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Longitudinal fiber dysfunction assessed during cine-cardiac magnetic resonance imaging is an independent predictor of adverse cardiac events

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Background

Left ventricular systole involves coordinated contraction of longitudinal, circumferential, and radial myocardial fibers. Longitudinal fiber dysfunction appears to be an early marker for a number of pathological states. We hypothesized that reduced mitral annular plane systolic excursion (MAPSE) measured during cine-Cardiac Magnetic Resonance (CMR) imaging reflects changes in longitudinal fiber function and may be an early marker for adverse cardiovascular outcomes.

Methods

400 consecutive patients with known or suspected coronary artery disease undergoing CMR were prospectively enrolled. Lateral MAPSE was measured in the 4-chamber cine view by two independent observers. Patients were prospectively followed for major adverse cardiac events (MACE) - death, non-fatal myocardial infarction, hospitalization for heart failure or chest pain, and late revascularization. Cox proportional hazards regression modeling was used to identify factors independently associated with MACE.

Results

The mean age of the study population was 58($\pm$ 15) years, with a mean ejection fraction of 59($\pm$ 14%). 31% of the individuals had known coronary artery disease and 33% were diabetic. 72 MACE occurred during a median follow-up of 14.5 months. By Kaplan-Meier analysis, patients with lateral MAPSE ≤1.11 cm (median) experienced significantly higher incidence of MACE than patients with a MAPSE >1.11 cm (p = 0.0270)

Figure 1 Kaplan-Meier curves for MACE in patients with MAPSE above and below the median.
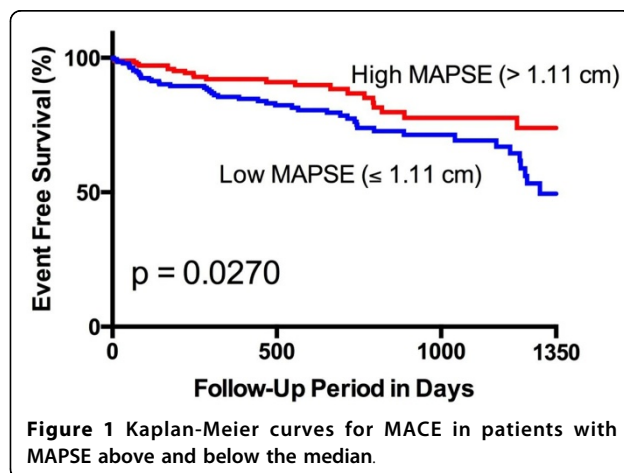
VARIABLES	Univariable		Multivariable	
	Hazard Ratio (95% CI)	P Value	Hazard Ratio (95% CI)	P Value
Age	1.016 (0.999-1.033)	0.0585	1.001 (0.981-1.021)	0.930
Male	1.014 (0.638-1.612)	0.9531	0.958 (0.567-1.619)	0.874
Diabetes	1.693 (1.058-2.713)	0.0309	1.354 (0.814-2.253)	0.243
Hyperlipidemia	1.326 (0.825-2.131)	0.2397	0.911 (0.530-1.566)	0.737
Smoking	0.998 (0.555-1.795)	0.9953	1.032 (0.553-1.924)	0.922
Hypertension	2.482 (1.189-5.181)	0.0066	2.242 (0.995-5.058)	0.052
LVEF	1.001 (0.985-1.017)	0.9234	1.012 (0.994-1.031)	0.189
LGE	1.263 (0.757-2.110)	0.3794	1.399 (0.756-2.588)	0.285
Lateral MAPSE	2.228 (1.051-4.679)	0.0331	2.431 (1.051-5.583)	0.037

Figure 2 Univariable and multivariable predictors of MACE.

(Figure 1). After adjustment for established predictors (ejection fraction, age, sex, diabetes, hyperlipidemia, smoking, hypertension, late gadolinium enhancement) lateral

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MAPSE remained a significant independent predictor of MACE (HR = 2.43 per cm decrease; p = 0.037) (Figure 2).

Conclusions

Longitudinal fiber dysfunction assessed with lateral MAPSE during cine-CMR is an independent predictor of MACE in patients with known or suspected coronary artery disease.

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