Case Report

Pneumatocele after Acute Respiratory Distress Syndrome in an Adult Patient: A Case Report

Gouthami Chennu^a Paulina Przydzial^a Yee Tchao^a Anthony Isedeh^a
Nikhil Madan^b

^aDepartment of Medicine, Newark Beth Israel Medical Center, Newark, NJ, USA; ^bDivision of Pulmonary and Critical Care Medicine, Department of Medicine, Newark Beth Israel Medical Center, Newark, NJ, USA

Keywords

Pneumatocele · Acute respiratory distress syndrome · Case report

Abstract

Pulmonary pneumatocele is a cystic, air-filled lesion in the lung parenchyma. It results from underlying inflammation or bronchial injury. It is seen in several lung pathologies including bacterial pneumonia, positive-pressure ventilation, chest trauma, chemical pneumonitis, and is most often seen in infants and children. On imaging, pneumatoceles appear as rounded, thin-walled, air-filled spaces in the lung parenchyma. The exact mechanism for forming pneumatoceles is not fully understood but thought to be due to a check-valve mechanism due to obstruction by inflammation causing air trapping in the damaged lung. These lesions are asymptomatic and transient in most patients and disappear by about 6 weeks. They usually do not require any specific treatment or intervention. Surgical intervention is only necessary when pneumatoceles cause cardiopulmonary compromise or rupture into the pleural space. We describe a case of a young adult who developed a pneumatocele after developing acute respiratory distress syndrome from community-acquired pneumonia treated with positive-pressure ventilation. He was managed conservatively with complete resolution of symptoms.

© 2020 The Author(s)
Published by S. Karger AG, Basel

Introduction

Pulmonary pneumatocele is defined as a cystic, air-filled lesion within the lung parenchyma. It is associated with bacterial pneumonia, chemical pneumonitis, blunt chest trauma, or positive-pressure ventilation, and is more commonly seen in infants and children than in adults. Both postinfectious and traumatic pulmonary pneumatoceles are unusual in adults, and to our knowledge, there are only a few reported cases in the literature. We present a case of a 26-year-old patient who developed a pulmonary pneumatocele after being treated for community-acquired pneumonia with positive-pressure ventilation.

Case Presentation

A 26-year-old male was brought to the Emergency Department after being found unconscious on the street. His past medical history was significant for alcohol abuse and marijuana use. He was emergently intubated in the emergency room for hypoxemic respiratory failure and was transferred to the intensive care unit. His initial laboratory data revealed a white cell count of 28,300/ μ L with a left shift, with normal hemoglobin and platelet count. His serum chemistries were within normal limits as well. Computerized tomography (CT) of the chest showed extensive, patchy, ground-glass opacities throughout the bilateral lung fields (Fig. 1). His P/F ratio was 258, consistent with mild acute respiratory distress syndrome. He was placed on intravenous antibiotics for presumed community-acquired and aspiration pneumonia. Blood and sputum cultures were negative for any organisms. He required mechanical ventilation for 2 days, and was safely transitioned to the general medical floors. He was discharged home after 6 days of hospitalization.

The patient then presented 2 weeks later with right-sided pleuritic chest pain and cough for 3 days duration. On examination, he was not in acute distress, he was afebrile with a heart rate of 74 bpm, respiratory rate was 16/min, saturation 96% on room air, and blood pressure was 112/68 mm Hg. Chest examination revealed decreased breath sounds over the right lung field. Physical examination was otherwise unremarkable. Chest X-ray revealed a large cavitary lesion in the right hemithorax suggestive of a pneumatocele (Fig. 2), and he was admitted to the hospital for further evaluation. CT chest was then done and revealed few, small cystic lesions in addition to the pneumatocele measuring $9 \times 8 \times 6$ cm in the right lower lobe (Fig. 3). The infiltrates seen on imaging during prior admission appeared to be resolving. He was given symptomatic treatment with pain control. Routine blood work including complete blood count, serum electrolytes, and liver function test were unremarkable. The patient's symptoms were well controlled with medications. Vital sign measurements including blood pressure and pulse oximetry were stable throughout the hospital stay. After discussion with the pulmonary and thoracic surgery team, the decision was made to manage the pneumatocele conservatively. He was discharged home with instructions to avoid high altitudes and refrain from smoking. At his 1-month follow-up, chest X-ray was done, which revealed reduced size of the pneumatocele, with a thinner wall and no evidence of pneumothorax (Fig. 4). He continued to remain asymptomatic.

Discussion

Pulmonary pneumatocele is an air-filled, thin-walled cystic lesion within the lung interstitium. They can present as single or multiple cystic lesions, multiple lesions occurring less frequently. Pneumatocèles are more commonly seen in infants, children, and adolescents, and are rare in the adult population [1]. In all cases of pediatric pneumonia, the incidence of postinfectious pulmonary pneumatocele is about 2–8%. In a study by Kunyoshi et al. [2], more than 70% of those cases occurred in children younger than the age 3 years. In adults, the incidence of pneumatocèles is much lower, with only a few reported cases in the literature [1, 3, 4]. In adults, causes include infections, trauma, and chemical pneumonitis. Most common infectious causes are *Streptococcus* and *Staphylococcus aureus* pneumonia. Traumatic causes of pneumatocele include blunt injury to the chest causing contusions and continuous positive-airway pressure in mechanical ventilation [1].

In our patient, both infection and trauma from positive-pressure ventilation likely contributed to the development of pneumatocele. Although the causal organism for the pneumonia was not identified in this case, it is important to note that microbial diagnosis of pneumonia can be achieved in less than 50% of the cases [5]. Traumatic pneumatocele occurs predominantly in children and adolescents [6]. The mechanism of injury is often due to non-penetrating chest trauma from motor vehicle accidents. The predilection for this age group is hypothesized to be due to their underlying anatomy: increased chest wall elasticity and pliability facilitates enhanced transfer of the traumatic impact into lung parenchyma. This increased elasticity and recoil result in larger changes in intrathoracic pressure, leading to parenchymal injury and disruption, and subsequent development of air-filled cavitations and pneumatocèles [1, 7]. The adult chest wall becomes increasingly stiff and less compliant as developmental changes ensue [8]. Any impact to the chest is thus transmitted more evenly to the bony thoracic structures, likely serving as a protective factor.

The underlying pathophysiology of postinfectious pneumatocele differs. Bronchial inflammation and exudates cause bronchiolar wall narrowing and lead to distal dilation of the bronchi and alveoli due to a ball-valve effect: the obstruction caused by inflammatory exudates acts as a one-way valve, allowing air to enter but not leave the cystic space [1]. These mechanisms result in hyperinflation and the formation and enlargement of the air-filled cavities.

In some instances, chronic marijuana smoking can lead to the formation of cysts in the lung. The cystic lesions are usually small and multiple, although giant lesions have been reported [9]. This happens usually after chronic marijuana smoking but can rarely happen with short-term exposure as well [10]. Marijuana-related cystic lung lesions usually continue to grow and do not resolve quickly, as seen in our patient presented here.

In general, pneumatocèles are uncomplicated and have a good prognosis. Management of uncomplicated pneumatocele primarily consists of the treatment of underlying pneumonia and monitoring. Uncomplicated pneumatocèles usually resolve spontaneously in a few weeks to months [1, 6]. Surgical intervention is seldom required in cases of secondary complications such as pneumothorax or tension pneumatocele causing cardiac or respiratory compromise. In our patient, the lesion was quite large, measuring 9 × 8 × 6 cm. He showed no signs of cardiac or respiratory compromise and was managed conservatively. At the 1-month follow-up, he was symptom free, and chest imaging confirmed a reduction in size of the pneumatocele, without complications.

Conclusion

Although more common in infants and children, pulmonary pneumatocele may rarely occur in the adult population, as evidenced by our patient. In adults, traumatic and infectious causes predominate. It is important to recognize these lesions and avoid procedures and surgical interventions when not indicated.

Statement of Ethics

The authors have obtained informed consent from the patient to publish his case (including publication of images).

Conflict of Interest Statement

The authors do not have any conflicts of interest to disclose.

Funding Sources

The authors did not receive any funding.

Author Contributions

Gouthami Chennu conceived and designed the paper, collected the data, and wrote the paper. Paulina Przydzial collected the data and assisted with writing the paper. Yee Tchoo collected data and assisted with writing the paper. Anthony Isedeh performed final edits. Nikhil Madan conceived and designed the paper, and performed final edits.

References

- 1 Jamil A, Kasi A. Pneumatocele [Updated 2020 Mar 21]. StatPearls [Internet] Treasure Island (FL): StatPearls Publishing; 2020 Jan. Available from <https://www.ncbi.nlm.nih.gov/books/NBK556146/>.
- 2 Kunyoshi V, Cataneo DC, Cataneo AJ. Complicated pneumonias with empyema and/or pneumatocele in children. *Pediatr Surg Int*. 2006 Feb;22(2):186–90.
- 3 Bajpai J, Kant S, Verma AK, Bajaj DK. Spontaneous lung pneumatocele in an adult with community-acquired pneumonia. *Egypt J Intern Med*. 2017;29(3):141–3.
- 4 McGarry T, Giosa R, Rohman M, Huang CT. Pneumatocele formation in adult pneumonia. *Chest*. 1987 Oct;92(4):717–20.
- 5 Cilloniz C, Martin-Loeches I, Garcia-Vidal C, San Jose A, Torres A. Microbial Etiology of Pneumonia: Epidemiology, Diagnosis and Resistance Patterns. *Int J Mol Sci*. 2016 Dec;17(12):2120.
- 6 Armstrong LB, Mooney DP. Pneumatocèles in pediatric blunt trauma: common and benign. *J Pediatr Surg*. 2018 Jul;53(7):1310–2.
- 7 Lai YK, Punjabi C, Eiger G. No gravity in this cavity. *Ann Am Thorac Soc*. 2014 Jun;11(5):841–3.
- 8 Papastamelos C, Panitch HB, England SE, Allen JL. Developmental changes in chest wall compliance in infancy and early childhood. *J Appl Physiol* (1985). 1995 Jan;78(1):179–84.
- 9 Reece AS. Cannabis as a cause of giant cystic lung disease. *QJM*. 2008 Jun;101(6):503.
- 10 Reece AS. Giant cystic lung disease with mediastinal compression in a short-term heavy cannabis smoker. *BMJ Case Rep*. 2011 Feb;2011:bcr0420102934.

Fig. 1. CT scan of the chest showing diffuse patchy areas of ground-glass opacification in central broncho-vascular distribution.

Fig. 2. a, b Anterior posterior and lateral views of X-ray showing a large cavitory lesion in the right hemithorax.

Chennu et al.: Pneumatocele after Acute Respiratory Distress Syndrome in an Adult Patient: A Case Report

Fig. 3. CT scan of the chest showing a large, thick-walled cavitation in the superior segment of the right lower lobe. There is also near complete resolution of the diffuse patchy ground-glass opacities.

Fig. 4. a, b Anterior posterior and lateral views of the chest X-ray showing the cavitory lesion in the right lung, which is now better visualized in the lateral view and is thin-walled compared to prior X-ray.