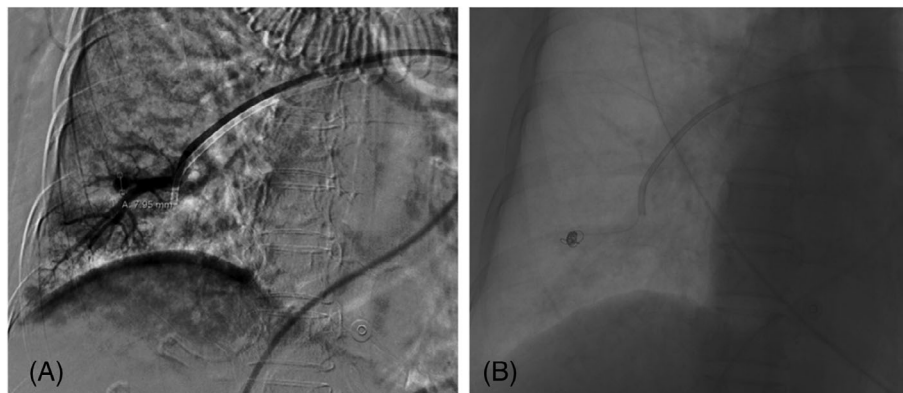


FIGURE 3 (A) Angiogram obtained when contrast material was injected through the catheter. Focal outpouching lesion was found at the anterior basal branch of the right lower lobe pulmonary artery. (B) Coil embolization was performed successfully.

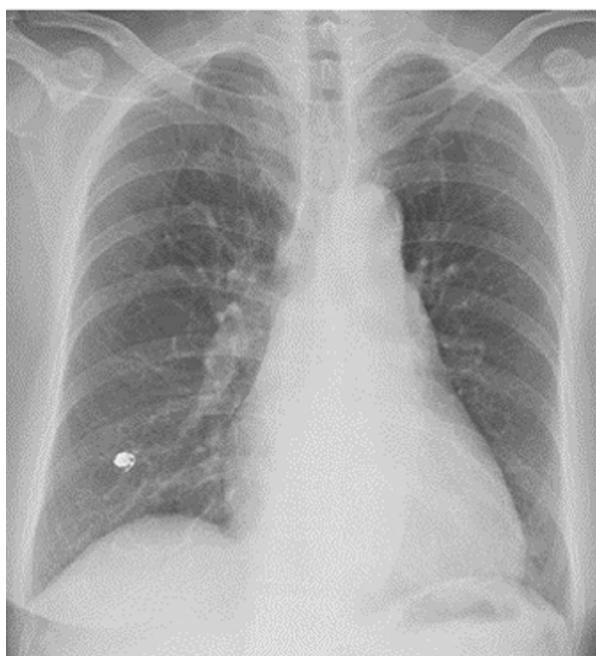


FIGURE 4 Chest radiograph shows resolution of pseudoaneurysm.

saccular aneurysm (Figure 3). The patient was extubated 1 day after the embolization. A follow-up chest radiography showed improved lung nodule and alveolar infiltration (Figure 4).

DISCUSSION

The clinical presentation of PAPs varies, ranging from no symptoms to massive, life-threatening haemoptysis.² PAPs may be congenital or acquired, and the most common causes of acquired PAPs are infection. Historically, tuberculosis and syphilis were the most common aetiologies of infectious-related PAP, both of which have dramatically reduced in prevalence during the post-antibiotic era.¹ A

Rasmussen aneurysm is a PAP caused by a contiguous tuberculous cavern. The vessel wall is destroyed and replaced by granulation tissue, resulting in segmental dilatation.^{2,5} In addition, several cases have reported PAPs due to endovascular seeding from septic emboli associated with confirmed infective endocarditis cases.^{1,3,8}

PAPs can be detected on standard chest x-ray as round, well-circumscribed nodules. Pulmonary angiography is the gold standard for diagnosis. However, in addition to being invasive, it provides only intraluminal imaging with little information of surrounding lung parenchyma and is no longer used for initial investigation. CTA is currently the investigation of choice in which a focal dilatation of a branch of pulmonary artery is performed.^{2,5} It can also detect peripheral PAPs for which a pulmonary angiography alone cannot be used due to the presence of thrombus or slow blood flow inside the PAPs.^{2,9} The current treatment for PAPs involves endovascular occlusion of the feeding vessel using coils, plugs or stents. Both proximal and distal vessels to the PAPs should be occluded.^{2,10}

Covid-19 has been strongly linked to diffuse alveolar damage and associated vasculopathy, manifesting with venous or arterial thromboembolism, or vasculitis.⁴ The exact pathophysiological mechanisms of the formation of pseudoaneurysm among patients with Covid-19 remain controversial. Several studies have reported PAPs presented by massive haemoptysis in severe Covid-19 pneumonia. Two cases reported PAPs associated with extensive lung lesion with cavity or pneumatocele,^{5,6} while another case reported 8-month delayed PAPs.⁷ Embolization was performed successfully in all cases. The pathogenesis of PAPs was proposed in three basic components: proinflammatory with endothelial damage, immune-thrombogenic and cavity with adjacent direct injury.⁶

In conclusion, PAPs are rare but potentially fatal cause of haemoptysis. Early detection and treatment are crucial to improve outcomes. Based on the findings of our case, we would like to increase awareness of PAPs among patients with severe pneumonia as a result of Covid-19.

ACKNOWLEDGMENTS

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CONFLICT OF INTEREST

None declared.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

ETHICS STATEMENT

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

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