

Longitudinal myocardial deformation in children after the Fontan operation: feasibility and impact of ventricular morphology in a multicenter setting

Koopman L.P. (1), Geerdink L. (2, 3), Bossers S.S.M (1), Kuipers I. M. (4), ten Harkel A.D. (5), van Iperen G. (6), Weijers G. (2), Rebel B. (1), Helbing W.A. (1), Kapusta L. (2, 7)

1) Department of Pediatrics, Division of Pediatric Cardiology, Erasmus Medical Center — Sophia Children's Hospital, Rotterdam, The Netherlands; 2) Department of Pediatric Cardiology, Radboud University Medical Centre — Amalia Children's Hospital, Nijmegen, The Netherlands; 3) Department of Pediatric Cardiology and Intensive Care medicine, Hanover Medical School, Hanover, Germany; 4) Department of Pediatric Cardiology, Academic Medical Center, Amsterdam, The Netherlands; 5) Department of Pediatric Cardiology, Leiden University Medical Center, Leiden, The Netherlands; 6) Department of Pediatric Cardiology, University Medical Center Utrecht — Wilhelmina Children's Hospital, Utrecht, The Netherlands; 7) Department of Pediatrics, Pediatric Cardiology Unit, Tel-Aviv Sourasky Medical Center, Tel Aviv, Israel.

Introduction: Assessment of single ventricle (SV) function in patients after the Fontan operation is clinically important. Controversy exists whether SV anatomy (right ventricular [RV] versus left ventricular [LV] morphology) influences SV function. Two-dimensional echocardiography is commonly used to assess SV function, but quantification is difficult due to differences in SV geometry compared to normal hearts. Myocardial deformation by speckle tracking echocardiography (STE) is less geometry dependent. **Study aims:** to assess feasibility of STE in patients after the Fontan operation and to investigate whether STE parameters differ between children with dominant RV and LV morphology. **Methods:** Cross-sectional, prospective, multicenter study (n= 109 children, 66 boys). Apical SV echocardiographic views were acquired using General Electric (GE, Vivid 7) or Philips (iE33) platforms. STE peak longitudinal strain (ϵ) and systolic strain rate (SR) of the lateral wall of the dominant ventricle were measured using vendor dependent software (EchoPac and QLAB). Independent T test was used to compare groups. Intra- and interobserver variability was assessed by coefficient of variation (COV) of STE parameters in twenty patients (10 GE/10 Philips). **Results:** Mean age at study was 12,0 (range 9,7-14,6) years. Dominant morphology of the SV was LV in 70 (64%) and RV in 39 (36%) children. Feasibility for STE measurements was 83% for GE and 78% for Philips ($p>0,05$). Intra- and inter observer COV ranged between 6 and 14% for both platforms. Peak global longitudinal ϵ was $-19,1\pm 3,7\%$ for GE and $-18,2\pm 4,4\%$ for Philips ($p=0,33$). Global longitudinal systolic SR was $-1,13\pm 0,34$ 1/s. for GE and $-1,15\pm 0,38$ 1/s. for Philips ($p=0,79$). Results for STE parameters in LV versus RV morphology are shown in the table.

	Longitudinal peak strain (%)			Longitudinal systolic SR (1/s.)		
	LV	RV	p-value	LV	RV	p-value
Apical-lateral	$-19,3\pm 5,8$	$-17,2\pm 6,1$	0,13	$-1,15\pm 0,34$	$-1,00\pm 0,44$	0,10
Mid-lateral	$-20,9\pm 5,8$	$-17,6\pm 6,4$	0,02	$-1,18\pm 0,46$	$-1,07\pm 0,45$	0,28
Basal-lateral	$-19,6\pm 6,0$	$-18,6\pm 5,0$	0,44	$-1,26\pm 0,51$	$-1,10\pm 0,45$	0,16
Global-lateral	$-19,5\pm 3,5$	$-17,7\pm 4,2$	0,04	$-1,20\pm 0,35$	$-1,04\pm 0,33$	0,04

Conclusions: Feasibility and reproducibility of STE in children with SV morphology after Fontan palliation is acceptable, results for longitudinal deformation are comparable between 2 vendors. Longitudinal deformation is lower in children with dominant RV's compared to dominant LV's.