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Coexistence of Intrapulmonary Bronchogenic Cyst and Congenital Cystic Adenomatoid Malformation
– A Case Report –

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Congenital cystic lesions of the lung are uncommon and a conjunction of two or more lesions is very rare. We report here on a case of coexisting intrapulmonary bronchogenic cyst and congenital cystic adenomatoid malformation in a 13-year-old female with a cystic mass in the right upper lobe of the lung. Computed tomography showed a cystic lesion measuring 2.5 cm with an air fluid level and surrounding multicystic lesions in the right upper lobe. On gross examination, the cut surface showed a cystic mass containing inspissated mucinous material, and the cystic mass was surrounded by multiple small cysts. Microscopically, the larger cystic cavity was lined with pseudostratified ciliated columnar epithelium. The submucosal tissue contained mucinous glands and plates of cartilage. The surrounding smaller cysts or irregular spaces were lined with bronchiolar-type respiratory epithelium. We propose that this hybrid lung lesion may represent the missing link in a common embryologic pathway determined by the timing of mesenchymal and epithelial interactions.

Key Words: Bronchogenic cyst; Cystic adenomatoid malformation of lung, congenital

Development of the respiratory system begins at 3 weeks gestation, and aberrations in the developmental processes may give rise to a group of structural abnormalities collectively referred to as bronchopulmonary foregut malformations (BPFMs). The common BPFMs include congenital cystic adenomatoid malformation (CCAM), pulmonary sequestration, congenital lobar emphysema, and bronchogenic cysts (BCs) and all these often present on imaging studies as abnormal cystic structures. Various types of BPFMs may occur in conjunction with one another or in association with other congenital anomalies.[1] The coexistence of CCAM and extralobar pulmonary sequestration (ELS) has been reported,[2-4] but other combined BPFMs are extremely rare. To the best of our knowledge, this is the first case report of intrapulmonary BC associated with CCAM to appear in the English medical literature with the exception of a case of coexisting ELS, CCAM and BC in a fetus.[5] We report here on a unique case of coexisting intrapulmonary BC and CCAM in a 13-year-old female and we review the relevant medical literature.

CASE REPORT

A 13-year-old female was referred to our hospital for evaluation following the incidental detection of a cystic mass in the right upper lobe of the lung during a physical examination. The patient had previously been in good health and she was asymptomatic. The physical examination was unremarkable. The routine laboratory test results were within normal limits. Chest X-ray showed a vague mass-like lesion in the right upper lobe. Computed tomography showed a cystic lesion that measured 2.5 cm in diameter with an air fluid level and surrounding multicystic lesions in the right upper lobe (Fig. 1). No evidence of an abnormal blood supply from the aorta to the cystic lesion

was observed. A CCAM was suspected. Bronchoscopic examination found no endobronchial lesion. The patient underwent the right upper lobectomy for removal of the cystic mass. On gross examination, the pleural surface was smooth. The cut surface showed a cystic mass measuring 2.5×2.3 cm and it contained inspissated mucinous material, and it was surrounded by multiple small cysts or irregular spaces, that measured up to 0.8 × 0.7 cm (Fig. 2A). Once the cystic content had been evacuated, the inner surface was found to be smooth with a thickened fibrotic wall. No solid portion was noted (Fig. 2B). The other lung parenchyma was unremarkable. Histologic examination showed that the larger cystic cavity was lined with pseudostratified ciliated columnar epithelium. The submucosal tissue contained mucinous glands and plates of cartilage, which were consistent with a bronchogenic cyst. The surrounding smaller cysts or irregular spaces were lined with bronchiolar-type respiratory epithelium, which was consistent with a type II CCAM (Fig. 3).

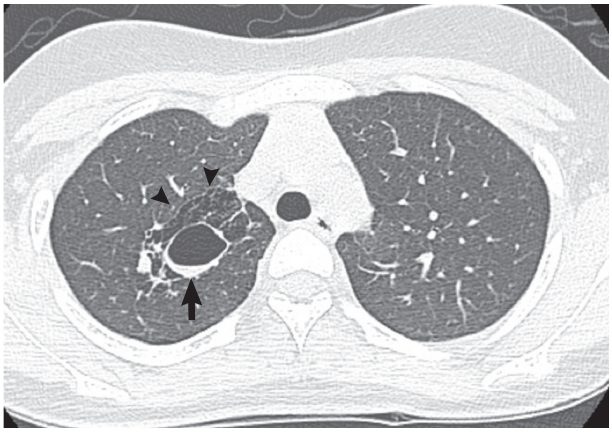

Fig. 1. Axial computed tomography image shows a cystic lesion measuring 2.5 cm with an air fluid level (arrow) in the right upper lobe and it is surrounded by small multicystic lesions (arrowheads).

DISCUSSION

Stoerk[6] was the first to describe a CCAM-like lesion in 1897, yet, it was not until 1949 that Ch'In and Tang[7] defined this cystic disease of the lung, which they called CCAM, and it is also known as adenomatoid hamartoma. Because some types are not cystic and they have only an adenomatoid appearance, the term "congenital pulmonary airway malformation (CPAM)" was recently proposed.[8] The term CCAM is now used together with CPAM. These lesions were initially classified into three types by Stocker,[8] who more recently added two more variants (types 0 and 4). While CCAM is regarded as a hamartomatous lesion of the bronchial tree by some, others favor a localized arrest in the development of the fetal bronchial tree as the etiology.[9] Some studies supported the notion that dysregulation in the branching morphogenesis of the lung is associated with the development of abnormal lung tissue, both in CCAM and in pulmonary sequestration.[10] We believe that this is the reason why pulmonary sequestration shows a relatively frequent conjunction with CCAM among the other congenital developmental anomalies. In fact, both of these are occasionally similar in histologic appearance. Thus, some researchers envisage an even wider 'sequestration spectrum' encompassing both pulmonary sequestration and CCAM.[11]

BCs arise from abnormal budding of the tracheobronchial tree during the development of the airway. Depending on the tim-

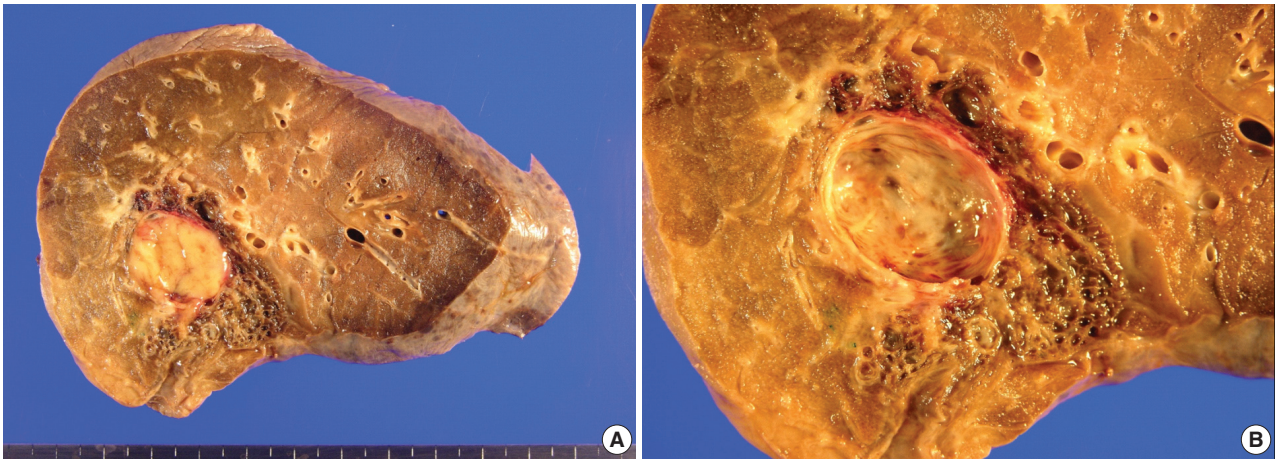

Fig. 2. (A) The cut surface shows a large cyst containing inspissated mucinous material, and the large cyst is surrounded by multiple smaller cysts. (B) Once the cystic content had been evacuated, a smooth inner surface like that of the bronchial wall with no solid portion is revealed within the large cyst.

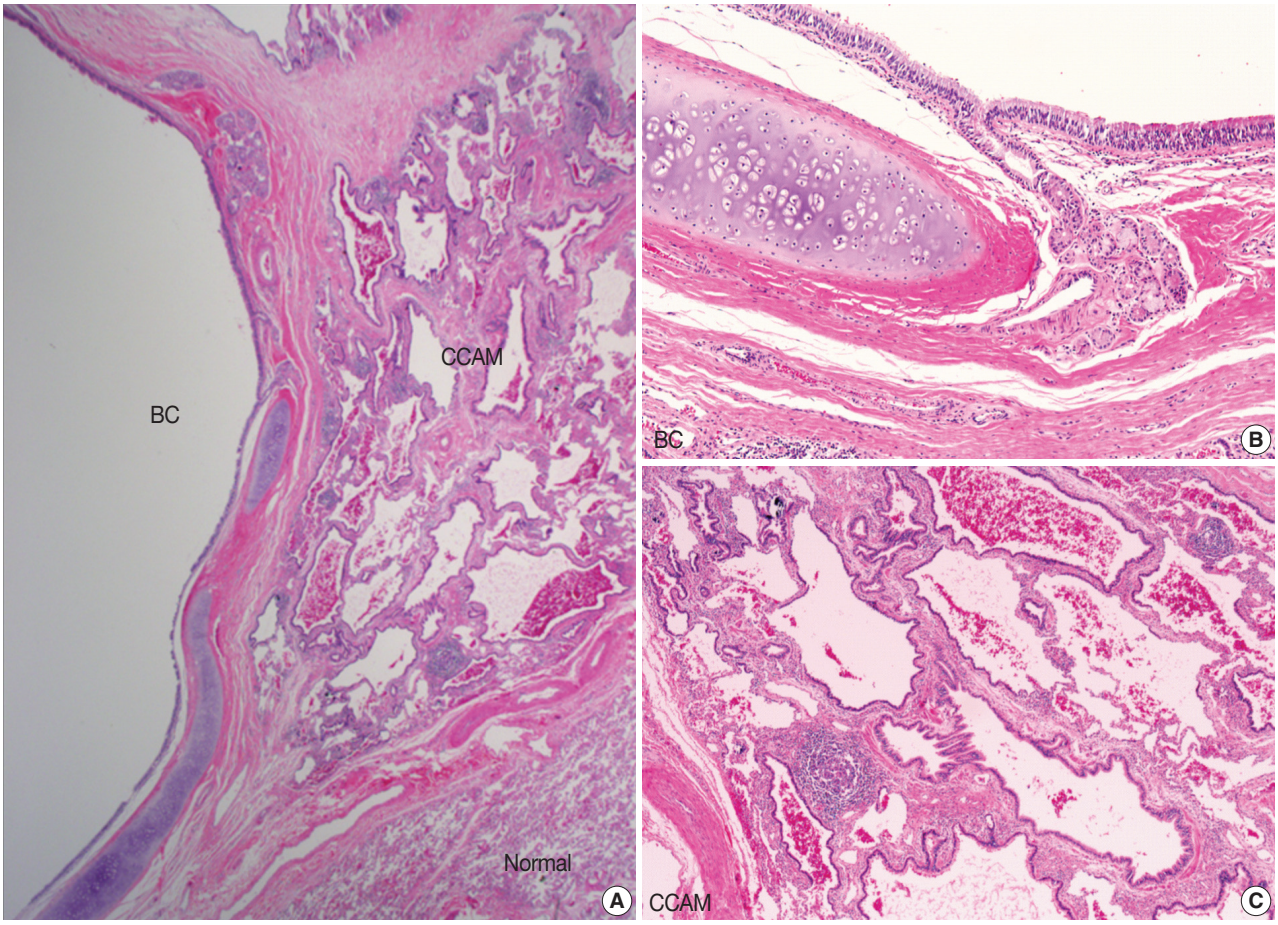

Fig. 3. (A) The lesion is composed of bronchogenic cyst (BC) with surrounding congenital cystic adenomatoid malformation (CCAM). (B) The BC wall shows a pseudostratified ciliated columnar epithelial lining with mucous glands and cartilage. (C) The CCAM area shows irregular cystic spaces lined with bronchiolar-type epithelium.

ing and orientation of this process, they can be located within the mediastinum, the lung parenchyma or rarely in the lower neck. Approximately one third of BC are intrapulmonary parenchymal lesions and two thirds are found within the mediastinum.

Some question in this case still need resolution. The first is the question of whether or not the larger cyst is a BC or a type I CCAM. The second is the question of whether or not the larger cyst is a BC or congenital bronchial atresia (CPA) with a bronchocele. A unilocular type I CCAM can be confused with an intrapulmonary bronchogenic cyst on both imaging studies and histologic examination. The classical appearance on radiologic examination shows the former as being air-filled, while the latter is fluid or mucus-filled. However, air in a bronchogenic cyst can be seen secondary to infection with erosion into a bronchus. Conversely, an infected CCAM is often fluid-filled.[9] Therefore, differentiation is often impossible with images only. On histologic examination, BCs contain mucinous material and they are lined with ciliated columnar or cuboidal epithelium. In most cases, the BC walls are thicker than those of CCAM. They are surrounded by tissue similar to that of the normal bronchus including cartilage, smooth muscle, elastic tissue, and mucous glands. We believe that these findings are key differentiating points. The CCAMs have thin walls and some have islands of cartilage, but these are focal and, not circumferential as in this case. Some researchers emphasized that the differentiating point between BC and CCAM is that BCs have cartilage on the cystic wall and CCAM do not.[12,13] However, other researchers have asserted that type O and type I CCAM can also have islands of cartilage.[14] Therefore, the presence of cartilage cannot be a decisive differentiating point between CCAM and BC. CPA with a bronchocele and BC have similar histologic findings like those of the normal bronchial wall, yet, the radiological appearance is virtually diagnostic, and this consists of ovoid or tubular hilar opacity with branches radiating out into a distal area of hyperinflation.[15] This case showed a round cyst with no surrounding

hyperinflation.

Early in development, the laryngotracheal groove arises as a ventral outpouching of the primitive foregut and it migrates caudad to give rise to the tracheobronchial tree. A case involving aberrant migration of cells in the primitive lung buds can give rise to numerous congenital anomalies, and these are broadly termed as congenital BPFMs.[5] The timing of separation of aberrant lung buds and the pulmonary mesenchyme may be crucial factors for determining the type of congenital anomaly.[5,16] First, regarding the timing of separation of aberrant lung buds, BC can arise when groups of epithelial cells separate from the developing trachea and lung buds early in development and they are too proximal to reach the pulmonary mesenchyme. Conversely, when separation occurs later on, the misplaced epithelial cells close to the developing mesenchyme can be influenced during differentiation. Pulmonary sequestration may then form. Second, pulmonary mesenchyme contributes to the differentiation of the pulmonary epithelium and to a branching morphogenesis. Hence, abnormality of the pulmonary mesenchyme contributes to the formation of CCAM by inducing abnormal proliferation of bronchioles without the formation of alveoli.[5,17] Hybrid lung lesions such as those seen in this case may represent the missing link in a common embryologic pathway and the type of lung lesion is determined by the timing of the mesenchymal and epithelial interactions.

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