
Late Presentation of Congenital Cystic Adenomatoid Malformation

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We present the case of a 9 year old girl with history of progressive pneumatoceles and infection since she was 3 years old. A chest computerized tomography revealed a cystic lung mass. The patient was taken to surgery and a left lower lobe lobectomy was performed. The pathologic diagnosis was that of a congenital cystic

adenomatoid malformation. We discuss the clinical presentation, and pathology of this entity with a brief review of the literature.

Keywords: Adenomatoid, Airway, Congenital, Cysts, Lung, Pulmonary, Malformation.

Congenital cystic adenomatoid malformation (CCAM) is a rare pulmonary malformation of unknown etiology. It was first reported in the English literature in 1949 by Ch'in and Tang (1) in a patient with generalized anasarca. In his review, he noted 10 previous cases reported in German and dated back since 1897. Later in 1977, Stocker et al. classified these lesions in three subtypes based on clinical, gross and microscopic criteria (2). Recently, Stocker has proposed the term congenital pulmonary airway malformation (CPAM), as not all lesions are cystic nor adenomatoid (3). In this CPAM classification, five types have been described based on the morphology and histology. The clinical presentation is varied but the majority of cases present early after birth with respiratory distress.

Chest computerized tomography is often diagnostic but histologic examination is essential for a definitive diagnosis. Surgery is most often advocated for treatment and to provide lesional tissue required for a definitive diagnosis.

Case Report

A 9 year old female with history of bronchial asthma, progressive pneumatoceles, multiple upper respiratory tract infections and several episodes of pneumonia

presented with intermittent febrile episodes in the evening for two weeks. She was treated with acetaminophen, but after two weeks of treatment she developed pain and discomfort on inspiration in the left flank, associated with low back pain and fever for another five days. She also complained of easy fatigability. The patient was evaluated at a private hospital where a chest x-ray revealed a left pulmonary hyperinflation and focal cystic changes. Compared with the previous chest images, when she was three years old, significant progression of cystic changes were noted in the left lower lobe. The possibility of bronchiectasia and an underlying left lower lobe bronchopneumonia was considered. A spiral computerized tomography of the thorax was recommended. A chest computerized tomography scan (CT scan) with contrast revealed trapping of air in the left lung with multiple bullae involving the left lower lobe, most prominent in the superior segment. There were also areas of fluid-filled cystic spaces and a pneumonic consolidation associated to the left lung base below the bullae, which could represent a superimposed infection. The possibility of congenital lobar emphysema with superimposed infection was another diagnostic consideration. The patient was transferred to our institution for further evaluation and management. At physical exam, she had a temperature of 38.9°C, a respiratory rate of 22 /min, a blood pressure of 110/60mm Hg and a heart rate of 105 beats/min; she was active, alert, febrile and ambulating. Her lungs presented diminished breath sounds and dullness on percussion on the left base but no wheezes, rales or rhonchi were heard. The rest of the physical examination was essentially negative. A white cell blood count revealed 26.8×10^3 white blood cells, a hemoglobin of 8.6 mg/dl, a hematocrit of 25%, a platelet count of $447,000/\text{mm}^3$. The differential cell count revealed 65% neutrophils, 19% lymphocytes,

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7% monocytes, 2% eosinophil, and 6% bands. A comprehensive metabolic panel was normal.

Her past medical history disclosed that she was born at term but admitted to the Neonatal Intensive Care Unit with respiratory distress requiring oxygen by a nasal cannula for one day. Chest x-rays at that time revealed what appeared to be a "pneumonic process", and echocardiogram was negative for heart disease. The patient completed treatment with intravenous antibiotics and was discharged home 15 days after birth.

Between 1 and 3 years of age, she presented various episodes of bronchial asthma and upper respiratory tract infections. At the age of three, she presented with respiratory distress, productive cough, and fever requiring hospitalization. A chest x-ray at that time revealed significant hyperinflation of the left lung with shifting of the mediastinal structures towards the right but no obvious pulmonary infiltrates or pleural effusions were noted. Evaluation with bronchoscopy was recommended to rule out the possibility of a non-opaque foreign body within the left main stem bronchus. A chest computerized tomography scan with contrast revealed air trapping and emphysematous changes in the left lower lobe, with mediastinal shift towards the right. No foreign bodies were noted within the visualized portions of the tracheobronchial tree by bronchoscopy. During hospitalization, she was treated with solumedrol and intravenous zinceft and was discharged home with oral antibiotics.

Chest roentgenograms three weeks later revealed changes in the left lung base that were compatible with pneumatoceles and hyperinflation of the remaining left lung. A chest x-ray at the age of six years revealed shift of the mediastinum to the right side, compensatory hyperaeration of the left lung and a round nodule in the left pulmonary base that had remained unchanged since she was three years old and probably represented the clinically suspected pneumatocele. Another chest x-ray, at age seven revealed hyperinflation of the left lung, probably related to air trapping.

After this long history of recurrent pulmonary infections and progressive pneumatoceles, possible bronchiectasis or congenital lobar emphysema, the Pediatric Surgery service evaluated the patient and concerned about the possibility of a congenital cystic adenomatoid malformation (CCAM or CPAM) or pulmonary sequestration recommended a left lower lobe lobectomy and excision of the lingula. The specimen was received in formalin and consisted of the left lower lobe measuring 14 x 8 x 7 cm, and weighing 250 gm. At the margin of resection, a bronchial segment was identified with mucus content. Externally, the pleura was gray and dull with

several nodules ranging in size from 0.3 to 1.5 cm in greatest diameter. Upon sectioning, multiple cysts were seen containing a tan yellow creamy material (Figure 1). These

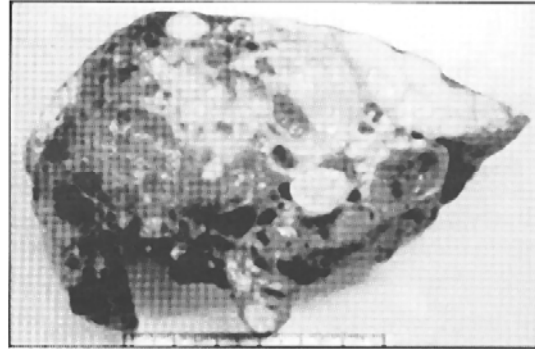


Figure 1. Multiple cysts containing a creamy material.

cysts occupied approximately 80% of the specimen. The remaining lung parenchyma was edematous with areas of consolidation. Microscopically, there were large cysts lined by pseudostratified ciliated epithelium with occasional back to back delicate walls and minimal inflammation (Figure 2). Other cysts were lined with

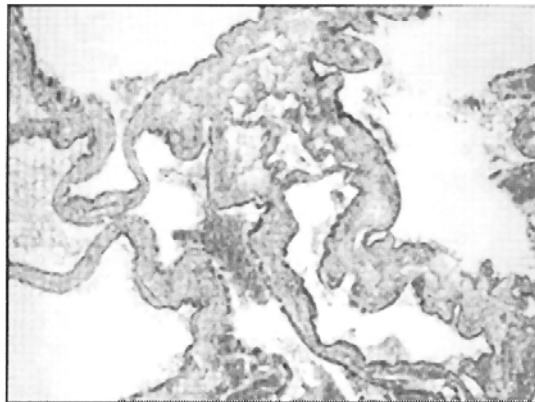


Figure 2. Multiple bronchiolar-like structures with little intervening normal lung and chronic inflammatory infiltrates.

cuboidal to columnar epithelium, and some cysts contained mucus mixed with acute and chronic inflammatory cells. Marked acute and chronic infiltrates were also seen within the interstitium but no fibrosis was evident. There were abundant alveolar macrophages. Based on the histology, the diagnosis of cystic adenomatoid malformation with associated acute pneumonia and bronchiolitis, focal organizing pneumonia and diffuse pulmonary edema was made.

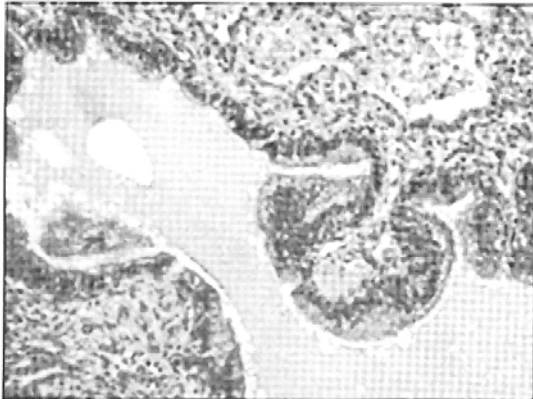


Figure 3. Bronchiolar-like structures focally arranged in tufts with abundant mucus-secreting cells.

During the post-operative period, she developed two pneumothoraces requiring chest tubes, antibiotics, and a pleurodesis in order to obliterate the pleural space with doxycycline to prevent recurrent pneumothorax. The patient improved and was discharged home after completing a course of intravenous antibiotics. On follow-up visits, she has been doing well and asymptomatic.

Discussion

Congenital pulmonary airway malformation (CPAM) is the new term proposed by Stocker (2) for congenital cystic adenomatoid malformation (CCAM). This is considered a better designation, as not all of these lesions are cystic nor adenomatoid in nature. Five types of CPAM have been described based on morphology and histological grounds. Type 0, known as acinar dysplasia or agenesis, is a rare malformation incompatible with life and usually associated with cardiovascular anomalies. Type 1, the most common type accounting for 65% of cases, is the large, predominant cyst type that usually presents in the first days of life but may go unnoticed till later in life. Type 2 is the medium sized cyst with an occurrence of 10-15% of the cases. It is seen exclusively in the first year of life and have the worst prognosis, as this lesion is often associated with other anomalies incompatible with life. Type 3 is the small cystic or solid type and occurs in 5% of cases. It is exclusively seen in the first days to months of life. Type 4 is the peripheral cyst type and accounts for 10-15% of cases. In this recent terminology, the lesion seen in this patient was best regarded as CPAM type I. Although at first the clinical presentation of recurrent episodes of pneumonias and pneumatoceles and gross appearance of the specimen suggested a pulmonary sequestration, the

histology of bronchiolar-like structures lined by pseudostratified epithelium in the absence of fibrosis and a systemic vascular supply militated against this diagnosis. Nor at surgery, an aberrant systemic vascular supply was identified feeding this lesion. The presence of dense infiltrates of chronic inflammatory cells and polymorphonuclear cells with organizing pneumonia correlated with the recurrent episodes of infection.

Cystic pulmonary airway malformation of the lung is a rare pulmonary malformation with a protean clinical presentation. It may present *de novo* with respiratory distress and pneumonia without previous symptomatology (4) or may present with repeated pulmonary infections, pneumothorax, hemoptysis, chest pain or as an incidental finding in radiologic images (5). Severe cases may present in utero with fetal hydrops but the majority of cases present in the perinatal period with respiratory distress. Few cases go unnoticed till later in life, after the first six months of life or even adulthood. The rarity of this lesion, less than 300 cases in infancy and less than 100 cases after infancy reported in the English literature (4), urges for a high level of clinical suspicion to make this diagnosis. Therefore, it is imperative that one considers this lesion if there is history of recurrent infections or a pneumonic process unresponsive to conventional therapy occurring always in the same anatomic site. An expeditious diagnosis benefits patients by preventing further expansion of the cysts which can cause a cascade of complications including air leaks, respiratory compromise and persistent pulmonary hypertension (7). Once in the differential diagnosis, radiologic images are helpful. A computerized tomography of the chest will be diagnostic, but pathology is essential for a definitive diagnosis. The etiology and pathogenesis of this lesion is unknown. It may occur as an sporadic lesion or in association with certain genetic syndromes such as trisomy 18 and hereditary renal dysplasia. Segmental bronchial atresia has recently been suggested as the primary pathogenetic defect that results in the development of a CCAM distal to the defect.

Treatment modalities are diversified. Some authors recommend to follow up those lesions that remain asymptomatic (4). Others recommend *in utero* resection when the size of the lesion is significant and causes fetal hydrops (8). Roggin et al. and Mashiach et al. have recognized that most lesions spontaneously regress or disappear but can also produce either fetal death from hydrops or neonatal death due to the associated pulmonary hypoplasia (9-10). Other authors recommend radical surgery for definitive diagnosis and treatment. This option eradicates the clinical symptoms and a portion of lung that is otherwise nonfunctional. It also avoids a recurrence and the rare occurrence of malignant

transformation as have been described in the medical literature(11). Long term survival is relatively good depending on the amount of normal lung tissue left after surgical resection (12) therefore long clinical and radiological follow up is recommended (5,11).

Resumen

Presentamos el caso de una niña de 9 años de edad con historial de neumatoceles progresivos e infección desde los 3 años de edad. Una tomografía computarizada de pecho demostró una masa quística pulmonar. La paciente fue llevada a cirugía donde se le realizó una lobectomía del lóbulo inferior izquierdo. El diagnóstico patológico fue una malformación quística congénita adenomatoide. Discutimos la presentación clínica y la patología con revisión de la literatura.

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