THE RELATION OF ONE-YEAR BIVENTRICULAR MECHANICS CHANGES FOR LONG-TERM SURVIVAL IN PATIENTS WITH PRECAPILLARY PULMONARY HYPERTENSION: CARDIOVASCULAR MAGNETIC RESONANCE FEATURE TRACKING STUDY

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BACKGROUND

Feature tracking (FT) technique is a novel method used to evaluate biventricular mechanics. Follow-up Cardiac magnetic resonance (CMR) and FT data could be helpful to evaluate the long-time survival in pulmonary hypertension (PH) patients. **The aim of this study** was to evaluate the relation of one-year biventricular function and mechanics changes with long-term mortality in precapillary (PH) patients.

METHODOLOGY

This retrospective study was conducted in the Hospital of Lithuanian University of Health Sciences Kauno klinikos. CMR data of 24 patients with confirmed precapillary pulmonary hypertension was analysed. Left (LV) and right ventricle (RV) ejection fraction (EF), indices of RV myocardial mass (MMi), LV and RV end diastolic and end systolic volumes (EDVi and ESVi) were evaluated using conventional CMR software. LV global longitudinal and circumferential strains (GLS, GCS), RV regional longitudinal strains (RV Free Wall LS, RV Septum LS) and global longitudinal strains (RV GLS) were calculated using CMR FT software package.

RESULTS

This study included 18 women and 6 men. The median age was 58.0 [47.3-70.0] years. Precapillary PH groups were as following: idiopathic pulmonary arterial hypertension 9 (37.5%), inoperable chronic thromboembolic pulmonary hypertension 6 (25.0%), Eisenmenger syndrome 3 (12.5%), PH associated with systemic sclerosis 6 (25.0 %).

All patients received specific PH therapy. One-year survival was 95.8%, three-year – 75.0%, five-year – 50.0%. Patients died mainly due to cardiopulmonary complications. Main results are presented in figures and tables.

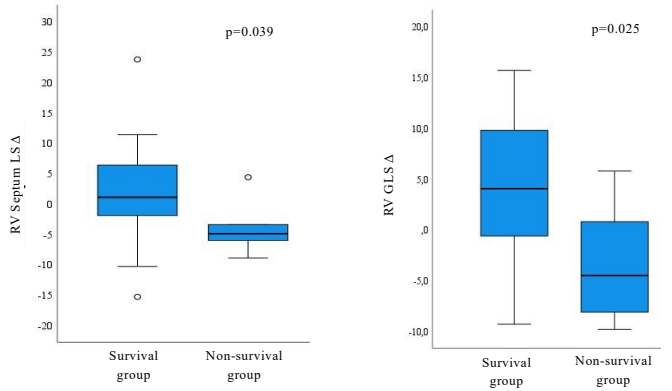

Fig. 1 *RV Septum LS and RV GLS dynamics comparison in three-year survival and non-survival groups*

The RV Septum LS and RV GLS dynamics of three-year survival group were better, when compared to the non-survival group (Δ=1.1% vs. Δ=-4.9% , p=0.039 and Δ=4.1% vs. Δ=-4.5%, p=0.025, respectively).

Table 1. *One-year changes of biventricular function and mechanics between the groups (three-year survival)*

Parameters	Three-year survival group (n=18))				Three-year non-survival group (n=6)			
	Baseline	One-year follow-up	Delta (Δ)	P value	Baseline	One-year follow-up	Delta (Δ)	P value
Biventricular mechanics								
LV GLS (%)	-17.6 [-22.7-(-15.5)]	-20.6 [-29.3-(-17.1)]	0.8 [-0.1-11.8]	0.058	-17.1 [-20.4-(-11.9)]	-21.1 [-33.0-(-10.7)]	1.8 [-5.3-21.1]	0.463
LV GCS (%)	-31.0 [-35.3-(-26.4)]	-37.4 [-41.7-(-29.7)]	4.5 [1.8-10.2]	**0.006**	-31.1 [-38.3-(-23.8)]	-31.4 [-38.7-(-22.0)]	2.8 [-4.4-3.7]	0.463
RV Free Wall LS (%)	-18.8 [-22.8-(-13.0)]	-24.0 [-30.9-(-17.6)]	5.8 [2.0-11.3]	**0.005**	-15.0 [-19.5-(-12.7)]	-17.4 [-20.1-(-12.0)]	0.5 [-5.9-6.6]	0.917
RV Septum LS (%)	-12.1 [-14.8-(-8.4)]	-13.1 [-18.4-(-7.4)]	1.1 [-2.1-6.4]	0.306	-12.4 [-16.3-(-7.5)]	-8.3 [-10.6-(-5.4)]	-4.9 [-6.7-(-1.5)]	0.075
RV GLS (%)	-13.5 [-17.7-(-10.8)]	-16.6 [-24.8-(-13.5)]	4.1 [-0.7-9.9]	**0.020**	-14.0 [-17.0-(-9.3)]	-10.3 [-15.3-(-5.4)]	-4.5 [-8.5-2.1]	0.249
Biventricular function								
RV EF (%)	40.5 [34.5-46.3]	35.5 [29.3-45.0]	3.0 [-5.3-8.0]	0.277	28.0 [23.5-36.3]	30.5 [17.75-38.25]	2.5 [-8.0-9.8]	0.753
LV EF (%)	56.5 [48.5-65.5]	60.5 [50.0-68.5]	-1.5 [7.3-9.0]	0.877	56.5 [41.5-66.5]	56.0 [38.75-60.75]	1.0 [-8.5-22.8]	0.600

Three-year survival group patients showed tendency to improve LV GLS (p=0.058), while the LV GCS increased significantly after the one-year period (p=0.006). The RV Free Wall LS and GLS increased during the one-year period (p=0.005 and p=0.020, respectively) in this group of patients. RV EF and LV EF did not change over one-year period in all groups (p>0.05).

Table 2. *One-year changes of biventricular mechanics between the groups (five-year survival)*

Parameters	Five-year survival group (n=12)				Five-year non-survival group (n=12)			
	Baseline	One-year follow-up	Delta (Δ)	P value	Baseline	One-year follow-up	Delta (Δ)	P value
Biventricular mechanics								
LV GLS (%)	-18.4 [-23.5-(-15.2)]	-19.7 [-27.9-(-17.0)]	0.6 [-2.5-8.5]	0.308	-16.7 [-20.6-(-12.9)]	-24.4 [-31.3-(-13.0)]	2.7 [-0.9-17.1]	0.117
LV GCS (%)	-30.6 [-34.6-(-26.5)]	-37.4 [-40.0-(-23.7)]	3.3 [-0.6-7.6]	0.084	-31.4 [-42.2-(-25.2)]	-33.6 [-47.1-(-28.6)]	3.6 [2.0-9.3]	0.060
RV Free Wall LS (%)	-20.8 [-26.7-(-17.1)]	-27.3 [-33.2-(-21.1)]	5.7 [-2.3-11.6]	0.055	-13.6 [-18.1-(-11.2)]	-19.0 [-20.9-(-13.8)]	4.7 [-1.5-6.7]	0.084
RV Septum LS (%)	-12.4 [-14.2-(-9.4)]	-14.5 [-20.6-(-10.5)]	1.7 [-1.8-10.0]	0.195	-11.3 [-17.5-(-7.3)]	-8.3 [-13.6-(-5.9)]	-3.6 [-5.8-3.7]	0.239
RV GLS (%)	-14.3 [-19.3-(-12.1)]	-21.8 [-15.5-(-15.0)]	4.1 [-0.3-10.0]	**0.050**	-12.1 [-15.6-(-9.9)]	-13.8 [-16.3-(-7.4)]	0.0 [-5.1-5.9]	0.906
Biventricular function								
RV EF (%)	45.0 [35.0-47.0]	37.0 [28.3-47.3]	-5.0 [-0.8-8.0]	0.052	31.5 [24.3-41.5]	32.5 [21.0-40.8]	1.5 [-9.0-7.5]	0.937
LV EF (%)	55.5 [49.0-62.5]	60.5 [43.0-66.8]	4.0 [-8.5-12.0]	1.000	61.5 [46.3-69.5]	56.0 [48.3-65.8]	9.0 [-3.5-8.3]	0.575

Five-year survival group demonstrated one-year increase of RV GLS (p=0.050). RV EF and LV EF did not change over one-year period in all groups (p>0.05).

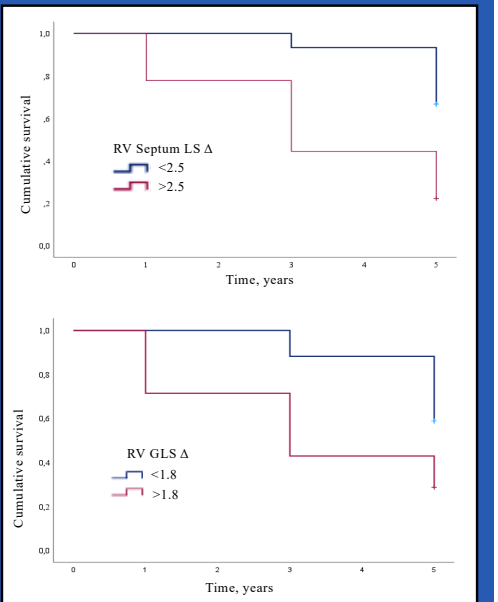

Fig. 2 *Kaplan-Meier survival curves based on RV mechanics*

RV GLS Δ >1.8, RV Septum LS Δ >2.5 parameters were associated with poor survival prognosis.

CONCLUSIONS

Novel FT technology can be used to detect sub-clinical biventricular dysfunction compared to conventional CMR data. One-year follow-up period could be used to predict clinical outcomes of precapillary PH patients.