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Predicting Emergency Atrial Septostomy In Prenatally Diagnosed Transposition Of The Great Arteries

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Background: Prenatal detection of transposition of the great arteries (TGA) improves outcome, but mortality still occurs in the pre-operative period due to inadequate mixing of the pulmonary and systemic circulations. Prenatal prediction of cases requiring emergency balloon atrial septostomy (BAS) remains difficult. It has been postulated that presence of oxygenated blood in the pulmonary artery causes relaxation of the pulmonary vasculature with subsequent increased pulmonary venous return predisposing to early postnatal closure of the interatrial communication. The objective is to identify prenatal markers which may predict the need for emergency BAS.

Methods: Prenatally diagnosed cases of isolated TGA in singleton pregnancies between January 2013 and December 2015 were reviewed. The appearance of the atrial septum (AS), the foramen ovale (FO) length and foramen ovale: total septal length (FO:TSL) were assessed at the third trimester fetal echocardiogram. The arterial valves, branch pulmonary arteries and arterial duct were measured from inner edge to inner edge in systole at maximal diameter. Assessments were made without knowledge of the postnatal outcome.

Results: 24 fetal echocardiograms were performed at a median gestational age of 34+2weeks (range: 29+0 to 36+2). An emergency BAS was required in 9/24 cases (table 1). All 3 cases with limited movement of the AS required emergency BAS. A hypermobile AS was not associated with emergency BAS (p= 0.60). An aneurysmal AS was identified in 21/24 cases and was seen more frequently in those cases which did not require an emergency BAS.
The FO length and the FO:TSL were significantly smaller in those who required an emergency BAS. An emergency BAS was required in 6/7 cases with FO <6mm and 6/8 cases with FO:TSL <0.4. There was no significant difference in arterial duct, semilunar valve, branch pulmonary artery size in those cases requiring emergency BAS and those that did not.

Conclusions:
1) Third trimester FO length and FO:TSL are smaller in those with inadequate mixing of pulmonary and systemic circulations after birth.
2) Third trimester FO <6mm or FO:TSL <0.4 should highlight the likelihood for emergency BAS.
3) Hypermobile and aneurysmal AS do not indicate inadequate postnatal mixing.

Table 1: Prenatal echocardiogram findings in TGA

	Emergency BAS	No emergency BAS	P value
No. of cases	9	15	
Foramen ovale length (mm) (mean ± sd)	4.9 ± 1.0 *	9.0 ± 2.8	0.005
Foramen ovale: total septal length	0.27 ± 0.07 *	0.44 ± 0.11	0.015
No. of cases with aneurysmal AS No. of cases with non-aneurysmal AS	6/21 * 3/3	15/21 0/3	P= 0.041
No. of cases with hypermobile AS No. of cases with mobile AS in left atrium No. of cases with fixed AS	2/5 4/16 3/3	3/5 12/16 0/3	P=0.60
Arterial duct diameter (mm)	3.9 ± 1.3	3.6 ± 0.9	0.54
Pulmonary valve diameter (mm)	7.0 ± 1.2	6.2 ± 1.0	0.08
LPA z score	1.6 ± 1.1	1.3 ± 0.7	0.65
RPA z score	0.8 ± 0.4	0.4 ± 0.8	0.52