COVID-19 presenting as pneumatoceles and spontaneous cavitary lesion as a late complication

Rajesh Kunadharaju, Alberto Monegro

SUMMARY
We report a case of an adult patient with COVID-19 pneumonia presenting as pneumatoceles as a late complication. These pneumatoceles are steroid-resistant and can predispose to cavitary lesions. These cystic lesions need close follow-up with repeat imaging as they can increase the risk of pneumothorax. It can take up to around 12 weeks for the spontaneous resolution of pneumatoceles.

BACKGROUND
COVID-19 pneumonia is radiographically commonly associated with bilateral patchy peripheral ground glass opacities. Consolidative opacities, septal thickening, pleural thickening are also seen during later stages. In COVID-19, pneumatoceles and cavitary lesions are rarely reported radiological findings during the progression of the disease. These are associated with increased risk of pneumothorax and are associated with increased morbidity and mortality. We report a case of a patient with COVID-19 presenting with steroid-resistant development and rapid progression of pneumatoceles and a spontaneous cavitary lung lesion.

CASE PRESENTATION
A 62-year-old Caucasian man diagnosed with COVID-19 infection for 2 weeks was admitted to our hospital with complaints of shortness of breath, cough and increased oxygen requirements. His medical history was significant for hyperlipidaemia, benign prostate hypertrophy, gastro-oesophageal reflux disease, anxiety, obstructive sleep apnoea and C4–C7 anterior cervical discectomy and fusion for cervical spondylitis. He is an ex-smoker with less than ten pack-years and quit smoking 20 years ago.

He denied any fevers, chills, chest pain, haemoptysis, chest tightness or wheezing. On examination, the patient was noted to have tachycardia, tachypnoea and bilateral crackles on auscultation. His repeat CT chest angiogram showed evidence of multiple thin walled (<2 mm) pneumatoceles surrounding with patchy ground glass opacities compared with the previous CT chest (figure 1).

Pulmonology and infectious disease were consulted to further evaluate new cystic lesions in the setting of progressive COVID-19 pneumonia. He was empirically treated with broad spectrum antibiotics and fluconazole for new cystic lesions.

INVESTIGATIONS
His initial lab work showed lactate 2.3 mmol/L, lactate dehydrogenase 565 U/L, C reactive protein 5.3 mg/
mL, brain natriuretic peptide 11 pg/mL, troponin <0.01 ng/mL, and D-dimer 2.15 mcg/mL. On further evaluation, the lab work showed negative streptococcus pneumoniae and legionella urine antigens, procalcitonin was <0.02 ng/mL, beta D glucan levels <31 pg/mL, aspergillus galactomannan <0.5 and had negative blood cultures. Due to a positive COVID-19 test and stable patient’s clinical status, diagnostic bronchoscopy was deferred.

DIFFERENTIAL DIAGNOSIS

The common differential diagnosis for cystic lung lesions with ground glass opacities are pneumatoceles in the setting of pneumonia, Pneumocystis jirovecii, desquamative interstitial pneumonia and lymphocytic interstitial pneumonitis.5 With the increased use of high-dose steroids in COVID-19, other infectious reasons like P. jirovecii should be considered along with underlying autoimmune disorders like Sjogren’s syndrome and desquamative interstitial pneumonia in patients with current smoking habits. As our patient’s initial CT chest showed no cystic changes, and the patient was noted to have normal beta D glucan levels and had no clinical signs of Sjogren’s syndrome or any other autoimmune disorder, we believe that the CT chest findings were consistent with pneumatoceles in the setting of the progression of the disease due to COVID-19 infection.

TREATMENT

The patient was treated with a repeat course of dexamethasone 6 mg, and empiric antibiotics were discontinued due to low suspicion of infection. The patient responded well to steroids with improvement in clinical status and oxygen requirements. He was discharged home with a 2-week prolonged course of dexamethasone 6 mg.

OUTCOME AND FOLLOW-UP

He had a follow-up CT chest 2 weeks after discharge for cystic lung lesions, which have shown resolution of some pneumatoceles and interval development of new multifocal bilateral cystic lesions and a solitary cavitary lesion measuring 5.9×4.3×4.4 cm in the right lung close to major fissure (figure 2). On the phone follow-up, the patient was stable with no worsening in his symptoms.

Around 6 weeks after discharge, the patient was seen in the pulmonary clinic as a follow-up. He was still complaining of mild cough and shortness of breath on exertion. He was requiring 1–2 L of oxygen supplementation intermittently during the day and continuously at night. Around 14 weeks after discharge, he was back to his baseline regarding his functional status. His cough improved, and he did not require oxygen supplementation anymore, with SpO2 96% on room air. His repeat CT chest showed improvement in cystic lesions with persistent streaky densities and ground glass opacities (figure 3). His pulmonary function test showed normal spirometry, normal lung volumes with reduced residual volume and mildly reduced diffusing capacity for carbon monoxide (DLCO). His 6 minute walk distance test measured a distance of 480 m with the lowest sat of 95% on exertion with recovery to 100% at rest.

DISCUSSION

In COVID-19 pneumonia, lung cavitory lesions are reported as late complications with an increase of pneumothorax.3 4 However, cystic lung lesions are rarely reported in COVID-19 radiologic findings. We present a case of a COVID-19-infected patient with radiological evolution of CT chest findings from mild bilateral ground glass opacities to extensive pulmonary infiltrates and new cystic lung lesions (figure 4). The natural progression of these lesions started as pneumatoceles surrounded by ground glass opacities and progressed to the spontaneous formation of cysts and cavitation in areas separate from prior infiltrates. The large cavitory lesions formed despite being on oral steroids to suggest that these changes were steroid resistant.
Although the mechanism for the formation of cystic lesion in COVID-19 pneumonia is not well understood, one potential mechanism is COVID-19-related microthrombi in pulmonary capillaries resulting in ischaemic and inflammatory parenchymal changes and postobstructive alveolar dilatation. The other mechanism is believed to be combination of parenchymal necrosis and check-valve airflow obstruction.

The chest X-ray alone is not adequate to diagnose these cystic lesions as seen with our patient (figure 1), and these patients are at risk of developing cavitary lesions and pneumothorax. A high degree of suspicion for the development of cavitary lesions should be present in patients presenting with pneumatoceles or cystic lung lesions. Repeat imaging in 4–5 weeks after initial symptom onset in patients with new cystic lesions should be considered to avoid undesired consequences of pneumothorax in prolonged intubated patients or patients on noninvasive ventilation for other reasons like obstructive sleep apnoea. In our patient, resolution of pneumatoceles and cavitation occurred in about 12 weeks while off of glucocorticoids.

The late complications of COVID-19 are still largely unknown. With the risk of spontaneous cavitary lesion formation, a close radiological follow-up during a prolonged hospital stay or an outpatient basis after hospital discharge should be considered for better clinical outcomes. There is no clear evidence that steroids would provide any benefit in delaying the progression of these cystic lesions.

**Learning points**

- COVID-19 can present with pneumatoceles and ground glass opacities.
- Pneumatoceles are steroid-resistant and can predispose to cavitary lesions.
- CT findings of cystic lesions need close follow-up with repeat imaging as these can increase the risk of pneumothorax.
- Resolution of cystic lesions can take up to 12 weeks.

**REFERENCES**

1. Ali F, Kunadharaju R, Thapar R. Radiological manifestations of COVID-19 before and after the disease—a comprehensive review. In: COVID-19 by cases: a pandemic review, 2021: 361–81.
2. Salehi S, Abedi A, Balakrishnan S, et al. Coronavirus disease 2019 (COVID-19): a systematic review of imaging findings in 919 patients. *AIR Am J Roentgenol* 2020;215:87–93.
3. Zoumitt Z, Bonilla M-F, Wahla AS, et al. Pulmonary cavitation: an under-recognized late complication of severe COVID-19 lung disease. *BMJ Pulm Med* 2021;21:1–8.
4. Afrazi A, Garcia-Rodriguez S, Maloney JD, et al. Cavitary lung lesions and pneumothorax in a healthy patient with active coronavirus-19 (COVID-19) viral pneumonia. *Interact Cardiovasc Thorac Surg* 2021;32:150–2.
5. Umar Shahzad M, Hari J, Ramitolla M, et al. Spontaneous tension pneumothorax as a complication of COVID-19. *Case Rep Med* 2021;2021:1–4.
6. Raoof S, Bondalapati P, Vidyula R, et al. Cystic lung diseases: algorithmic approach. *Chest* 2016;150:945–65.