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Abnormal longitudinal cardiac rotation is a new marker of regional LV myocardial dysfunction in children and young adults with end-stage renal failure undergoing hemodialysis

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Background: Cardiac dysfunction frequently complicates the clinical course of patients with end-stage renal failure (ESRF). Recently, we observed abnormal longitudinal cardiac rotation (LR) among patients with ESRF. In this study we sought to quantify LR mechanics in patients undergoing hemodialysis (HD).

Methods: Twenty-four subjects, 12 patients (58% male; age 17.5 ± 4.4 years) with ESRF undergoing HD, and 12 aged-matched controls, were prospectively studied. All patients underwent echocardiographic studies before and 1 hour after HD. LR mechanics were quantified with two-dimensional speckle tracking echocardiography using a 5-segment-rotation-model (2 lateral and 2 septal segments, 1 apical segment). We also assessed longitudinal strain, displacement and mechanical dyssynchrony.

Results: A typical pattern of LR was noted in all controls. This physiological LR pattern was characterized by a predominant early-systolic counterclockwise rotation (CCWR) of the lateral segments, and a late-systolic clockwise rotation (CWR) of the septal segments. A small end-systolic apical rotation was noted in all controls. LR abnormalities were identified in 5/12 (41.6%) of ESRF patients, and included an apical counterclockwise motion pattern (n = 2), or a delayed septal clockwise rotation pattern (n = 3).
Time to peak CCWR increased significantly after HD (preHD: median 35.6% (range 29.2 – 39.0%) vs. postHD: 41.0% (32.7 – 49.3%), p = 0.008). Moreover, CCWR of the lateral segments significantly increased after HD (p = 0.019). Timing of late systolic CWR occurred significantly earlier in systole in patients than in controls (preHD: 72.0% (60.0 – 84.3%) vs. controls 87.6% (82.1 – 91.8%), p = 0.033), and showed a significant prolongation after HD (p = 0.003).
Longitudinal strain was significantly reduced in patients, both before and after HD. Similarly, patients showed more dyssynchrony (p = 0.009). In contrast, septal displacement was significantly reduced in patients after HD (p = 0.003). A negative correlation was observed between regional lateral strain and septal displacement (p = 0.01). Moreover, septal displacement correlated significantly with timing of CCWR and CWR.

Conclusions: LR abnormalities were demonstrated in a large proportion of patients with ESRF. Abnormal LR motion seems a feasible and reliable new marker of regional LV myocardial dysfunction in ESRF patients.