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Poor agreement between echocardiographic and CMR derived peak strain parameters in patients with repaired Tetralogy of Fallot

Van den Bosch E. (1, 2, 3), De Vries E.M. (1), Kamphuis V.P. (3, 4), Duppen N. (1), Kroft L.J.M (5), Roest A.A.W (4), Ten Harkel A.D.J (4), Helbing W.A. (1, 6), Koopman L.P. (1)
Erasmus University Medical Center, Department of Paediatrics, division of Paediatric Cardiology, Rotterdam, The Netherlands (1); Erasmus University Medical Center, Department of Radiology and Nuclear Medicine, Rotterdam, The Netherlands (2); Netherlands Heart Institute, Utrecht, The Netherlands (3); Leiden University Medical Center, Department of Pediatrics, division of Paediatric Cardiology, Leiden, The Netherlands (4); Leiden University Medical Center, Leiden, Department of Radiology, The Netherlands (5); Radboud university medical center, Department of Paediatrics, division of Paediatric Cardiology, Nijmegen, The Netherlands (6)

Objectives
Patients with Tetralogy of Fallot (TOF) are at risk for deterioration of ventricular function. Echocardiography and cardiovascular magnetic resonance imaging (CMR) are used to assess ventricular function. Both imaging modalities can assess myocardial deformation (strain), which has been linked to cardiac outcome. This study aims to: 1) describe echocardiographic-strain and CMR-strain parameters and their reproducibility using the same post-processing software, 2) investigate the agreement between echocardiographic-strain and CMR-strain and 3) investigate the potential correlation between strain and other CMR parameters.
Methods
In a prospective multicentre study patients underwent a CMR and echocardiography on the same day. Echocardiographic-strain and CMR-strain of the left ventricle, LV (longitudinal and circumferential) and right ventricle, RV (longitudinal) were analysed with the same post-processing software (TomTec), which contained a new dedicated RV algorithm. Inter-observer agreement and agreement between echo-strain and CMR-strain was evaluated using Bland-Altman analysis, coefficient of variation (CoV) and interclass correlation coefficient. Correlations between strain and CMR parameters were evaluated using the Spearman's rank or Pearson's correlation coefficient.
Results
We included 40 TOF patients, 27 (72%) male. The median age was 18.8 years (IQR: 15.4-24.2), time after TOF repair 18.1 years (14.8-23.2). The agreement between global peak echo-strain and CMR-strain parameters is shown in Table 1. A significant difference in peak RV global longitudinal (RVGLS) derived from echocardiography and CMR was found (-21.3±4.9 vs -24.4±4.8, p=0.007). The inter-observer CoV for RV and LV peak echo-strain and CMR-strain ranged between 9.8-17.9% and 9.3-15.2% respectively. CMR derived LV and RV ejection fraction (EF) correlated significantly with echocardiographic LV global circumferential strain (r=-0.36, p=0.03 and r=-0.51, p=0.001) and LV global longitudinal strain (r=-0.41, p=0.01 and r=-0.47, p=0.003). Echocardiographic RVGLS was significantly associated with LVEF (r=-0.36, p=0.03) but not with RVEF. CMR RVGLS was significantly associated with RVEF (r=-0.46, p=0.01) and LVEF (r=-0.36, p=0.03)
Conclusions
We report that the agreement between echo-strain and CMR-strain parameters in a cohort of TOF patients is weak, despite using the same post-processing software with a dedicated RV measurement tool. This limits the ability to interchange these imaging modalities in the follow-up of individual patients.

Table 1: Agreement between Echocardiographic and CMR Peak Strain Parameters

Peak Strain Parameters	*Mean bias (%)*	*Limits of agreement (%)*	*CoV (%)*	*Intraclass correlation Coefficient*
LV- Global Longitudinal Strain (n = 37)	0.23	-9.15 - 9.60	25.7	0.271
LV- Global Circumferential Strain (n = 36)	1,17	-11.91 - 9.56	23.9	0.377
RV- Global Longitudinal Strain (n = 35)	0.58	-12.00 - 13.16	32.0	0.110

Abbreviations: CoV: Coefficient of variation, CMR: Cardiovascular magnetic resonance, LV: left ventricular, RV: right ventricular.