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Regional rotation of the left ventricle in healthy and cardiomyopathic subjects measured with radial myocardial tagging

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Background

Left ventricular rotational deformation, which arises from contraction of myofibers arranged in a helical structure, plays a crucial role in cardiac mechanics. Myocardial dysfunction in cardiomyopathies is usually associated with altered diastolic rotation [1-3]. However, regional myocardial abnormalities in various cardiomyopathies may result in regional alterations of both systolic and diastolic rotational motion. The regional variation of LV rotation in healthy subjects has been previously studied [4-7]. We hypothesize that LV regional rotation abnormalities may be a sensitive marker in heart diseases where myocardial structure is disordered. In this regard, we investigate the regional rotation pattern of the mid LV wall in both healthy subjects and patients with cardiomyopathies. In this study, LV regional rotation is assessed through dense radial tagging [8], which facilitates analysis of the rotational motion and provides detailed regional measurement by increasing the achievable circumferential resolution.

Methods

LV tagging in a dense radial pattern was performed at the mid LV short axis level in twelve healthy subjects and nine cardiomyopathic patients at 1.5T or 3.0T. Number of radial taglines was set to 22 per circle. Corresponding short axis cine images were available in all subjects. The mid LV short axis was divided into 6 circumferential segments according to the AHA 17-segment model. To compute rotation of each specific segment, the tag points located on the segment were automatically detected and traced through successive frames. Finally, the rotation of each LV sector was estimated using the spatial coordinate of the tag points plus that of the LV center of mass.

Results

The resulting mid ventricular rotation values and rotation rates in myopathic patients were decreased relative to healthy subjects in most circumferential segments (table 1 & Figure 1). Moreover, as is shown in Figure 1, the homogeneity of regional rotations at the mid level is more pronounced in healthy subjects compared with cardiomyopathic patients.

Conclusions

Initial results with high density radial tagging suggest a heterogeneous and diminished pattern of regional rotation in patients with cardiomyopathy. This may potentially reflect an imbalance in LV mechanical function and lead to decreased global rotation. Regional heterogeneity of rotation may merit further study as a myocardial functional marker. The simple and rapid calculation of regional

Table 1 Global and regional peak rotation at mid LV for healthy subjects vs.

	Mean Peak Rotation (degree)	
	Healthy Subjects	CMY Patients
InfSep	5.99 ± 4.45	3.87 ± 2.16
Inf	5.55 ± 2.59	4.79 ± 2.01
InfLat	6.41 ± 2.54	6.23 ± 2.57
AntSep	6.26 ± 4.76	6.24 ± 3.76
AntLat	6.90 ± 2.19	4.90 ± 4.44
Ant	6.07 ± 3.74	5.01 ± 4.781
Global	5.52 ± 2.75	4.37 ± 2.64

cardiomyopathic patients

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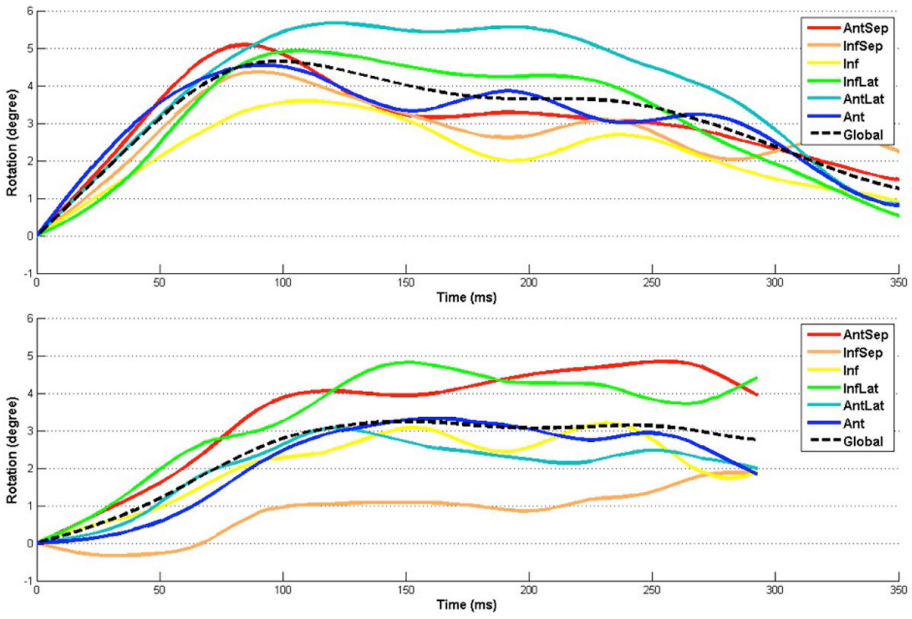

Figure 1 Mean regional rotation of Mid LV in 12 healthy subject (up) and 9 cardiomyopathic patient (down).

rotation supported by radial tagging provides a unique advantage to study this parameter.

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Images were obtained through DCVI section at UCLA.

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