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Longitudinal hemodynamic assessment of fetuses with TGA to predict the perinatal course – the pilot study.

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Introduction: Transposition of the great arteries (TGA) is one of the most common congenital heart diseases, well-tolerated prenatally, however life-threatening for the newborn. The main concerns are: the foramen ovale (FO) restriction, sometimes coexisting with persistent pulmonary hypertension (PPHN), which may preclude efficient intracardiac mixing. Numerous parameters have been described to predict the need for urgent balloon atrioseptostomy (BAS) and the occurrence of PPHN after birth, with often conflicting results. The aim of this study is to develop and test a different method, based on a thorough, longitudinal observation of intracardiac blood flows, to predict the hemodynamic status of the newborn with TGA.

Methods: Retrospective-prospective analysis of echocardiographic examinations of 66 fetuses diagnosed with simple TGA (small VSDs included) in a reference fetal cardiology center between 2011-2017.

Results: Based on our observations we developed a flowchart of fetal TGA assessment presented below. Its usefulness in predicting the newborn's condition is shown in the table.

1. FO flow R→L or bidirectional, blood mixing assessed by Color Doppler:
 - a. mixing clearly visible→ NO RESTRICTION.
 - b. mixing limited by interatrial septum [IAS]→ go to point 2/3.
2. Short, thickened, usually hypermobile FO valve, R→L unrestrictive DA flow, systolic velocity usually $PT=Ao$ or $PT>Ao$ → FO RESTRICTION.
3. Long FO valve bulging deeply into the left atrium:
 - a. DA L→R diastolic flow, systolic velocity $PT<Ao$ → FO RESTRICTION, possibly technically difficult BAS.
 - b. If in subsequent examinations the atrial septum excursion decreases or septum becomes hypermobile; end-systolic and/or diastolic L→R DA flow → increased pulmonary flow→ RISK OF PPHN.
4. DA restriction/narrowing OR long lasting (≥5 weeks) limited interatrial mixing→ HIGH RISK OF PPHN.
5. Obligatory assessment every 1-2 week after 35 week of pregnancy.

Prediction	Outcome			Sensitivity	Specificity	PPV	NPV
	No restriction	Urgent BAS	BAS+PPHN				
No restriction	25	1	0	83,3%	97,2%	96,2%	87,5%
Urgent BAS	3	11	5	78,6%	84,6%	57,9%	93,6%
BAS+PPHN	2	2	17	77,3%	90,9%	81,0%	88,9%

Conclusions: Longitudinal assessment and interpretation of fetal TGA hemodynamics seems to predict the newborn's condition with high accuracy and specificity, which is important in planning the perinatal period, especially in cases with suspected PPHN.