

# Epidemiological and Clinical Characteristics of Adults with Coronavirus Disease 2019 Complicated with Pneumothorax

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## ABSTRACT

**Background:** The major brunt of coronavirus disease-2019 (COVID-2019) is borne by the lungs. The major cause of morbidity and mortality in COVID-19 patients is a compromise of the respiratory system. Pneumothorax is noted as an insignificant proportion of patients suffering from COVID-19, but it jeopardizes the clinical recovery significantly. We, in the case series of 10 patients, will be summarizing the epidemiological, demographic, and clinical characteristics of COVID-19 patients who also developed pneumothorax.

**Patients and methods:** All the confirmed cases of COVID-19 pneumonia diagnosed between May 1, 2020 and August 30, 2020, admitted at our center meeting the inclusion criteria and whose clinical course was complicated by pneumothorax were made part of our study. Their clinical records were studied, and epidemiological, demographic, and clinical data of these patients were collected and compiled in this case series.

**Results:** All the patients in our study required ICU care, and 60% received non-invasive mechanical ventilation, while 40% of the patients progressed to intubation and invasive mechanical ventilation. A total of 70% of the patients in our study had a successful outcome, while 30% succumbed to the disease and expired.

**Conclusion:** Epidemiological, demographic, and clinical characteristics of COVID-19 patients complicated with pneumothorax were evaluated. Our study showed that pneumothorax also developed in some patients who had not received mechanical ventilation, indicating that pneumothorax could be a secondary complication of SARS-CoV-2 infection. Our study also emphasizes the fact that even the majority of patients whose clinical course was complicated by pneumothorax had a successful outcome emphasizing the need for timely and adequate intervention in such cases.

**Keywords:** Coronavirus disease-2019, Pneumothorax, SARS-CoV-2 infection.

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## INTRODUCTION

Infection with the SARS-CoV-2 virus was first identified in the Wuhan province of China.<sup>1</sup> This infection speeded over months to take the form of a pandemic. As date of writing this article more than 3 crore people have been infected with this virus worldwide.<sup>2</sup> COVID-19 can complicate any organ of the body, and many of its systemic effects are still being explored, but the most affected organ remains the lungs.<sup>3-5</sup> The most common symptoms of patients with SARS-CoV-2 infection include fever, cough, and shortness of breath in some selected cases. The cluster and severity of symptoms vary with the disease intensity, and some patients can even progress to dyspnea at rest, including desaturation mandating the need for mechanical ventilation.

It has been demonstrated that the SARS-CoV-2 virus has a strong predilection for lung and respiratory ailments that are primarily responsible for morbidity and mortality in patients suffering from COVID-19 infection. Pneumonia secondary to SARS-CoV-2 infection leads to ventilation and perfusion mismatch and can also lead to fibrotic changes in the lung parenchyma. This already compromised respiratory system can further be pushed to the brink by the development of pneumothorax in patients suffering from COVID-19 pneumonia.

Numerous patients of COVID-19 have been mechanically ventilated till date, and we are presenting here a case series regarding epidemiological and clinical characteristics of 10 confirmed COVID-19 patients who developed pneumothorax either spontaneous or after initiation of mechanical ventilation.

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We aim to provide an important review on this matter which helps treating physicians in making informed decisions with regards to COVID-19 pneumonia complicated by pneumothorax.

## PATIENTS AND METHODS

Adults with confirmed COVID-19 infection complicated with pneumothorax were retrospectively recruited from our center. Ethical approval was obtained from the ethical committee.

### Inclusion Criteria

- Age between 18 years and 80 years.
- Proven SARS-CoV-2 infection confirmed by reverse transcriptase-polymerase chain reaction (RT-PCR).
- Confirmed COVID-19 pneumonia complicated by pneumothorax between May 1, 2020 and August 30, 2020 were included in the study.

Diagnosis of SARS-CoV-2 infection in these patients was as per the recommendation of the World Health Organization interim guidance.

### Exclusion Criteria

- All cases below 18 years of age and above 80 years of age.
- Cases that were not confirmed on the RT-PCR report.
- Cases with central line insertion in the internal jugular vein within 24 hours prior to the pneumothorax onset.

Clinical records of the patients meeting the inclusion criteria were evaluated, and their clinical, demographic, and epidemiological data were collected. All the included cases were confirmed with SARS-CoV-2 infection by quantitative real-time RT-PCR.

### RESULTS

A total of 10 adults with confirmed COVID-19 infection and pneumothorax were included in the study. In total, 70% of the included patients were male and 30% were females. The oldest patient in the study was 79-years-old, and the youngest patient was 43-years-old. The most common initial symptoms among the study group were fever (90%), cough (70%), and sore throat (70%), while 40% of the patients had their symptoms progressing to shortness of breath. Only two patients in the study (20%) had a history of confirmed contact with a COVID-19 confirmed case. As for the comorbidities, one patient (10%) was a confirmed case of chronic obstructive pulmonary disease (COPD), while 20% of the patients had a history of hypertension and 10% of the patients had a history of diabetes mellitus type-2.

A total of 60% of the patients included in the study had leukocytosis, while 10% had leucopenia. None of the patients included in the study showed lymphopenia. Alanine transferase (ALT) levels were largely within the normal limits in the study population with the peak ALT level recorded as 82 U/L. Procalcitonin levels were risen in 40% of the study population with peak procalcitonin levels recorded as 3.46 ng/mL.

All the patients included in the study had bilateral infiltrates and pneumothorax in CT scans of the chest. All the patients included in the study required ICU admission. In total, 60% of the patients included in the study received non-invasive mechanical ventilation prior to the development of pneumothorax, while 40% of the patients progressed to the requirement of invasive mechanical ventilation of whom only one fourth received invasive ventilation prior to the development of pneumothorax and the rest three fourth patients developed pneumothorax after the initiation of invasive mechanical ventilation. All of the patients included in the study received oxygen therapy, steroids, antibiotics, and Remdesivir. Tocilizumab was used in six patients (60%), and 70% of the patients included in the study received hydroxychloroquine. After treatment, 70% of these patients were successfully discharged from the hospital, while 30% of the patients, unfortunately, succumbed to the disease and expired.

### DISCUSSION

The current study aims to describe the epidemiological, demographic, and clinical characteristics of patients with COVID-19 and pneumothorax. There are case reports describing the incidence of both spontaneous and mechanical ventilation-related pneumothorax in patients with COVID-19 infection. Of the 10 patients included in the study, seven (70%) were males.

Similar findings with a more male predilection for pneumothorax in COVID patients were also echoed in a similar study done by Martinelli et al.<sup>6</sup> Similar findings with males being more commonly infected with SARS-CoV-2 infection and having a more severe course of the disease were also noted in some other studies as well.<sup>5</sup> There have been only observational studies relating pneumothorax secondary to SARS-CoV-2 infection and it is possible that some cases may have coincidental relations. But the percentage of COVID-19 cases complicated by pneumothorax is much more than the usual rate of pneumothorax in the general population,<sup>7-9</sup> indicating that COVID-19 can lead to secondary pneumothoraces in some cases.

How SARS-CoV-2 infection leads to pneumothorax requires further study and evaluation. However, radiological lung changes are frequent in patients suffering from COVID-19 pneumonia, and it is a possibility that multiple mechanisms might be responsible for this complication. Numerous studies have described the radiological progression from areas of consolidation to bullae.<sup>10-12</sup> There are previous case reports indicating cyst formation in some cases, concluding that the development of pneumothoraces is not related to barotrauma alone. Similarly, we have also reported pneumothorax in some patients who have not received mechanical ventilation. Similar findings of cyst formation as a complication of acute respiratory distress syndrome (ARDS) secondary to SARS were also described in some previous case reports.<sup>13</sup>

Management of COVID-19 patients on mechanical ventilation complicated by pneumothorax presents a clinical challenge, and there are case reports describing pneumothorax resistance to chest drain ultimately requiring surgery in COVID-19 patients.<sup>14</sup>

The small study population in our case series limits us to draw any conclusions with regard to overall prognosis, but previous studies have suggested that the development of pneumothorax in coronavirus-infected patients is a grave prognostic marker.<sup>15-18</sup>

Further studies are needed to develop the causal relationship between COVID-19 and the development of pneumothorax. Further studies into the mechanism involved in the development of this complication can help clinicians to take preventive actions.

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