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RESEARCH LETTER

Pericardial effusion in the first trimester of pregnancy

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Prenatal pericardial effusion (PE) is defined as a pericardial fluid collection of >2 mm.

The etiology is diverse as it can be a benign finding in milder forms (2–7 mm) in the absence of sonographic abnormalities, but it can also be associated with chromosomal anomalies (trisomy 21), infections (toxoplasmosis, cytomegalovirus, rubella, herpes and parvovirus), tumors (teratoma, rhabdomyoma) and congenital ventricular outpouchings (diverticula, aneurysms) or even rarely with a congenital capillary hemangioma of the pericardium.

We report the prenatal diagnosis at 11 weeks of a PE most likely caused by a ventricular diverticulum, necessitating pericardocentesis. This non-consanguineous couple has one healthy daughter but the mother also had one early miscarriage (at 7 weeks) and another pregnancy with late fetal death at 34 weeks with a negative pathological examination. This study is in approval with the ethical recommendations of the University Hospital Leuven.

A scan at 11 weeks revealed bilateral massive pericardial fluid (Figure 1(a-b)). No other structural anomalies were detected and there was no evidence of a cardiac tumor. Karyotyping after chorionic villus sampling was normal (46, XY) and screening for infections (toxoplasmosis, cytomegalovirus, herpes, rubella, parvovirus) was negative.

Preterm prelabor rupture of membranes occurred at 17 weeks with a constant oligohydramnios (amniotic fluid index, AFI: 5 cm <5th centile).

Because of persistence of the PE, the parents opted for a pericardocentesis at 22 weeks combined with amnion infusion (500 cc normal saline solution) and amnion patch (200 mL Hartmann, 20 mL thrombocytes and 20 mL plasma infusion) via a 20 gauge needle under antibiotic profylaxis. Six cc of dark yellow fluid was aspirated, negative for infectious screening.

Following the procedure, leakage of amniotic fluid continued and a persistent oligohydramnios with deepest pocket of maximum 2 cm was present. Lung hypoplasia seemed very likely due to the early PE and subsequent oligo-anhydramnios from 17 weeks, the canalicular period of lung development. However, the lung/head ratio remained favorable (>1) and the thoracic/abdominal circumference was rather small (0,76).

Hospital admission started at 26 weeks with monitoring of fetal well-being and maternal infectious parameters because the parents had asked for all steps to be taken to save this child.

The PE reappeared at 27 weeks, but was mild (4 mm). Corticosteroids for lung maturation were given.

At 30 weeks, a cesarean section was performed due to preterm labor and breech position [weight, 1420 g (50th centile); length, 41 cm (50th centile); head circumference, 28 cm (50th centile)] and Apgar scores 7 (at 1 min) and 8 (at 5 min). Respiratory support, at first, with high-frequency oscillation (9 days) and thereafter with nasal CPAP (22 days) and extra oxygen (21 days) as well as surfactant and systemic corticotherapy (dexamethason) was given. Bronchopulmonary dysplasia was present.

Ophthalmological examination showed a normal right-sided anterior eye segment but a left-sided dysgenesis of the anterior segment with left-sided microphtalmia and sclerocornea. Otherwise, clinical examination was normal.

At day 22, the male infant had to be reintubated due to a cardiac collapse and cardiac tamponade; cardiac surgery revealed a massive hematoma that was removed. Pathological examination of the pericardial biopsy showed granular tissue and no micro-organisms.

After this intervention the boy recovered well. At present, he is 6 months of age with normal neurological examination.

Isolated PE without other fluid collections covers a wide spectrum of etiologies from transient forms to genetic and chromosomal anomalies. A high incidence (30%) of chromosomal anomalies, mainly trisomy 21,

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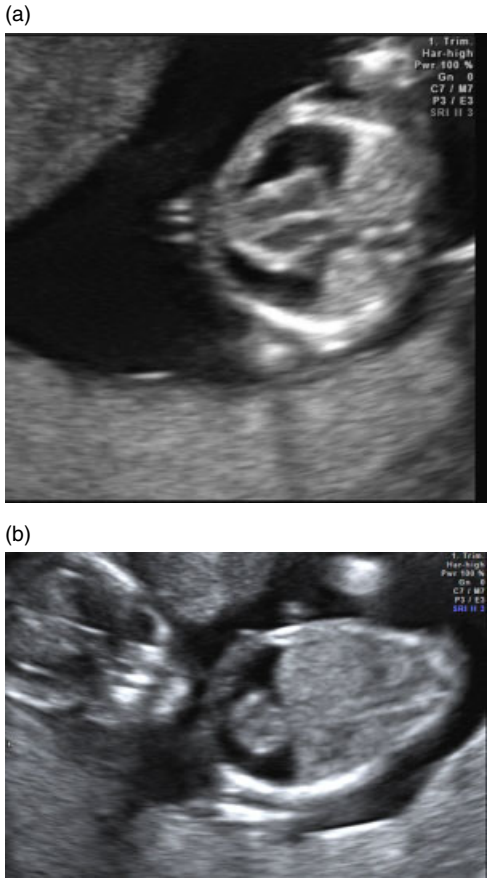

Figure 1—(a-b)-Ultrasound at 11 weeks with the pericardial effusion (PE)

has been reported in isolated PE (Di Salvo *et al*., 1994; Hirashima *et al*., 2000; Marijon *et al*., 2006; Ohlow, 2006). In these aneuploidies, a myeloproliferative disorder may produce PE in the absence of structural or rhythmic abnormalities (Hirashima *et al*., 2000).

Infections (toxoplasma, cytomegalovirus, rubella virus, herpes virus and parvovirus) can also cause PEs.

Cardiac etiologies of PE can be tumors (teratoma, rhabdomyoma), a pericardial capillary hemangioma and ventricular outpouchings such as diverticula and aneurysms (Sepulveda *et al*., 2000; Thorp *et al*., 2000; Bernasconi *et al*., 2004; Del Rio *et al*., 2005).

In retrospect, looking back at the stored clips, a mild subvalvular left ventricular diverticulum was most likely the cause of the early first trimester and massive PE in this infant.

A congenital ventricular diverticulum is a rare congenital malformation characterised by outpouching of the ventricular wall. It can result as a primary congenital defect of the wall or as the result of weakness in the wall due to ischemia or *in utero* infection with viral myocarditis. It is most often located at the apex or at the subvalvar area of the left ventricle.

The main differential diagnosis is a ventricular aneurysm: diverticula have a narrow communication with the ventricular cavity and can be seen as a finger- or hook-like appendix emerging from the ventricular wall. They are smaller than aneurysms. Aneurysms are more likely to be akinetic.

Ultrasonography shows the diverticulum, but often significant PE is present, as in this case. The origin of the PE is unknown but can be the consequence of a congestive cardiac failure or friction between the dilated ventricle and the surrounding pericardium (Del Rio *et al*., 2005).

A cardiac diverticulum is not typically associated with chromosomal anomalies, but other cardiac malformations such as ventricular septal defects and more complex cardiopathies are also frequent as well as other vascular anomalies (persistent left vena cava superior, coarctation of the aorta) and extracardiac malformations (such as midline defects) (Ohlow, 2006).

The prognosis of a cardiac diverticulum is often favorable although pregnancy termination in early diagnoses from 13 weeks with PE has been performed due to the risk of pulmonary hypoplasia (Carles *et al*., 1995; Cesko *et al*., 1998). Pericardocentesis is advised when spontaneous resolution of the effusion does not occur by 20 weeks or when cardiac failure is likely (Del Rio *et al*., 2005).

In the presented case, the PE was massive and already present at 11 weeks of gestation making the diagnosis of a small diverticulum difficult. After pericardocentesis at 20 weeks, no clear defect in the ventricular wall was seen, although in retrospect the stored images most likely are indicative of a left-sided diverticulum. In the neonatal period, an emergency cardiac surgery due to cardiac collapse with tamponade was necessary and a large hematoma was removed; we can speculate that a rupture of a small diverticulum occurred at this point. As associated anomaly, this infant shows a left-sided dysgenesis of the anterior segment with left-sided microphtalmia and sclerocornea (Peters' anomaly).

Peters' anomaly can be seen in chromosomal anomalies (trisomy 13, 15 and others). Other systemic associations described are congenital heart disease (such as ventricular septal defect, tetralogy of Fallot), spinal defects, genitourinary abnormalities, external ear abnormalities, hearing loss, cleft lip and palate, short stature and developmental delay. The critical event occurs in the first trimester of pregnancy during the formation of the anterior chamber of the eye. The *PAX6* gene is involved in ocular embryogenesis, and mutations in this gene are described in some patients with Peters' anomaly (Azuma *et al*., 1999; Harissi-Dagher and Colby, 2008). At present, the parents want to wait for a further DNA analysis.

In conclusion, this case represents an early first trimester (11 weeks) PE, possibly due to a ventricular diverticulum, with associated oligohydramnios from 17 weeks' gestation making pulmonary hypoplasia very likely but with a relatively favorable outcome.

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