Case Report

Intrathoracic Extrapleural Air Mimicking Pneumothorax: Secondary to Barotrauma in COVID-19

Mayur C. Vira, Ramachandra R. Rao, Rajeev U. Mehta

Department of Radiology, Saifee Hospital, Mumbai, Maharashtra, India

Abstract

This case illustrates a potential complication of mechanical ventilation in COVID patients, which can mimic as a pneumothorax on chest X-rays. Recognizing this complication in critically ventilated patients is important to avoid unnecessary surgical intervention, which can further add to the patient's morbidity and increase the duration of hospital stay.

Keywords: Barotrauma, COVID-19, extrapleural air, pneumothorax mimic

INTRODUCTION

Imaging patients of the intensive care unit (ICU) has an important role in their management. The portable chest radiograph is the most frequently requested imaging modality. In spite of its shortcomings, it commonly detects pathologies that change the patient care. However, these can sometimes be misleading, thus altering the management of the ICU patients, and computed tomography (CT) imaging is then required to further reassess the diagnosis. Advances in imaging technology have made it possible to obtain good-quality CT images even in extremely breathless patients.^[1] This is an interesting case report of a COVID-19 patient where thoracic imaging played a critical role in diagnosing and altering the management of the patient.

CASE REPORT

An octogenarian male patient presented to the emergency department with breathlessness and fever for the past 5 days. The patient was a known case of myasthenia gravis, on medications for the past 15 years. The initial chest radiographs showed ill-defined peripheral ground-glass haziness in bilateral lung fields [Figure 1]. He was admitted in the ward for suspected COVID patients, and a nasopharyngeal swab was sent for reverse transcription–polymerase chain reaction examination which turned out to be positive.

In spite of intubation and mechanical ventilation, the patient had worsening oxygen saturation levels. Follow-up portable chest radiographs were carried out for the same, which revealed diffuse bilateral ground-glass attenuation. A clinical diagnosis of acute respiratory distress syndrome (ARDS) was made.

Finally, a tracheostomy was done on the 12th day of the illness. Subsequent portable chest radiographs showed diffuse subcutaneous emphysema and pneumomediastinum. In addition, there was abnormal right-sided intrathoracic lucency representing pneumothorax causing partial atelectasis of the right lung [Figure 2].

An intercostal drainage tube was inserted for the pneumothorax on the right side. Follow-up radiographs did not reveal any significant change in the degree of pneumothorax. Finally, high-resolution computed tomography (HRCT) of the chest was advised to check both the position of the intercostal drainage tube and the lung parenchymal changes.

HRCT of the chest revealed diffuse ground-glass attenuation in the lung parenchyma bilaterally, underlying diffuse

Address for correspondence: Dr. Mayur C. Vira,
Department of Radiology, Saifee Hospital, Maharshi Karve Road,
Charni Road East, Mumbai - 400 004, Maharashtra, India.
E-mail: drmayurvira@gmail.com

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septal thickening, and patches of consolidation along the posterior-dependent aspects [Figure 3].

Extensive subcutaneous and intermuscular emphysema was seen along the chest walls on either side, extending to involve the lower cervical and upper abdominal regions.

There was extensive air in the mediastinum outlining the great vessels and pericardium [Figure 4]. This air was dissecting inferiorly into the extraperitoneal space, as well as the retroperitoneum.

There was moderate degree of air in the right hemithorax in the extrapleural space that was mimicking a pneumothorax on the chest X-rays. It showed multiple thin and smooth intrinsic septa and fascial webs that are classically seen in the air collections in the extrapleural space. This was causing partial atelectasis of the right lung parenchyma [Figures 4 and 5]. The intercostal drainage tube was withdrawn, and the patient was managed conservatively.

Figure 1: Frontal chest radiograph revealing ill-defined peripheral ground-glass haziness in bilateral lung fields

Figure 3: Axial image of high-resolution computed tomography chest showing diffuse bilateral ground-glass attenuation and posterior-dependent patches of consolidation with underlying septal thickening, consistent with changes of acute respiratory

DISCUSSION

One of the dreaded complications of mechanical ventilation is barotrauma, which may lead to increased morbidity and mortality. Severe underlying pulmonary disease and longer duration of mechanical ventilation are associated with increased incidence of barotrauma, especially in patients with ARDS.^[2] We report a rare case of COVID-19-associated ARDS with barotrauma and significant extrapleural air mimicking a pneumothorax.

The management of abnormal air collections in the thorax depends on its location. Tension pneumothorax requires surgical intervention.^[3] Subcutaneous emphysema, intrathoracic extrapleural air collection, and pneumomediastinum are few conditions that are usually not considered as

Figure 2: Frontal chest radiograph showing diffuse subcutaneous emphysema, pneumomediastinum and an abnormal right-sided intrathoracic lucency representing pneumothorax, causing partial atelectasis of the right lung

Figure 4: Axial image of high-resolution computed tomography chest showing extensive air in the mediastinum outlining the great vessels and pericardium. Moderate degree of air in the right hemithorax showed multiple thin and smooth intrinsic fascial webs that are classically seen in the air collections in the extrapleural space

Figure 5: Coronal computed tomography scan image of the chest showing extensive intrathoracic air on the right, showing multiple thin fascial webs representing air collection in the extrapleural space, causing partial atelectasis of right lung

medical emergencies and need only clinical monitoring.^[4-6] Pneumomediastinum secondary to tracheal/esophageal rupture may require emergency surgical care. Pneumopericardium is treated by emergency pericardiocentesis in a case of cardiac tamponade.^[7]

Examples of air collection in the chest wall include subcutaneous emphysema and air in the intrathoracic extrapleural space. Anatomically, the intrathoracic extrapleural space and the pleural cavity are in proximity, and hence, abnormal accumulation of air in this extrapleural space mimics pneumothorax on radiographs. This differentiation is crucial to avert the need of thoracocentesis.^[8]

The most common source of pneumomediastinum is the terminal air spaces of the lung. When the alveoli rupture, air migrates into the mediastinum resulting in pneumomediastinum. Air ruptures from the alveolus into the perivascular and peribronchial fascial sheath in the presence of a pressure gradient between an alveolus and the interstitium. At the lung roots, the fascial sheath may rupture for air to enter into the mediastinum.^[9]

Air within the extrapleural space may be due to extension of pneumomediastinum in barotrauma. It can sometimes result from esophageal or tracheobronchial rupture. Extrathoracic air extending from the neck, chest wall, peritoneal cavity, or retroperitoneum, into the mediastinum, can also cause air accumulation in the extrapleural space.^[4]

Some radiographic findings can help their differentiation between a true pneumothorax and extrapleural intrathoracic air. Air distribution does not change with patient's position in extrapleural intrathoracic air. In addition, there will be visible fascial webs in this air collection, outside of the pleural line, better detected on CT examination. The pleural line shows increased waviness in extrapleural air collections than typically seen in pneumothorax.^[8]

The 2002–2004 SARS epidemic reported barotrauma cases ranging between 12% and 34%. A pneumothorax rate of 30% was reported in ICU-intubated patients during the MERS epidemic. In one of the studies, 15% of patients with COVID-19 infection requiring invasive mechanical ventilation had barotrauma, and this was more likely in younger patients with COVID-19. In addition, COVID-19–positive patients with barotrauma had longer duration of hospitalization.

Looking at these high rates of barotrauma in the times of epidemics and pandemics, we must keep in mind the possibility of extrapleural air that can mimic a pneumothorax on chest X-rays, to avoid unnecessary thoracocentesis and adding to the patients morbidity.^[10]

Pulmonary barotrauma usually requires only supportive and conservative management. Adequate settings of the mechanical ventilation parameters such as tidal volume, transpulmonary pressure, and positive end-expiratory pressure are some of the lung-protective strategies that can decrease the rate of complications.^[11]

CONCLUSION

In recent scenario of COVID pandemic, there is an increasing requirement of mechanical ventilation. Chest CT scans can provide great insight on whether the intrathoracic air collections are in the pleural cavity or extrapleural in location, thus avoiding unnecessary surgical intervention, especially in critically ventilated patients.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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