

Transposition of the Great Arteries and Intact Ventricular Septum: postnatal morphological and functional echocardiographic patterns

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INTRODUCTION: To improve the understanding of the pathophysiology of Transposition of the Great Arteries with Intact Ventricular Septum (TGA/IVS) and the cardiac remodeling occurring from the fetal life we performed a morphometric and functional echocardiographic assessment in fetuses and newborns. Additionally, we studied the echocardiographic differences in those who developed persistent pulmonary hypertension (PPHT) before the arterial switch operation.

METHODS: Prospective case-control study performed in a tertiary referral center, including fetuses and newborns with diagnosis of TGA/IVS during a three year period. Morphometry and systolic and diastolic function parameters were compared with age and body-surface matched healthy controls. TGA/IVS patients were classified in PPHT and non-PPHT groups.

RESULTS (Table): Twenty one TGA/IVS patients were included during the study period. Morphometric and functional echocardiographic data is shown in the Table. Compared to controls, fetuses with TGA/IVS had bigger right atriums and aortic valves. Both right and left systolic and diastolic function were slightly increased with overall higher aortic cardiac output.

Postnatally, TGA/IVS showed bigger atriums and globulous right ventricles with bigger aortic valves. Heart rate and overall function was significantly increased resulting in both aortic and pulmonary higher cardiac output. In fetal life, patients with PPHT had smaller foramen ovale (5.8 vs 7.8mm) with higher bulging ratios (0.60 vs 0.45) compared to non-PPHT. The pulmonary velocity (84.5 vs 117cm/s), pulmonary index (2.91 vs 4.4 ml/Kg/min) and QP/QS (0.83 vs 0.94) were lower.

CONCLUSIONS: TGA/IVS patients show morphometric and functional changes of increased overall volume and output predominantly in the aortic component from fetus to newborn, probably due to compensatory mechanisms secondary to brain hypoxia. Patients with PPHT have lower pulmonary output values already present in the prenatal period. Therefore, measurement of QP/Qs in the prenatal period might help the early recognition of PPHT patients.

Table: Echocardiographic parameters in TGA/IVS in fetal and postnatal life

	Fetal TGA (21)	Controls (50)	<i>p</i>	Neo TGA (21)	Controls (63)	<i>p</i>
HR (bpm)	140 ± 8	142 ± 10	0.427	149 ± 13.9	126 ± 18	<0.001
Aortic CO (ml/min)	662 ± 370	388 ± 192	0.001	1146 ± 436	685 ± 225	<0.001
Pulm. CO (ml/min)	515 ± 213	454 ± 204	0.223	1061 ± 330	738 ± 195	<0.001
QP/QS	0.89 ± 0.36	1.26 ± 0.50	0.005	1.1 ± 0.7	0.95 ± 0.3	0.884
RA area (cm ²)	2.42 ± 0.76	1.84 ± 0.73	0.022	3.1 ± 1.1	2.1 ± 0.4	<0.001
LA area (cm ²)	1.74 ± 0.54	1.70 ± 0.61	0.703	2.6 ± 0.9	2.0 ± 0.4	<0.001
AV diam (mm)	6.94 ± 1.44	5.56 ± 1.42	0.001	9.2 ± 0.9	7.7 ± 0.6	<0.001
PV diam (mm)	6.61 ± 1.17	6.11 ± 1.52	0.185	7.9 ± 1	8.1 ± 0.6	0.144
Right FAC (%)	27 ± 12	28 ± 11	0.742	49 ± 7	29 ± 23	<0.001
Tricuspid S' (cm/s)	8.8 ± 1.9	7.6 ± 1.3	0.028	7.7 ± 1.8	5.6 ± 1.5	<0.001
Tricuspid E (cm/s)	46 ± 8	43 ± 8	0.164	88 ± 29	51 ± 15	<0.001
Aortic vel (cm/s)	82 ± 18	83 ± 15	0.349	98 ± 25	75 ± 15	<0.001
Left EF (%)	71 ± 14	62 ± 11	0.035	71.8 ± 8.2	63.7 ± 8.4	0.001
Mitral S' (cm/s)	6.8 ± 2.1	6.8 ± 1.2	0.323	6 ± 1.7	4.4 ± 1.1	<0.001
Pulm. vel (cm/s)	94 ± 19	70 ± 14	<0.001	114 ± 33	81 ± 12	<0.001
Mitral E (cm/s)	41 ± 6	38 ± 8	0.170	91 ± 26	58 ± 15	<0.001

TGA/IVS: Transposition of the great arteries and intact ventricular septum; CO:cardiac output; RA:right atrium; LA:left atrium; AV:aortic valve; PV:pulmonary valve; FAC:fractional change area; QP/QS calculated as ratio between pulmonary and systemic cardiac output; Data shown as mean ± SD.