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Cardiac magnetic resonance feature tracking in repaired Fallot patients predicts ventricular tachycardia but not deterioration of ventricular function

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Introduction: Main determinants of morbidity and mortality in patients with repaired Tetralogy of Fallot (TOF) are ventricular tachyarrhythmia's and deterioration of right ventricular (RV) function. Myocardial strain has shown to be predictive of outcome in several cardiovascular diseases, including congenital heart diseases. The aim of our study was to evaluate the predictive value of CMR-derived strain parameters in repaired TOF patients for developing ventricular tachycardia (primary outcome) and deterioration of ventricular function (secondary outcome).

Methods: Patients with repaired TOF who underwent cardiac magnetic resonance (CMR) investigation between January 2007 and March 2016 were included. Strain and strain-rate of both ventricles were assessed using CMR feature tracking. Primary outcome was a composite of the occurrence of sustained ventricular tachycardia (VT) or symptomatic non-sustained VT requiring invasive therapy. Univariate Cox-regression analysis was performed, after which all significant parameters were fit into a multivariate Cox-regression analysis model. Secondary outcome was analyzed in a subgroup of patients that underwent a second CMR after 1.5 to 3.5 years. Deterioration was defined as reduced RV ejection fraction (EF) of ≥10%, reduced left ventricular (LV) EF of ≥10% or increased indexed RV end-diastolic volume (EDVi) of ≥30mL/m2 compared to baseline. Patients marked as 'deteriorated' were 1:2 propensity-score matched at baseline, based on conventional mass/volume CMR measures to patients without ventricular deterioration. Strains and strain-rates were compared between groups to assess whether these parameters precede changes in conventional measures.

Results: 172 patients (median age 24.3 years, 54 patients <18 years) were included. Throughout the median follow-up of 7.4 years, 9 patients (4.5%) experienced the primary endpoint of VT. In the multivariate model, LV systolic circumferential strain-rate was independently predictive of primary outcome with an area under the curve in receiver-operator characteristic (ROC) analysis of 0.79. 70 patients underwent a serial CMR, of whom 14 patients (20%) showed ventricular deterioration. Myocardial strain and strain-rate parameters at baseline did not differ between the 'deteriorated' and 'not-deteriorated' group.

Conclusions: In repaired TOF patients, LV systolic circumferential strain-rate has a strong and independent predictive value of developing VT. No predictive value of strain parameters for deterioration of ventricular function could be demonstrated.