Comparison of clinical parameters between the hypertrophic cardiomyopathy patients with different extracellular volume values

Authors: Aleksandra Karabinowska-Małocha MD[1] , Ewa Dziewięcka MD [1], Aleksandra Budkiewicz[2], Łukasz Żydzik [2], Sylwia Wiśniowska-Śmiałek MD, PhD[1], Katarzyna Holcman MD, PhD[1], Prof. Piotr Podolec [1] MD, PhD, Paweł Rubiś MD, PhD, Assoc. Prof. [1]

[1] John Paul II Hospital, Jagiellonian University Medical College, Institute of Cardiology, Krakow, Poland
[2] Jagiellonian University, Students' Scientific Group on Heart Failure, Krakow, Poland

Introduction

Cardiac fibrosis is common in hypertrophic cardiomyopathy (HCM) and it is responsible for diastolic dysfunction, arrythmias and end-stage heart failure. Cardiac magnetic resonance (CMR) is a validated tool for fibrosis assessment – both replacement and interstitial. Both types of fibrosis coexist in HCM. With T1 mapping used in the CMR studies, interstitial fibrosis can be quantified by measuring extracellular volume (ECV).

Purpose

To compare selected clinical variables in HCM patients with higher and lower values of ECV and suggest predictors of elevated ECV.

Materials and methods

50 patients (aged 51.7±14.3; 70% males) with a diagnosis of HCM

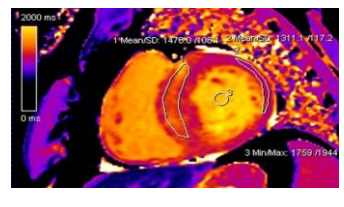

Figure 1. Native T1 times

Cardiac magnetic resonance to assess interstitial fibrosis expressed by ECV

ECV median (28.1%)

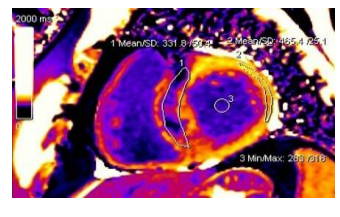

Figure 2. Post-contrast T1 times

ECV <28,1% (n=24) **ECV ≥28,1% (n=25)**

Compared parameters: baseline characteristics including risk factors for sudden cardiac death,
late gadolinum enhancement (LGE) presence and extent,
echocardiographic data,
high sensitive troponin T and NT-proBNP levels

Uni- and multivariate logistic regression models analyzed the associations between the analyzed parameters and the presence of higher value of ECV if p value was <0.1.

Results

Patients with a higher value of ECV had greater LGE extent (Table 1), lower maximal left ventricular outflow tract (LVOT) gradient (Table 2) and significantly higher level of NT-pro BNP (Table 3). Moreover, they presented higher troponin T level, however the analysis presented only a trend towards significance. In univariate regression models maximal LVOT gradient and LGE extent showed statistical significance (Table 4). Lower LVOT gradient and greater LGE extent were associated with higher value of ECV however the variables did not present the significance in the multivariate model.

Table 1. Comparison of baseline characteristics between the groups with higher and lower ECV.

Parameter	ECV <28,1% (n=24)	ECV ≥28,1% (n=25)	P value
Age [years]	53.1±15.2	50.8±13.8	0.58
Male sex [n,%]	18 (75%)	16 (64%)	0.4
LVOT obstruction [n,%]	11 (45.8%)	7 (28%)	0.19
LGE presence [n,%]	16 (66.7%)	21 (84%)	0.16
LGE extent [%]	3.32±3.35	6.6±5.98	0.035
Syncope [n,%]	4 (16.7%)	2 (8%)	0.35
Family history of sudden cardiac death [n,%]	2 (8.3%)	2 (8%)	0.97
Ventricular tachycardia [n,%]	7 (29.2%)	7 (28%)	0.93
Estimated 5-year risk of sudden cardiac death [%]	3.53±2.9	3.45±3.37	0.31
NYHA class	1.5±1.02	1.32±0.99	0.6
Hypertension [n,%]	17 (70.8%)	12 (48.%)	0.1
Atrial fibrillation [n%]	4 (16.7%)	2 (8%)	0.35

Table 2. Comparison of echocardiographic data between the groups with higher and lower ECV.

Echocardiographic data:	ECV <28,1% (n=24)	ECV ≥28,1% (n=25)	P value
Left ventricle end-diastolic diameter [mm]	45.1±7.8	43.9±6.6	0.56
Max. wall thickness [mm]	18.8±5.5	20.3±4.2	0.46
Left ventricular ejection fraction [%]	62.5±9.6	64.4±10.2	0.2
Left atrium diameter [mm]	44.3±6.6	42.8±6.7	0.43
Left atrial volume index [ml/m²]	58.7±41.5	49.9±31.9	0.36
Max. LVOT gradient [mmHg]	50.6±46.9	24.3±23.3	0.05
E/A	1.48±1.4	1.3±0.6	0.66
E' intraventricular septum [m/s]	0.07±0.03	0.08±0.12	0.055
E/E'	10.4±4.3	11.8±4.5	0.21
Right ventricular systolic pressure [mmHg]	21.4±8.5	25.6±11	0.14

Table 3. Comparison of selected biochemistry data between the groups with higher and lower ECV.

Biochemistry data:	ECV <28,1% (n=24)	ECV ≥28,1% (n=25)	P value
High sensitive troponin T [ng/ml]	0.016±0.02	0.025±0.02	0.075
NT-proBNP [pg/mL]	677.7±1056	1279.04±1415.6	0.0067

Table 4. Uni- and multivariate regression models for presence of higher value of ECV.

	Univariate		Multivariate	
Parameter	OR [95%CI]	P value	OR [95%CI]	P value
E' intraventricular septum	2.65 [0.003-2610.7]	0.78	-	-
High sensitive troponin T	9.7 [0.5-159]	0.1		-
NT-proBNP	1.0002[0.99-1.0007]	0.41	-	-
Max. LVOT gradient	0.98 [0.96-0.99]	0.028	0.98 [0.96-1.003]	0.08
LGE extent	1.16 [1.006-1.34]	0.036	1.12 [0.97-1.3]	0.11

Conclusions

Patients with HCM and higher ECV value presented higher NT-proBNP level, lower maximal LVOT gradient and greater LGE extent. It may suggest a link between the amount of replacement and interstitial fibrosis and relationship between progressive heart failure and diffuse fibrosis. Lower LVOT gradient may suggest progressive stiffness of the left ventricle and the associated inability to generate higher gradients.

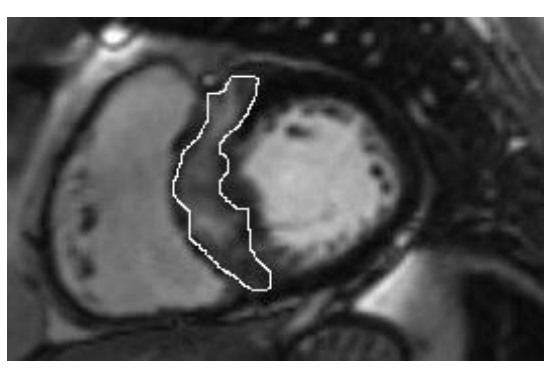

Figure 3. Short axis late gadolinium enhanced (LGE) image

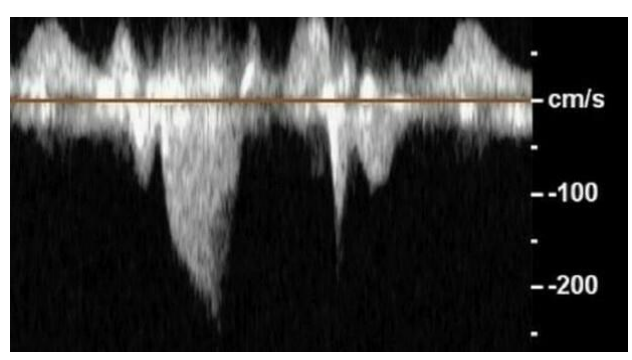

Figure 4. Elevated LVOT gradient measured in echocardiography