



## Spontaneous Pneumomediastinum as a Complication of COVID-19 Infection: A Case Series

Kyle Cilia<sup>\*1</sup>, Thelma Xerri<sup>2</sup>, Luca Conti<sup>3</sup>, Maria Alessandra Zammit<sup>2</sup> and Manuel Fenech<sup>2</sup>

<sup>1</sup>Department of Medicine, Mater Dei Hospital, Msida, Malta

<sup>2</sup>Department of Infectious Diseases, Mater Dei Hospital, Msida, Malta

<sup>3</sup>Department of Respiratory Medicine, Mater Dei Hospital, Msida, Malta

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\*Corresponding author: Dr Kyle Cilia, Department of Medicine, Mater Dei Hospital, Msida, Malta.

### Abstract

*Spontaneous pneumomediastinum is the presence of free air around mediastinal structures and frequently associated with other forms of extra-alveolar air, such as pneumopericardium, and pneumothorax. It is an uncommon occurrence and typically presents with pleuritic chest discomfort, dyspnea, odynophagia, and neck pain. It is frequently seen following chest trauma or in patients with underlying lung or connective tissue disorders. COVID-19 infection has been linked to spontaneous pneumomediastinum. We present two case reports of pneumomediastinum in two male patients whilst being treated for COVID-19 pneumonia. In one case, the pneumomediastinum was completely spontaneous whilst in the second case it was likely secondary to high flow nasal oxygen therapy. In both cases, patients were treated conservatively, and follow-up chest imaging showed complete resolution. One should keep in mind the possibility of such complication and have a low threshold for chest imaging in patients failing to improve or have sudden deterioration.*

*Keywords: COVID-19; Pneumomediastinum; Lung; Ventilation; Imaging*

### Case Series

We report a case of a 37-year-old male, previously healthy, admitted with COVID-19 pneumonia. He presented with a 1-week history of high-grade fever, dry cough and exertional dyspnea and tested positive for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) on polymerase chain reaction (PCR) nasopharyngeal swab.

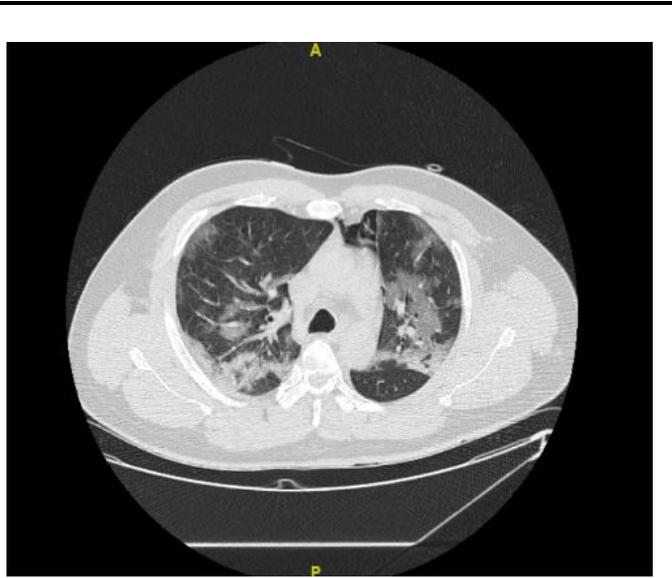
On initial examination, the patient was clinically distressed with a respiratory rate (RR) of 26 breaths/min with a hypoxia of 86% on room air on pulse oximetry. Arterial blood gases (ABGs) on 10 l/min via normal face mask (NFM) showed type-1 respiratory failure, with a pH of 7.3 (normal 7.35 – 7.45), pCO<sub>2</sub> of 22.6 mmHg (normal 35 – 45mmHg) and a pO<sub>2</sub> of 107 mmHg (normal >80 mmHg). Initial investigations showed a lymphopenia of 0.64 x 10<sup>9</sup>/l (normal 0.97 – 3.26 x

10<sup>9</sup>/l) and slightly raised C - reactive protein (CRP) of 62 mg/l (normal 0 – 5 mg/l). Chest x-ray (CXR) confirmed bilateral foci of consolidations, worse on the right side consistent with a COVID-19 pneumonia.

He was started on co-amoxiclav, dexamethasone 6mg daily intravenously (IV) for 5 days with omeprazole cover, enoxaparin 40mg subcutaneous daily as thromboprophylaxis and single loading dose of remdesivir 200mg IV, followed by once-daily maintenance doses of 100mg for further 4 days as an antiviral agent.

Despite biochemical improvement over the first 3 days of treatment, the patient remained hypoxic with high oxygen requirements. A computed tomography (CT) scan of the thorax was performed and showed extensive ground-glass changes bilaterally with air in the mediastinum surrounding the cardiomediastinal

structures extending up into the left side of the neck. No pneumothoraces or subcutaneous emphysema were noted. (Figure 1)



**Figure 1:** Extensive ground-glass changes bilaterally with air in the mediastinum surrounding the cardiomeastinal structures extending up into the left side of the neck.

Following cardiothoracic input, the patient was treated conservatively and kept on high oxygen therapy. On day 6, patient improved significantly, with normal oxygen saturation on room air and normalization of biochemical markers. He was discharged home after 10 days of hospital stay, having completed a total of 5 days dexamethasone and remdesivir, together with a 1-week course of antibiotics.

On review during his 6-week follow up visit, the patient was deemed to be fully recovered, asymptomatic with stable parameters. A repeat CXR at 6 weeks showed clear lung fields except for a small area 13 x 5 mm in size likely to be due to residual fibrosis.

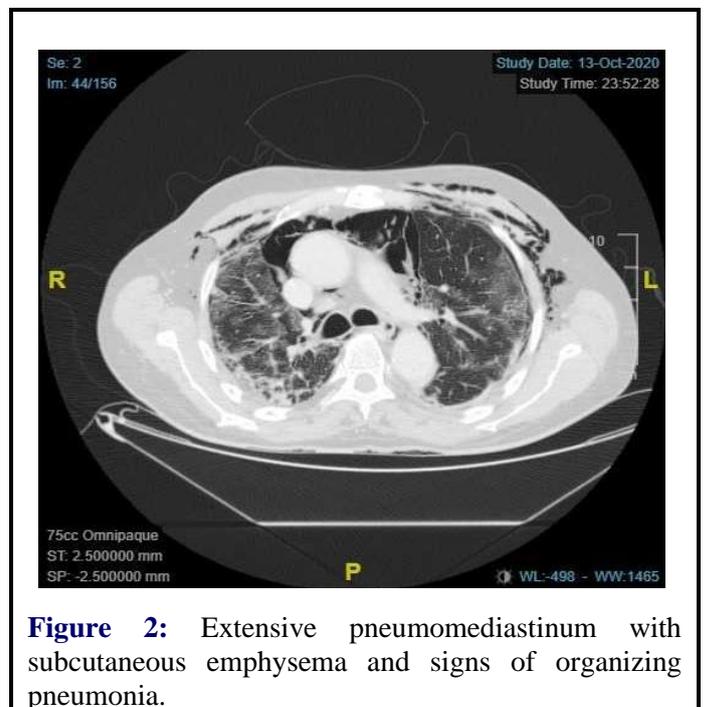
Another case we encountered is of a 60-year-old male, with a history of hypertension, who presented to the emergency department with progressive dyspnea over the course of a week after testing positive for SARS-CoV-2 on a PCR test in the community.

On initial assessment, he was visibly distressed with oxygen saturations down to 85% on room air and a RR of 21 breaths/min. He was also noted to be febrile. Initial investigations showed a lymphopenia of  $0.84 \times 10^9/l$  (normal  $0.97 - 3.26 \times 10^9/l$ ) with a CRP of 207 mg/l (normal 0 – 5mg/l). D-Dimer and lactate dehydrogenase (LDH) were both elevated to 1640ng/ml (normal 0 – 500 ng/ml) and 655 U/l (normal 135 – 220

U/l) respectively. ABGs showed a Type 1 respiratory failure, with pH of 7.46,  $pCO_2$  of 33 mmHg and  $pO_2$  of 72 mmHg, however he maintained normal oxygen saturations on 10 L/min oxygen via NFM. A CXR revealed bilateral patchy airspace shadowing consistent with COVID-19 pneumonia.

He was also started on dexamethasone 6 mg IV, remdesivir, enoxaparin 40 mg Daily and antibiotic cover of co-amoxiclav and clarithromycin IV. On day 3 of his hospital stay, he needed higher oxygen demands, and despite oxygenation at 15 L/min via a non-rebreather mask (NRM), saturations were still at 94%. He required transferred to Intensive Therapy Unit (ITU) and was started on high flow nasal cannula therapy (HFNC) at a flow rate of 35 L/min with an  $FiO_2$  of 80%.

Patient improved significantly and after 8 days in ITU he was transferred back to the ward on an NFM, maintaining good saturations with low oxygen requirements. Thirteen days post admission, he was noted to be tachypnoeic with sudden hypoxia again. A repeat CXR showed a right apical pneumothorax measuring 1.5 cm with evidence of a pneumomediastinum and subcutaneous emphysema extending over the lateral wall of both hemithoraces and right neck tissue. CT Thorax was performed showing extensive pneumomediastinum with subcutaneous emphysema and incidental pancreatitis. (Figure 2)



**Figure 2:** Extensive pneumomediastinum with subcutaneous emphysema and signs of organizing pneumonia.

He was transferred back to ITU and restarted on HFNC at 40 L/min with an  $FiO_2$  of 70%. Antibiotics were upgraded to piperacillin-tazobactam in view of

pancreatitis for better gram negative and anaerobic coverage. The patient improved daily, with normalization of inflammatory markers and decreasing oxygen dependence. After two weeks in ITU, he was transferred back to the ward, needing only oxygen via nasal prongs (NP) at 2 l/min.

A repeat CT Thorax 4 weeks after showed complete resolution of the pneumomediastinum and pneumothorax, however signs of severe organizing pneumonia were observed. Prednisolone at 40mg daily was started as per respiratory consultation advice, with a tail down regimen for a total of six weeks. He remained stable and was discharged from hospital after a 2-month stay.

## Discussion

Spontaneous pneumomediastinum is the presence of free air around mediastinal structures due to air leakage from alveoli secondary to a pressure gradient between the alveolus and the perivascular sheaths [1].

This condition is mostly seen following chest trauma or in patients with underlying respiratory pathologies, such as interstitial lung disease and connective tissue disorders [2], but it also has been noted to be associated with COVID-19 infection, as a direct consequence of the COVID pneumonia itself or secondary to prolonged invasive and non-invasive ventilation with high end-expiratory pressure [3].

Patients typically present with pleuritic chest discomfort, dyspnea, odynophagia and neck pain. Hamman's sign, a crunching sound synchronous with the patient's heartbeat, can also be elicited on examination. Other patients present with a sudden deterioration with increasing oxygenation requirements.

The underlying pathophysiology of spontaneous pneumothorax and spontaneous pneumomediastinum in SARS-CoV-2 has not yet been confirmed, however it is likely to be multifactorial. The extensive alveolar damage and increased distal airway pressure secondary to coughing in patients with COVID-19 infection result in rupture of the alveoli, causing air leakage into the surrounding pulmonary interstitium [4]. The increased positive pressure and high flow rates with HFNC in already compromised alveoli likely contribute to further rupture.

CT imaging is the diagnostic gold standard in suspected spontaneous pneumomediastinum [3]. Uncomplicated spontaneous pneumomediastinum is managed conservatively with bed rest, adequate analgesia and avoidance of maneuvers which increase intrathoracic pressures such as Valsalva manoeuvre [5]. In patients

who are increasingly symptomatic, high-flow oxygen inhalation therapy is used in order to reduce airway pressure and enhance air leak re-absorption by nitrogen washout. Considering the extent of lung damage in patients with COVID-19, this approach might be insufficient, with interventions such as endotracheal intubation, thoracostomy tube insertion or immediate surgery being the treatment of choice [6,7]. With ongoing development in treatment of COVID-19 infection, especially the use of IV dexamethasone and Remdesivir, together with vaccination, such complication should be encountered less frequently [8,9].

## Conclusion

This case series highlights the importance of early diagnosis of such complication to ensure immediate treatment and prevent further deterioration. Although an uncommon scenario, clinicians should have a low threshold for chest imaging in COVID-19 patients, especially in those with sudden respiratory deterioration.

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## Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships, or other conflict of interest that could have appeared to influence the work reported in this paper.

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