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Case Report

Bilateral acute pulmonary embolism and Covid-19 pneumonia: CT findings

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Abstract

Since the widespread of acute respiratory syndrome infection caused by coronavirus-19, unenhanced computed tomography (CT) was considered a useful imaging tool commonly used in early diagnosis and monitoring of patients with complicated Covid-19 pneumonia. If there is clinical or laboratory suspicion of pulmonary embolism complicating Covid-19 pneumonia, CT angiogram of the pulmonary arteries may be necessary. Here we describe the case of a 52 years old man, affected by a high-risk myelodysplastic syndrome patient, with Covid-19 pneumonia, complicated by a bilateral massive acute pulmonary embolism. An unenhanced CT and then a CT pulmonary angiography were made, and the patient was immediately hospitalized and treated.

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Background

Since December 2019 the world is facing a rapidly expanding pandemic of lower respiratory tract infection by a novel coronavirus severe respiratory syndrome coronavirus-2 (SARS-CoV-2). In some patients, this viral infection causes a clinical syndrome referred to as coronavirus disease 2019 (Covid-19), but the heterogeneity of the disease course poses a challenge to healthcare providers and optimal management of patients. The use of CT imaging in the diagnosis and follow-up had rapidly grown, and radiological patterns along the disease course are increasingly understood. To date, the most of all the available literature regarding SARS-CoV-2 infection relies on unenhanced CT, which is considered the first-line imaging tool [1] and had even proven useful to diagnose Covid-19 pneumonia when initial polymerase chain reaction screening is negative [2]. Current guidelines advocate the use of unenhanced chest CT for the diagnosis, severity assessment and monitoring of Covid-19 disease [3]. Though detection of typical lung imaging features of Covid-19 does not require intravenous contrast agent use, patients with known Covid-19 and sudden onset clinical deterioration with unexplained worsening of dyspnea or chest pain, may benefit from

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vascular enhancement to be appropriately diagnosed and managed.

**Case presentation**

In a 52 years old man, affected by a high-risk myelodysplastic syndrome, nasopharyngeal sampling was positive for SARS-CoV-2. His cardiovascular past medical history included hypertension and diabetes mellitus. Now, he had persistent chest pain, shortness of breath, hypoxia, dry cough and fever (38°C-38.5°C) since about four days, without clinical improvements from taking paracetamol at home.

At Emergency Room the patient had:
- normal baseline ECG;
- Echocardiographic evaluation showed a dilated and severely hypokinetic right ventricle with a mean derived pulmonary arterial pressure of 55mm Hg;
- MV significantly reduced in both lung areas;
- sO2 of 90%;
- Laboratory: leukopenia (3.3 G/L); thrombopenia (129 G/L); increased values of C-reactive protein (220 mg/L), LDH and procalcitonin.

First of all, an unenhanced chest CT (high resolution computed tomography) was performed, that showed (Picture 1, A - D): bilateral and multifocal GGO predominantly located at the periphery of all five pulmonary lobes; basal sub-pleural fibrotic streaks in both lungs; bilateral pulmonary interstitial thickenings; consolidations in the posterior-basal segments of right and left lower lobes, and right pleural effusion.

![Picture 1](image1.png)

**Picture 1** - (A - D): Chest HRCT patterns of bilateral Covid-19 pneumonia of the patient. Bilateral and multifocal GGO predominantly located at the periphery of all five pulmonary lobes; basal sub-pleural fibrotic streaks in both lungs; bilateral pulmonary interstitial thickenings; consolidations in the posterior-basal segments of right and left lower lobes, and right pleural effusion.

Two days later the patient worsened his symptoms. D-dimer was high (1.020 lg/mL). For this, a CT pulmonary angiography was urgently performed and showed a bilateral massive acute pulmonary embolism (Picture 2, A - D).

CT pulmonary angiography showed the presence of extensive hypodense filling defect, compatible with bilateral pulmonary embolism, at the common trunk of the pulmonary artery and affecting the right and left branches, also extending to the main segmental branches for the upper and lower pulmonary lobes on the right, and lower lobe on the left.

Based on these CT findings, patient was treated with multi-drug therapy (based on low molecular weight heparin, lopinavir/ritonavir, azithromycin, hydroxychloroquine) and oxygen. He was observed and monitored in his vital parameters, with a slow evolution of the clinical situation towards stability. The patient survived his pulmonary embolism and his Covid-19 pneumonia, and, after about one month of hospitalization, he had returned at home. Now the patient will perform a clinical-radiological and laboratory follow-up.

**Discussion**

Acute pulmonary embolism is a serious complication of Covid-19 pneumonia. Even though the etiology of acute
pulmonary embolism associated with Covid-19 pneumonia remains unclear, adequate treatment can be initiated immediately considering the outcome of untreated pulmonary embolism. The incidence of acute pulmonary embolism in patients diagnosed with Covid-19 is currently unknown; however, the available biological and clinical data raise concerns about unsuspected pulmonary embolism and calls for research on this specific topic. Recently, Chen et al. showed that patients with Covid-19 are at risk of acute pulmonary embolism. Given the large number of Covid-19 patients seeking medical care, the international society on thrombosis and haemostasis (ISTH) advocates the use of laboratory tests, including D-dimers, prothrombin time, and platelet count to stratify patients at risk of adverse outcome and who need hospital admission [4]. In summary, patients requiring hospital admission for Covid-19 pneumonia should receive prophylactic with low molecular weight heparin to prevent thromboembolism, in the absence of contraindication. Furthermore, CT has quickly become a cornerstone in both the diagnostic workup and follow-up of SARS-CoV-2 infection and is usually performed unenhanced. However, patients with known Covid-19 disease may have acute pulmonary embolism. In the case of elevated D-dimer levels on admission or sudden clinical worsening, CT pulmonary angiography should be considered since pulmonary embolism is a life-threatening but potentially treatable condition.

**Conclusions**

CT is important not only in the early stages of Covid-19 diagnosis, but also in the evaluation of complications and concomitant pathologies during the subsequent course of the disease, orienting toward the best clinical management/outcome for the patient.

**Patient Consent**

The patient confirmed the consense for publication of our case report.

**REFERENCES**

[1] Ai T, Yang Z, Hou H, Zhan C, Chen C, Lv W, Tao Q, Sun Z, Xia L. Correlation of chest CT and RT-PCR testing in Coronavirus Disease 2019 (COVID-19) in China: a report of 1014 cases. Radiology 2020:200642. doi:10.1148/radiol.2020200642.

[2] Xie X, Zhong Z, Zhao W, Zheng C, Wang F, Liu J. Chest CT for typical 2019-nCoV pneumonia: relationship to negative
RT-PCR testing. [published online ahead of print, 2020 Feb 12]. Radiology 2020:200343. doi:10.1148/radiol.2020200343.

[3] ACR recommendations for the use of chest radiography and computed tomography for suspected Covid-19 infection, Available at: https://www.acr.org/Advocacy-and-Economics/ACR-Position-Statements/Recommendations-for-Chest-Radiography-and-CT-for-Suspected-Covid-19-Infection, [accessed 16.03.2020].

[4] Thachil J, Tang N, Satoshi G, Falanga A, Cattaneo M, Levi M, Clark C, Ibaet T. ISTH interim guidance on recognition and management of coagulopathy in COVID-19. J Thromb Haemost 2020. doi:10.1111/jth.14810.