Three-Dimensional Analysis of Regional Left Ventricular Endocardial Curvature from Cardiac Magnetic Resonance Images

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Left ventricular (LV) remodeling is usually assessed using changes in LV volume. Because this methodology disregards regional changes that may occur independently of volume, we hypothesized that 3D analysis of regional endocardial curvature could provide useful information on localized remodeling, and tested this approach on cardiac magnetic resonance (CMR) images. CMR images (Siemens 1.5T) were acquired in 44 patients: 14 normal controls (NL), 15 with dilated cardiomyopathy (DCM), and 15 with ischemic heart disease (IHD). LV endocardial surface was semi-automatically reconstructed throughout the cardiac cycle (TomTec). Custom software was used to calculate for each point on the surface the curvedness, normalized to take into account instantaneous LV size, Cn. Normalized curvedness was compared between groups of segments: NL (N=401), DCM (N=255) and IHD (N=92). While in NL segments, both maximum and minimum Cn values were comparable in basal and mid-ventricular segments, they were significantly higher in the apical segments. Additionally, percent change in Cn was higher in mid and apical compared to basal segments ($p<0.05$). At all LV levels, Cn values in IDC segments were lower ($p<0.05$) than in NL and IHD segments. In contrast, percent change in Cn was significantly lower in both IHD and DCM segments compared to NL. 3D analysis of regional LV endocardial curvature from CMR images provides quantitative information, which is consistent with the known pathophysiology, and may thus prove clinically useful in the evaluation of LV remodeling.