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# Case Series - Cystic Lung Lesions (CLL), and Pneumothorax in COVID-19 Patients

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## Abstract

The prevalence of cystic lesions in COVID-19 patients is around 9%. The cystic lesions in COVID-19 patients are clear thin-walled, exhibiting size variability, and size is <2.5cm. Pneumothorax in COVID-19 Patients is also a rare occurrence of 0.66%.

**Keywords:** COVID-19, Cystic Lesions, Pneumothorax, High-Flow Nasal Cannula (HFNC), Long-Term Oxygen Therapy (LTOT), acute respiratory distress syndrome (ARDS), High - Resolution Computed Tomography (HR CT)

## Introduction

Cystic lesions in COVID-19 patients are a rare occurrence and Guru Murthy, B et al reports that the prevalence of cystic lesions 9in COVID-19 patients is 9%, and Aggarwal, A et al also describes the structure of the cystic lesion as well defined, thin-walled, measures <2.5cm, but also shows variability in size [1,2]. In COVID-19 patients, Zantah, M et al report the occurrence of Pneumothorax is around 0.66%[3].

Xu, Z et al described that lung cystic lesions are formed due to fibro myxoid exudates that construct valves in the bronchus thus working as a one-way valvular system that traps the air and enables the cystic formation[4]. Duzgan SA et al and Parekh M et al explained in their study on difficulty of identification of these cysts due to several over lapping diagnostic entities by clinical, and radio logical methods [5, 6].

Chong, W. H et al reported cystic lung lesions, and Pneumothorax in COVID 19 who are also infected by HIV, and all the reported patients were male patients[7]. Shirani, F et al described the structure of the lung cyst in COVID-19 patients in chest radiography and CT as opacities of airspace and ground glass appearance[8].

Rafiee, M. J et al describe the distribution of cystic lung lesions, and Pneumothorax in COVID-19, and the distribution was in the basal area of the lung lobe, multifocal, and predominant distribution was peripheral[9].

**Case report 1:** Male, 59 (yrs)

**Clinical Presentation**

A 59 years old male patient was admitted to the ICU for diseases severity of COVID-19.

**Symptoms**

- Worsening hypoxia.
- Persistent spikes of fever.
- Breathlessness.

**Primary Identification**

- COVID 19.
- Chest X-ray (CXR) showed bilateral heterogeneous opacities in the lower zone.
- After ventilator usage, the patient developed Ventilator-Associated Pneumonia (VAP) with Multi-Drug-Resistant (MDR) Klebsiella.
- CXR showed pneumothorax on the left side.
- CXR showed pneumothorax on the right side also.

**Intervention**

- COVID-19 protocol of treatment provided.
- For hypoxia, High-Flow Nasal Cannula (HFNC) started.
- As HFNC was not supporting the patient, a ventilator was used for the patient.
- For pneumothorax, Intercostal Chest Drain (ICD) was inserted for the left side.
- For pneumothorax on the right side, Intercostal Chest Drain (ICD) was also inserted for the right side.
- Started with high-end antibiotics and anti-fibrotic (Nintedanib).

**Follow-up**

- On the 14$^{th}$ day of admission, the COVID-19 swab turned out negative.
- The patient required only low-flow oxygen.
- As the patient required low O2, the left side ICD is removed.
- The right side ICD was also removed.
- After 2 months of treatment, the patient was discharged with Long-Term Oxygen Therapy (LTOT) and Venous Thrombo-Embolism (VTE) prophylaxis along with advice for chest physiotherapy.
- On follow-up in the Out Patient Department (OPD) visits follow-up of High-Resolution Computed Tomography (HRCT) showed only a few centrilobular emphysematous changes with fibrotic bands and atelectasis.

**Confirmatory Identification**

- CT thorax showed multiple sub-pleural cystic lesions in the left lung, the largest measuring 14 x 9 x 9 cm with mass effect to the subjacent lung parenchyma. Ground glass attenuation and interlobular septal thickening also appeared.

Figure1. Pneumothorax on Right side

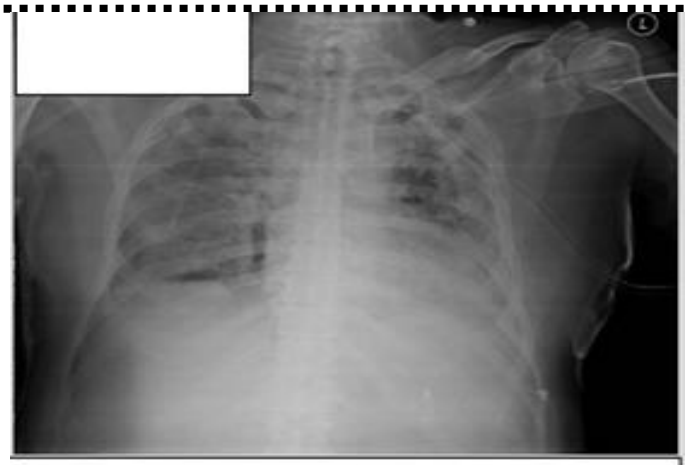

Figure 2. Pneumothorax on Left side

Figure 3. Follow up-CXR

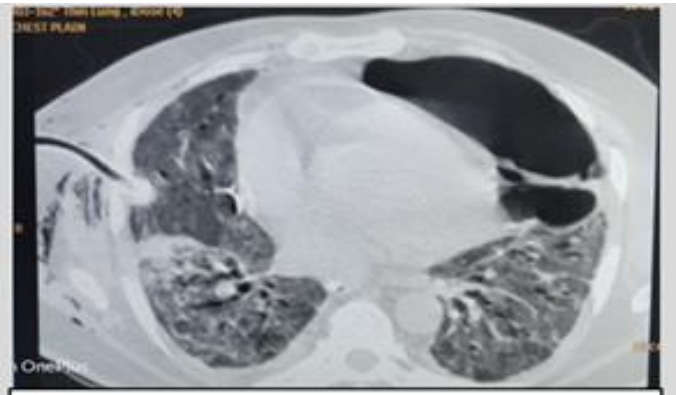

Figure 4. CT-During COVID 19

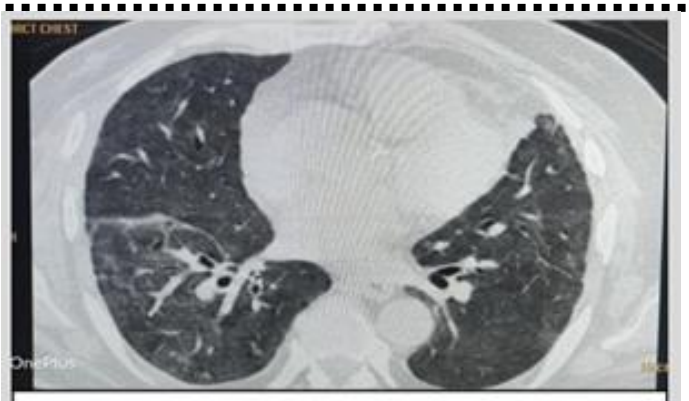

Figure 5. CT-Post-COVID 19-After 3 Months

**Case report 2: Male, 39 (yrs)**

**Clinical Presentation**

A 39 years old male patient was admitted to the ICU for diseases severity of COVID-19.

**Symptoms**

- Respiratory distress

**Primary Identification**

- COVID 19.
- CXR showed right-sided Pneumothorax.

**Intervention**

- COVID-19 protocol of treatment provided.
- For Pneumothorax, Intercostal Chest Drain (ICD) was inserted for the right side.
- The treatment dose of Anti-coagulants started.

**Follow-up**

- On the 15$^{th}$ day of admission, the patient required only low-flow oxygen.
- As the patient required low O2, the Right side ICD is removed.
- Repeat CT-PA taken 15 days later had shown complete resolution of the pneumomediastinum and pneumothorax with multiple thin-walled cysts in the medial segment of the right middle lobe and lingula and sub-pleural cysts along the left oblique fissure.

- After 24 days of admission, patient review to OPD after 1 month showed minimal residual breathlessness and CXR showed normal lung parenchyma.

**Confirmatory Identification**

- CT pulmonary angiogram (CT-PA) on the right side showed pneumothorax with pneumomediastinum, air attenuation pockets, and multiple sub-segmental filling defects with pulmonary artery dilation.

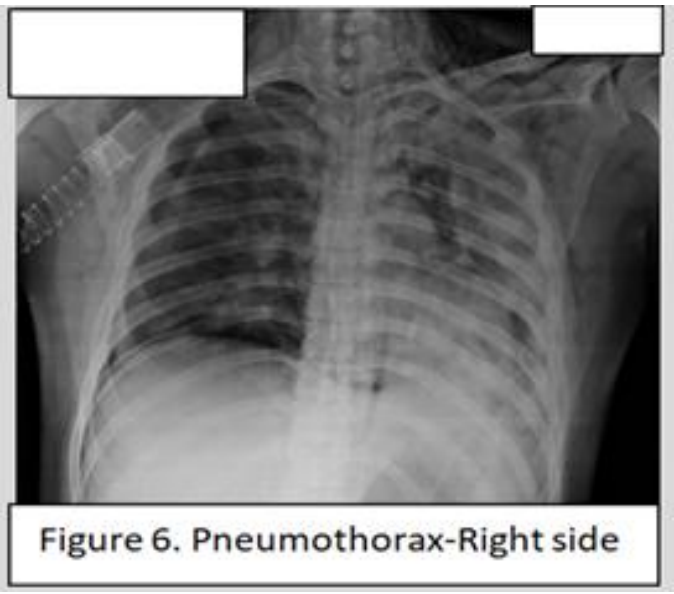

Figure 6. Pneumothorax-Right side

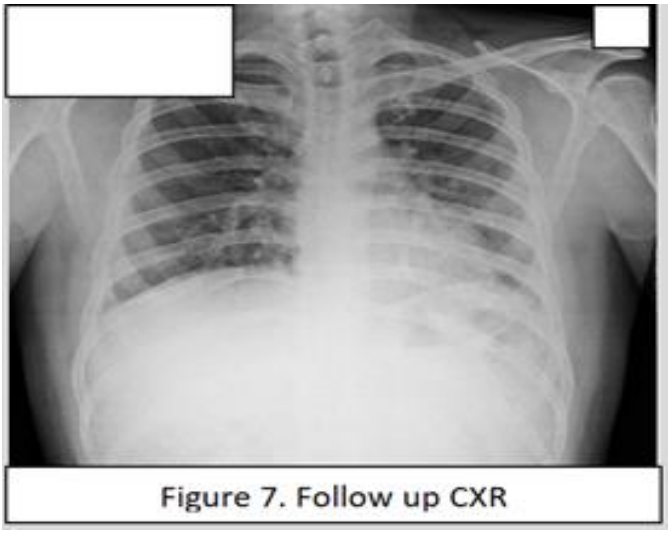

Figure 7. Follow up CXR

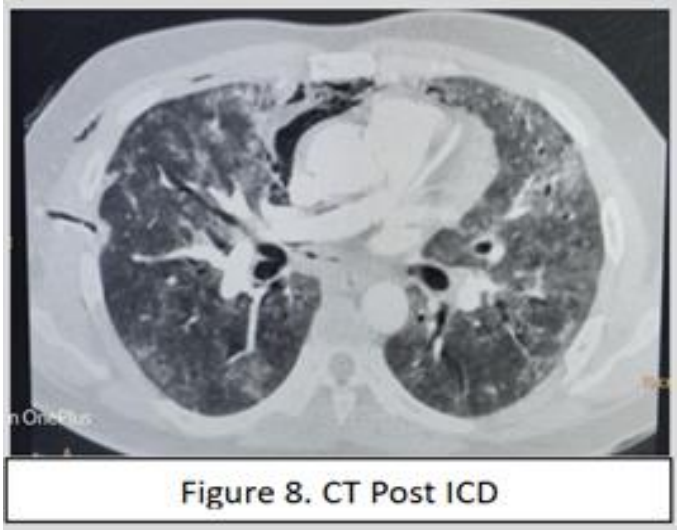

Figure 8. CT Post ICD

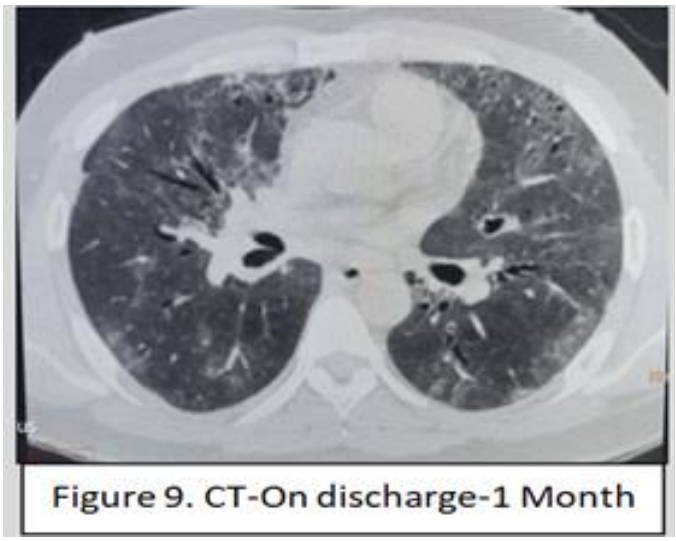

Figure 9. CT-On discharge-1 Month

**Clinical Presentation**

A 45 years old male patient was admitted to the ICU for diseases severity of COVID-19.

**Symptoms**

- Respiratory Issues, and severe breathlessness.
- Elevated D-dimer values were found.

**Primary Identification**

- COVID 19.
- Severe Pneumonia.
- Identified with right-sided spontaneous Pneumothorax.

**Intervention**

- COVID-19 protocol of treatment provided.

- For severe Pneumonia, High-Flow Nasal Cannula (HFNC) started.
- On tapering oxygen support.
- For Pneumothorax, ICD was inserted for the right side.
- Pigtail was also inserted for the trapped air.

**Follow-up**

- After 2 weeks of post-admission, COVID-19 turned out negative.
- The patient was discharged after 3 weeks.

**Confirmatory Identification**

CT showed right-sided Pneumothorax with few loculated Pneumothorax and fibro bronchiectasis changes in the bilateral lower lobe with features suggestive of Pneu mothorax.

Figure 10.CXR on admission

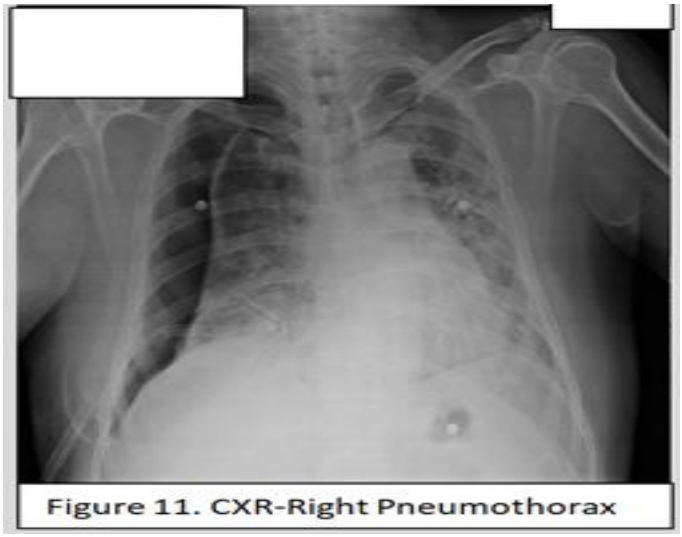

Figure 11. CXR-Right Pneumothorax

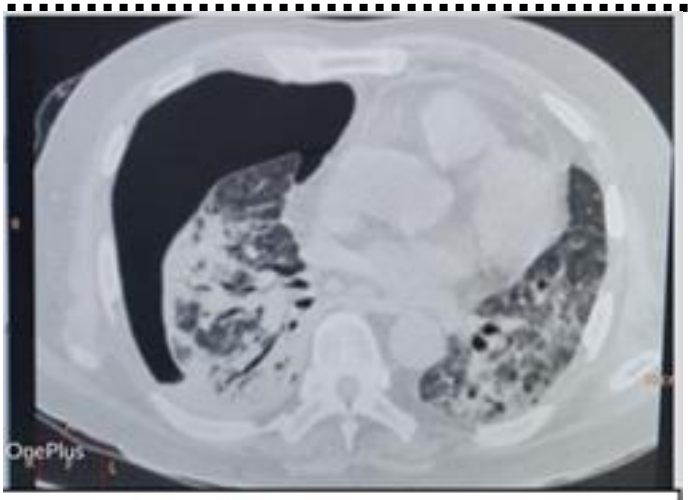

Figure 12. CT Post ICD

**Result**

Pneumothorax was observed in all three patients. Case 1 received an invasive ventilator, case 2 a non-invasive ventilator, and case 3 received her HFNC, followed by a violent cough that caused a pneumothorax. Therefore, it is conceivable that the addition of a ventilator may lead to cyst formation and subsequent development of pneumothorax.

**Discussion**

COVID-19 patients suffer from several com plications; among them, acute respiratory distress syndrome (ARDS) is one of the complications that lead COVID-19 patients towards type I respiratory failure leading to mortality.

Phaua, J et al [10], and Alhazzani, W et al [11] reported that around 5-15% of COVID-19 patients require intensive care, and also they require ventilator support. As per current recommendations 2 reasons for intubation of COVID-19 patients, the first being severe hypoxemia with (PaO2/FiO2->200 mm Hg), and later protecting health care workers from viral infection.

In COVID-19 patients, a high-pressure ventilator causes cystic formation leading to Pneumothorax. Gosangi, B et al [12] described that mechanical ventilators in high

pressure cause the disruption or injury of the alveoli wall which results in barotrauma lung cysts, Pneumome diastinum, and Pneumothorax.

Gupta, V. K et al [13] reported that lung cysts are usually found at the surfaces of the sub-pleural region of weaker alveoli and also found on inter-tubular septa. Gupta, V. K et al also explained that lung cysts cannot be confirmed by the CXR, but CT confirms the lung cyst as air-filled pockets, thin-walled, and found predominantly in the middle and upper part of the lobes. We also found and confirmed lung cysts by CT in our 3 patients of the case series.

Langlet, B et al [14] explained that CT is the best diagnostic tool that identifies lung cysts than CXR. The CT identifies lung cysts and Pneumothorax as dot-like, radiolucent air bubble-like structures found in the bronchi and also in the pulmonary artery; we also found similar structures in our 3 patients of case series.

Hamad, A. M. M et al [15] described the hypothesis behind lung cysts in COVID-19 patients is as the viral particles infect the alveolar wall, trigger the cytokine storm leading to alveolar rupture, hence forming the cysts filled with air, and we are also compatible with the hypothesis of Hamad, A. M. M et al.

Blondeau-Lecomte, E et al [16] studies found a lung cyst measuring 6.4 x 5.1 x 4.8 cm in the right lobe, we also found a lung cyst measuring 14 x 9 x 9 cm in one of the patients of our case series.

**Conclusion**

From these case studies, we conclude that Mechanical ventilator with high pressure in COVID-19 patients leads to lung cyst and Pneumothorax formation; hence we suggest and recommend from our case series that clinicians or pulmonologist based on individual patient's clinical judgment, usages of ventilators with minimal pressure or Positive End-Expiratory Pressure (PEEP) or Non-Invasive Positive Pressure (NIV-PP) will avoid consequences like lung cyst, and appropriate antibiotic regimen will eradicate Pneumothorax leading to complete recovery of COVID-19 patients with lung cyst and Pneumothorax.

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