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CASE REPORT Open Access

Covid-19-related pulmonary artery pseudoaneurysm managed with endovascular intervention

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Abstract

Background Pulmonary pseudoaneurysm (PAP) is a fatal complication of severe acute respiratory syndrome caused by coronavirus 2 infections in the lungs. Other causative agent such as fungal and tubercular also responsible for this entity. Early detection and treatment can save a patient's life.

Case presentation Here we describe a case of a left pulmonary artery pseudo aneurysm in a 54-year-old patient with COVID-19 pneumonia who presented with massive hemoptysis and which was treated with endovascular embolization.

Conclusion It is caused by vasculopathy due to immunosuppression /immune dysregulation in COVID-19. Minimally invasive endovascular embolization of pseudoaneurysm carries less mortality and morbidity.

Keywords Pseudoaneurysm, Pulmonary, Hemoptysis

Background

Pulmonary artery pseudoaneurysms (PAP) are a rare occurrence. They have a high tendency to rupture and cause massive hemoptysis with a high mortality rate if left untreated. Infection remains the leading acquired cause of pseudoaneurysm formation with a strong association with tuberculosis (Rasmussen's Aneurysm), although incidence has decreased with effective antibiotic therapy [1, 2]. In the current era, most cases of pulmonary artery pseudoaneurysm are related to trauma or iatrogenic causes for example post biopsy, pulmonary artery catheterization and lobectomy [1, 3]. COVID-19-related PAP is very rare with only a few cases so far being reported in the literature [4–6].

Case presentation

A 54-year-old male presented with complaints of fever, headache, shortness of breath, and chest pain for 10 days. He was a chronic smoker with a history of multiple comorbidities i.e. diabetes mellitus, hypertension, coronary artery disease, and chronic kidney disease with post-renal transplant status. No previous history of pulmonary TB or other lung infections. On examination his sensorium was good. BP was 158/96 mmHg on antihypertensive drug. The respiration rate was 20 per minute. The pulse rate was 78 per minute. Routine blood investigation was normal except for a raised erythrocyte sedimentation rate (>48 mm/hr). Hb level was 14.9 gm/dl. Lymphocytes were borderline. He was positive for RT-PCR SARS-CoV-2. The patient was put on BiPAP because of decreased SpO_2. Intravenous remdesivir and prednisolone were administered in addition to supportive care. The patient showed gradual improvement, was weaned off low-flow nasal prongs, and discharged on

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oxygen supplementation afterward. After 15 days patient developed a cough, high-grade fever, and massive hemoptysis with a 2 g/dl drop in hemoglobin level (12.9 gm/dl). The respiration rate was 30 per minute. The pulse was 92 per minute. BP was 140/90 mm HG. The chest radiograph (Fig. 1) showed patchy areas of consolidation in both lobes with lower zone predominance. NCCT chest (Fig. 2a) showed a cavitary lesion in the left lower lobe with internal hyperdense contents, consolidation, and air foci (arrow). CECT arterial (Fig. 2b) and venous (Fig. 2c) phase images reveal a pseudo aneurysm (arrows). Post-COVID-19/ infective changes were seen as interlobular septal thickenings, ground glass opacities, and traction bronchiectasis (arrow in 2d). Necrotizing pneumonia, invasive fungal infection, septic embolism, bronchiectasis, and arteriovenous malformations are other imaging differential diagnoses.

Therapeutic procedure/Technique: The patient was shifted to the intervention radiology suite for pseudoaneurysm embolization. The procedure was done under general anesthesia. The right femoral vein was accessed and the 8F vascular sheath was secured. Using a 100 cm long 5Fr MPA catheter (Cook Medical Bloomington, Indiana, USA) and soft curved tip guide wire (Radiofocus, Terumo Corporation, Tokyo, Japan), the left pulmonary artery was cannulated. Digital subtraction angiography revealed a round pseudoaneurysm (yellow arrow in Fig. 3b) with a small feeding vessel from the segmental branch (red arrow in Fig. 3) of the lower lobe pulmonary artery. With an 80 cm long 6Fr introducer sheath (arrowhead in Fig. 3) (Flexor Check-Flo, Cook Medical, Bloomington, Indiana, USA) placed in the lower lobe pulmonary artery, the feeding artery was cannulated with a 130 cm long 2.7Fr microcatheter system (Progreat, Terumo Corporation, Tokyo, Japan) (arrow in Fig. 3). Further microcatheter was advanced to aneurysm (curved arrow in Fig. 3c). Liquid embolic agent N-butyl-2 cyanoacrylate (NBCA) was chosen as the embolic agent and 0.6 ml of NBCA: Ethiodized oil (Lipiodol Guerbet LLC, Villepente France) in a 1:1 ratio or 50% was injected to embolize the pseudoaneurysm with a prior 5% Dextrose flushes. Post embolization there was no contrast opacification of pseudoaneurysm suggesting complete occlusion (Fig. 3d). During his stay in the intensive care unit, the patient's general condition improved. There were no further episodes of hemoptysis and was discharged in stable condition. The patient improved with symptomatic care. On follow-up, no further chest-related complaint was observed. KOH mount was negative for fungal.

Discussion

Pulmonary and extrapulmonary vascular dysfunction due to COVID-19 along with pulmonary immunothrombosis (also termed pulmonary intravascular coagulation) as seen in severe COVID-19 are thought to contribute to pseudoaneurysm formation. In addition, SARS-CoV-2 has been directly related to inflammatory and vasculitic processes affecting pulmonary vasculature, coronary arteries, cutaneous arteries, and Kawasaki vasculitis-like phenomenon [7, 8]. Other than that high risk of opportunistic bacterial and invasive fungal infections like mucormycosis in COVID-19 patients puts these patients at high risk of pseudoaneurysm formation [9].

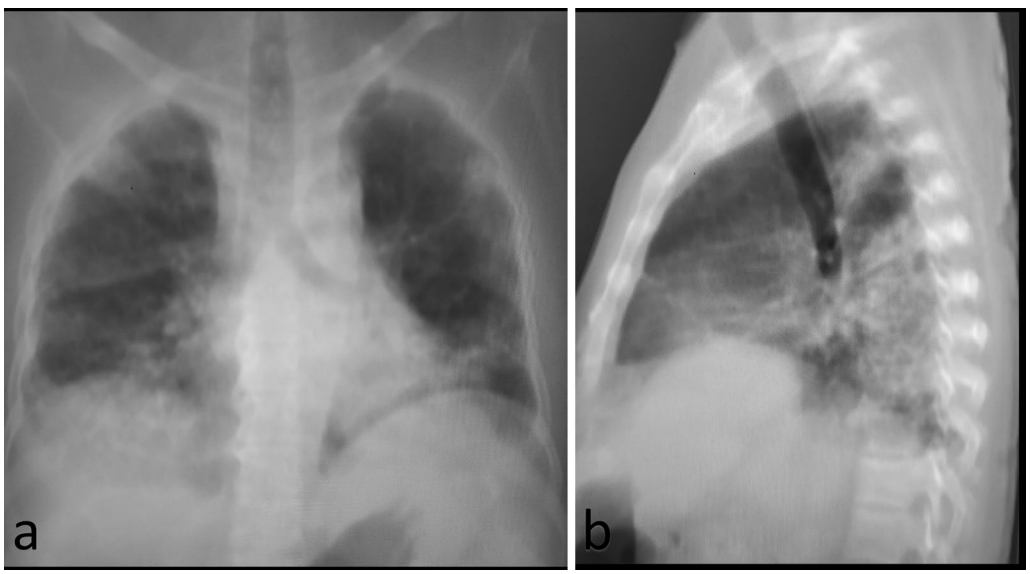

Fig. 1 (Chest Radiograph) AP (**a**) and Lateral (**b**) views show patchy areas of consolidation in both lobes with lower zone predominance

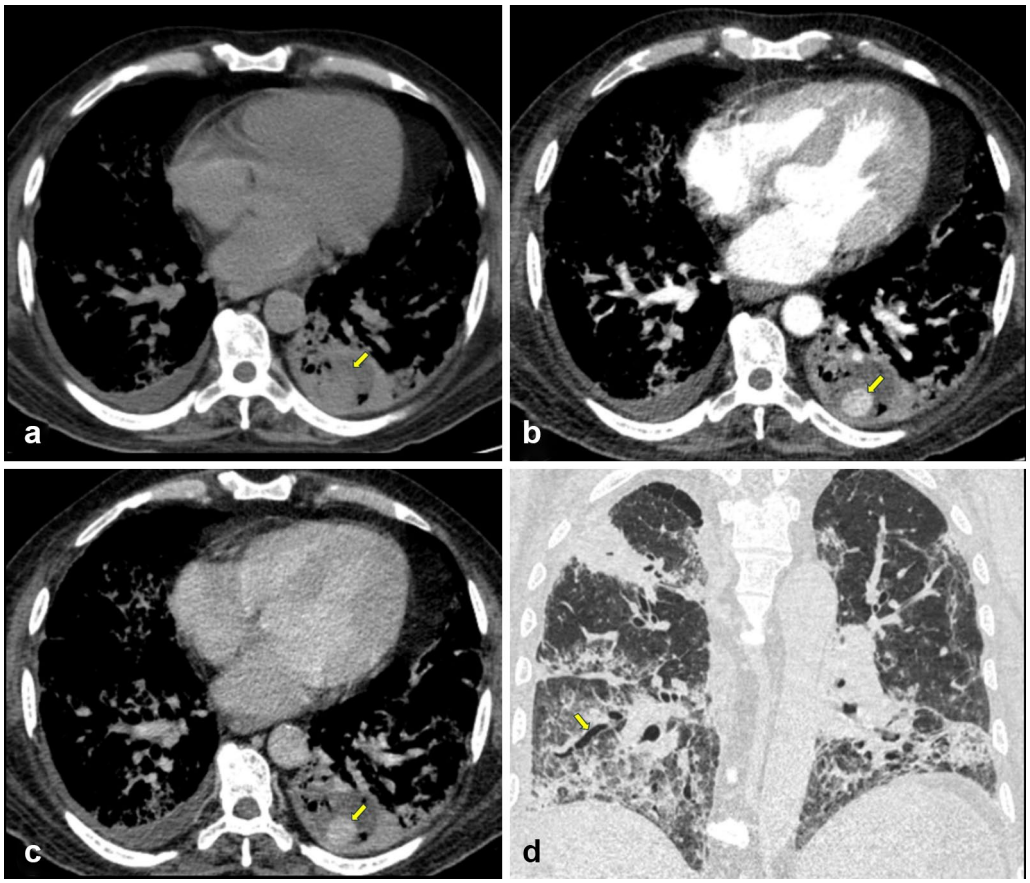

Fig. 2 (Multiphase CT): NCCT **a** shows a cavitatory lesion in the left lower lobe with internal hyperdense contents and air foci (arrow). Arterial (**b**) and venous (**c**) phase post-contrast images show pseudoaneurysm (arrows) associated with the cavitatory lesion. Lung window (**d**) showing post-COVID-19 changes in the form of septal thickening, ground glass opacities, and traction bronchiectasis (arrow)

Due to sparse clinical experience, there are no clear guidelines for the management of PAP. Treatment strategies include either open surgery or endovascular treatment. Some authors advise conservative management of small pseudoaneurysms with mandatory regular CT scans [10]. Open surgical techniques used for the treatment of PAP are lobectomy, segmental resection, aneurysmectomy, or pneumonectomy. Endovascular embolization of PAP is a less invasive alternative. It uses coils, gel foam, detachable balloons, glue, or vascular plugs and has a good clinical and technical success rate. Coils may be deployed inside the aneurysm sac to allow thrombus formation or they are placed in the parent artery proximal and distal to the aneurysm to 'trap' it. Some authors believe that deploying coils with the aneurysm sac may lead to rupture and acute hemorrhage [6, 11]. In our case, the feeding artery was selectively cannulated with a microcatheter, and embolization with N-butyl-2 cyanoacrylate (glue) was done. Selective embolization with coils or glue results in less parenchymal loss and decreases intraoperative complications as compared to open surgical resection or large artery occlusion. Our patient had no further episodes of hemoptysis and was discharged in stable condition.

Conclusion

There is limited clinical data to suggest a causative relationship between COVID-19 and PAP. It may be related to vasculopathy associated with COVID-19 or associated with superadded angioinvasive fungal infection due to immunosuppression /immune dysregulation in COVID-19. Minimally invasive endovascular embolization of pseudoaneurysm carries less mortality and morbidity.

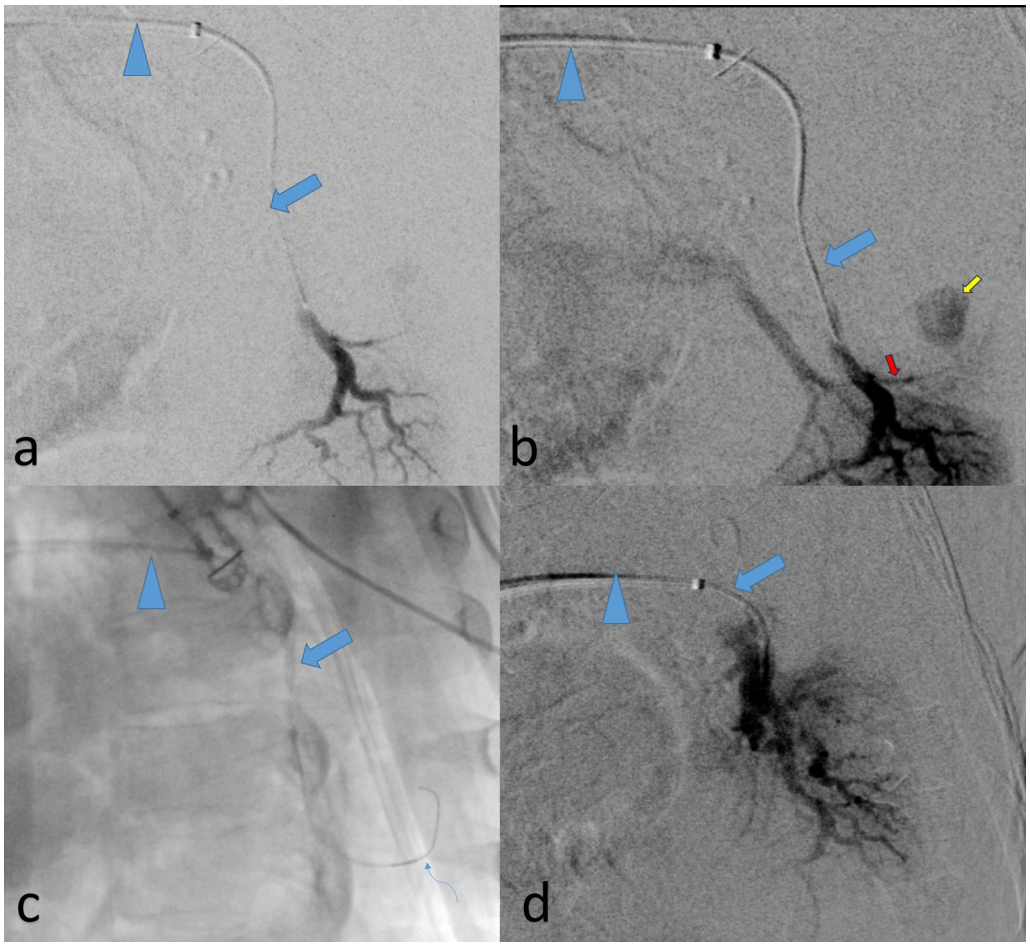

Fig. 3 (Digital Subtraction Angiography): Early arterial (**a**) and delayed arteriovenous phase (**b**) of the left lower lobe segmental pulmonary artery DSA show a Pseudoaneurysm (yellow arrow 3b), with a feeding vessel (red arrow in 3b). Selective cannulation of the arterial feeder by micro wire and catheter assembly Pseudoaneurysm (curved arrow in c). Post glue injection check angiogram (**d**) showing complete occlusion of pseudoaneurysm. (Arrowhead Long sheath shuttle, arrow = Progrete microcatheter)

Abbreviations

PAP	Pulmonary artery pseudo aneurysm
COVID-19	Coronavirus disease of 2019
TB	Tuberculosis
RT-PCR	Reverse transcriptase polymerase chain reaction
BiPAP	Bi-level positive airway pressure
SARS-CoV-2	Severe acute respiratory syndrome—Corona virus
NCCT	Non contrast computed tomography
CECT	Contrast enhanced computed tomography

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Author contributions
SAH, BDC and RRY contributed to the acquisition, analysis, conception, design, and drafting of the work. All authors have agreed both to be personally accountable for their contributions and ensured that questions related to the accuracy or integrity of any part of the work, even ones in which one was not personally involved, are appropriately investigated, resolved, and the resolution documented in the literature.

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Availability of data and materials
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Declarations

Ethics approval
The research compiled with the Helsinki Declaration of 1964.

Consent to participate
Retrospective, consent waiver.

Consent for publication
Consent for publication has been obtained from the patient in writing; however, their identity is not disclosed. All the authors have approved submitting the manuscript to your esteemed journal. On behalf of all the contributors, I will act as guarantor and correspond with the journal from this point onward.

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

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