



# Longitudinal myocardial deformation as a predictor of impaired ventricular function in children after the Fontan operation

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## Background:

The short term survival of children with single ventricle (SV) heart defects after the Fontan operation has improved over the last decades, but impaired cardiac function is a major cause of morbidity and mortality over time. Cardiac magnetic resonance imaging (cMRI) is the golden standard in assessing SV function, but high costs and limited availability hamper its routine use. A cheaper and more available alternative for assessing SV function is echocardiography.

## Study aims:

To describe the association between myocardial deformation parameters assessed by speckle tracking echocardiography (STE) and SV function assessed by cMRI.

## Methods:

Cross-sectional, multicenter study in 109 children after completion of the Fontan operation. Echocardiography and cMRI were performed on the same day. STE peak longitudinal strain and systolic strain rate (SR) of the lateral wall of the dominant ventricle were measured off-line using the apical SV echocardiographic view. Impaired SV function by cMRI was defined as ejection fraction (EF) < 45%. Pearson correlation was used to assess associations between methods and independent T-test was used to compare groups.

## Results:

- Mean age at study was 12,0 (range 9,7-14,6) years.
- cMRI was performed in 70/109 participants (64%).
- Mean cMRI EF was 53% (range 34-75%).

Table 1: Association between cMRI and myocardial deformation parameters

	Global Lateral Longitudinal Strain					Global Lateral Longitudinal Systolic SR						
	N	Correlation		Linear regression			N	Correlation		Linear regression		
		Pearson R	$\beta$	SE	p-value	Pearson R		$\beta$	SE	p-value		
cMRI-SV EF-rest	70	-0,30	-0,148	0,057	0,01	70	-0,21	-0,010	0,006	0,07		
cMRI-SV cardiac index	70	-0,33	-0,001	0,001	0,05	70	-0,17	-0,070	0,050	0,10		
cMRI-SV EF-dobu stress	49	-0,23	-0,094	0,060	0,12	49	0,02	0,001	0,008	0,89		
cMRI-SV EF change	49	-0,12	-0,071	0,006	0,08	49	-0,22	-0,016	0,010	0,12		
cMR-SV $\Delta$ cardiac index	49	-0,07	0,000	0,001	0,64	49	-0,12	-0,073	0,000	0,39		

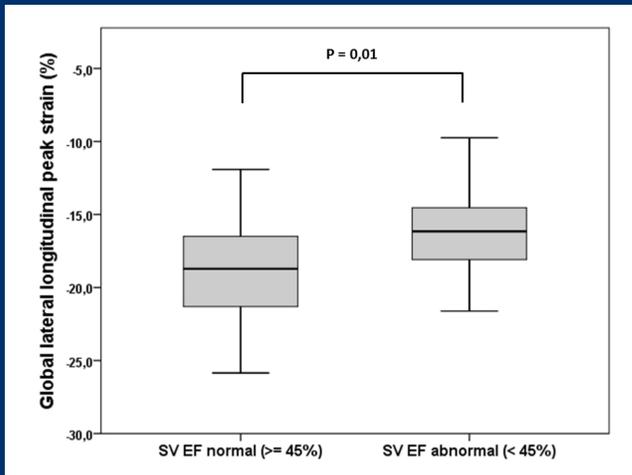


Figure 1A: Box-Whistler plots, global lateral longitudinal strain in children with normal and abnormal ejection fraction (EF) by cMRI

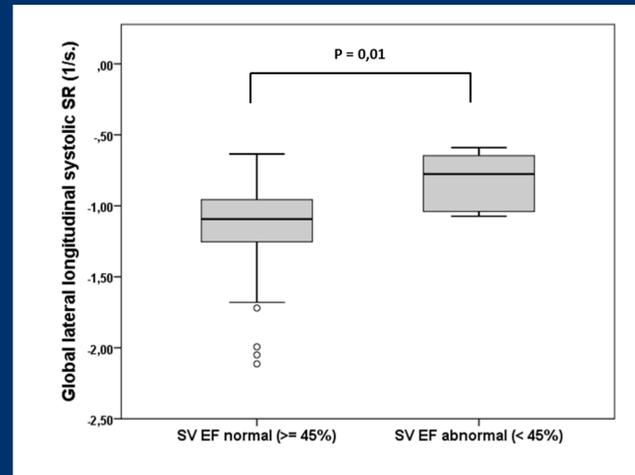


Figure 1B: Box-Whistler plots, global lateral longitudinal strain rate in children with normal and abnormal ejection fraction (EF) by cMRI

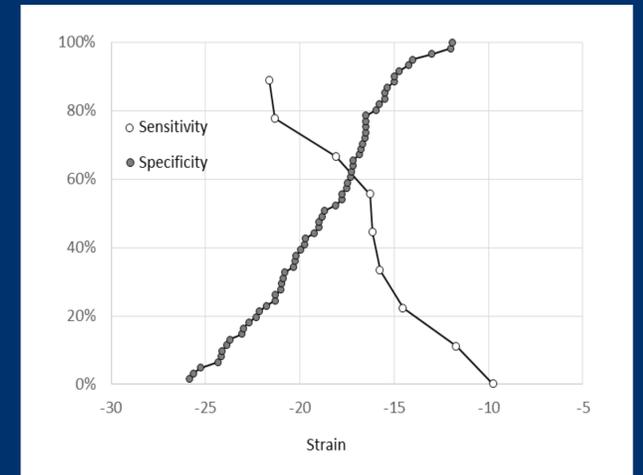


Figure 2A: Sensitivity-specificity curves for global lateral longitudinal strain in predicting single ventricle ejection fraction of below 45%

## Conclusion:

- SV systolic function is generally well preserved in contemporary pediatric patients after the Fontan operation, but some patients have impaired SV function assessed by cMRI.
- STE myocardial deformation parameters are modestly correlated with SV EF by cMRI but might be of use in predicting impaired EF in children after the Fontan operation.

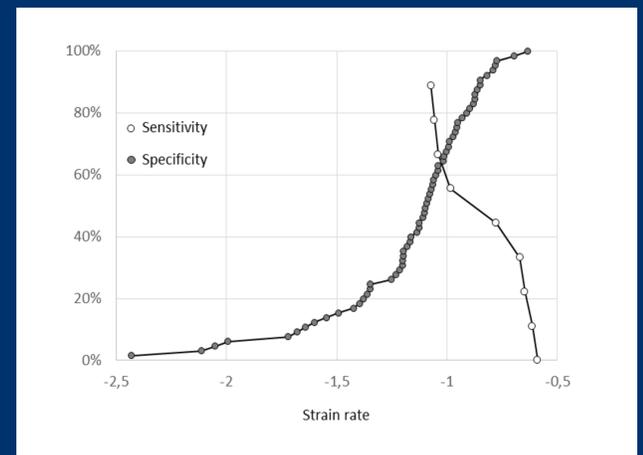


Figure 2B: Sensitivity-specificity curves for global lateral longitudinal strain rate in predicting single ventricle ejection fraction of below 45%