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Case Report

Giant lung bulla extending to the contralateral hemithorax

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ABSTRACT

Smoking constitutes one of the most significant risk factors in the etiology of giant bullous emphysematous lung disease, leading to the development of massive bullous lesions. This clinical entity is one that poses a diagnostic challenge due to confusion with spontaneous pneumothorax on imaging modalities. In this case report, we present a 52-year-old male patient with underlying Chronic Obstructive Pulmonary Disease (COPD) and a significant history of smoking. The patient presented to the emergency department with chest pain and acute dyspnea. Following the detection of a giant bulla on thoracic computed tomography (CT), the patient was referred to our clinic due to respiratory limitation and the necessity for planned preventive surgical management. This presentation is primarily designed to address the identification of large lung bullae, their integrated management in conjunction with underlying COPD, the radiological criteria for differentiating a bulla from pneumothorax, and to share our operative observations regarding the surgical intervention.

Keywords: giant bulla, pneumothorax, emphysema, bullectomy, vanishing lung syndrome

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Introduction

The entity of the giant bulla was first documented in the literature by Burke in 1937. These lesions are clinically defined as emphysematous structures that occupy more than 30% of a hemithorax and anatomically exhibit a predilection for localization primarily within the upper lobes. A commonly accepted synonym for this condition, reflecting the severe reduction in functional lung parenchyma seen radiologically, is Vanishing Lung Syndrome [1]. Depending on the size of the bulla, patients may be asymptomatic or may experience complaints such as chest pain and dyspnea. Especially in the presence of pneumothorax, cough and increasing shortness of breath may be observed.

In the radiological evaluation, the compression atelectasis or absence of discernible pulmonary markings within the bulla cavity on a chest radiograph creates a diagnostic dilemma that can be readily confused with spontaneous pneumothorax. High-resolution thorax computed tomography (CT) is the preferred diagnostic imaging method for detailed evaluation to differentiate between giant bulla and pneumothorax [2].

Both the patient's clinical presentation and comparative diagnostic imaging techniques are indispensable components of the diagnostic process. The invasive procedure chosen holds critical importance because performing a tube thoracostomy for a suspicion of pneumothorax—can lead to severe iatrogenic complications if a giant bulla is instead present. Such complications include the development of bronchopleural fistulas and persistent, massive air leaks, thereby necessitating accurate differentiation [3,4]. Symptomatic improvement and lung expansion cannot be achieved in these patients with incorrect interventions [5].

This presentation is primarily designed to identification of large lung bullae, their integrated management in conjunction with underlying COPD, the radiological criteria for differentiating a bulla from pneumothorax, and to share our operative observations regarding the surgical intervention.

Case Report

We present the case of a 52-year-old male with an established diagnosis of chronic obstructive pulmonary disease (COPD) and smoking history of 80 pack-years. His medical history includes intermittent emergency room visits with chest pain and shortness of breath. Initial suspicion of pneumothorax based on a chest radiograph performed at another clinic was subsequently clarified by thoracic CT, which confirmed the presence of a giant bulla. The patient was ultimately referred to our clinic for management of respiratory distress and consideration for preventive surgical management.

Physical examination revealed decreased breath sounds in the upper zone of the right lung. Laboratory examinations, including CRP and WBC values, were within normal ranges. Thoracic CT showed large air cysts in the right lung and anterior mediastinum extending towards the opposite hemithorax. The right lung was partially collapsed, and increased emphysematous ventilation was observed in both lungs (Figures 1,2). The chest radiograph taken in our clinic showed a radiolucent area in the right hemithorax compatible with a bullous lesion, with the trachea deviated towards the left side (Figure 3).

Surgical excision was planned under general anesthesia. During videothoracoscopic exploration, a giant bullous area originating from the upper lobe was detected, filling a large part of the right hemithorax. Tight adhesions in the bullous lung fields extending from the anterior mediastinal area to the opposite hemithorax were released using blunt dissection and an energy device. Following adhesiolysis, wedge resection was applied to the intact lung tissue on the lateral side of the upper lobe, forming the base of the bulla (Figure 4), thereby achieving lung expansion. A pleural tent was created for preventive purposes against the risk of postoperative air leakage. Histopathological examination was consistent with bullous and emphysematous changes.

Postoperatively, no complications developed. Chest radiographs showed the trachea in normal localization and successful parenchymal expansion (Figure 5). The chest tube was removed on the 7th postoperative day, and the patient was discharged in full recovery.

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

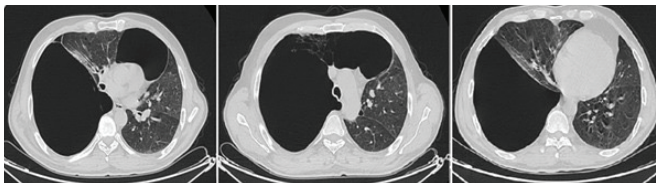

Figure 1. Axial reformatted thoracic CT images showing the giant bullous lesion originating from the right upper lobe and compressing the adjacent parenchyma.

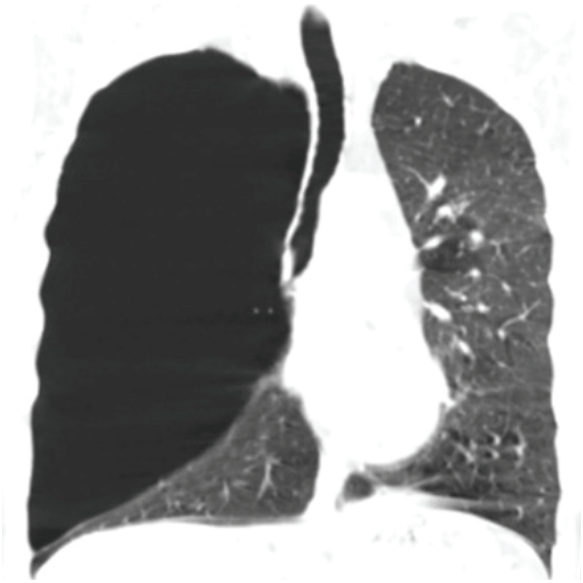

Figure 2. Coronal reformatted thoracic CT sections demonstrating the extent of the giant bulla originating from the right upper lobe and its mass effect on the parenchyma.

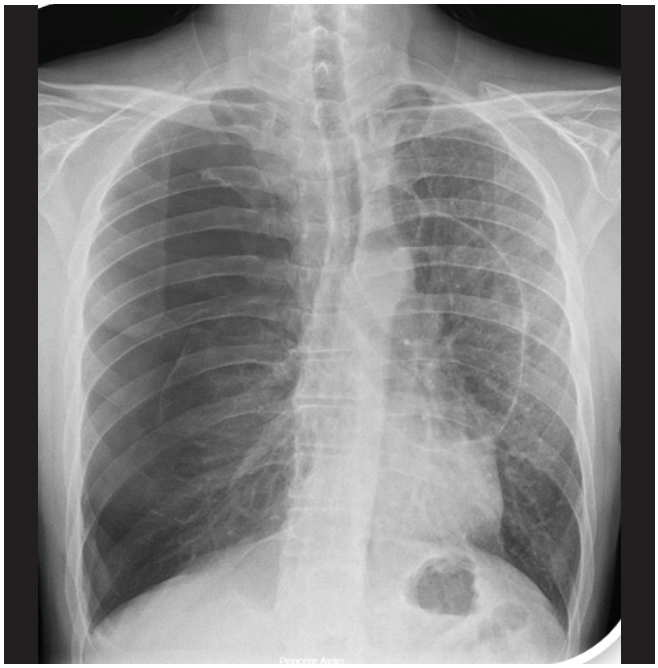

Figure 3. Preoperative posteroanterior (PA) chest radiograph. Significant deviation of the trachea to the left side is observed due to the expansile bullous lesion and increased aeration in the right hemithorax.

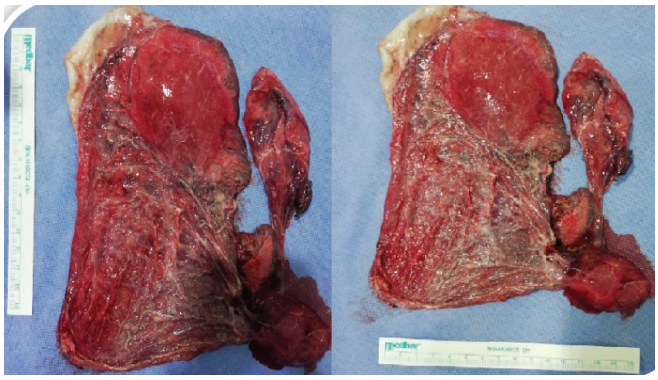

Figure 4. The resected specimen of the bullous lung tissue following wedge resection.

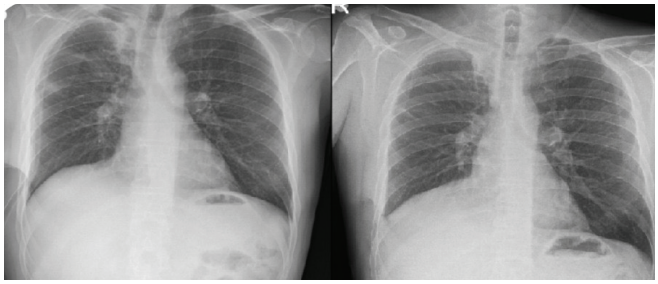

Figure 5. Postoperative PA chest radiographs (early and late periods) showing the return of the trachea to its normal midline position and successful re-expansion of the lung parenchyma.

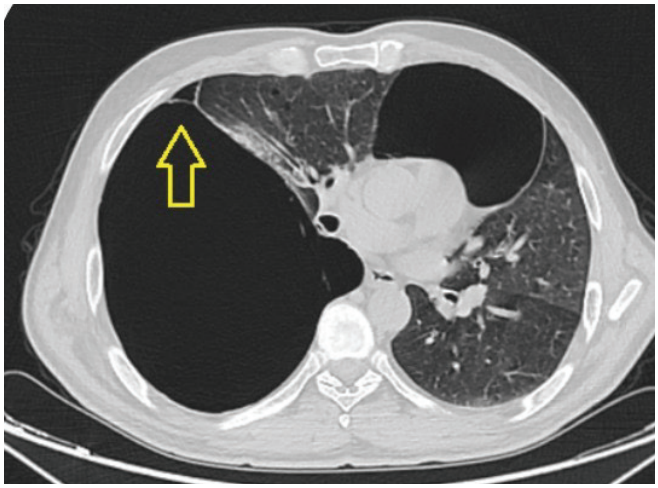

Figure 6. Thoracic CT scan demonstrating the "double wall sign" (indicated by the yellow arrow), which aids in differentiating pneumothorax from bullae.

Discussion

Bullous lung disease is a sequela of emphysema, resulting from the pathological, irreversible dilatation of the airspaces located distal to the terminal bronchiole. The lesions, known as bullae, are defined as air-filled cystic spaces within the pulmonary parenchyma that achieve a minimum diameter of 1 cm. This bullous emphysematous change is a frequent component of COPD, with

cigarette smoking recognized as the predominant etiological factor driving its development [6].

Giant pulmonary bullae are associated with several syndromic conditions, among which Vanishing Lung Syndrome (VLS) is the best characterized. VLS is defined by the presence of massive bullous destruction predominantly in the upper lobes, resulting in compression of the residual lung parenchyma [7]. The condition is frequently linked to cigarette smoking, alpha-1 antitrypsin deficiency (AATD), and connective tissue disorders. In AATD, mutations in the SERPINA1 gene cause a protease-antiprotease imbalance leading to panlobular emphysema, predominantly in the basal zones, often progressing to early indications for lung transplantation [8]. In Marfan and Ehlers–Danlos syndromes, fragility of elastic fibers predisposes to bilateral, multiple bullae and recurrent spontaneous pneumothorax; therefore, pleurodesis is recommended to reduce postoperative recurrence rates [9]. Moreover, HIV infection and inhalational cocaine abuse are associated with apical bullous changes and diffuse parenchymal injury [10,11]. Since pulmonary hypertension and right ventricular overload are common in these patients, preoperative assessment of pulmonary vascular resistance and right ventricular function is essential for optimal surgical planning and perioperative management [12].

Depending on the size of the bulla, patients may be asymptomatic or may describe complaints such as chest pain and dyspnea. More acute dyspnea and chest pain appear to occur in pneumothorax compared to giant bullae. In our patient, the main reason for admission was worsening dyspnea. Giant bullae cause mediastinal shift and parenchymal compression, leading to clinical symptoms [13,14]. Diagnosis is usually suspected by clinical history and physical examination but must be confirmed by imaging. In our patient's radiographs, the trachea and mediastinum were pushed towards the opposite side, a condition that can be confused with tension pneumothorax.

In radiological evaluation, there is an absence of pulmonary signs on the chest radiograph, a clinical condition that can be confused with spontaneous pneumothorax. In the presence of a giant bulla, there is an asymmetric radiolucent appearance that causes compression in the lung parenchyma, whereas in the presence of pneumothorax, a line belonging to the visceral pleura separated from the chest wall is often seen, and bronchovascular branches are not seen lateral to this line. In thorax CT, the "double wall sign" is used to distinguish pneumothorax from giant bullas. It occurs in the presence of air surrounding the wall of the bulla and the wall of the bulla is observed parallel to the parietal pleura. The presence of this sign supports pneumothorax and guides in determining the appropriate location when applying tube thoracostomy [15]. The double wall sign is also observed in our patient's CT findings (Figure 6).

Sometimes the line defining the border of the bulla can be confused with the visceral pleural line on localized pneumothorax. However, the line bordering the bulla is usually more horizontal. Signs used to detect pneumothorax in patients with giant bullous emphysema like our patient are compressed or consolidated lung, nonanatomical hyperlucency, and the double wall sign. The absence of this sign provides evidence against the diagnosis of pneumothorax and may prevent unnecessary chest tube placement. Additionally, if the patient has pneumothorax and a chest tube is placed, immediate symptomatic relief should be provided and there should be radiological evidence of lung re-expansion on subsequent chest radiographs.

Surgical resection (bullectomy) is indicated for bullae filling more than 30% of a hemithorax, especially if there is compression of adjacent lung parenchyma and dyspnea. Benefits of resection include alleviating dyspnea, improving ventilation/perfusion matching, reducing intrathoracic pressure, and improving hemodynamic function [16]. While Video-Assisted Thoracoscopic Surgery (VATS) reduces hospital stay and pain [17], it may be associated with higher recurrence rates compared to thoracotomy [18]. To minimize postoperative air leaks, techniques such as partial pleurectomy, apical pleural tent application, and abrasion can be applied [19]. We performed a perioperative pleural tent application, and no air leakage occurred postoperatively.

In conclusion, pneumothorax and giant bulla are distinct pathologies. Understanding their clinical and radiological differences is crucial to avoid inappropriate invasive procedures and to determine the correct surgical management.

Declaration of conflicting interests

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Authors' contribution

DH: Conceptualization, Methodology, Writing - original draft. NO: Data curation, Investigation. TUK: Validation, Visualization. EA: Supervision, Writing - review & editing.

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