

Oral presentation

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## Degree of mitral regurgitation and left ventricular scarring are more powerful predictors of long-term outcomes than volumes and sphericity: a multi-modality imaging study in patients with severe ischemic cardiomyopathy

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### Background

Patients with ischemic cardiomyopathy (ICM) and severe left ventricular (LV) systolic dysfunction exhibit adverse left ventricular (LV) remodeling, with increasing sphericity, which predicts long-term mortality. Myocardial scarring, measured accurately by delayed hyperenhancement cardiac magnetic resonance (DHE-CMR), and mitral regurgitation (MR), also predicts outcomes in such patients.

### Objective

In patients with severe ICM, we sought to assess the impact of LV sphericity, myocardial scarring (both measured on CMR) and MR (measured on Doppler echocardiography), on long-term survival.

### Methods

Patients (n = 326) with > 70% disease in  $\geq 1$  epicardial coronary artery (77% men, median age 66 years and median LV ejection fraction or EF of 22%) undergoing Doppler echocardiography and CMR (Siemens 1.5-T scanner, Erlangen, Germany) were studied. CMR evaluation included long and short axis assessment of LV function on balanced steady state free precession images along with assessment of myocardial scar (on phase-sensitive inversion recovery DHE-CMR sequence ~10-20 minutes

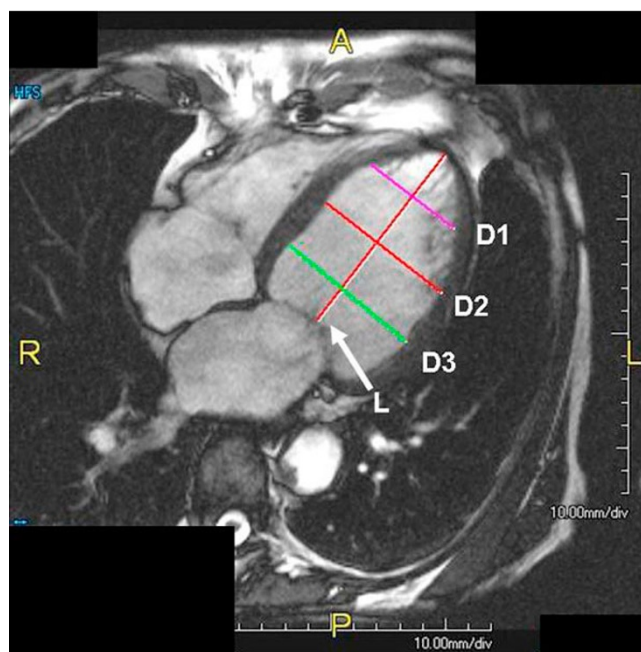


Figure 1

Table 1:

	Univariable Analysis	
	Hazard ratio (CI)	p-value
<i>Clinical variables</i>		
Age	1.03 (1.01-1.05)	0.001
Female Gender	2.00 (1.31-3.07)	0.002
Diabetes Mellitus	1.26 (0.82-1.940)	0.3
Hypertension	0.95 (0.62-1.46)	0.8
Statins	0.74 (0.49-1.12)	0.1
Beta-blockers	0.71 (0.47-1.06)	0.1
Angiotensin converting enzyme-inhibitors	0.75 (0.49-1.14)	0.2
Aldosterone antagonists	1.17 (0.74-1.86)	0.5
Post-CMR coronary bypass grafting	<b>0.62 (0.41-0.93)</b>	<b>0.02</b>
Post-CMR mitral valve repair/replacement	1.10 (0.68-1.79)	0.7
Post-CMR defibrillator/resynchronization therapy	0.73 (0.45-1.20)	0.2
<i>Echocardiographic variables</i>		
Vena contracta	<b>5.70 (2.94-11.04)</b>	<b>&lt; 0.001</b>
<i>CMR variables</i>		
LV ejection fraction	0.98 (0.96-1.003)	0.1
LV end-diastolic volume index	1.004 (0.99-1.008)	0.1
Indexed left atrial volume	1.006 (0.99-1.02)	0.3
Indexed (D1+D2+D3)/3L (cm/m <sup>2</sup> )	<b>1.23 (1.06-1.44)</b>	<b>0.007</b>
Semiquantitative total scar score	<b>1.21 (1.00-1.46)</b>	<b>0.04</b>
Semiquantitative regional scar score		
Anterior	1.06 (0.90-1.23)	0.5a
Lateral	1.13 (0.97-1.31)	0.1
Inferior	<b>1.24 (1.06-1.44)</b>	<b>0.008</b>

after injection of 0.2 mmol/kg of Gadolinium dimenglumine). Scar was measured automatically measured as > 2 SD above viable myocardium. LV scar score (defined as summed segmental scar score per patient divided by 17, with maximum being 4) was recorded on DHE-CMR images as: 0 = none, 1 = 1-25%, 2 = 26-50%, 3 = 51-75%,

and 4 = > 75%; and subdivided into 7 anterior, 5 inferior and 5 lateral segments. LV volumes and LV ejection fraction were calculated. LV sphericity was measured on end-diastolic 4-chamber cine view as D1+D2+D3/3L (Figure 1). LV volumes and sphericity was indexed to body surface area. Vena contracta (cm) was measured on Doppler

echocardiography. A composite end-point of cardiac transplantation and all-cause mortality was recorded.

### Results

Over a follow-up of 4.0 years [interquartile range 2.6, 5.1], there were 92 events (87 deaths and 5 cardiac transplantations). Results of Univariable Cox Proportional survival analysis are shown in Table 1. However, on multivariable survival analysis, only age (hazard ratio or HR 1.04 [1.02-1.06],  $p < 0.001$ ), gender (HR 2.04 [1.33-3.14],  $p < 0.001$ ), vena contracta (HR 4.60 [2.32-9.14],  $p < 0.001$ ) and inferior scar score (HR 1.27 [1.09-1.49],  $p = 0.002$ ); and not LV volumes or sphericity remained significant predictors of outcomes (C-index 0.77 and chi-square of overall model 50.17,  $p < 0.001$ ).

### Conclusion

In ICM patients with severe LV dysfunction, degree MR and myocardial scarring (particularly inferior scar) are better predictors of long-term outcomes, as compared to LV volumes, EF or sphericity.

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