

Spontaneous pneumothorax as a manifestation of COVID-19: A case report

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Abstract

Spontaneous pneumothorax (SP) is an uncommon complication of COVID-19, mostly in association with pre-existing lung conditions or under positive pressure ventilation. SP has been reported to occur in approximately 1% of the patients with COVID-19. We report here a case of a 47-year-old non-smoker gentleman without any pre-existing lung disease, who was admitted to our facility with fever, cough and shortness of breath and for 3 days with progressive worsening and chest pain over last 24 hours. Chest radiography revealed the diagnosis of right-sided pneumothorax with widespread patchy infiltrates on the left lung field. He was tested positive for COVID-19 and cultures for secondary bacterial infections were negative. A chest drain was secured and he was given antibiotics, steroid, heparin and remdesivir. However, the patient died within next 2 days due to progressive respiratory failure. This report emphasizes awareness of the possibility of SP as a complication of COVID-19; early identification and treatment of this entity may help decrease the associated mortality and morbidity. In conclusion, the possibility of SP should always be considered in the workup of a patient of SARS-CoV-2 infection having acute shortness of breath with or without chest pain. We would like to highlight this significant, though rare, presentation of COVID-19 and urge clinicians to maintain a high index of suspicion.

Key word: COVID-19; pneumothorax; ventilation; infiltrates.

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Introduction

Coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was declared a pandemic on 11th March 2020. COVID-19 has claimed over 5 million lives as of 31st October 2021, the deaths attributed to its growing range of complications. While acute respiratory distress syndrome (ARDS), acute respiratory failure (ARF), thromboembolism, secondary infection and acute kidney injury are commonly documented complications (1,2,3); pneumothorax has been estimated to occur in approximately 1% of the patients. Spontaneous pneumothorax (SP) can be defined as a pathological collection of air inside pleural space without any definite traumatic mechanisms (4). The pathomechanism of SP in COVID-19 is still undetermined (5,6); it is thought that SARS-CoV-2 causes cystic and fibrotic degeneration of lung parenchyma, leading to alveolar tear. Furthermore, persistent coughing and positive pressure causes increased intrapulmonary pressure, thereby enhancing the risk for SP development.

In this case report, we describe the clinical course of a

47-year-old Indian male without any pre-existing lung disease, who presented with fever and cough followed by rapidly progressive shortness of breath with desaturation; eventually diagnosed as COVID-19 with right sided SP. A chest drain was secured on emergency basis and he was given antibiotics, steroid, heparin and remdesivir; however, he died within next 2 days due to progressive respiratory failure. This patient's case highlights the potential risk of developing SP in the setting of SARS-COV-2 infection, in absence of any pre-existing pulmonary comorbidity, active smoking, and positive pressure ventilation. Thorough search of the Pubmed and Medline database revealed only a handful of such cases in English language literature.

Case History

A 47-year-old gentleman, without history of contact with known or suspected SARS-CoV-2 positive patient, presented to the department of Internal Medicine of our institution on 05/07/2021 with fever, shortness of breath and cough for 3 days. His symptoms progressively worsened and he developed chest pain in the last 24 hours. He was non-diabetic and non-hypertensive, with no history of smoking or

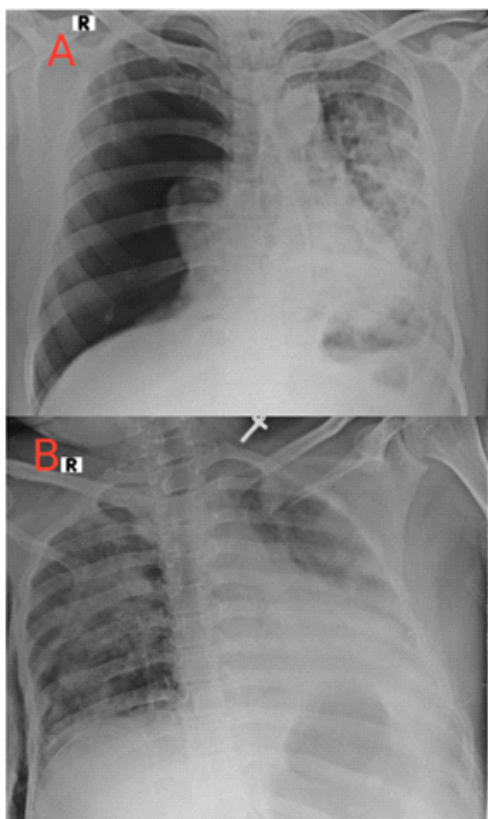
pre-existing lung disease. There was no significant family history of any lung disease.

On examination, he was febrile (temperature- 100.6 F) with a radial pulse of 134/minute. His blood pressure was 101/58 mm Hg, respiratory rate 39/minute, capillary blood glucose 87 mg/dl and oxygen saturation 66% on room air. Respiratory examination showed asymmetrical lung expansion with diminished breath sounds over right side of chest.

Arterial blood gas at admission revealed respiratory acidosis with compensatory metabolic alkalosis (pH of 7.32, pCO₂ of 46 mmHg, HCO₃ of 28 mEq/L). Basic blood parameters were unremarkable except for elevated acute phase reactants and D-dimer. A chest X-ray was performed at the time of admission, which demonstrated features suggestive of a right-sided pneumothorax with shifting of the mediastinum to the left, with widespread patchy infiltrates on the left lung field. (Figure 1A) Computed tomography (CT) scan thorax to better delineate the pneumothorax and parenchymal involvement, and CT pulmonary angiogram to rule out pulmonary embolism could not be performed due to logistic issues. Reverse transcription-polymerase chain reaction (RT-PCR) of nasopharyngeal and oropharyngeal swabs taken were positive for SARS-CoV-2. Blood and sputum cultures for secondary bacterial infections revealed no growth.

Figure 1

Chest radiography showing right-sided pneumothorax with shifting of the mediastinum to the left, with widespread patchy infiltrates on the left lung field (Panel A); Expansion of the right lung after placement of chest tube (Panel B).



Chest drain was secured under emergency setting and patient was started on oxygen supplementation. (Figure 1B) He was treated with a combination of remdesivir (intravenous loading dose of 200 mg on day-1, followed by 100 mg once daily), dexamethasone (6 mg once a day through intravenous route), enoxaparin (60 mg once a day through subcutaneous route) and meropenem (1 gm thrice a day through intravenous route) along with supportive care in the Intensive Care Unit (ICU). The patient, however, gradually deteriorated and died 2 days after admission due to progressive respiratory failure and multi-organ dysfunction.

Discussion

SP is known to present secondary to chronic obstructive pulmonary disease, pneumonia, lung cancer and interstitial lung disease (4). It usually occurs young tall and slim men in the age group of 15-30 years. Smoking can increase its risk up to 20-fold. Most of the patients present with shortness of breath and ipsilateral pleuritic type of chest pain (7). SP is a common complication in some pulmonary infections (8), such as *Pneumocystis jirovecii*, *Staphylococcus aureus* and *Klebsiella pneumoniae*. Infection with SARS-CoV-2 is mainly characterized by febrile illness associated with respiratory symptoms; predominantly cough, shortness of breath and lung infiltrates being present in most of the hospitalized patients. SP as the presenting feature of COVID-19 at the emergency department is unusual (< 1% cases) (9). Exact incidence of SP in COVID-19 is currently unknown (3, 10). In most of these cases (11), invasive ventilation or noninvasive positive pressure ventilation was applied prior to the development of pneumothorax. In other cases (12), it appeared several weeks after the pulmonary infection, resulting in persistent inflammatory infiltrates and formation of bullae/cyst. The proposed pathomechanism of SP (10) in patients with pulmonary infection is direct invasion of organism combined with necrosis of pulmonary parenchyma with adjacent pleura. Autopsy studies of lungs in patients died of severe COVID-19 (13), reported diffuse alveolar damage with fibromyxoid exudates and cystic pulmonary lesions. Those cystic lesions may develop in the lung even in absence of positive pressure ventilation (14). A few studies (15) also concluded that the incidence of SP is higher in patients with overwhelming systemic inflammation (characterized by raised inflammatory markers) and multiple organ failure.

Several cases of pneumothorax in COVID-19 have been described in literature since the pandemic began, which suggest that, most commonly, pneumothorax develops during the course of illness as a complication, under positive pressure ventilation or in association with pre-existing lung conditions, often detected upon subsequent investigations rather than in initial radiograph. However, Quincho-Lopez et al (16) detailed 20 cases of COVID-19 associated with pneumothorax, of which 6 had no reported comorbidities. A retrospective study on 60 patients of COVID-19 with pneumothorax (3), revealed that only 9 presented with pneumothorax on initial chest radiograph. In a study by Yang et al (17), in a series of 92 deceased patients with COVID-19, only one presented with SP. A systematic review of thorough

review of existing literature by studying 919 patients with COVID-19 by Salehi *et al* (18), revealed only a few cases of SP which was described by them as a possible progression of the disease process. Endres F *et al* (19) reported two cases of spontaneous pneumothorax associated with SARS-CoV-2 infection without any associated preexisting pulmonary comorbidity. A retrospective study by Yang *et al* in Wuhan (20), China reported about 2% occurrence of SP in patients with COVID-19. A multicentric study by Miró *et al* (9) reported about 40 patients (0.05%) with SP out of a cohort of 71,904 patients with COVID-19; they also reported a worse outcome in those patients.

The presenting patient was non-smoker, had no history of any pulmonary disease, and had not received any positive pressure ventilation support before presentation, which are well-known risk factors for development of SP. The cystic and fibrotic damage of lung parenchyma with the adjacent pleura due to SARS-CoV2 causing an enhanced risk of alveolar tear, combined with the rise in intrapulmonary pressure due to persistent cough might be the possible etiology in our patient.

The potential mechanisms for development of SP in COVID-19 are yet to be understood. We would like to acquaint the clinicians about this potential pulmonary complication of SARS-CoV2 infection, so that focused clinical examinations, imaging and timely management can be done to save the life of the patient.

Conclusion

Spontaneous pneumothorax is an uncommon complication of COVID-19, mostly in association with pre-existing lung conditions or under positive pressure ventilation. This case demonstrates spontaneous pneumothorax as a presenting manifestation of COVID-19 and emphasizes the importance of thorough history taking, clinical examination and chest radiography to avoid delay in diagnosis and appropriate management.

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Authorship contribution

Both the authors prepared the manuscript with adequate planning and execution, contributed to review of literature, critical revision of content and final approval of manuscript. All authors are in agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Statement of Ethics

An informed written consent was obtained from the patient's father after full explanation regarding the images of his son being published for academic interest. The patient's

father did not have any objection regarding use of images and gave due permission to use them.

Our research complies with the guidelines for human studies and was conducted ethically in accordance with the World Medical Association Declaration of Helsinki. However, ethical approval was not required for this article in accordance with the Institutional Ethics Committee. Written informed consent was obtained from the patient for publication of this case report and accompanying images after full explanation regarding his images being published for academic interest.

Competing interests

The authors declare no conflicts of interest.

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