Spontaneous pneumomediastinum in patients with COVID-19: A case series

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ABSTRACT

As the COVID-19, pneumonia has evolved into global pandemic and with increase in numbers of various strains, wide range of imaging findings are being recognised. One of the rare imaging findings seen in patients with COVID-19 pneumonia is pneumomediastinum. Although most of the cases of pneumomediastinum are related to barotrauma secondary to iatrogenic intubation and mechanical ventilation, there have been multiple cases presenting with spontaneous pneumomediastinum. Here we describe five different COVID-19 positive patients who were diagnosed with spontaneous pneumomediastinum in CT scan of chest. Exact mechanism regarding this is still being debated nevertheless; one theory states the cause as diffuse alveolar injury due to cytokine storm and inflammatory response. The resultant air then tracks along the peribronchial and perivascular sheath to the mediastinum. Pneumomediastinum can have life threatening consequences and represent poor prognosis of the patients.

Introduction

Coronavirus disease-19 (COVID-19) is caused by a Severe Acute Respiratory Syndrome Corona virus- 2 (SARS CoV-2). It was first detected in Wuhan, China, in December 2019. Since then, the cases have increased and it has become a global pandemic. Multiple variant strains have been detected and wide heterogeneity of clinical symptoms and presentation is seen[1].Radiological manifestation in COVID-19 pneumonia has a variable appearance but typical features consist of pulmonary opacities (both ground glass attenuations and consolidations) with a peripheral/subpleural distribution, often involving the posterior regions of both lungs specifically[2].

There has been significant increase in intubations and mechanical ventilation in patients with COVID-19 pneumonia which has resulted in increased incidence of subcutaneous emphysema, pneumothorax and pneumomediastinum[3,4]. However, there have been cases of spontaneous pneumothorax and pneumomediastinum reported in patients with COVID-19 who were not intubated or had mechanical ventilation[5-7]. It remains unclear whether these events are a potential indicator of worsening infection as this is a potentially life threatening complication. In this paper, we describe five cases of spontaneous pneumomediastinum in patients with COVID-19 pneumonia.

Case Details

Case 1

Fifty-two years old male presented to emergency with cough for 8 days, fever for 4 days and shortness of breath for 2 days. He had no other chronic co-morbidities. Patient tested positive for COVID-19 by reverse transcription polymerase chain reaction (RT-PCR). Patient's saturation was not being maintained on high flow oxygen and HRCT chest was done. HRCT chest revealed peripherally predominant ground glass opacities with interlobular septal thickening. Consolidations were seen predominantly in bilateral basal segments. Free air was seen within the mediastinum and subcutaneous plane of bilateral lower neck (Fig 1). As the patient's condition worsened, he was intubated and put on mechanical ventilation. Unfortunately, the patient succumbed to death on 11th day after admission.

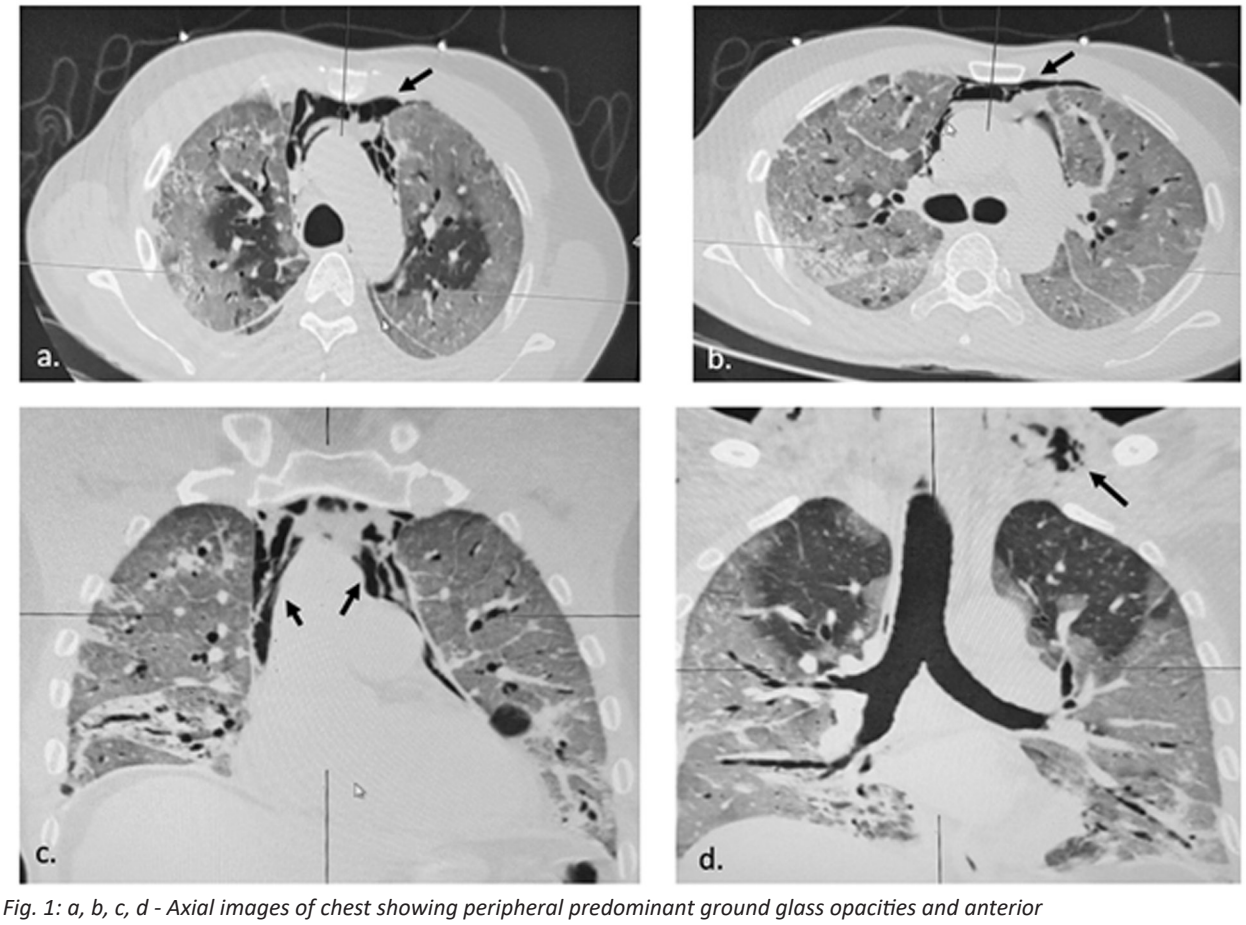

Fig. 1: a, b, c, d - Axial images of chest showing peripheral predominant ground glass opacities and anterior pneumomediastinum (arrow). Coronal image: pneumomediastinum (arrow). Coronal image: subcutaneous emphysema (arrow).

Case 2

Fifty-six years old male referred from other hospital due to requirement of ICU. Patient had tested positive for COVID-19 by RT-PCR 5 days back after complaint of cough for 7 days. HRCT chest of the patient was done before the admission into ICU which showed diffuse ground glass opacities with interlobular septal thickening. Subpleural parenchymal bands were also seen in lingular segments of left upper lobe and basal segments of right lower lobe. Consolidations with air bronchograms were seen in basal segments of left lower lobe. Free air was seen within bilateral pleural cavity, mediastinum and subcutaneous plane of lower neck (Fig. 2). Patient was admitted to ICU and intubated. However, patient died 2 days after admission due to multiorgan dysfunction.

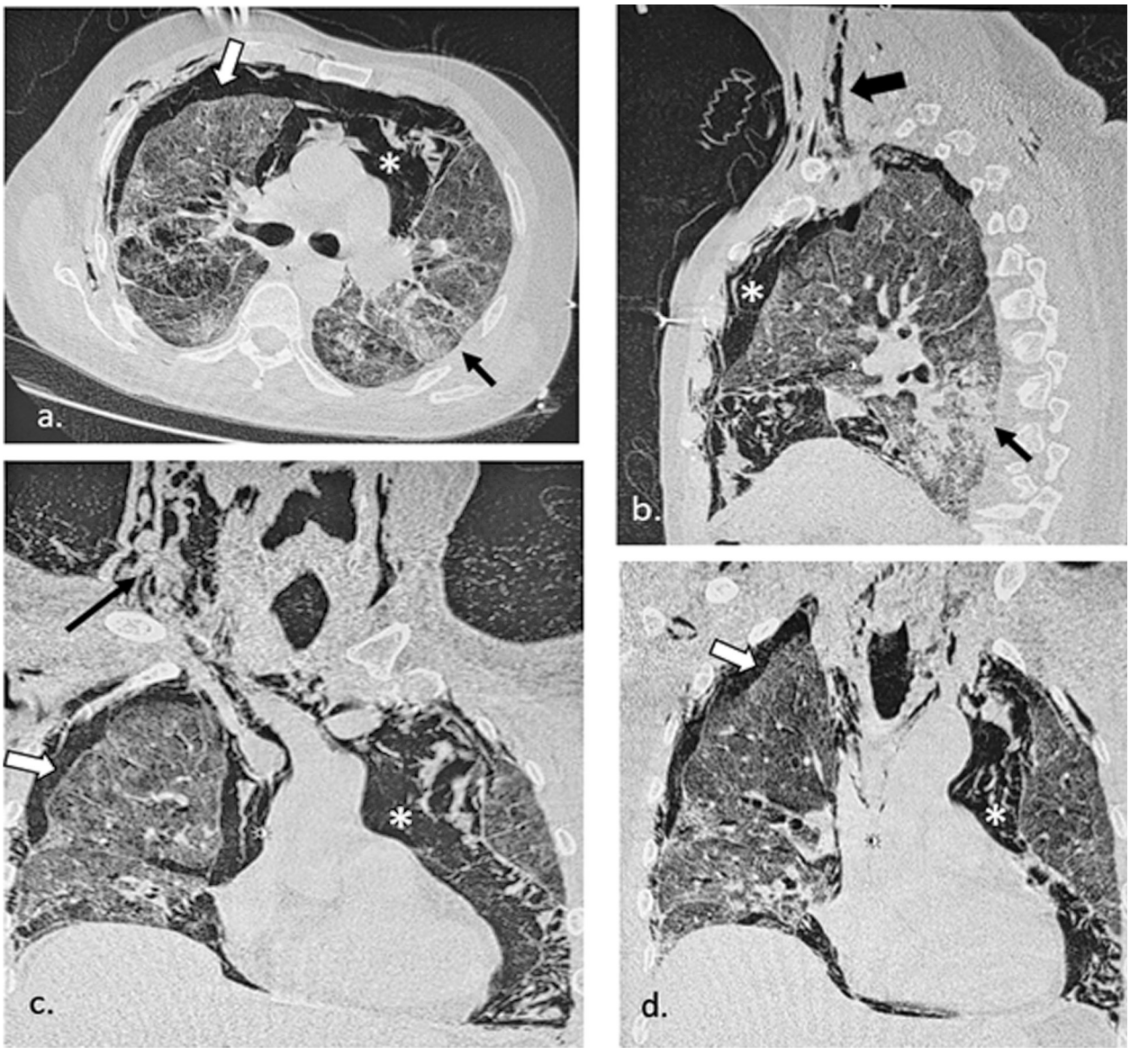

Fig. 2: a- Axial image showing diffuse ground glass opacities and consolidation (line arrow), pneumothorax (white box arrow) and pneumomediastinum (*). b- Sagittal image: consolidation (line arrow), subcutaneous emphysema (black box arrow) and pneumomediastinum (*). c, d - coronal images: pneumothorax (white box arrow), pneumomediastinum (*) and subcutaneous emphysema (line arrow).

Case 3

Seventy-four years old male with diabetes and hypertension presented with worsening cough and shortness of breath after he had tested positive for COVID-19, 10 days back by RT-PCR. His HRCT chest revealed diffuse ground glass opacities and consolidation more on right side. Small amount of air was seen in the mediastinum (Fig. 3). After 5 days patient had further decrease in oxygen saturation and was intubated. Unfortunately, the patient passed away due to ARDS.

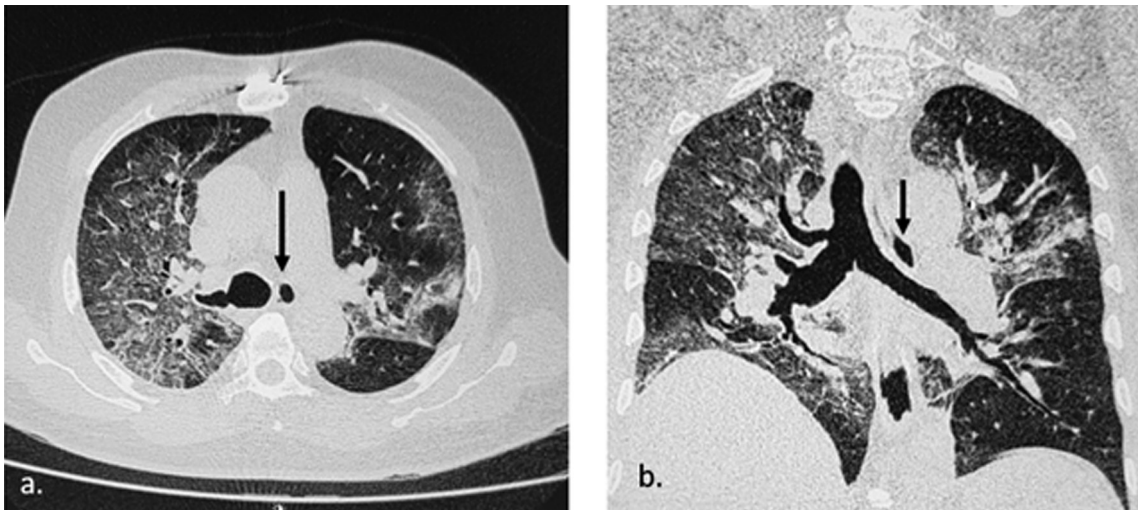

Fig. 3: a, b - Axial image of chest showing ground glass opacities with interlobular septal thickening more on right side and pneumomediastinum (arrow). Coronal image: pneumomedastinum (arrow).

Case 4

Fourty-seven years old male with worsening dyspnea and cough for 4 days presented to emergency with history of contact with COVID-19 pneumonia in family member. Patient tested positive for COVID-19 by RT-PCR and HRCT chest was done. It revealed diffuse ground glass opacities with interlobular septal thickening. Consolidation was also seen predominantly involving the basal zones. Free air was visualised in mediastinum and subcutaneous tissue in neck (Fig. 4). Patient was intubated and transferred to ICU but patient could not survive.

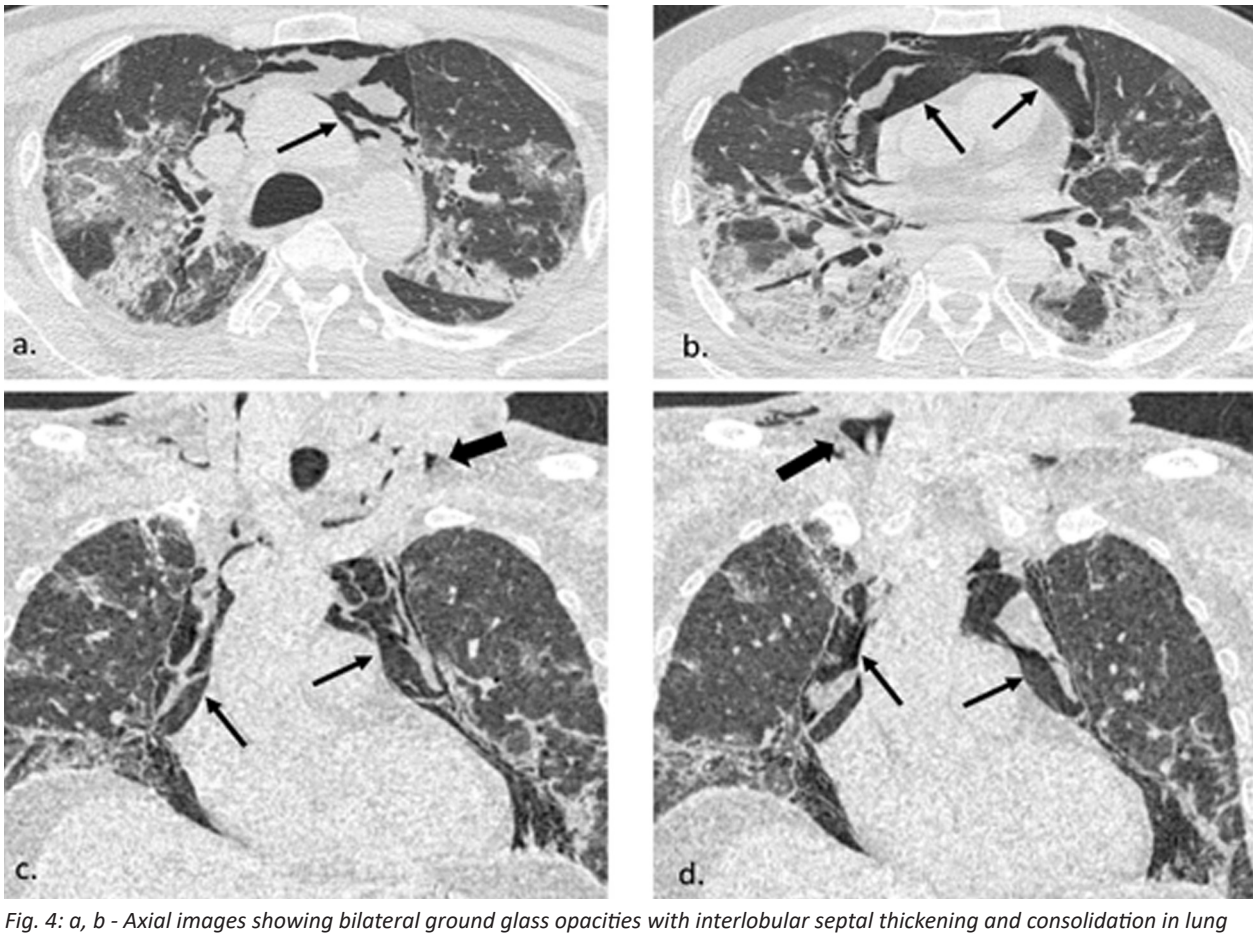

Fig. 4: a, b - Axial images showing bilateral ground glass opacities with interlobular septal thickening and consolidation in lung fields. Pneumomediastinum as shown by arrow. c, d- Coronal images: Pneumomediastinum (line arrow) and subcutaneous emphysema (box arrow).

Case 5

Fourty-nine years old male presented to emergency with history of cough and chest pain for 8 days. Patient tested positive for COVID-19 by RT-PCR. CT pulmonary angiography was done with suspicion of pulmonary embolism. No embolism was seen; however, lung window revealed diffuse ground glass opacities more on the lower lobes and posterior basal segments. Consolidation and subsegmental atelectasis of anterior segment of left upper lobe was noted. Multiple parenchymal bands were seen scattered in bilateral lung fields with free air in mediastinum (Fig. 5). However, the patient did not require intubation and was treated conservatively with oxygen mask and patient was discharged after 12 days.

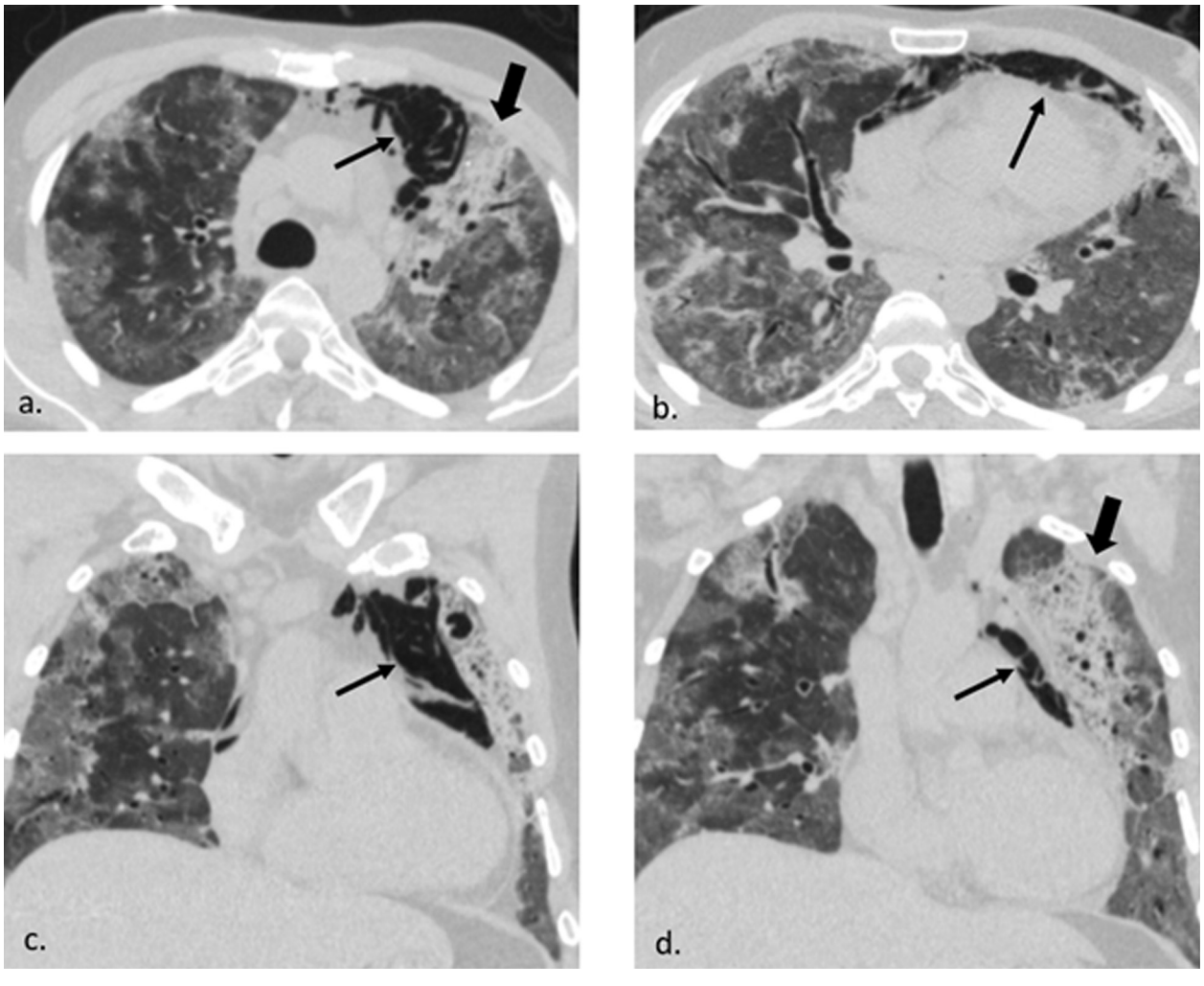

Fig. 5: Non Contrast CT of the chest (lung window): a, b - Axial image showing ground glass opacity and interlobular septal thickening. Consolidation with passive atelectasis of anterior segment of left upper lobe (Box arrow), pneumomediastinum (line arrow). c, d- Coronal images: Consolidation in left upper lobe (box arrow) and pneumomediastinum (line arrow).

Discussion

The typical imaging findings in COVID-19 pneumonia are peripheral based bilateral ground glass opacities and/ or consolidation predominantly in lower lobes. In addition, GGO with superimposed interlobular septal thickening and visible intralobular lines ("crazy paving") may be present, particularly later in disease time course[3]. As time has passed and with surfacing of newer variants, rarer imaging features are being seen in patients such as pneumothorax and pneumomediastinum. Many patients with severe COVID-19 pneumonia are eventually intubated which increases the likelihood of pneumomediastinum or pneumothorax, with one study showing incidence upto 10%[8]. However, there have also been cases of patients with pneumomediastinum and pneumothorax without prior history of intubation[5-7].

Pneumomediastinum is most often caused by increased airway pressures, secondary to mechanical ventilation or airway obstruction; however, other causes include a rise in intrathoracic pressure (such as from the Valsalva manoeuvre); strenuous activity; severe vomiting (diabetic ketoacidosis, anorexia nervosa); trauma to the thoracic cavity; oesophageal rupture; thoracic,head and neck surgery, particularly with resultant tracheobronchial injury; and alveolar injury due to underlying diseases such as infection and sarcoidosis[9].

In our series, we have five patients with pneumomediastinum without prior history of intubation or underlying lung disease. Only one patient had history of smoking. The cause for spontaneous pneumomediastinum in COVID-19 patients is still unclear. One of the possible mechanisms of injury involved in these cases could be a cytokine storm induced diffuse alveolar injury or direct viral infection of type I and type II pneumocytes making alveoli more liable to rupture resulting in alveolar membrane rupture[10]. As all the patients in our series had cough which could also be the additive factor for alveolar rupture. The resultant interstitial air circulates through the peri-bronchial and perivascular sheaths to the mediastinum, popularly known as 'Macklin phenomenon'[11]. This free air can also extend into pleural cavity or subcutaneous tissues.

Pneumomediastinum is usually self-limiting and is managed conservatively. Treatment of the underlying causes and least damaging ventilator settings possible to achieve adequate oxygenation are the mainstays in managing PM. However, pneumomediastinum can lead to worsening respiratory acidosis and failure. COVID-19 patients with pneumomediastinum seem to have a more complicated clinical course and poor outcome. In our series, all five patients were treated conservatively with only one survival while rest of the patients succumbed to the illness.

Conclusions

Pneumomediastinum is a rare complication increasingly associated with COVID-19 pneumonia. It is mostly due to barotrauma following intubation in sick patients. However, there have been multiple cases of spontaneous pneumomediastinum without prior history of intubation most likely indicating extensive alveolar membrane damage. Pneumomediastinum in Covid patients is a poor prognosticator with increased morbidity and prolonged hospital stay for the patients. However, more studies need to be done to determine its prognostic significance and, if it is identified as a marker of disease progression, specific therapeutic measures and recommendations must be established.

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