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Meeting abstract

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1000 Ventricular-vascular coupling is independently associated with exercise capacity in patients with ischemic cardiomyopathy: a cardiac multi-modality imaging study

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Introduction

Left ventricular (LV) systolic dysfunction due to ischemic cardiomyopathy (I-CMP) leads to reduced exercise capacity. Ventricular-vascular coupling (VVC), a ratio of effective arterial to LV elastance, represents forward flow efficiency of LV, independent of mitral regurgitation.

Purpose

In I-CMP patients, we sought to a) assess relationship between resting VVC and maximum oxygen consumption corrected for peak heart rate (MVO_2/pHR), an accurate measure of exercise capacity in patients on β-blockers, and b) compare value of VVC versus other determinants of exercise capacity.

Methods

43 patients with I-CMP (age 59 ± 9 years, 88% on β-blocker) underwent cardiopulmonary exercise testing, echocardiography and cardiac magnetic resonance (CMR, 1.5 T Siemens Scanners, Erlangen Germany) for cardiac transplant evaluation. MVO_2/pHR and diastolic filling variables (echocardiography) were measured in a standard fashion. CMR LV indices [end-systolic (ESV), end-diastolic (EDV), stroke volume (SV), all in ml, and LVEF] were measured using the standard contiguous short-axis slices from apex to base, using the balanced steady state free precession cine sequence (TE = 1.6 msec, TR = 3.3 msec, flip angle = 70° and slice thickness 8–10 mm, field of view varied from 228–330 in the x-direction and 260–330 in the y-direction and matrix size varied from 140–180 in the x-direction and 256 in the y-direction, giving a spatial resolution of 1.5–2.1 mm (x-direction) by 1.1–1.4 mm (y-direction). For patients able to suspend respiration, breath hold duration was 10–15 sec, depending on the heart rate; otherwise, images were acquired using 3 signal averages. Subsequently, off-line analysis was performed using Argus analytical software (Siemens Medical Solutions, Erlangen, Germany) to assess LV volumes and LVEF, in a standard fashion. VVC was calculated as: [Effective arterial elastance (end systolic pressure ÷ stroke volume index)/LV end-systolic elastance (end systolic pressure ÷ LV systolic volume index)].

Results

Mean LVEF, ESV, EDV, and SV were 24 ± 8%, 228 ± 107 ml, 297 ± 111 ml, and 66 ± 20 ml respectively. Mean MVO_2/pHR was 13 ± 3 ml/beat. Predictors of MVO_2 are shown in Table 1. On stepwise regression, only VVC significantly predicted MVO_2/pHR.

Conclusion

In I-CMP patients with LV dysfunction, VVC predicts MVO_2/pHR that can potentially be used as a potential therapeutic target.

Table 1: Univariate and multivariate predictors pf MVO_2/peak HR.

	MVO_2/peak HR		
	Correlation coefficient (rho)	*P* value	Multivariate analysis *P* value
Clinical characteristics			
Age	-0.006	0.9	
Gender	0.1	0.5	
NYHA class	-0.14	0.4	
Baseline SBP	0.22	0.16	
Baseline DBP	-0.02	0.9	
Echocardiographic and CMR features			
E max	-0.39	**0.009**	0.1
E/A ratio	-0.23	0.1	
E wave deceleration time	0.35	**0.02**	0.5
CMR features			
LV end-systolic volume	-0.41	**0.006**	0.9
LV end-diastolic volume	-0.28	0.07	
Stroke volume	0.14	0.3	
LV ejection fraction	0.36	**0.02**	0.6
Ventricular vascular coupling	0.45	**0.002**	**0.001**
Ea	-0.28	0.09	
Ees	0.39	**0.009**	

NYHA indicates New York Heart Association; SBP, systolic blood pressure; DBP, diastolic blood pressure; E max, mitral E wave velocity; LV, left ventricle; Ea, Arterial elastance; Ees, left ventricular systolic elastance.