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Detection of regional wall motion abnormalities by three dimensional speckle-tracking in young patients after HTx

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Objective: Three dimensional speckle-tracking (3DST) is a new echocardiographic method to investigate left ventricular cardiac deformation. In children the technique has not been widely used. The follow-up of patients after HTx is a potential target as cardiac performance can be negatively influenced by acute or chronic rejections. This study aims to evaluate the potential of the method to detect regional fibrosis in comparison to cardiac magnetic resonance (CMR) imaging, to find correlations with functional parameters of cardiac performance as well as to assess reproducibility in pediatric patients post HTx.

Method: 11 consecutive patients (20.7±3.8, 14.6-28 ys, 6 female) who presented for routine outpatient consultation 14.1±8.2, 1.5-22 ys after HTx were investigated with echocardiography and CMR. In addition to routine diagnostic workup, 3DST (IE 33, X5-1 transducer, calculation with LV-Analysis 3.1[Tomtec]) and estimation of extracellular volume (ECV, 3T TX Achieva with dStream technology, R5.3, Philips, calculation with HDZ-NRW, Bad Oeynhausen) was performed. Regional wall motion abnormalities were calculated as >20% segmental deviation from mean global strain values in all directions measured. The same method was applied to T1-Mapping analyses. Reproducibility was assessed by Bland Altman statistics.

Results: All patients were in sinus rhythm, 7 with RBBB, 1 with LBBB. Acute rejection was suspected in none. Ejection Fraction (EF, 61±2.9) was normal, no echocardiographic signs for diastolic dysfunction by E/E´(6.6±1.8). 3DST analysis calculated normal global values for 3D-strain (-34.9±4.6%), circumferential strain (-28.9±3.2%) and longitudinal strain (-19.7±3.0%), reduced values for radial Strain (40.9±4.8%). Segmental wall motion abnormalities were detected in 9 patients distributed on 15 septal segments (AHA 2,3,8). In comparison to CMR these segments did not have elevated regional ECV-values, that did not correlate with the strain values ($r < 0.5$). Intraobserver-variability of mean average segmental strain values was 0.2±22% (LOA -43.5-44%).

Conclusions: 3DST permits identification of septal regional wall motion abnormalities in otherwise normal working hearts post HTx. Most probably this is based on electrical dyssynchrony, as regional fibrosis could not be detected by T1-Mapping. Reproducibility of 3DST results was acceptable. This method may help in the follow-up of pediatric patients post HTx in combination with CMR-ECV measurements.