

Case report

DiGeorge syndrome associated with left lung aplasia

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Abstract. We report a patient with clinical and cytogenetic findings consistent with DiGeorge-velocardiofacial syndrome and aplasia of the left lung. To the best of our knowledge, this is the first reported case of DiGeorge-velocardiofacial syndrome associated with unilateral lung aplasia. Gadolinium enhanced three-dimensional magnetic resonance angiography demonstrated associated right-sided aortic arch and left pulmonary artery agenesis.

Unilateral pulmonary agenesis is frequently a sporadic malformation [1]. More than 50% of patients with pulmonary agenesis also have anomalies included in the VATER association as well as heart defects [2]. Pulmonary lobation disorders and dysplasias have been reported in conjunction with thymic disease [3].

We describe a female neonate in whom the previously unreported feature of pulmonary aplasia was present in association with the classical findings of DiGeorge syndrome. The thymus could not be identified on CT and conventional MRI sequences in this patient, while gadolinium (Gd) enhanced magnetic resonance angiography (MRA) non-invasively depicted the right-sided aortic arch and absence of the left pulmonary artery.

Case report

A 22-day-old female infant was admitted to hospital with the diagnoses of congenital cyanotic heart disease and hypocalcaemia. She was born by Caesarean section to a 21-year-old healthy mother at 38 weeks gestational age. The delivery and early post-natal period were uncomplicated. On physical examination, a high arched palate and short philtrum were noted in addition to the characteristic facial appearance of DiGeorge syndrome (low set ears, nasal ridge, fish mouth and hypoplastic mandible). She had central cyanosis. Breath sounds were decreased over the left hemithorax. A systolic murmur was heard over the praecordium. Serum calcium and parathormone

levels were 5.1 mg dl^{-1} and 1 pg ml^{-1} , respectively. Immunological studies showed decreased levels of peripheral lymphocytes, T-cells and T-cell subsets. The lymphoproliferative response to phytohaemagglutinin mitogenes was also decreased. Serum immunoglobulin levels were within normal limits.

Echocardiography demonstrated ventricular and atrial septal defects and a single atrioventricular valve (AV channel defect). A chest radiograph showed complete opacification of the left hemithorax and ipsilateral shift of the mediastinum (Figure 1). The right lung was overdistended and herniated into the left hemithorax. CT showed a right-sided aortic arch, lack of lung tissue on the left side, and a 1 cm rudimentary left stem bronchus that ended in a blind pouch. No thymus was observed on CT. Conventional MR



Figure 1. Posteroanterior chest radiograph shows increased density of the left hemithorax and marked displacement of mediastinum to the left. The right lung is overinflated.

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sequences confirmed the CT findings. Furthermore, the right-sided aortic arch and absence of the left pulmonary artery were successfully demonstrated on Gd enhanced MRA (Figures 2a,b).

Chromosome analysis using fluorescent *in situ* hybridization with a DNA probe (N25) specific for DiGeorge showed the presence of monosomic microdeletion at 22q11.2.

After the definite diagnosis, a prophylactic antibiotic for *Pneumocystis carinii*, as well as oral calcium supplements and vitamin D were administered to the patient.

Discussion

Complete or partial absence of third and fourth pharyngeal pouch derivatives that contain thymus and parathyroid glands is the main feature of DiGeorge syndrome. Malformations including conotruncal congenital heart defects, cleft plate, velopharyngeal insufficiency, transient hypocalcaemia, T-cell abnormalities and typical facial appearance are reported in conjunction with DiGeorge syndrome [4, 5]. Although the aetiology is not clear, genetic, teratogenic and mechanical factors may contribute to the pathogenesis of the syndrome [2]. The deletion of 22q11.2 chromosomal segment is a characteristic feature.

Developmental defects of lung may be associated with congenital malformations of skeletal, cardiovascular, genitourinary and gastrointestinal systems [2]. Pulmonary dysplasia accompanied by thymic disorders is also reported [3]. However, the association of DiGeorge syndrome and pulmonary aplasia has not been reported before.

Severe anomalies in lung formation have been classified as: (i) agenesis, in which there is complete absence of lung tissue, bronchus and vessels at the affected side; (ii) aplasia, in which a rudimentary bronchus is present with no sign of obvious pulmonary parenchyma; and (iii) extreme hypoplasia, in which the bronchus is fully developed but small in size and ends in a fleshy structure without evidence of pulmonary lobes [6]. The chest radiographic findings of pulmonary agenesis include: opacification of the ipsilateral hemithorax, hyperaeration of contralateral lung, ipsilateral elevation of the hemidiaphragm and approximation of ribs on the affected side [2, 7]. Congenital atelectasis of a lung should be considered in the differential diagnosis [8].

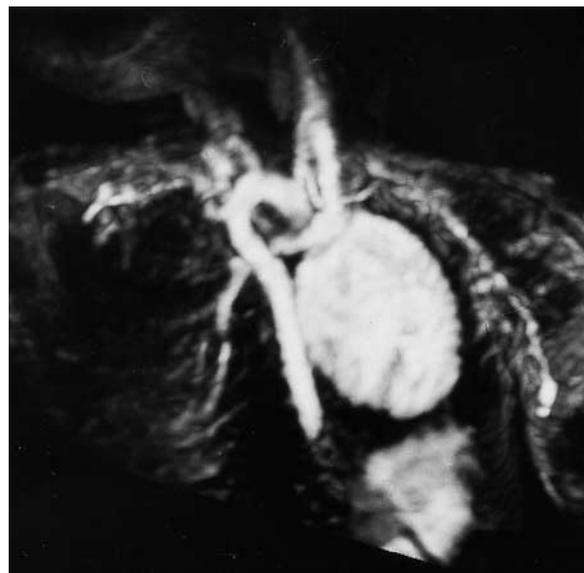
Contrast enhanced CT is successful in depicting mediastinal anatomy. Tracheal compression by a displaced or abnormal vascular structure can be seen on CT [7]. Absence of the pulmonary artery on the affected side or a thread-like remnant of this vessel can be observed [2, 8].

Conventional MR sequences are extremely helpful for demonstrating absence of the pulmonary artery. They are particularly useful in displaying disorders of the hilar pulmonary arteries from their origin at the level of the pulmonary out-flow tract. MRI is increasingly used for the assessment of mid and distal portions of the pulmonary arteries [9].

In recent years, three-dimensional (3D) Gd enhanced MRA with or without breath-hold techniques has been successfully used to demonstrate the main mediastinal vascular structures in a paediatric age group [10, 11]. The major



(a)



(b)

Figure 2. (a) On the right anterior oblique projectional (MIP) image (6.3/1.2, 20° flip angle), the right-sided aortic arch and the course of the descending aorta can be clearly seen. (b) Right inferoanterior oblique projectional angiogram (MIP) (6.3/1.2, 30° flip angle) shows the right pulmonary artery throughout its course.

problem in non-breath-hold techniques is degradation of images by artefacts due to motion and respiration. Another disadvantage of Gd enhanced MRA is simultaneous visualization of the arterial and venous system resulting from the rapid haemodynamic status in this age group [11]. However, even in these cases the quality of images is acceptable and images providing clinical information regarding the vessels can be obtained, as in our case. When compared with conventional angiography, 3D Gd enhanced MRA does not require heavy sedation or general anaesthesia and it can show the vascular structures in a few minutes without any arterial puncture [10].

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