Spontaneous Pneumothorax in Patients of COVID 19 Pneumonia

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Abstract
COVID 19 pandemic has put a massive strain on healthcare all over the world. Every day new data is getting released and various complications are being reported in patients of COVID 19 Pneumonia. One such complication is pneumothorax and pneumomediastinum. Both these conditions can lead to an increase in mortality and morbidity in patients with COVID 19 pneumonia. We studied 476 patients of COVID 19 pneumonia at our hospital, out of which 18 (3.78%) had developed pneumothorax and/or pneumomediastinum. While most of these patients were on some form of positive pressure ventilation (invasive/non-invasive), some of them had a HRCT Chest suggestive of either air trapping and/or cyst formation. Three patients had developed bilateral pneumothorax while on non-invasive ventilator. Nine of the 18 patients expired and nine were discharged.

Through this article, we would like to emphasize that an acute deterioration in hypoxemia in a COVID-19 patient could indicate a pneumothorax. Pneumothorax as well as pulmonary thromboembolism are reported complications in COVID-19 and clinician vigilance is required during assessment of patients, as both share the common symptom of breathlessness and therefore can mimic each other.

Introduction
Spontaneous pneumothorax secondary to underlying lung disease can result in worsening of clinical condition of a patient. Even a small pneumothorax in patients with a diseased lung can severely compromise pulmonary functions and cause hemodynamic instability. Prompt recognition and treatment of pneumothorax is necessary to minimize morbidity and mortality.

Pneumothorax is a potentially life-threatening complication in patients with ARDS, especially those on mechanical ventilation. In a study of 84 patients with severe ARDS from 48 intensive care units (ICUs), 48.8% had an evidence of a pneumothorax.1 Many factors may precipitate the occurrence of pneumothorax in ARDS, such as the mechanical ventilation settings, the clinical severity of ARDS.1,2

Besides, pneumothorax is a known complication in patients with cystic lung diseases and emphysema. CT chest in patients with COVID 19 has revealed a variety of pattern like ground glass opacities, air trapping and in later stages cyst formation and fibrosis. Also, the high pressures on ventilators could lead to barotrauma and subsequent pneumothorax and pneumomediastinum.

Here, we studied 476 patients of COVID 19 pneumonia, out of which 17 developed pneumothorax and one developed pneumomediastinum without pneumothorax during the course of their illness. Four patients had both pneumothorax and pneumomediastinum. One patient presented with pneumothorax and was diagnosed as COVID 19 pneumonia later, rest all the patients developed pneumothorax while in the ward. Our aim is to provide an insight into how this complication can change the clinical outcome of the patients and can affect the mortality and morbidity.

Method
We studied patients who were more than 12 years of age and diagnosed as COVID 19 by RT-PCR (Reverse transcriptase-polymerase chain reaction) or CBNAAT (Cartridge based nucleic acid amplification test) or Rapid antigen test. 476 such cases

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Results

Out of the 476 patients studied, 17 COVID 19 pneumonia patients (3.57%) had developed pneumothorax and one patient had pneumomediastinum without pneumothorax. Three patients had bilateral pneumothorax. Four out of 17 (23.52%) had both pneumothorax and pneumomediastinum. All of them had pneumonia on Chest X-ray which can be attributed to COVID 19. Statistical data of these 18 patients is mentioned below.

Demographics: Five (27.77%) of the 18 patients were females. Four (22.22%) patients were less than 30 years of age while a total of 12 (66.66%) patients were less than 50 years of age.

Clinical presentation and diagnosis: Of these 18 patients, 17 had pneumothorax and one had pneumomediastinum without pneumothorax. Four out of 17 (23.52%) had both pneumothorax and pneumomediastinum. Only one patient presented with pneumothorax and was diagnosed as COVID 19 later, while one patient developed pneumothorax after discharge from ICU. Rest all the patients developed pneumothorax during the course of their treatment.

Clinical course and outcome: All except two patients deteriorated initially after the development of pneumothorax (deterioration in the form of increase
Discussion

It is a well-known fact now that COVID 19 is a multisystem disorder which most adversely affects the lungs and its most severe form can lead to acute respiratory distress syndrome (ARDS). Many studies have suggested that apart from the viral damage, uncontrolled inflammation also causes damage to the lungs in COVID 19 ARDS. Supporting this hypothesis, elevated levels of C Reactive Protein, ferritin, d-dimer and inflammatory cytokines and chemokines are observed in patients with severe COVID 19.

Secondary spontaneous pneumothorax is the most common type of pneumothorax which occurs in an already diseased lung. Most common causes include COPD, pulmonary tuberculosis, malignancy, sarcoidosis, pneumocystis jirovecii pneumonia, interstitial lung diseases etc. According to a study published in 2015 from GMERS Medical College in Gujarat, the rate of spontaneous pneumothorax in India is around 99.9 per 1,00,000 hospital admissions. Most of them were secondary to COPD and pulmonary tuberculosis. According to another study from Western India from 2014, off the 57 patients of hydropneumothorax, Tuberculosis (TB) was etiology in 80.7% patients, acute bacterial infection in 14%, malignancy in 3.5%, and obstructive airway disease in 1.8%.

Patients with COVID 19 may be at increased risk of developing pneumothorax. Various factors which can contribute to this include lung fibrosis, use of positive pressure ventilation, patients with already diseased lungs like COPD, tuberculosis etc. CT chest findings in a patient with COVID 19 include ground glass opacities evolving into consolidation, air trapping, cystic changes, and in later stages septal thickening and fibrosis. Lung fibrosis causes a decrease in the compliance of the lungs and can cause injury with even slight increase in airway pressures. Similarly, cystic changes are also noted in a COVID lung which can lead to alveolar tear. There are also reports suggestive of development of air trapping and later bulla formation in patients with COVID 19 with subsequently lead to a pneumothorax. Also, continuous coughing and prolonged positive pressure ventilation can lead to increase in intrathoracic pressure, damage to the subpleural alveoli and its rupture leading to a pneumothorax.

The above images (Figures 5, 6) are of a 43 year old male from our series, non-smoker, who never received positive pressures and had developed pneumomediastinum. According to a multicentre retrospective case series from 2020 based from UK out of 6574 COVID 19 patients, 60 (0.91%) had pneumothorax and 11
had isolated pneumomediastinum as compared to 3.78% COVID-19 patients who developed pneumothorax in our study. In their series, 44% of the patients who had developed pneumothorax were on positive pressure ventilation as compared to 72.22% in our series. However, their case series concluded that the overall 28 days survival was not significantly different in patients with and without pneumothorax. They also observed that survival was lower in patients on invasive ventilation but the difference was not statistically significant.9

Management of pneumothorax with a chest tube proved beneficial in some of our patients as has been described in some studies. Patients who developed tension pneumothorax along with ARDS had a worse outcome.

It has also been described previously that development of a pneumothorax is a grave prognostic sign10 and same can be reflected in our series where 52.94% patients expired despite a chest tube insertion. However, was their death directly related to development of pneumothorax cannot be established due to multiple factors in patients of ARDS. But our study does show that pneumothorax can result in increased mortality and morbidity in patients with already diseased lungs. Especially in patients with COVID-19 ARDS and fibroed lungs who are on positive pressure ventilation can have persistent air leak for a long duration. Two patients who died acutely before the tube could be inserted had signs suggestive of a tension pneumothorax in the form of sudden drop in blood pressure, saturation and increase in peak inspiratory pressure on the ventilator and aspiration of air by a needle failed to save them.

Conclusion

Through this study we would like to emphasize that development of a pneumothorax in a COVID-19 patient can be a fatal sign and early diagnosis and treatment with a chest tube may be beneficial for such a patient. In patients of COVID-19 pneumonia with acute deterioration of breathlessness and hypoxemia, apart from pulmonary thromboembolism, a differential diagnosis of pneumothorax should always be kept in mind and prompt intervention with an intercostal drainage tube can improve the prognosis in such patients.

References