

# Unilateral primary pulmonary agenesis and hypoplasia in monozygotic twins

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Ann Saudi Med 2012; 32(1): 90-92

PMID: 22156648 DOI: 10.5144/0256-4947.2012.90

We describe 10-month-old identical female twin infants, one with primary left-sided pulmonary agenesis and the other with primary left-sided pulmonary hypoplasia. They came to our outpatient clinic complaining of persistent dry cough. The clinical examination revealed decreased air entry over the left hemithorax. Chest x-rays showed complete left-sided radio-opacity in both the twins. The chest computed tomography scan with contrast confirmed the diagnoses of left-sided pulmonary agenesis (twin A) and left-sided hypoplasia (twin B). No other associated congenital anomaly was noted in either of the twins. To our knowledge, such a condition in live monozygotic twins has not been previously reported in published studies.

The spectrum of lung underdevelopment ranges from total bronchial and parenchymal agenesis to mild pulmonary parenchymal hypoplasia. Lesion severity and other associated anomalies are determined by the in utero fetal developmental stage at the time of insult. Isolated primary congenital pulmonary hypoplasia occurring in the absence of other anomalies is very rare. We present hitherto unreported cases of clinically well identical twins with isolated unilateral lung anomalies.

## CASE

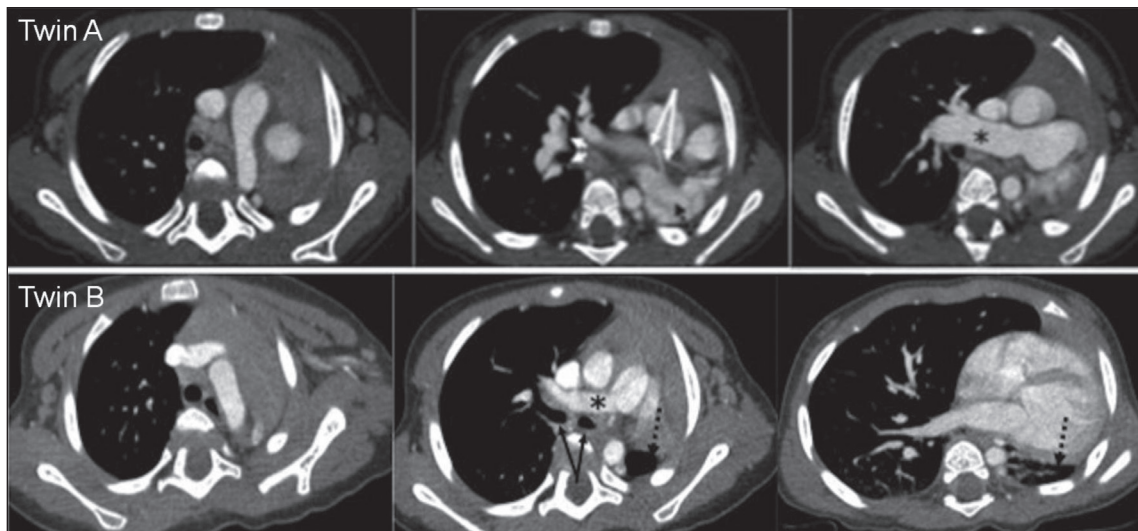
Ten-month-old identical female twin infants presented to the Pediatric Pulmonary Division at King Khalid University Hospital, Riyadh, complaining of persistent dry cough. The parents were consanguineous and the pregnancy was uneventful. Oxygen saturation was 98% in room air in these clinically well infants. In both, the trachea was central, but the apex beat was displaced to the left anterior axillary line. The percussion note was dull, and air entry was diminished over the left hemithorax. The chest x-ray showed a left-sided homogeneous opacity with a mediastinal shift toward the left and hyperinflation of the right lung. The chest computed tomography (CT) scan with contrast (**Figure 1**) confirmed the diagnoses of left-sided pulmonary agenesis

(twin A) and left-sided hypoplasia (twin B). Further examination and investigations revealed no associated anomalies.

## DISCUSSION

Congenital pulmonary hypoplasia may be regarded as primary (idiopathic) or secondary (when it occurs in association with environmental factors or other congenital anomalies). The incidence of pulmonary hypoplasia ranges from 9 to 11 per 10000 live births and 14 per 10000 births.<sup>1</sup> In a study looking at 850 perinatal autopsies, assessing pulmonary hypoplasia as a cause of death over a period of 25 years,<sup>2</sup> lung hypoplasia was found in 96 (11.3%) cases; 89 (92.7%) cases were secondary type (associated with major congenital malformation) and 7 (7.3%) cases were primary type. In more than 90% of the patients with secondary lung hypoplasia, the renal and genitourinary anomalies were the most common anomalies, followed by diaphragmatic hernia and musculoskeletal dysplasia.

Given the pathological diagnostic difficulty in some cases and association with a variety of other abnormalities, the incidence is likely to be more common than generally recognized. Reduction in hemithoracic volume, pulmonary vascular perfusion, fetal respiratory movement, and volume of lung fluid and its com-



**Figure 1.** Selected images of contrast enhanced computed tomography (CECT) scan of the chest with Twin A demonstrating a completely absent left lung, left main pulmonary artery and left main bronchus. Large right main pulmonary artery (\*), right bronchial branches (tiny white arrows), organized sequestered lung tissue (black arrow), with arterial blood supply from ascending aorta (long white arrows). Twin B CECT scan of the chest demonstrates hypoplasia of left lung (black dotted arrows), tracheal bifurcation (black arrows), large right main pulmonary artery (\*). Absent left main pulmonary artery.

position are said to have a causal role in secondary pulmonary hypoplasia.<sup>3</sup> Morphological classifications by Boyden,<sup>4</sup> Monaldi and Landing<sup>5</sup> describe 3 to 4 degrees of maldevelopment. Mardini's classification<sup>6</sup> based on angiographic data separates patients into two groups: (I) complete absence of pulmonary parenchyma and ipsilateral pulmonary artery with no systemic arterial supply and (II) hypoplastic parenchyma with blood supply (a) from pulmonary artery and (b) from systemic artery (sequestration). An exact classification of our cases is difficult. We can say that the twin A belongs to the first group and the twin B to the second group; however, both had a small amount of sequestered lung. The clinical findings depend on the degree of pulmonary abnormality and the presence of other congenital malformations. The patient is usually symptomatic, and the physical examination reveals thoracic cage asymmetry, reduced ipsilateral chest wall movements along with the reduction/absence of air entry in the affected side.

Radiographically, there was radio-opacity in the ipsilateral hemithorax. Compensatory herniation of the contralateral lung across the mediastinum with a shift of mediastinum, along with rib abnormalities, and a bell-shaped chest are seen. The compensatory herniation of the contralateral lung may cause some confusion in diagnosis. The CT scan may be required to establish the degree of the lesion and to differentiate hypoplasia from other conditions that may closely

mimic it radiographically, like atelectasis from other causes or unilateral hyperlucent lobe as in Swyer-James-McLeod syndrome.<sup>7</sup> Fiber-optic bronchoscopy, bronchography, and magnetic resonance angiography may also be used to aid the diagnosis. Although antenatal diagnosis is possible, most cases present during the postnatal period or are incidentally diagnosed during childhood when complicated by pulmonary infection.<sup>5,8</sup> When diagnosed antenatally, interventions like serial amniotransfusions in cases of premature rupture of membranes before 32 weeks' gestation and trying to seal the defect in the membranes transcervically by fibrin glue can potentially increase the fetal lung volume and promote lung development.<sup>3</sup>

Most symptomatic infants presenting very early with respiratory distress usually need supportive therapy varying from supplemental oxygen for the milder form of hypoplasia to extracorporeal membrane oxygenation (ECMO) in infants with congenital diaphragmatic hernia. While considering fetal surgery or ECMO, care has to be taken to keep in mind the poor prognosis when this condition is associated with other severe anomalies like renal agenesis or thanatophoric dysplasia. One can otherwise hope for growth and lung maturation if enough pulmonary parenchyma is available to sustain life.

While remaining realistic about the prognosis in these cases, care should be taken to follow up regularly to monitor growth and development of associ-

ated complications like pulmonary hypertension. These children are vulnerable to infections and hence emphasis should be there for consideration of palivizumab prophylaxis, and they should also receive pneumococcal and influenza vaccinations. Any insult like pneumonia or aspiration to the remaining/healthy lung should be aggressively managed.

Cases of unilateral secondary lobar pulmonary agenesis in siblings<sup>9</sup> and a case series with secondary pulmonary hypoplasia in 4 children with parental consanguinity have suggested an autosomal recessive mode of

inheritance.<sup>10</sup> A recent report of prenatally diagnosed primary pulmonary hypoplasia in fraternal twins—the diagnosis being confirmed following termination<sup>11</sup> — and our cases do add weight to the genetic hypothesis. Although the genetic cause is not implied in concordant congenital malformations occurring in monozygotic twins,<sup>9</sup> either an identical environmental or a genetic insult is plausible in these cases. Further studies to look at the genetic causality for primary pulmonary hypoplasia in the background of consanguinity need to be undertaken.

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