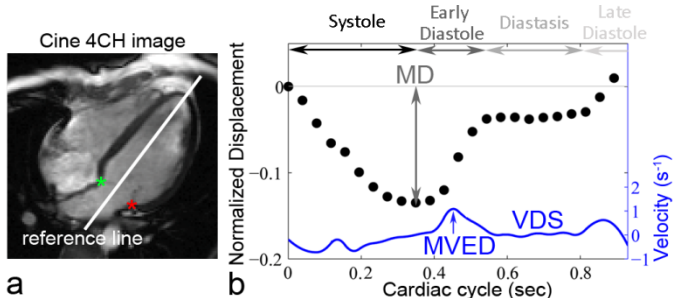


# Quantitative Assessment of Atrioventricular Junction Motion in Patients with Hypertrophic Cardiomyopathy-A Cine MRI Study

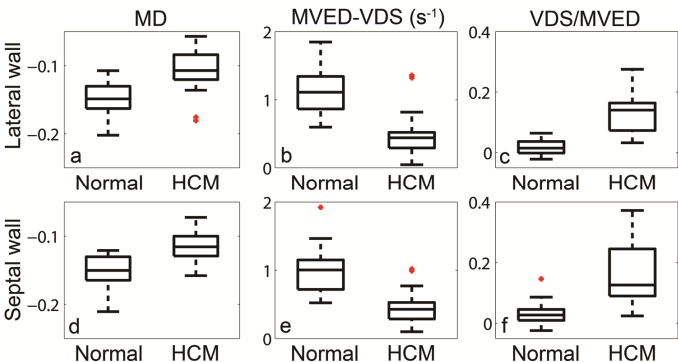
Sohae Chung<sup>1</sup>, Shahryar Saba<sup>2</sup>, Robert Donnino<sup>2</sup>, Monvadi B. Srichai<sup>1</sup>, Stuart D. Katz<sup>2</sup>, and Leon Axel<sup>1</sup>

<sup>1</sup>Radiology Department, NYU Langone Medical Center, New York, NY, United States, <sup>2</sup>Leon H. Charney Division of Cardiology, New York University School of Medicine, New York, NY, United States

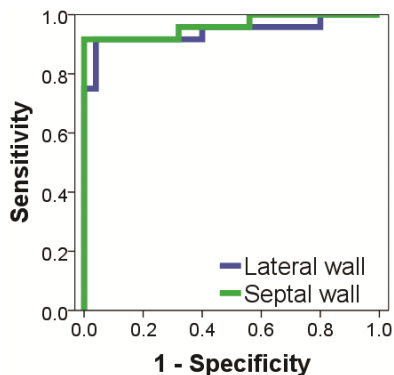
**Introduction:** While cardiac left ventricular (LV) systolic function is commonly assessed with the simple global measure of ejection fraction (EF), assessment of LV diastolic function necessarily involves consideration of its dynamics, which are determined by a combination of pressures and myocardial relaxation. In our previous study [1], we demonstrated a novel and efficient method for assessing LV diastolic function with MRI in patients with heart failure with preserved EF, using conventional cardiac cine MR images to track the motion of the atrioventricular junction (AVJ), similar to tissue Doppler imaging or speckle tracking in echocardiography. Since the AVJ is clearly defined in long-axis cine MRI, its position can be readily tracked through the cardiac cycle, allowing us to measure its longitudinal motion over time. In this work, we assessed LV diastolic function as measured using the AVJ motion in



**Figure 1.** (a) Cine 4CH long-axis image with a reference line and AVJ points on lateral and septal walls. (b) Normalized displacement and corresponding velocity curves indicating measured values.



**Figure 2.** Boxplots of (a,d) MD, (b,e) MVED-VDS (s<sup>-1</sup>), (c,f) VDS/MVED for (top) lateral wall and (bottom) septal wall (p < 0.05 for all).



**Figure 3.** ROC curves

patients with hypertrophic cardiomyopathy (HCM), a group known to have altered LV relaxation.

**Methods:** From routine clinical cardiac MR studies previously performed at NYU Langone Medical Center, we retrospectively evaluated cardiac 4-chamber view cine MR images of 24 patients with known HCM (45 ± 10 (25-59) years old; 1.5T Avanto, Siemens). For comparison, 14 age-matched normal subjects (37 ± 13 (28-63) years old; 3T Tim Trio, Siemens) were scanned to obtain

similar images. Conventional cardiac cine imaging was performed with the following parameters: TR/TE = 2.4 ms/1.4 ms, flip angle = 51°, slice thickness = 6 mm, spatial resolution = 1.6 mm × 1.6 mm, and temporal resolution ~ 45 ms. The AVJ position was manually tracked in all images and projected onto a reference line drawn from the apex to the middle of the base (Fig. 1a). The displacement relative to a reference point taken at end-diastole was calculated during the cardiac cycle. Three parameters were selected for the analysis (Fig. 1b): (a) maximum displacement normalized by the LV length (MD), (b) difference between maximum velocity during early diastole and average velocity in diastasis (MVED-VDS), and (c) VDS/MVED. Receiver operating characteristics (ROC) and multivariate discriminant analysis for normal and HCM groups were calculated.

**Results:** Figure 2 shows boxplots of the three parameters and the corresponding means ± standard deviation for normal and HCM subjects: (a) -0.15 ± 0.02, -0.11 ± 0.03, (b) 1.11 ± 0.31, 0.49 ± 0.32, (c) 0.017 ± 0.02, 0.19 ± 0.21, (d) -0.16 ± 0.03, -0.11 ± 0.02, (e) 1.33 ± 1.49, 0.46 ± 0.22, (f) 0.03 ± 0.04, 0.19 ± 0.17, respectively (p < 0.05 for all). Figure 3 shows the ROC curve for distinguishing between normal and HCM groups using all three parameters for the lateral and septal walls. The area under the curve (AUC) was 0.943 ± 0.037 (sensitivity 91.7%, specificity 96%; p < 0.001). For the septal wall, the AUC was 0.963 ± 0.027 (sensitivity 91.7%, specificity 100%; p < 0.001).

**Discussion:** This study describes a simple and potentially valuable noninvasive approach for assessing LV diastolic function in HCM patients, using cardiac cine MRI to measure the AVJ motion during the cardiac cycle. Since this method can be implemented on any conventional MRI system, it has the potential to improve our understanding of diastolic dysfunction and to assist in patient care. **References:** [1] S. Chung, et al., Proc. ISMRM 2011