Bronchopleural fistula associated persistent pneumothorax in a patient recovering from COVID-19 pneumonia: A case report

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Introduction

Coronavirus belongs to RNA viruses that cause respiratory, neurologic, enteric, and hepatic diseases distributed among mammals, including humans and birds (1). A novel coronavirus discovered in late 2019 in China caused Coronavirus Disease 2019 (COVID-19). It is associated with complications like severe viral pneumonia, ARDS, AKI, cardiac injury, liver dysfunction, spontaneous pneumothorax, lung cavitation, pleural effusion, pericardial effusion, along with other minor ailments like fever, loss of smell, myalgia, dry cough, lymphadenopathy (2) (3).

Pneumothorax due to COVID-19 pneumonia is very rare, and few cases are reported with bronchopleural fistula-associated persistent pneumothorax while recovering from COVID-19 pneumonia (4) (5) (6).

Case History

A 57-year-old male with shortness of breath, fever, dry cough, and chest pain was admitted to our center. Six weeks back, he was diagnosed with COVID-19 on RT-PCR and was being managed at another center with oxygen via nasal cannula at 2L/minute. However, due to the increased severity of his symptoms, he was referred to our center.

His medical history was notable for type 2 diabetes mellitus and hypertension for six years. He had been non-compliant with his medication for one year. He had a myocardial infarction two years back, for which coronary artery grafting was performed. He also had features of hypertensive heart disease with mild concentric left ventricular hypertrophy and grade 2 left ventricular diastolic dysfunction.

The physical examination at admission revealed an ill-looking patient with bilateral crepitations. Blood investigations showed a fasting blood glucose level of 165.3 mg/dl and a post-prandial glucose level of 226.6 mg/dl. He was managed with IV antibiotics, heparin, insulin on a sliding scale, and other supplemental medications. He developed an acute kidney injury with hyperkalemia during the course, which resolved after three days.

On the 10th day of admission, he had worsening shortness of breath and an inability to maintain saturation at an oxygen flow rate of 2Lit/min. Therefore, a chest X-ray (Figure: 1a) was performed, which showed a right-sided pneumothorax associated with bilateral lung opacities. However, a chest X-ray performed six days after admission showed no findings suggesting pneumothorax (Figure 1b).

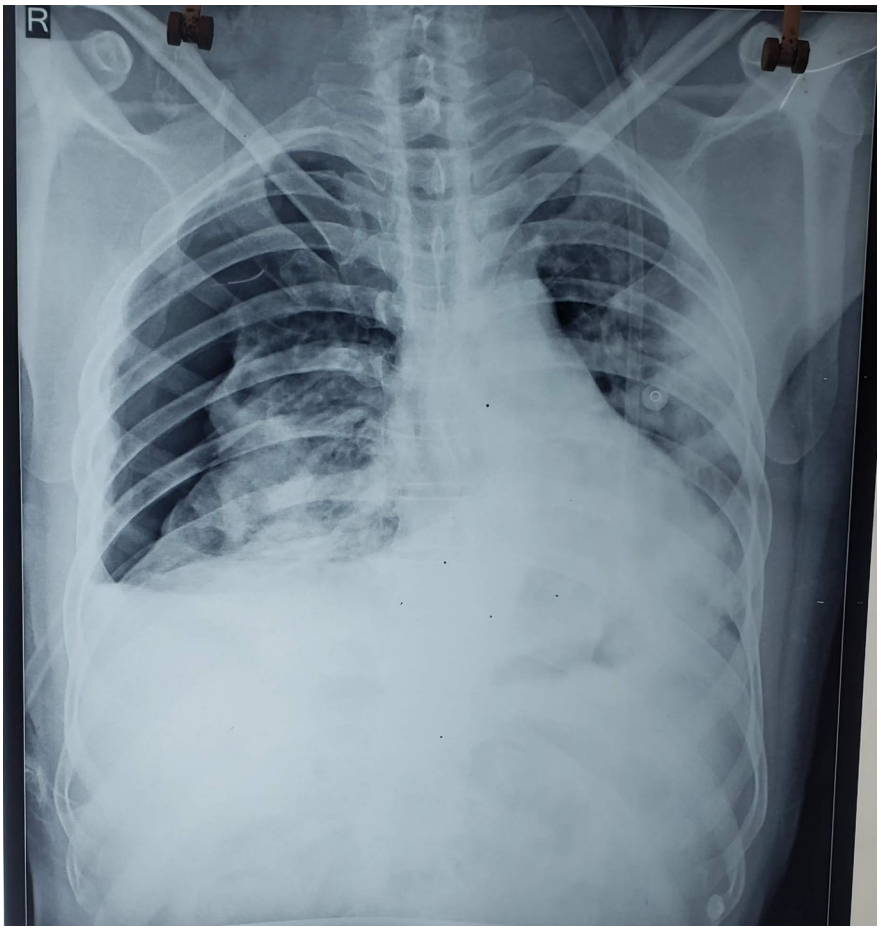

Figure 1a. Chest X-ray showed bilateral lung opacities with a visible visceral pleural line, absent lung markings, and peripheral radiolucency on the right side, suggesting pneumothorax.

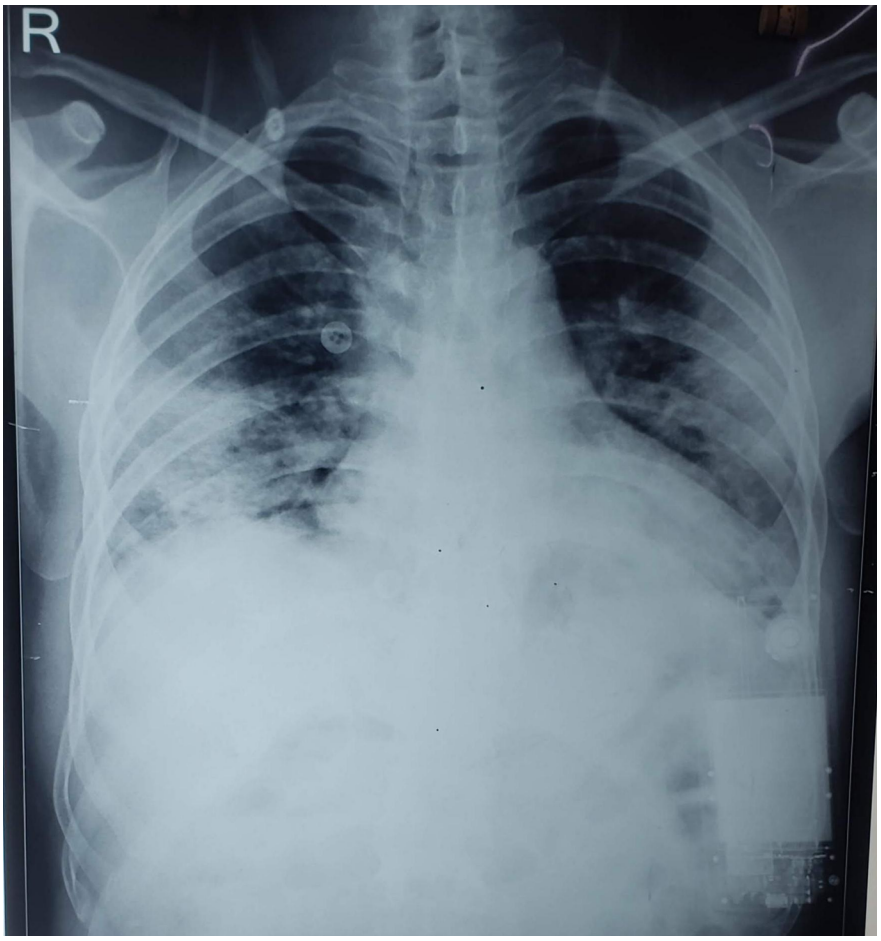

Figure 1b. Chest X-ray showing bilateral lung opacities (before pneumothorax)

The patient was managed with a non-rebreather face mask with an oxygen flow rate of 15 L/minute, and a chest tube was inserted at the fourth intercostal space to drain the pneumothorax. Despite those measures, he deteriorated, for which an HRCT chest was ordered. HRCT scan (Figure 2a, Figure 2b.) revealed a right hydropneumothorax with passive right lung atelectasis and an intermediate walled cavity in the right lower lobe with bronchopleural fistula. Also, multifocal ground glass consolidations were seen predominantly in bilateral peripheral lung fields with fibro-bronchiectatic changes with crazy pavement patterns suggesting sequelae of COVID-19 pneumonia.

Figure 2a.

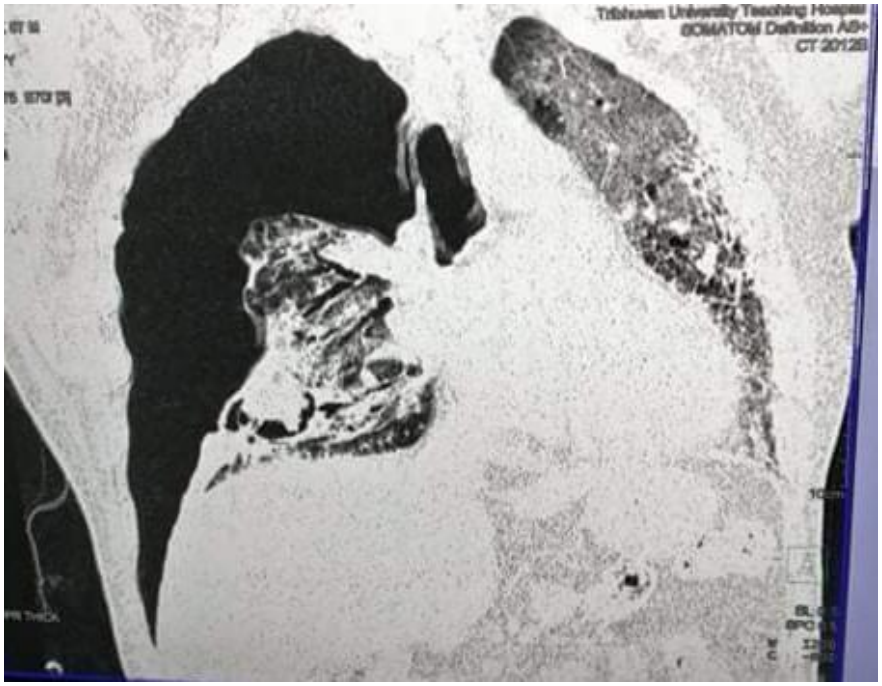

Figure 2b.

Figure 2a and Figure 2b are HRCT scans showing right-sided hydropneumothorax with an intermediate walled cavity in the right lower lobe with BPF and multifocal consolidation with ground glass in bilateral lung fields with fibro bronchiectatic changes and crazy pavement patterns.

The patient showed no sign of improvement even after placement of the chest tube for three days. Therefore,

a repeat chest X-ray had to be performed that revealed minimal re-expansion of the right lung, indicating persistent pneumothorax. For this, the chest tube's functionality was assessed, which showed signs of leakage, and a second chest tube had to be inserted. Despite implementing all necessary and aggressive interventions, the patient's overall condition continued to deteriorate, necessitating collaboration with the thoracic surgical team to plan a surgical procedure for repairing the bronchopleural fistula. Regrettably, despite efforts to stabilize the patient, his condition deteriorated rapidly, resulting in an unfortunate outcome.

Discussion:

Pneumothorax is the presence of air in pleural space, which can be broadly classified as spontaneous and traumatic (7). Spontaneous pneumothorax not associated with any underlying lung disease is called primary, and those associated with some underlying lung disease are categorized as secondary (7). Our patient, who was in the recovery phase of COVID-19, experienced a spontaneous pneumothorax. Given the association with COVID-19 pneumonia, this condition was classified as a secondary spontaneous pneumothorax. The occurrence of pneumothorax in COVID-19 patients varies, with a range of 0.3% in hospitalized individuals and a higher prevalence of 12.8% to 23.8% among those who require mechanical ventilation(8). A study by Chong et al. did not identify age or active smoking status as a risk factor for COVID-19-related pneumothorax (8). Our patient smoked one pack of cigarettes daily and stopped just after he was diagnosed with COVID-19.

Studies have shown the development of subpleural bullae that are visible on X-ray or CT scans before the occurrence of spontaneous pneumothorax. However, in our patient, a Chest X-ray (Figure 1b.) performed six days before the development of pneumothorax didn't show any subpleural bullae (2). Interestingly, the pneumothoraces that are caused due to COVID-19 usually tend to be right-sided and unilateral, as seen in our case as well (8).

Conservative treatment is recommended to manage asymptomatic pneumothorax, i.e., without significant breathlessness. Simple aspiration must be performed for symptomatic cases and should be admitted and observed for at least 24 hours(10). Intercostal drainage is recommended for those patients who fail to respond with aspiration and in all cases of secondary pneumothorax. The procedure is, however, not recommended for asymptomatic secondary pneumothorax or patients with apical pneumothorax measuring less than 1cm (10). Weissberg et al. recommend chest tube drainage when pneumothorax occupies more than 20% of pleural space. In our case, more than 50% of the pleural space on the right lung was occupied by pneumothorax, which warranted the placement of a chest tube(11).

However, even with the chest tube in-situ, there was minimal lung re-expansion, which prompted further investigations to discover the cause of persistent pneumothorax. An HRCT scan of the lungs showed the presence of a Bronchopleural Fistula (BPF), an abnormal connection between a bronchus and pleural space associated with very high morbidity and mortality. Many factors are related to developing a bronchopleural fistula, including necrotizing infection of the lungs, persistent spontaneous pneumothorax, radiotherapy, and chemotherapy(9). Our patient may have developed the fistula due to persistent spontaneous pneumothorax. BPF may be associated with empyema of the lungs if it persists for a long duration, for which chest drainage and long-term antibiotics are crucial to treatment (6). In our patient, after visualization of hydropneumothorax on HRCT, surgical consultation was done to assess the functionality of the previously inserted chest tube and to manage the BPF surgically. The second chest tube drain was inserted to give negative suction pressure as the first chest tube was not functioning correctly. Endobronchial intervention is preferred for seriously ill patients with small-size fistulas. The endobronchial intervention included sealing agents like glues, blood patches, or endobronchial valves. Surgical management is usually indicated for large bronchopleural fistula measuring more than 8 mm in size or persistent symptomatic pneumothorax due to the BPF (6). Surgical intervention, although planned, could not be performed as our patient succumbed to death due to rapid deterioration, even with appropriate management.

Conclusion

Pneumothorax and bronchopleural fistula are rare complications of COVID-19 pneumonia. This case report emphasizes the challenges in managing these conditions in patients recovering from COVID-19 pneumonia.

Early recognition, appropriate diagnostics, and timely intervention are crucial for optimal outcomes. Close monitoring and careful management are necessary for pneumothorax and bronchopleural fistula in COVID-19 patients, with conservative or interventional approaches based on symptoms and severity.

Further research is needed to understand the underlying mechanisms and risk factors associated with pneumothorax and bronchopleural fistula in COVID-19 patients. Improved knowledge in this area will aid in developing effective management strategies and ultimately improve patient outcomes. Healthcare providers should remain vigilant for these complications in COVID-19 patients and be prepared to intervene promptly to minimize morbidity and mortality.

Conflicts of Interest

The authors have no conflict of interest to declare.

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MR conceptualized the study, reviewed, edited the manuscript, and was in charge of the case; MS and MR wrote the original, reviewed and edited the manuscript; AK, NP, NKS, SB, and PP reviewed the manuscript.

Data Availability statement

All the required information is in the manuscript itself.

Consent Statement

Written informed consent was taken from the patient before the initiation of the study to publish this report.

References:

1. Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, et al. A Novel Coronavirus from Patients with Pneumonia in China, 2019. N Engl J Med [Internet]. 2020 Jan 24 [cited 2021 Jun 11]; Available from:*https://www.nejm.org/doi/10.1056/NEJMoa2001017*

2. Spiro JE, Sisovic S, Ockert B, Böcker W, Siebenbürger G. Secondary tension pneumothorax in a COVID-19 pneumonia patient: a case report. Infection. 2020 Dec 1;48(6):941–4.

3. Ucpinar BA, Sahin C, Yanc U. Spontaneous pneumothorax and subcutaneous emphysema in COVID-19 patient: Case report. J Infect Public Health. 2020 Jun 1;13(6):887–9.

4. Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. The Lancet. 2020 Feb 15;395(10223):507–13.

5. Sun R, Liu H, Wang X. Mediastinal Emphysema, Giant Bulla, and Pneumothorax Developed during the Course of COVID-19 Pneumonia. Korean J Radiol. 2020 May;21(5):541–4.

6. Talon A, Arif MZ, Mohamed H, Khokar A, Saeed AI. Bronchopleural Fistula as a Complication in a COVID-19 Patient Managed With Endobronchial Valves. J Investig Med High Impact CaseRep. 2021 Jan 1;9:23247096211013216.

7. Noppen M, De Keukeleire T. Pneumothorax. Respiration. 2008;76(2):121–7.

8. Chong WH, Saha BK, Hu K, Chopra A. The incidence, clinical characteristics, and outcomes of pneumothorax in hospitalized COVID-19 patients: A systematic review. Heart Lung. 2021 Sep 1;50(5):599–608.

9. Henry M, Arnold T, Harvey J. BTS guidelines for the management of spontaneous pneumothorax. Thorax. 2003 May;58(Suppl 2):ii39–52.

10. Weissberg D, Refaely Y. Pneumothorax: Experience With 1,199 Patients. Chest. 2000 May 1;117(5):1279–85.

11. Placik DA, Taylor WL, Wnuk NM. Bronchopleural fistula development in the setting of novel therapies for acute respiratory distress syndrome in SARS-CoV-2 pneumonia. Radiol Case Rep. 2020 Nov 1;15(11):2378–81