Case Report

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Case Series of Pneumomediastinum and Subcutaneous Emphysema in COVID-19 Patients

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ABSTRACT

Spontaneous pneumomediastinum has been reported in association with COVID-19. Pneumomediastinum could remain elusive until computed tomography is performed. Hence, we need to be vigilant even though it generally has a benign clinical course.

We presented four confirmed COVID-19 cases with typical ground glass opacity on chest radiograph. All four had the computed tomography that re- vealed pneumomediastinum, pneumothorax and subcutaneous emphysema. Only one patient had pneumomediastinum after intubation.

Pneumomediastinum is a devastating finding which should be picked up as early as possible and must be excluded in COVID patients whom deteriorate quickly, as adequate time may pass before any viable intervention can be done to expedite the patients' recovery.

Introduction

COVID -19 is the pandemic that caused 4,010,834 deaths with reported 85,291,530 confirmed cases of COVID-19 as of 7 July 2021. [2] The prevalence and virulence of COVID-19 cause the surge in the numbers of patient admitted to ICU due to the extensive lung infection and cytokine release syndrome. The incidence of spontaneous pneumomediastinum, pneumothorax and subcutaneous emphysema were initially thought to be rare but the numbers are seeing an upward trend, especially among the critically ill. [3]

The involvements of both the alveolar and interstitial components of the lung parenchyma are integral to the pathology involved in SARS-CoV2 (COVID-19). The manifestation of ground glass appearance on the computed tomography peaks between days 6 to 11 of illness. [4] Therefore, the occurrence of pneumomediastinum along this timeframe makes the management of this complication all the more challenging. We present four confirmed cases of COVID19

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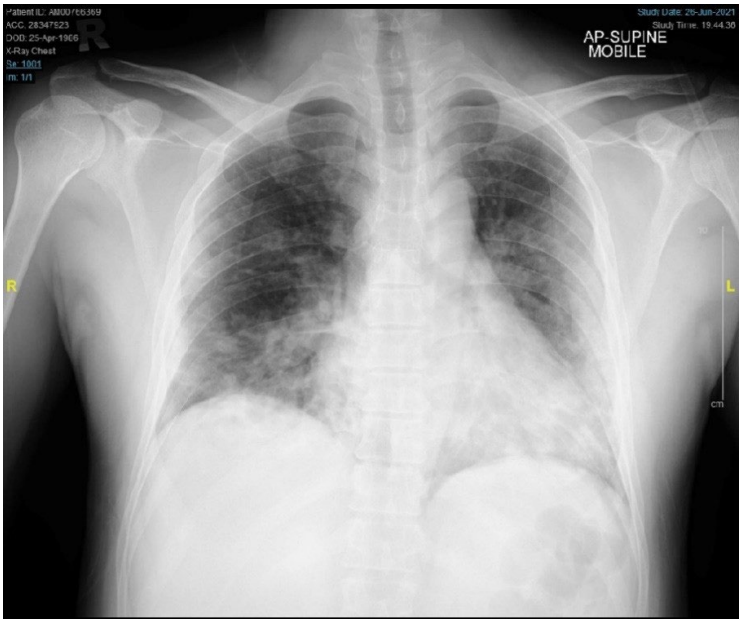

Fig. 1. Initial CXR on 26/6/2021 showing bilateral ground glass opacities.

and have discussed about the possible mechanisms involved in their developing pneumomediastinum.

Case presentation

Patient 1

A 35-year-old male, nonsmoker with no significant past medical or surgical history initially developed symptoms of dry cough and low-grade fever on 21/6/21. He experienced pleuritic chest pain started on 25/6/21 with his SpO2 90% on room air, while the other vital signs were stable. He was diagnosed with Covid-19 based on Reverse transcription (RT)-PCR done on 22/6/21. Subsequently, he progressed to Category 4 Covid-19 complicated by adult respiratory distress syndrome on 25/6/21 necessitating Modified CPAP to maintain an oxygen saturation of 97% (PaO2:FiO2 ratio of 98). During admission, his blood pressure was 120/61, with a heart rate of 97 beats / minute. His laboratory results showed white cell count of 10.3 $x10^9$/L (Absolute lymphocyte count ALC: 1.2), elevated ferritin at 4349 ng/mL (22 - 322), LDH at 1000 U/L (120 - 246) and CRP elevated at 132.3 mg/dL (4 - 10). He had hepatocellular transaminitis picture with alanine aminotransferase (ALT) 258 IU/L (10 - 49), aspartate aminotransferase (AST) 311 IU/L (0-33), alkaline phosphatase (ALP) 123 IU/L (46 - 116), and total bilirubin 16.7µmol/L (5-21). He received antibiotics, enoxaparin and omeprazole. His fast clinical deterioration as pleurisy and increased oxygen requirement prompted repeated chest radiography and computed tomography. The repeat chest X-ray depicted bilateral pulmonary ground glass infiltrates and features of pneumomediastinum and subcutaneous emphysema (Fig. 2). The ensuing computed tomography (Fig. 3) confirmed the organizing pneumonia (50 - 75% of overall lung involvement) as well as pneumomediastinum. Esophagram was clear. He managed to make a recovery with the oxygen support without mechanical ventilation and corticosteroid as per RECOVERY trial. [5] He was discharged uneventful on day 24 after weaned off oxygen therapy for 48 hours.

Patient 2

A 46-year-old healthy non-smoker lady presented on 1/7/21 with 4 days of fever, runny nose, dry cough, sore throat, loss of sense of smell and reduced effort tolerance. She was confirmed COVID-19 based on RT-PCR (28/6/2021) (Fig. 4). She deteriorated rapidly and was put on Modified CPAP on 6/7/21 (day 9 of illness). She received a course of Dexamethasone with Tazocin, and Enoxaparin. At this time, her ABG showed pH of 7.42, pCO2 50, pO2 83, HCO3 of 32.4 with SpO2 of 96% (PFR 138). A day later (7/7/21, day 10 of illness), she was tachypneic at a rate of 32 breaths/minute, SpO2 of 82%. At that time her ABG showed a pH of 7.42, pCo2 51, pO2 55, SpO2 89%, HCO3 of 33. She also had a CRP value of 72.2, WBC of 15.5 (ALC 0.9) with mildly raised ALT at 79 IU/L. She was put on Non-Invasive Ventilation in the ward with FiO2 of 1, 16 breaths per minute and she managed to achieve oxygen saturation up to 97% (PFR 55). She was subsequently intubated for severe ARDS and put on

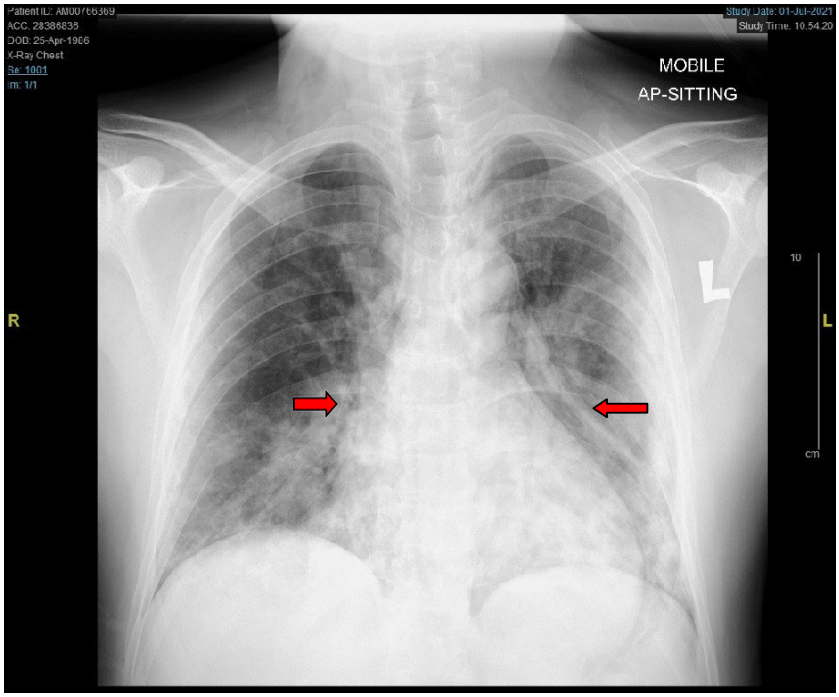

Fig. 2. Plain anterior posterior chest radiography demonstrating radiolucent areas bilaterally (Red arrow) within the region of the mediastinum (left > right) with double bronchial signs. There was soft tissue gas at the neck region.

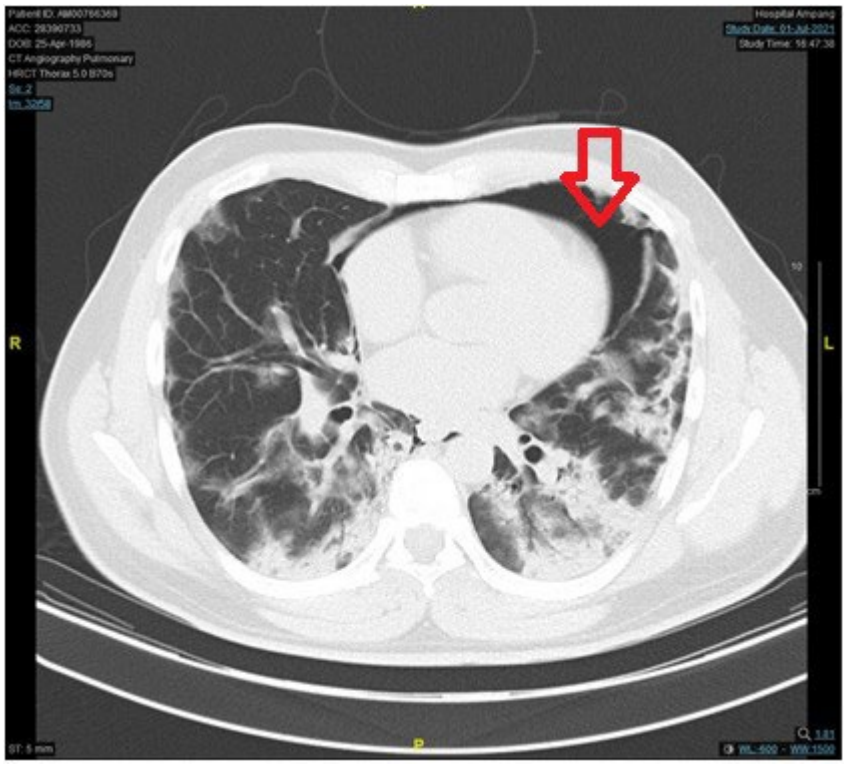

Fig. 3. HRCT window image showing features of organizing pneumonia and pneumomediastinum.

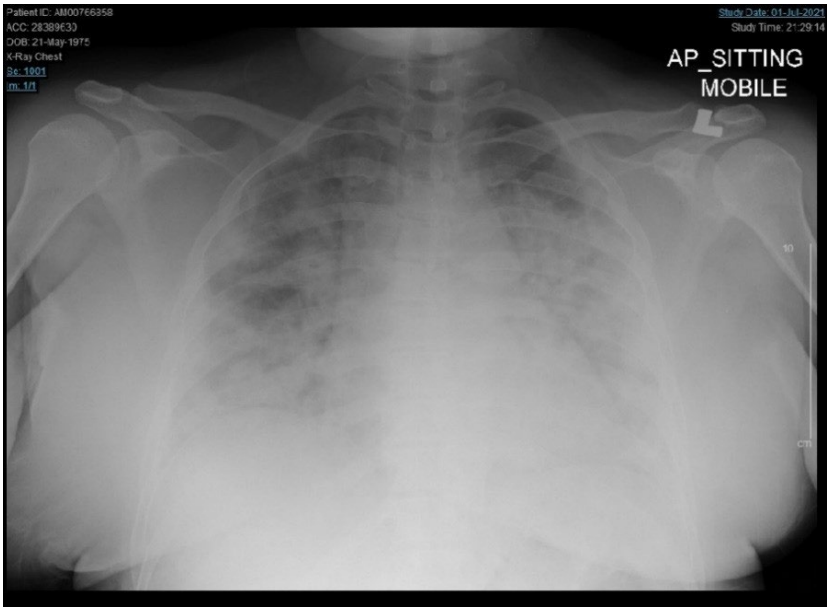

Fig. 4. Chest X-ray on admission showing a prominent heart and mediastinum, with bilateral patchy ground glass opacities.

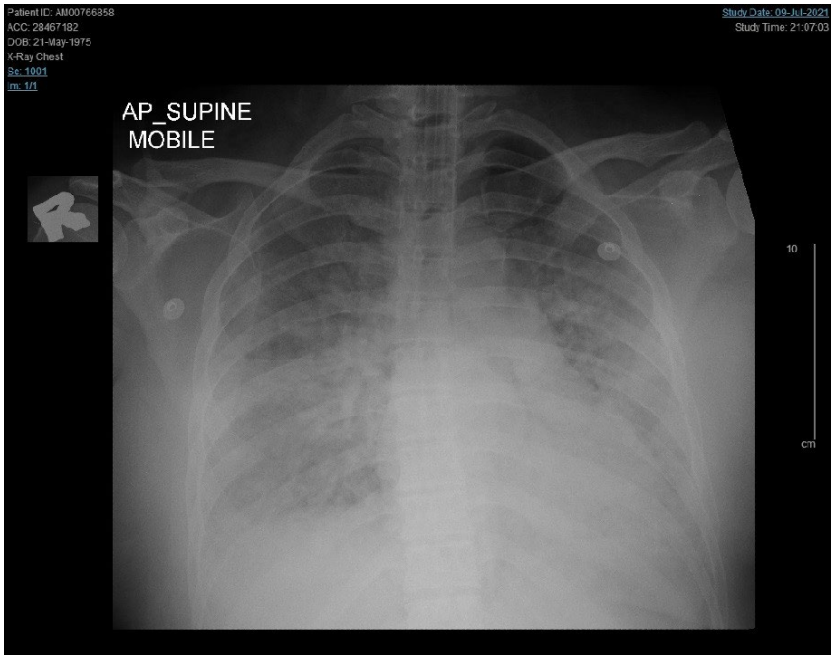

Fig. 5. A repeat chest X-ray confirming the position of the endotracheal tube, along with bilateral ground glass opacities.

low tidal volume ventilation (LTVV) in prone position (Fig. 5). She remained hemodynamically supported with intravenous noradrenaline infusion running at 0.1mcg / kg / min and on ventilator settings of FiO2 0.5, PEEP 10, Rate 18.

The computed tomography on 12/7/21 showed a right lower lobe subsegmental artery pulmonary thrombus, ground glass organizing pneumonia (>75% involvement), as well as a small right pneumothorax and pneumomediastinum (Fig. 6). She received a course of meropenem after noticing her tracheal aspirate culture taken on 8/7/21 which grew *Klebsiella Pneumonia*. She succumbed due to ventilator acquired pneumonia.

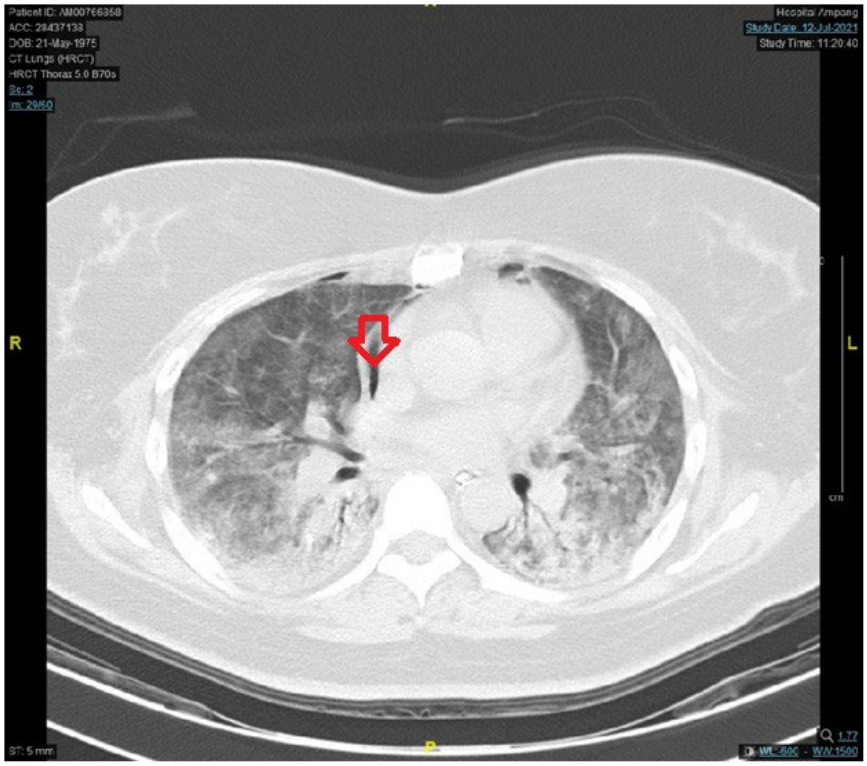

Fig. 6. An image taken on HRCT scan showing a small right anterior pneumothorax and pneumomediastinum.

Patient 3

A 58-year-old non-smoking man with type 2 diabetes mellitus and hypertension presented with high-grade fever, shortness of breath (SPO2 83% on air) and running nose. He had category 4 COVID-19 with positive RT-PCR test. He received dexamethasone and subcutaneous enoxaparin. His saturation of oxygen on air was only maintained at 83% (Fig. 7). Throughout the stay, he deteriorated and was intubated with low tidal volume ventilation in prone position. His ventilation setting worsened. Prompt computed tomography demonstrated extensive subcutaneous emphysema, pneumothorax and pneumomediastinum besides patchy peripheral and bronchovascular ground-glass opacities (GGO) in both lung fields (Fig. 8-10). There were no diaphragmatic injury and no esophageal perforation. However, his condition was complicated by type 2 myocardial infarction with troponin I of 1000, with newly developed RBBB. He was supported on noradrenaline, at ventilator setting of PEEP 8, respiratory rate 14, oxygen FiO2 0.5 after insertion of chest tube. Patient succumbed on day 14 of COVID.

Patient 4

A 39- year-old Malay with hypertension and obesity (BMI 30) presented with 1 week history of fever, anosmia, cough, diarrhea and shortness of breath. He had laboratory confirmed RT-PCR positive COVID-19 and was put on steroid in view of dependent on oxygen therapy. His oxygen requirement increased on day 7 of illness and so was his CRP from 12 to 70 mg/dL. His PFR ratio was 110. He was put on noninvasive ventilation. The computed tomography on day 18 reported ground glass opacity with bilateral lung field of moderate organizing pneumonia consolidation (50-75%) and pneumomediastinum (Fig. 11-13)· He was not intubated. He recovered on NIV and a course of steroid, enoxaparin and antibiotics. He managed to be discharged home on day 16 of COVID-19 infection in a hemodynamically stable condition.

Discussion

Spontaneous pneumomediastinum is thought to be a rare condition, although most of the time it occurs with subcutaneous emphysema. Some of the known common causes are protracted vomiting, incessant coughing, bronchial asthma, chronic lung disease, pulmonary infection, recreational drug inhalation and Valsalva maneuver during parturition which causes increased intrathoracic pressure. Some of the common surgical causes are trauma to the chest, esophageal rupture and mechanical ventilation.[6] Most cases

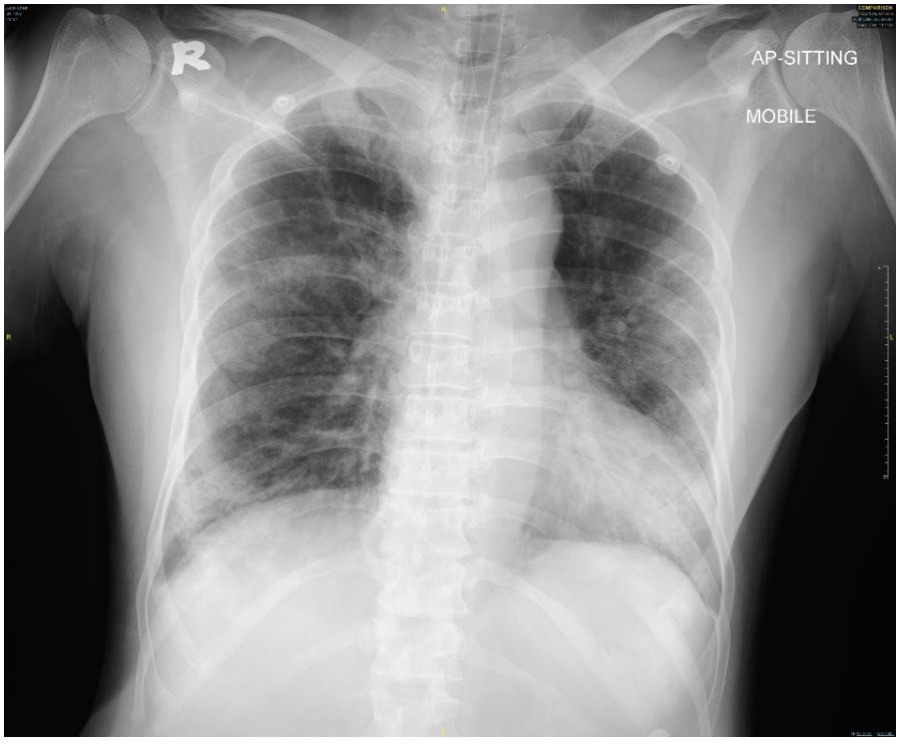

Fig. 7. Chest radiograph on admission revealed mild classic COVID-19 appearance (multiple bilateral peripheral opacities predominantly at lower zone)

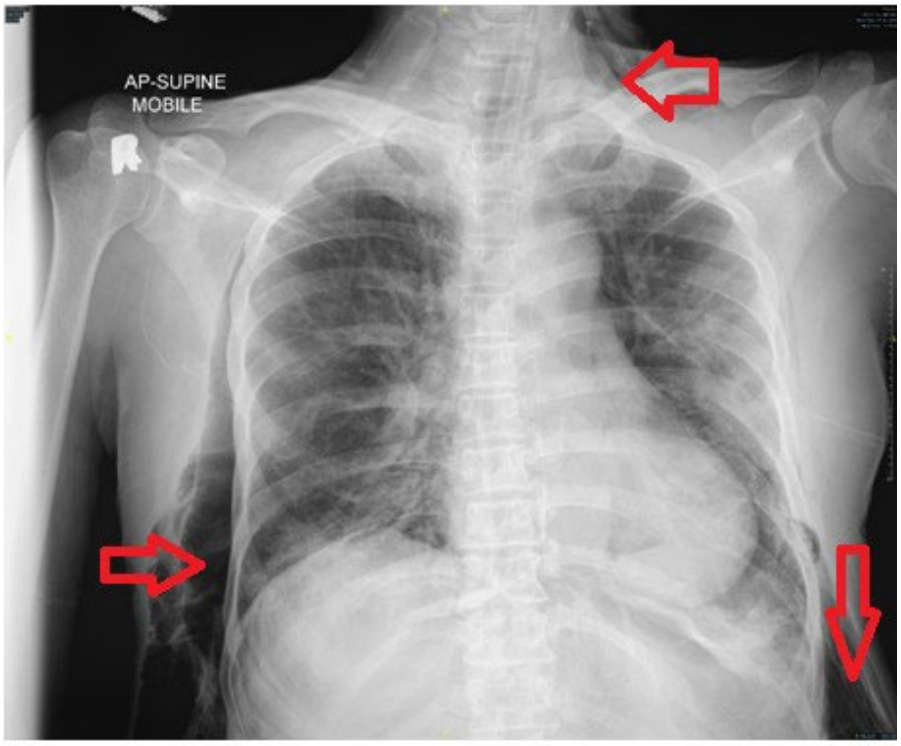

Fig. 8. Repeated chest radiograph showed extensive subcutaneous emphysema at neck region and bilateral chest as well as abdominal walls.

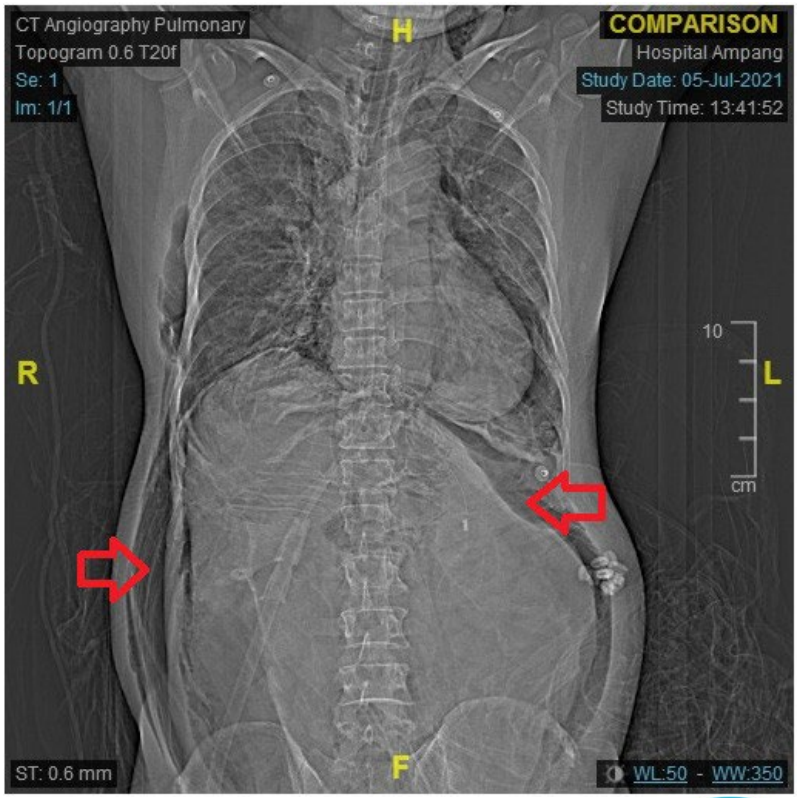

Fig. 9. Sagittal CT revealed extensive subcutaneous emphysema with pneumomediatinum

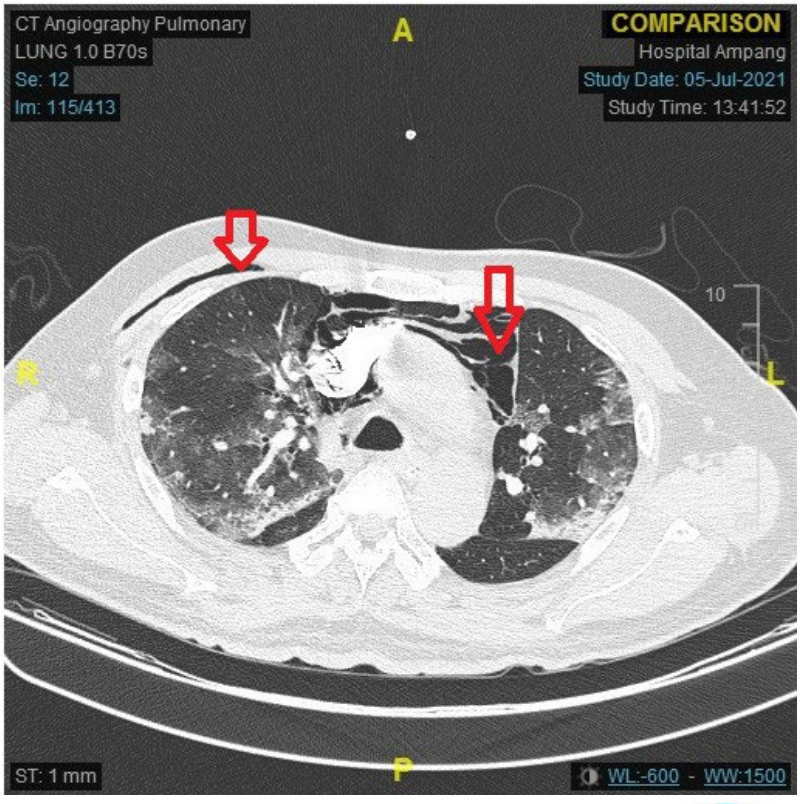

Fig. 10. Axial CT revealing subcutaneous emphysema with pneumomediatinum (Red arrow) and GGO with consolidation.

Fig. 11. Chest radiography demonstrated non homogenous patchy bilateral peripheral and lower lungs opacities which suggested that the presence of superimposed bacterial infections.

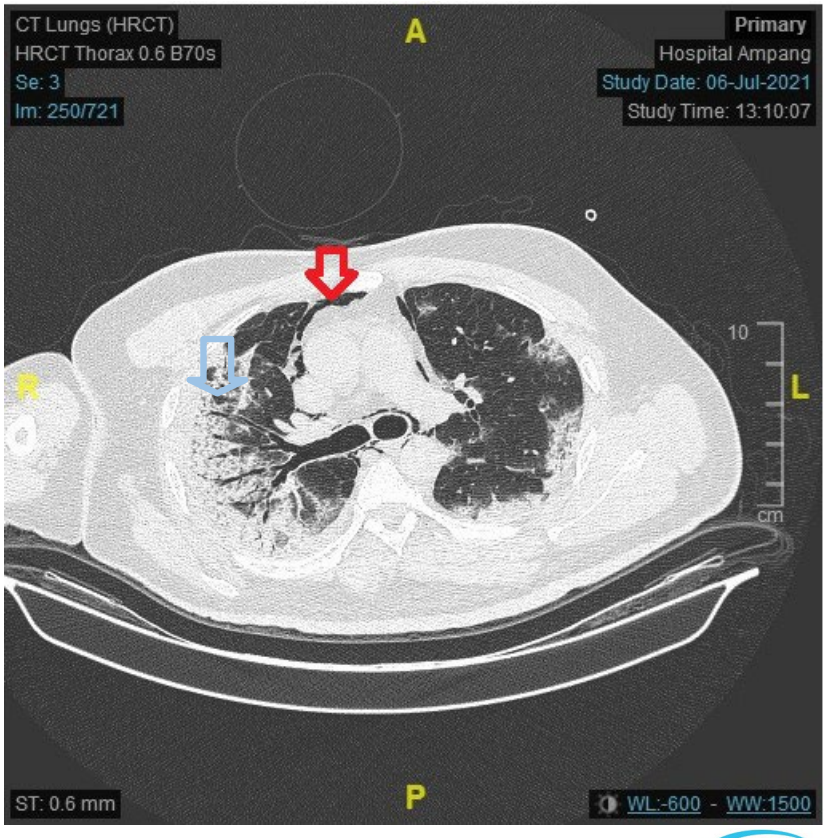

Fig. 12. Coronal CT showed diffuse parenchymal consolidation with air bronchogram (Blue arrow) and GGO in bilateral lung fields besides pneumomediastinum (Red arrow).

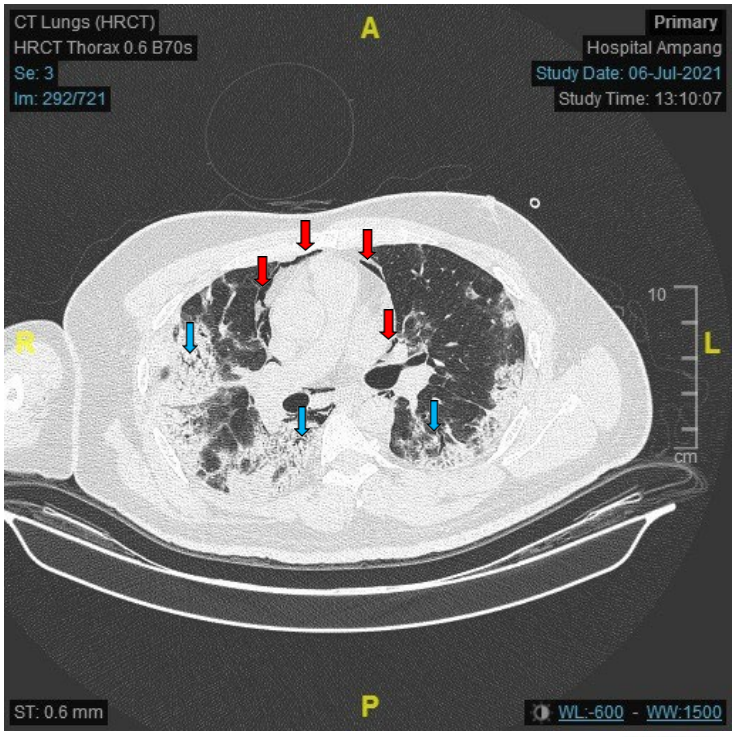

Fig. 13. Coronal CT showed diffuse parenchymal consolidation with air bronchogram (Blue arrow) and GGO in bilateral lung fields besides pneumomediastinum (Red arrow).

are managed conservatively, although a minority of patients makes a dramatic recovery after undergoing invasive procedures (e.g: chest tube drains).

Spontaneous pneumomediastinum is rare in viral pneumonia, where the incidence of pneumothorax is reported to be in the range of only 1% of cases. [7, 8] Although pneumomediastinum is infrequent, it can be a cause of respiratory compromise that will eventually necessitate close monitoring.

COVID-19 causes adult respiratory distress syndrome (ARDS) by virtue of attacking the lungs first leading to the devastating cytokine release syndrome. With its longest possible incubation period of 14 days, most cases become symptomatic on day 5 of illness. [9] The possible airway inflammation has made the edema more susceptible to injury and hence instrumentation poses a higher risk. The risk of having baro-trauma is higher with greater PEEP, prone position and longer intubation period. In our series only one patient was intubated and likely developed pneumomediastinum secondary to barotrauma. All discussed patients had no history of previous pulmonary disease, pneumothorax, or tobacco use. There was no Mackler triad as in Boerhaave syndrome except subcutaneous emphysema. The esophagram was done on only 1 symptomatic patient and the result was negative. The increased pressure in alveolar and diffuse alveolar injury in severe acute respiratory syndrome-associated coronavirus pneumonia seem to be a more plausible reason in making alveoli more likely to rupture especially in the event of increased intrathoracic pressure. [10, 11] Moreover, the presence of pneumomediastinum in COVID-19 infection nonetheless could indicate a more severe clinical condition. [12]

In the pandemic time, chest radiographs are falling short of being a standard radiological investigation in screening for pneumomediastinum as it is usually limited by the underperforming of lateral chest radiography. [13] If it is clinical indicated (e.g: in the presence of subcutaneous emphysema or worsening of COVID infection) computed tomography remains a gold standard in diagnosing pneumomediastinum.

Learning point

1. Spontaneous pneumoperitoneum (SPM) can be an incidental finding following a COVID infection.
2. SPM can be managed conservatively.
3. We only perform contrast enhanced swallow study if there is clinical suspicion of esophageal tear (Boerhaave syndrome).
4. Barotrauma induced pneumothorax in COVID patient is not uncommon.

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Disclaimers

The opinions expressed by authors contributing to this journal do not necessarily reflect the opinions of the Centers for Disease Control and Prevention or the institutions with which the authors are affiliated.

Ethical Considerations

Consent

The consent was taken from the patient for the case report to be published.

Compliance with ethical guidelines

There were no ethical considerations to be considered in this research.

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Authors' contributions

All authors equally contributed in preparing this article.

Conflict of interest

Authors declare that there is no conflict of interest.

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