Diagnosis of complete d-transposition of great arteries with cMRI

By Julian Luetkens, Christopher Hart and Thomas Vollbrecht, University Hospital Bonn

As prenatal diagnosis of critical congenital heart disease reduces mortality and morbidity after birth, correct assessment of fetal cardiovascular anatomy and complicating features such as a restrictive foramen ovale is crucial for both, parental counselling and planning therapeutic care[1][2][3]. Because fetal echocardiography as the gold standard may be limited especially in late gestational age, fetal cMRI may serve as an additional approach in prenatal characterization of CHD[4].

CASE PRESENTATION

The presented fetus is at gestational age of 36+0 weeks with underlying maternal risk factors for development of CHD which are adipositas (BMI 39 kg/m²) and gestational diabetes mellitus. During routine obstetric ultrasound screening at 2nd trimester of pregnancy a suspicion of d-TGA was determined.

INVESTIGATION

Both fetal echocardiography and fetal cMRI performed on the same day confirmed a complete d-TGA *(Figure 1)* and demonstrated non-restrictive interatrial communication via the foramen ovale *(Figure 2)*. Whereas fetal echocardiography was limited by maternal obesity, fetal cMRI clearly ruled out often associated malformations such as ventricular septal defect or other types of congenital heart diseases *(Figure 3)*.

DIFFERENTIAL DIAGNOSIS

Fetal cMRI confirmed the suspicion of complete d-TGA reported by previous echocardiography and demonstrated normal interatrial communication via the non-restrictive foramen ovale. Additional value was given due to imaging of the lungs that revealed normal development without signs of pulmonary venous dilation indicating restrictive interatrial communication or anomalous pulmonary venous return.

TREATMENT

The fetus was given prostaglandins immediately after birth to maintain patency of the ductus arteriosus and atrial septostomy to enlarge the foramen ovale. 3 weeks after birth an arterial switch procedure was performed.

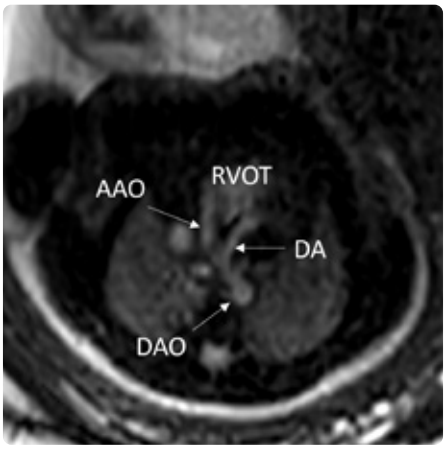

Figure 1: Axial bSSFP Cine: ventriculoarterial discordance with the right ventricular outflow tract connected to the ascending aorta. The main pulmonary artery/ductus arteriosus (DA) arises from the left ventricle and joins the descending aorta (DAO). AAO: ascending aorta, DA: ductus arteriosus, DAO: descending aorta, RVOT: right ventricular outflow tract

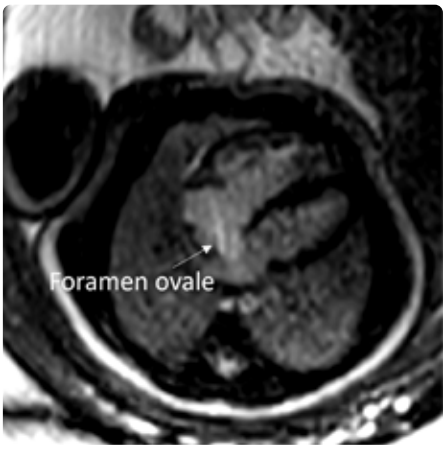

Figure 2: Axial bSSFP Cine: normal interatrial communication via the non-restrictive foramen ovale

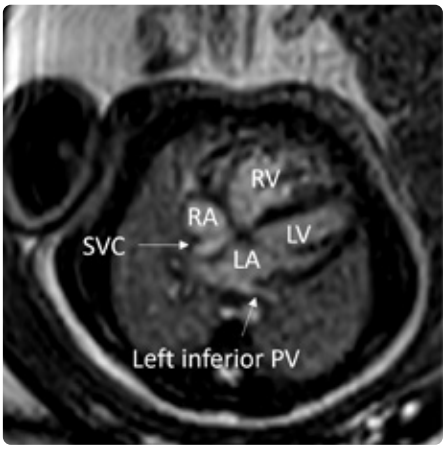

Figure 3: Axial bSSFP Cine: 4-chamber-view demonstrating regular venoatrial connections and atrioventricular concordance. LA: left atrium, LV: left ventricle, PV: pulmonary vein, RA: right atrium, RV: right ventricle, SVC: superior vena cava

OUTCOME AND FOLLOW-UP

Due to prenatal diagnosis, the delivery took place at our university hospital, where the newborn could receive special treatment in the neonatal intensive care unit. After cardiac surgery, regular expert cardiological follow-up is scheduled.

TAKE HOME MESSAGES

In cases where fetal echocardiography is limited assessable, fetal cMRI may serve as an adjunct diagnostic tool for the evaluation of the fetal heart. In critical CHD where complicating features such as a restrictive atrial communication may affect postnatal therapy and outcome, further assessment of pulmonary veins and fetal lungs can be performed by fetal cMRI.

REFERENCES

1. Holland BJ, Myers JA, Woods CR. Prenatal diagnosis of critical congenital heart disease reduces risk of death from cardiovascular compromise prior to planned neonatal cardiac surgery: a meta-analysis. Ultrasound Obstet Gynecol. 2015;45(6):631–638. doi: 10.1002/uog.14882.
2. Bonnet D, Coltri A, Butera G, et al. Detection of Transposition of the Great Arteries in Fetuses Reduces Neonatal Morbidity and Mortality. Circulation. 1999;99(7):916–918. doi: 10.1161/01.CIR.99.7.916.
3. Tuo G, Paladini D, Montobbio G, et al. Prenatal Echocardiographic Assessment of Foramen Ovale Appearance in Fetuses with D-Transposition of the Great Arteries and Impact on Neonatal Outcome. Fetal Diagn Ther. 2017;42(1):48–56. doi: 10.1159/000448995.
4. Wielandner A, Mlczoch E, Prayer D, Berger-Kulemann V. Potential of magnetic resonance for imaging the fetal heart. Semin Fetal Neonatal Med. 2013;18(5):286–297. doi: 10.1016/j.siny.2013.05.006.