Recurrent pneumothorax in a Critically ill ventilated COVID-19 patient

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Background
• Clinical investigation with computed tomography (CT) scanning is ubiquitous in modern medicine
• There have been several cohort studies investigating the radiological changes in patients with COVID-19 lung disease [1,2]
• The most common CT findings are bilateral ground-glass opacification (GGO) (87.5-88%), consolidation (31.8%) with peripheral (76%) or multilobar involvement (78.8%), most commonly seen in the first 14 days of patients admission
• There are a handful of case reports of spontaneous pneumothorax and pneumomediastinum in the COVID-19 population [3-4]

Patient journey
• A young 33-year-old woman presented to the emergency department with a one-week history of cough, shortness of breath and myalgia, with no other significant past medical history
• Febrile at 38.5°C. tachycardic at 110bpm with a stable blood pressure and saturating 95% on room air. Her bloods were unremarkable
• Chest radiograph (CXR) demonstrated bilateral patchy areas of increased opacity and prominent lung markings (Figure 1)
• She was admitted to the acute medical unit, but her respiratory function rapidly deteriorated, necessitating a trial of non-invasive ventilation.
• She quickly failed this when on the intensive care unit (ICU), needing intubation and mechanical ventilation. She was confirmed SARS-CoV-2
• A repeat CXR showed considerable interval worsening of parenchymal opacification within both lungs (Figure 2).
• She required different ventilation strategies, including multiple proning positions
• She was referred for Extra Corpoaral Membrane Oxygenation (ECMO) at a regional ECMO centre. She had been ventilated for more than ten days, it was felt that the patient would not benefit from ECMO
• She was started on a course of methylprednisolone (1mg/kg, BD) for a week and her ventilation mode was modified to Airway Pressure Release Ventilation (APRV).
• There was an initial improvement in her oxygenation, without any significant deterioration in arterial carbon dioxide concentration (PaCO₂) or pH, and plateau pressures around 30cmH₂O.
• However, at day 14, the beneficial effect of APRV was not sustained, and she was switched back to a mandatory ventilation mode
• On the same day, one of her prone positioning, her airway pressures increased dramatically with cardiovascular compromise. She was clinically diagnosed with tension pneumothorax

Patient journey - continued
• She was immediately placed supine and received a needle decompression, followed by insertion of bilateral intercostal chest drains (ICDs) (Figure 3)
• After a period of recovery and stability, she had a tracheostomy placed after 24 days
• However, failed to progress in her respiratory wean
• She did develop a swinging pyrexia with raised inflammatory markers, including a procalcitonin of 6.4
• A thorax CT was ordered to investigate. This demonstrated a large loculated left hydro-pneumothorax, bilateral anterior pneumatoceles, widespread bilateral ground-glass and crazy paving appearances with the radiological appearance of classic COVID-19 pneumonia (Figure 4).
• Due to the complexity of her ICD management and CT findings, a Cardio-thoracic surgical input was sort
• After Cardio-thoracic MDT discussion, she was deemed too unwell for surgical interventions initially, opting for conservative management with ICDs
• After her initial ICD, she went on to have several more ICDs, including an ICD under video-assisted guidance to place due to the complexity of her pneumothorax.
• Despite placement of multiple ICDs, serial thoracic CT scans showed persistent changes with an increase in the size of the left sided hydro pneumothorax
• After 60 days, she successfully underwent a video-assisted thoracoscopic surgery (VATS) for a washout of empyema and further placement of ICD
• After 109 days on ICU, she was successfully decannulated and stepped down to a respiratory ward, where she continued to receive the appropriate physiotherapy
• She was discharged to a rehabilitation facility after a total of 116 days inpatient stay
• She has been subsequently discharged home following an additional period of rehabilitation. Her most recent thorax CT showed significant improvement, with a large reduction in the size of her left hydro pneumothorax (Figure 5)
• She is awaiting non-urgent outpatient follow up with the COVID-19 clinic and thoracic surgeons

Discussion
• We present a rare case and CT findings of a young woman, with no significant medical history or underlying lung pathology, who developed extensive bilateral pulmonary changes including a large, persistent hydro pneumothorax and pneumatoceles following COVID-19 infection
• This is a rare complication of COVID-19 not previously reported in the literature and it has a significant impact on this patient’s recovery, resulting in the delayed progress of her weaning from mechanical ventilatory support and a prolonged stay in the intensive care unit
• In our patient, the underlying mechanism for her recurrent pneumatoceles, hydro pneumothorax and development of pneumatoceles are unclear
• Whether it is a combination of inflammatory injury from COVID-19 pneumonia and barotrauma has not been determined, severe COVID-19 lung infection itself may lead to a chronic cystic lung disease state, or possibly related to barotrauma and volutrauma as a result of the difficult mechanical ventilation pathway she endured
• Early MDT discussions with cardio-thoracic anaesthetists and surgeons was essential, deciding early thoracotomy would have been to high risk a procedure and adopting a more conservative approach
• This is a rare complication of COVID-19 not previously reported in the literature and it has a significant impact on this patient’s recovery

References

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