

Left ventricular myocardial work in patients with high gradient severe symptomatic aortic stenosis

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Background: Left ventricular myocardial work (LVMW) is a novel method to evaluated left ventricular (LV) function using pressure-strain loops. It might correct global longitudinal strain (GLS) for afterload, being eventually useful to assess whether GLS reduction is due to reduced contractility (reflected as reduced myocardial work) or increased afterload (reflected as increased myocardial work).

Aim: To describe indices of LVMW in a group of patients with severe symptomatic aortic stenosis (AS).

Methods: We prospectively studied 104 consecutive patients (age: 71 years [IQR 66.5–75.5] years, 51% men) with severe symptomatic high gradient AS: mean transaortic pressure gradient: 56.5mmHg [IQR 46.8–67.8]; aortic valve area: 0.73cm² [IQR 0.61–0.88]; indexed stroke volume: 47.7±1.3 mL/m² (11 patients with low-flow AS), preserved LV ejection fraction (EV) (LVEF: 56.0% [51.0–61.3]; GLS: –14.5% [IQR –16.1 to –10.6]), with no previous coronary artery disease and no history of cardiomyopathy. Beyond complete transthoracic echocardiography, all patients underwent cardiac magnetic resonance for LV myocardium tissue characterization. As proposed for AS, LV systolic pressure was corrected adding the mean transaortic pressure gradient to non-invasive systolic blood pressure cuff measurement in the echocardiographic algorithm. Four LVMW indices were collected in 83 patients (patients excluded for atrial fibrillation, left bundle branch block or absence of non-invasive blood pressure registra-

tion) and correlated to LV function indexes, LV hypertrophy and remodeling, myocardial tissue characterization, BNP and troponin levels (Pearson or Spearman correlation). These same indexes were compared in patients with LV ejection fraction (EF) below and above 50%, normal and reduced flow and presence of replacement fibrosis.

Results: Global constructive work (GCW) (2658.6±76.4mmHg%), global myocardial work (GMW) (2218.7±74.9mmHg%) and global wasted work (GWE) (262.0mmHg% [198.8–339.5]) were high above normal with concomitant lower work efficiency (WE) (88.0% [83.2–91.8]). Weak correlations were found between LVMW indexes and parameters describing aortic valve severity, flow and LV function (table). Except for significant differences of LVMI in patients with reduced LV ejection fraction (GCW 2770.3±687.4 vs 2056.0±380.7mmHg%, p=0.014 and GMW 2362.5±657.9 vs 1621.3±319.9, p=0.021 in patients with LV EF>50% vs. LV EF<50%, respectively) work indexes were neither significantly different in low-flow patients nor in those with myocardial late gadolinium enhancement.

Conclusions: Global constructive and myocardial work are increased in these patients with severe aortic stenosis. This might reflect an increased afterload predominance rather than a LV functional impairment, particularly relevant in this group of patients with exclusive high gradient disease and preserved LVEF.

		r (correlation coefficient)	p-value			r (correlation coefficient)	p-value
GLS	GCW	-0.406	0.000	AVA	GCW	-0.016	0.887
	GMW	-0.389	0.001		GMW	0.013	0.907
PDS	GCW	-0.198	0.095	AVmean	GCW	0.237	0.033
	GMW	-0.046	0.703		GMW	0.212	0.049
LVEF	GCW	0.492	0.000	NT-pro BNP	GCM	-0.016	0.887
	GMW	0.534	0.000		GMW	-0.035	0.763
SVi	GCW	0.451	0.000	Troponin	GCW	-0.238	0.041
	GMW	0.434	0.000		GMW	-0.213	0.070
Indexed Mass [CMR]	GCW	-0.068	0.556	Zva	GCW	-0.236	0.035
	GMW	-0.073	0.428		GMW	-0.239	0.034

Correlations between left ventricle myocardial work and parameters describing Left ventricle function and flow (GLS [global myocardial strain]; PDS [mechanical dispersion]; LVEF [left ventricle ejection fraction]; SVi [indexed stroke volume]; Indexed LV Mass CMR [cardiac magnetic resonance]; NT-pro BNP; Troponin, aortic valve severity (AVA [aortic valve area]; Avmean [mean transaortic gradient]) and Zva [valvuloarterial impedance].

Correlations between LVMI – LV function