

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 Corporal 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 **methyl prednisolone (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 30 cmH₂O.
- 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, during one of her prone positionings, her **airway pressures increased dramatically with cardiovascular compromise**. She was clinically diagnosed with **tension pneumothorax**

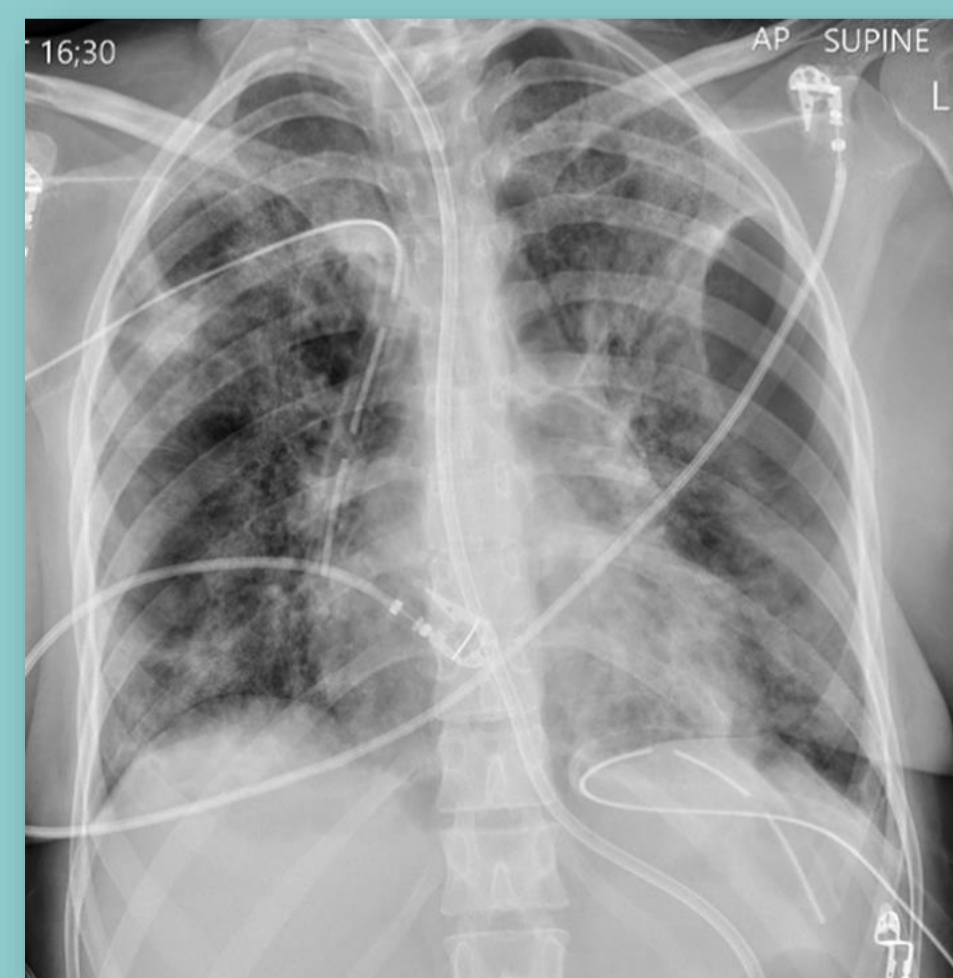
Figure 1. Admission Chest X-ray



Figure 2. Admission to ICU, post intubation



Figure 3. Day 14 post insertion of chest drains



Acknowledgements

To the co-authors of this case report and to all the critical care staff at University Hospital Southampton for their care of the patient.

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 sought
- 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 hydro-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

Figure 4. Serial axial sections of thorax computed tomography (CT) (Panel A-D), showing bilateral ground glass opacification, pneumatoceles (white arrows) with large complex left hydro-pneumothorax (green arrows).

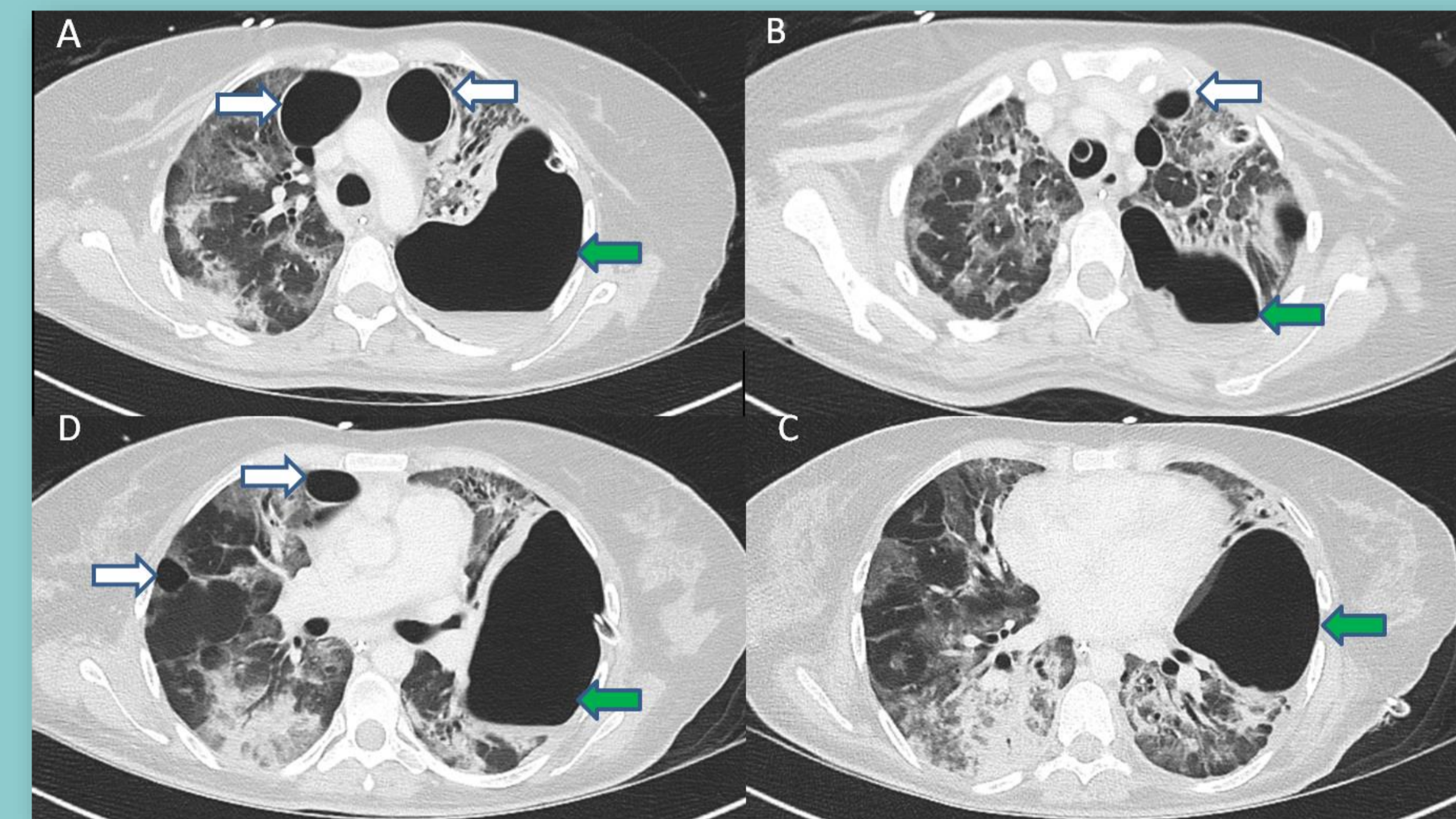


Figure 5. Serial axial sections of thorax computed tomography (CT), post decannulation and for surgical planning. Shows some bilateral scarring from COVID-19 infection, significant improvement in the size of the left hydro-pneumothorax but residual pneumatoceles anteriorly.



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 had 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 pneumothorax, 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 with ICD
- This is a rare complication of COVID-19 not previously reported in the literature and it has had a significant impact on this patient's recovery

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