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Case report

Alveolar hemorrhage in the setting of COVID-19: Report of a successful vascular intervention and embolization ☆☆☆

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ABSTRACT

The coronavirus disease 2019 (COVID-19) is characterized by viral pneumonia with mild to moderate symptoms. Emerging studies suggest that some patients may experience uncommon complications, such as thrombotic or hemorrhagic episodes. Here we present a 59-year-old male patient who had a hemorrhage episode from a branch of the pulmonary arteries and was treated by interventional embolization. Our case report demonstrates the importance of early diagnosis of hemorrhagic complications of COVID-19 and the possible benefits of early vascular intervention.

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Introduction

The viral pneumonitis caused by the coronavirus disease 2019 (COVID-19) is characterized by dyspnea, coughs, and radiologic signs such as diffuse ground-glass opacities [1]. With the dissemination of the virus worldwide, uncommon clinical presentations have also been suggested, such as rapidly progressive pneumonia, pulmonary thromboembolism, and the involvement of other body systems, with further abnormal clinical scenarios emerging as the disease further progresses

[2]. Appropriate diagnostic and therapeutic interventions have remained a challenge for some of the conditions, which has warranted the involvement of other medical specialties. Radiologists have been at the front line of diagnosing COVID-19 as CT imaging has shown an optimal sensitivity and positive predictive value [3]. However, the emergence of certain conditions has further involved radiologists, specifically interventional radiologists, in managing COVID-19. Until now, treatment has consisted of anti-malarial drugs, anti-inflammatory drugs, anti-coagulation medication, antibiotics, and oxygen therapy with various means [4]. However, new complications have required new therapeutic procedures. Here we report a

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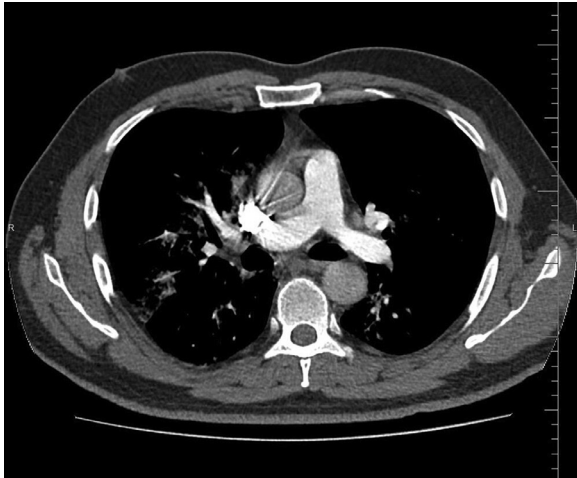


Fig. 1 – Axial computed tomography with pulmonary angiography shows normal filling of the bilateral pulmonary artery without filling defect.



Fig. 2 – Axial high resolution computed tomography showed diffuse bilateral ground-glass and alveolar consolidation.

patient who needed interventional embolization of a vessel following an episode of alveolar hemorrhage.

Case report

A 59-year-old male patient was admitted to our emergency department with frequent hemoptysis from 7 day's ago. The patient had coughs and low-grade fever from 10 day's before hospitalization and had self-quarantined himself for the past days because of a positive polymerase chain reaction test for COVID-19.

On admission, the patient had stable vital signs. The physical examination showed a body temperature of 38°C, blood pressure of 130/80 mm Hg, a pulse of 100 beats per minute, respiratory rate of 22 breaths per minute, and oxygen saturation of 93% while the patient was breathing ambient air. Auscultation of both hemithorax showed diffuse rales and rhonchi. Other physical examinations were generally unremarkable.

The patient reported progressive dyspnea, which had culminated in the patient becoming bedridden most of the day. The patient also reported hemoptysis, which had started 7 day's ago and had increased in frequency.

On the first day of admission, the patient further deteriorated, presenting with massive hemoptysis and had a reduction of blood hemoglobin level to 8.5 mg/dl from 15 mg/dl during 24 hours, and became hypoxic (80% oxygen saturation while on the nasal cannula). The second computed tomography revealed progression of lung involvement as extensive bilateral diffuse central and peripheral ground-glass opacities and alveolar consolidation was seen (Fig. 1).

The patient was admitted to the intensive care unit (ICU) and was treated with azithromycin 500 mg via orogastric tube daily and was started on hydroxychloroquine 400 mg loading dose followed by 200 mg twice daily for a 7-day course. According to our previous experience about thromboembolic events in COVID-19, further evaluation by computed to-

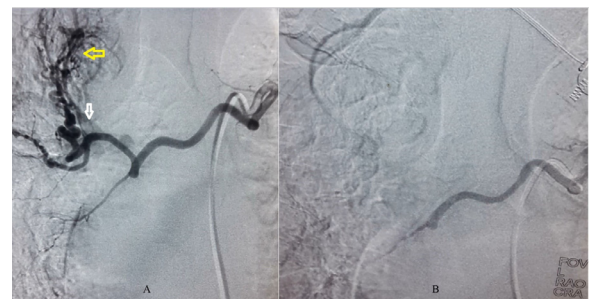


Fig. 3 – (A) Digital subtraction angiography showed abnormal blush in right upper lobe (yellow arrow) and arteriovenous shunt (white arrow). (B) Post embolization angiogram showed complete occlusion of arteriovenous shunt and elimination of abnormal blush (Color version of the figure is available online.)

graphic pulmonary angiography (CTPA) was performed to rule out pulmonary thromboembolism (PTE) (Fig. 2).

CT angiography was performed, which did not show any signs of PTE.

The patient received 2 units of packed red blood cell (RBC) and fresh frozen plasma. Two tuberculosis specimens were sent, which came negative in the following days. The patient was treated with supplemental oxygen, delivered by nasal cannula, and a consultation was done with the interventional radiology department to perform bronchial artery angiography for diagnosis and possible treatment of the source of bleeding. After insertion of a 6 f sheath, selective angiography of the bronchial artery was performed. Both right and left bronchial arteries originated from 1 common trunk. Super selective angiography of the right bronchial artery showed a focus of abnormal vessels on the right upper and middle lobe (Fig. 3). Then after catheterization with a microcatheter, embolization was performed by polyvinyl alcohol particles (350–550 micrometer).

After Embolization, conservative treatment was continued. On the 30th day of admission, the patient's clinical condition had improved. His blood oxygen saturation had increased to 94 % while he was breathing ambient air; thus, Supplemental oxygen was discontinued. He was afebrile, and all symptoms had resolved with the exception of his cough, which had decreased in severity. The patient was discharged from the hospital on the 31st day of admission.

Discussion

In this case report, we discuss a patient who deteriorated because of an arterial hemorrhage from a bronchial artery. The patient was treated by vascular intervention and embolization.

Similar case reports have been published where patients reported hemorrhagic complications. Conti et al. reported 2 patients. The first patient was a 76-year-old male who was being treated with azithromycin, anti-viral drugs, steroids, and low molecular weight heparin (LMWH). Seven days from admission, the patient developed severe abdominal pain, a sudden fall of blood pressure to 80/60 mmHg, and a decrease in hemoglobin levels. CT image of the abdomen showed a collection anterior to the left iliopsoas muscle and signs of active bleeding. The second case was a 72-year-old female who had a femoral venous thrombosis and was put on a therapeutic dosage of LMWH. Ten days after admission, the patient developed similar symptoms to the first patient and two late enhanced spots suggestive of active hemorrhage. Both patients had normal prothrombin time (PT) and partial thromboplastin time (PTT) values during hospitalization. Both patients had hemorrhages from branches of the inferior epigastric arteries. The authors contributed the etiology of the bleeding to COVID-19, either by increasing intra-abdominal pressure while coughing or by causing diffuse endovascular damage related to a cytokine storm [5]. The authors did not correlate the bleeding to LMWH use. Lucatelli et al., however, reported a series of cases with massive hemorrhage in COVID-19 patients receiving Heparin. Almost all patients had intramuscular bleeding, 1 had intracranial bleeding, 1 had retroperitoneal bleeding, and 1 had splenic bleeding. The patients were either considered for interventional embolization of the bleeding vessels or were managed conservatively.

Although limited patients have been described with serious hemorrhagic complications in the respiratory system, autopsies of those dying from COVID-19 have shown that alveolar hemorrhages are a common finding in those dying and are interestingly accompanied by the inappropriate formation of thrombi [6]. This finding in pathology examination of human tissues could be supplemented with in vitro studies which clearly show a dysfunctional coagulation system and platelet function [7]. Furthermore, autopsies show signs of diffuse alveolar damage with a rich infiltrate of inflammatory cells, which could contribute to damage to small alveolar vessels [8,9]. This is not to undermine the existence of

gross thrombi formation in the lungs of those deceased, accompanied by deep venous thrombosis [10]. These autopsies and clinical studies reporting PTE have been the basis for the inclusion of LMWH in the therapeutic regimen for COVID-19 patients [11]. But emerging evidence shows that COVID-19 patients are also at an increased risk for hemorrhages, thus necessitating thorough evaluation of patients for any signs of it.

Patient consent

Written informed consent was obtained from the patient.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.radcr.2021.04.034](https://doi.org/10.1016/j.radcr.2021.04.034).

REFERENCES

- [1] Mohammadi A, Mohebbi I, Khademvatani K, Pirnejad H, Mirza-Aghazadeh J, Gharebaghi N, et al. Clinical and radiological characteristics of pediatric patients with COVID-19: focus on imaging findings. *Jpn J Radiol* 2020;38(10):987–92.
- [2] Lovato A, de Filippis C. Clinical presentation of COVID-19: A systematic review focusing on upper airway symptoms. *Ear Nose Throat J* 2020;99(9):569–76.
- [3] Kanne JP, Bai H, Bernheim A, Chung M, Haramati LB, Kallmes DF, et al. COVID-19 imaging: What we know now and what remains unknown. *Radiology* 2021:204522.
- [4] Sanders JM, Monogue ML, Jodlowski TZ, Cutrell JB. Pharmacologic treatments for coronavirus disease 2019 (COVID-19): A review. *Jama* 2020;323(18):1824–36.
- [5] Conti CB, Henchi S, Coppeta GP, Testa S, Grassia R. Bleeding in COVID-19 severe pneumonia: The other side of abnormal coagulation pattern? *Eur J Intern Med* 2020;77:147–9.
- [6] Carsana L, Sonzogni A, Nasr A, Rossi RS, Pellegrinelli A, Zerbi P, et al. Pulmonary post-mortem findings in a series of COVID-19 cases from northern Italy: a two-centre descriptive study. *Lancet Infect Dis* 2020;20(10):1135–40.
- [7] de Oliveira Toledo SL, Nogueira LS, das Graças Carvalho M, Rios DRA, de Barros Pinheiro M. COVID-19: Review and hematologic impact. *Clinica Chimica Acta* 2020;510:170–6.
- [8] Schaller T, Hirschtbühl K, Burkhardt K, Braun G, Trepel M, Märkl B, et al. Postmortem examination of patients with COVID-19. *Jama* 2020;323(24):2518–20.
- [9] Pourafkari L, Mirza-Aghazadeh-Attari M, Zarrintan A, Mousavi-Aghdas SA. Hypercoagulopathy of COVID-19: A review of the clinical experience, pathophysiology, and considerations in prophylaxis and treatment. *Iran J Med Sci* 2020.
- [10] Deshpande C. Thromboembolic findings in COVID-19 autopsies: pulmonary thrombosis or embolism? *Ann Intern Med* 2020;173(5):394–5.
- [11] Porfídia A, Pola R. Venous thromboembolism and heparin use in covid-19 patients: juggling between pragmatic choices, suggestions of medical societies and the lack of guidelines. *J Thromb Thrombolysis* 2020;50(1):68–71.