Case Report

Atypical Antenatal Presentation of an Unusual Nonmucinous Papillary Variant of Giant Congenital Pulmonary Airway Malformation Masquerading as Congenital Diaphragmatic Hernia with Volvulus

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Abstract

We report a case of a huge congenital pulmonary airway malformation (CPAM) that was referred as congenital diaphragmatic hernia (CDH). Initial ultrasound evaluation revealed a huge cystic lesion with septations, in the thorax, causing mediastinal shift and compression effects, suggesting the possibility of a thoracic lymphangioma, or bowel herniation with obstruction. A fetal magnetic resonance imaging reported possible bowel herniation through a posterior defect in the diaphragm, with volvulus, reinforcing the diagnosis of CDH. It was only on autopsy and subsequent histopathology examination that the diagnosis of a rare variant of CPAM–nonmucinous papillary type, could be made. To the best of our knowledge, a CPAM this huge has not been reported prenatally at this gestation. We recommend considering the potential diagnosis of CPAM in any thoracic cystic irrespective of its size or appearance.

Keywords: Atypical presentation of congenital pulmonary airway malformation, congenital pulmonary airway malformation, nonmucinous papillary variant, type I congenital pulmonary airway malformation

Introduction

Congenital pulmonary airway malformation (CPAM), is defined as a hamartomatous, dysplastic developmental abnormality of the lung leading to abnormal airway patterning and branching during lung morphogenesis.[1] It is the most common congenital lung lesion, accounting for 95% of all lung anomalies.[1,2] The incidence has been estimated to be 1.25/10,000 pregnancies and is on a rise, with more cases detected antenatally with the help of efficient ultrasound technology and expertise.[3]

We report a case of a huge CPAM that was referred as congenital diaphragmatic hernia (CDH) with bowel herniation with obstruction. Later, autopsy and histopathological examination confirmed it as a rare variant of CPAM–nonmucinous papillary type.

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Case Report

A 29-year-old primigravida, at 19 weeks 6 days gestation based on her last menstrual cycle, with no pregnancy complications, was referred with a suspected diagnosis of CDH and transposition of great arteries. Two-dimensional (2D) ultrasonography using Voluson, E10, GE Healthcare Technologies, Milwaukee, WI, USA, curved linear array transducer revealed a huge, fluid-filled, tubular cystic lesion measuring 6.9 cm × 5.1 cm × 4.3 cm, occupying the entire left and most of the right hemithorax and extending into the abdomen, displacing the heart, and right lung to the extreme right [Figure 1a].

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The lesion had no solid areas but showed multiple septations. Two-dimensional power Doppler was used to assess the vascularity, which however did not reveal any obvious arterial feeder. A small cystic area was visible below the lesion in the abdomen, suggesting intraabdominal stomach [Figure 1c]. Bowel loops were seen confined to the abdomen, nonetheless, diaphragmatic continuity could not be demonstrated at certain areas. Lung-to-head ratio (LHR) was 0.38 and O/E LHR was 16.6%, suggesting extreme lung compression and thereby a very poor prognosis. Three-dimensional ultrasonography did not add much information. A CPAM volume ratio (CVR) was not calculated at this point as the diagnosis of a CPAM was not considered initially. Fetal growth assessment showed an abdominal circumference more than two standard deviations from the mean. There were marked polyhydramnios, fetal ascites, and subcutaneous edema [Figure 1b], suggesting early hydrops. A thorough targeted scan was performed, which revealed no other anomalies. Detailed echocardiography revealed a dextroposed heart with ventricular disproportion, left being larger, and normally related great vessels. A provisional diagnosis of nonimmune hydrops fetalis secondary to thoracic lymphangioma, encysted hydrothorax, or CDH with bowel obstruction was made. A fetal magnetic resonance imaging (MRI) was subsequently performed, which suggested the possibility of an absent left hemidiaphragm [Figure 2d] with a well demarcated, large, tubular cystic lesion with haustrations-like incomplete septae, and occupying the entire left hemithorax causing severe ipsilateral pulmonary hypoplasia [Figure 2a and b]. Furthermore, the lesion appeared to be extending into the abdomen [Figure 2b and c]. This, together with the presence of small bowel loops in the center of the abdomen and minimal ascites raised suspicion of a large bowel herniation into the thorax causing mediastinal shift [Figure 2b] with possible obstruction/volvulus. The diagnosis was thus revised as left CDH (Bochdalek type) with obstructed large bowel loops.

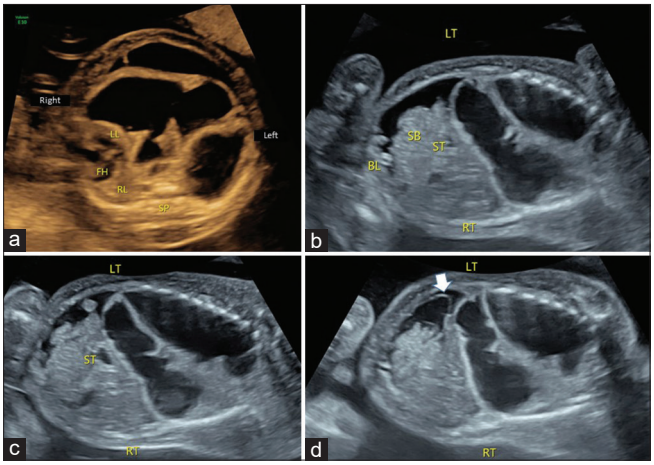

Figure 1: (a) Sonographic image of the transverse section of the thorax at the level of the heart showing a cystic lesion occupying most of the thorax causing extreme dextroposition of the heart, (b) coronal view of the fetus showing ascites, subcutaneous edema, and cystic lesion. Furthermore, diaphragmatic continuity is not maintained, (c) coronal view demonstrating intraabdominal stomach, (d) section showing ascites with an intact diaphragm (arrow). FH: Fetal Heart, LL: Left Lung, RL: Right Lung, Sp: Spine, ST: Stomach, SB: Small Bowel, BL: Bladder, LT: Left, and RT: Right

The dismal prognosis owing to the significantly compressed mediastinum, pulmonary hypoplasia early in pregnancy, and hydrops was explained to the family and they chose not to continue the pregnancy. A medical termination was resorted to and she expelled a stillborn male fetus weighing 930 g.

A detailed autopsy showed an otherwise normal-looking male fetus with gross subcutaneous edema. On opening up the fetal trunk, the diaphragm was found to be intact with normal intestinal loops confined to the abdomen [Figure 3]. The thorax showed a hyperinflated multi-lobulated cystic lesion occupying almost the entire cavity, pushing the mediastinum, particularly the heart, to the extreme right [Figure 3a]. The whole of the right lung and lower lobe of the left lung were intact. A small segment of the normal lung was noted in the posterior upper part of the lesion suggesting the lesion was confined to the insula of the left lung [Figure 3b].

The heart was structurally normal with concordant large arterial connections. No other malformation was noted. Gross examination of the cystic mass revealed hugely distended cystic lobes, with the largest cyst measuring >4 cms in diameter (Stocker Type 1).[1] However, microscopic evaluation did not show the typical ciliated bronchial epithelial cells seen with Type 1 CPAM. Instead, multiple closely packed cysts lined by nonciliated columnar epithelium without cytonuclear atypia, arranged as papillary projections were noted. Nevertheless, smooth muscle cells were seen in a few areas of the cyst wall as were multiple small clusters of mucinous cells interspersed throughout the lesion, as seen in Type 1 [Figure 4]. These

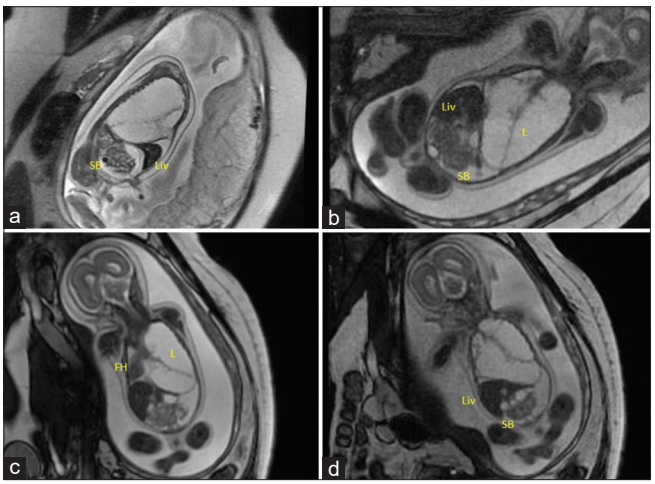

Figure 2: Fetal magnetic resonance imaging showing a tubular cystic lesion occupying the whole of the thorax with intact diaphragm and liver on the right side in a parasagittal section (a). Small bowel is seen distinctly occupying the center of the abdomen with the presence of ascites (a, c, d) and coronal FIESTA view (b) of the fetus showing possible discontinuation of the diaphragm with herniation of the volvulus into the thorax. SB: Small Bowel, L: Tubular cystic lesion, Liv: Liver, and FH: Fetal Heart

findings were consistent with a rare papillary variant of Type I CPAM.[4]

Discussion

CPAM is grouped into five (Types 0–4) by Stocker. In 2002, he also recommended the term CPAM as being preferable to the term congenital cystic adenomatoid malformation because not all types of CPAM are cystic and adenomatoid. For example, type 0 is not a cystic lesion, and types 0, 1, and 4 are not adenomatoid lesions.[5,6] Ultrasound is the diagnostic modality of choice with 100% sensitivity in a level 2 scan around 16–22 weeks. CPAM is classified into microcystic (<5 mm) and macrocytic (>5 mm) based on the ultrasound features, with later being associated with better outcomes and grows slowly.[1]

In our case, the ultrasound scan could not differentiate between CDH, thoracic lymphangioma, and encysted hydrothorax. CPAM was considered as a differential possibility but was avoided in the report as the ultrasound image pattern did not fit in with any of the three known types of CPAM based on the Stocker's classification.[1]

MRI is found to have similar diagnostic accuracy to USG and better at identifying a feeding vessel.[7] It can be an important adjunct in unclear cases and can mainly differentiate CPAM from CDH.[8] However, MRI concluded that this fetus showed features consistent with CDH of the large bowel with volvulus and obstructive dilatation. It was only at autopsy that CPAM was confirmed. The disparity in diagnosis by the two imaging modalities emphasizes the unusual presentation in this case.

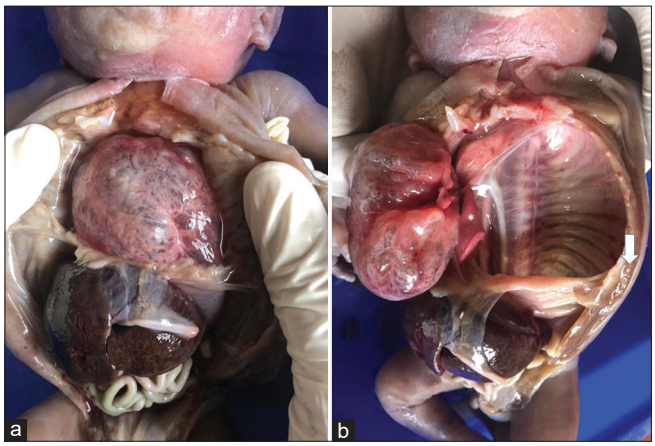

Figure 3: Fetal autopsy showing (a) abdominal contents confined to the abdomen and a large cystic lesion occupying the entire thorax, (b) Intact diaphragm separating the abdominal from the thoracic cavities, enlarged lobe of the left lung is pushed to one side comparing the size of the lobe with normal lower lobe (marked in Asterix). Subcutaneous edema is marked with white arrow

Prognosis of a fetus with CPAM largely depends on associated anomalies, the presence of hydrops, volume of the cysts, and the presence of a dominant cyst. CPAM is prognosticated using CVR, defined by the volume of the lung lesion divided by the head circumference to normalize for gestational age.[9] A CVR >1.6 predicts an 80% increased risk of fetal hydrops, whereas a ratio <1.6 is associated with a survival rate of 94% and <3% risk of hydrops. Our fetus was hydropic with a huge cystic lesion causing mediastinal shift. CVR measured retrospectively was 3.58. This, with an O/E LHR of 16.6% as mentioned previously, suggested that the lesion was exceptionally huge, causing mediastinal shift and compressing thoracic contents. To the best of our knowledge, a CPAM this huge has not been reported prenatally at such early gestation.

Immunohistochemistry of the lining epithelium was used as the basis of classification by Morotti *et al*. and suggested two subtypes. Type 1–3 showing bronchiolar epithelium possibly arising at the pseudoglandular stage and Type 4 with the acinar-alveolar type of epithelium suggesting an arrest at the saccular stage of development.[10] Type 1 is the most common, comprising 60%–70% and is thought to arise from the distal bronchi or proximal bronchioles. It is characterized by thin-walled cysts of 2–10 cm in diameter lined by well-differentiated ciliated pseudostratified columnar epithelium and walls containing elastic tissue along with smooth muscle. Mucinous cells and abnormal cartilage are also found in few cases.[11] In our case, the typical ciliated cells in the bronchial epithelium were not seen; instead, an unusual nonmucinous papillary pattern was observed. To the best of the author's knowledge, this is only the second case in literature. This case bears a lot of resemblance with the only reported case of this variant earlier this year by Koopman in a lobectomy specimen of a 6-weeks-old female child.[4] Both these fetuses had their first presentation at 20 weeks and early onset of hydrops. The similarity between the postnatal Computed tomography pictures of the reported case and ultrasound pictures of the present case suggests the typical huge cystic pattern with early onset of hydrops. This is the first case of antenatal detection of this papillary variant of CPAM with MRI, autopsy, and histopathological correlation.

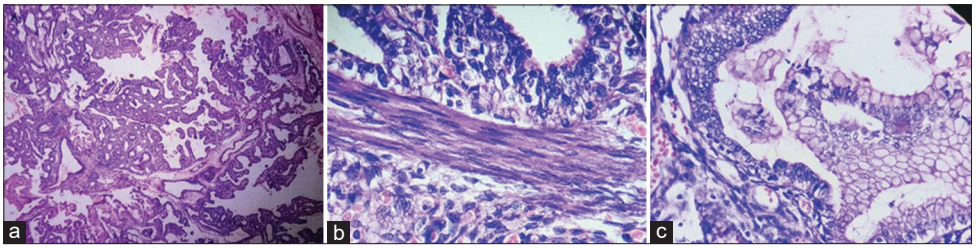

Figure 4: Histopathology of the lesion showing complex papillary architecture lining the cyst wall (a) with smooth muscle cells (b) and multiple small clusters of mucinous cells (c), suggesting a papillary variant of Type 1 CPAM

Type I CPAM has got malignant potential, the mucinous component is associated with mucinous adenocarcinoma in the setting of mutation in the KRAS gene. In the previous case, molecular analysis showed the presence of KRAS mutation. However, the significance of this finding is yet to be established. A molecular analysis could not be performed in our case as the parents did not agree to further testing.

We conclude that CPAM should be considered as one of the differential diagnosis in any thoracic cystic lesion detected antenatally, irrespective of its size or ultrasound appearance. MRI may not be conclusive in thoracic lesions with varied presentations. Postnatal or autopsy correlation is mandatory for an accurate diagnosis. Histopathological examination, including molecular analysis, can aid in diagnosing as well as further understanding the pathogenesis and malignant potential of CPAM. This being the first case to be reported of the antenatal presentation of nonmucinous papillary variant of Type 1 CPAM, suggests that this type may oftentimes be overlooked since most of them would undergo termination of pregnancy or result in early neonatal demise precluding accurate detection.

Declaration of patient consent

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

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Nil.

Conflicts of interest

There are no conflicts of interest.

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