The influence of afterload on left ventricular contractility: 2D-strain and dyssynchrony in stress echocardiography.

Karev E.[1]; Verbilo S.[1]; Malev E.[1]; Prokudina M.[2]; Suvorov A.[3]

[1]Almazov National Medical Research Centre, Saint Petersburg, Russian Federation
[2]International Heart Center, Saint Petersburg, Russian Federation
[3]Feron, Pharmacological supervision, Moscow, Russian Federation

Background Hypertensive response to exercise (HRE) has negative prognostic value but its impact on the left ventricle (LV) contractility and on stress echocardiography (SE) results remains controversial. The global longitudinal strain (GLS) and LV dyssynchrony changes in response to afterload increase were shown even in patients with narrow QRS at rest, but not on exertion.

Purpose We aimed to analyze the relation between the blood pressure (BP) during SE and LV GLS and dyssynchrony changes.

Methods We performed exercise SE on treadmill in 96 patients without coronary artery stenosis (invasive or CT coronary angiography). Patients divided into two groups: HRE (n = 41) and normal response to exercise (NRE) (n = 55). We analyzed GLS and standard deviation of time between the onset of QRS and segmental longitudinal strain peaks (STE-TIME SD) using speckle tracking and 3d-ejection fraction (EF) at rest and on exertion.

Results 2D-EF increase was higher in patients with NRE, but 3D-EF did not differ between groups. Wall motion abnormalities (WMA) on peak stress were detected more often in patients with HRE who had higher wall motion score index (WMSI). GLS on exertion and its increment were lower in HRE group (Fig. 1 - "Bull's eye" diagrams of GLS at rest and on exertion in patient with NRE (upper panel) and HRE (lower panel)). Among dyssynchrony markers we revealed higher values of STE-TIME SD on exertion in HRE group (Table 1). Moreover the analysis showed positive correlations between BP level on exertion and peak GLS (r = 0.56, p < 0.0001), GLS increase (r = 0.54, p < 0.0001) and STE-TIME SD on exertion (r = 0.27, p < 0.02)

Conclusions HRE is associated with less increment in GLS and 2D-EF on exertion. Besides LV dyssynchrony signs can appear in response to exaggerated afterload increase even in patients with narrow QRS complexes.

Patients with HRE more often show stress-induced WMA and have greater WMSI on exertion in absence of coronary artery lesions, thus HRE can alter the specificity of the test in transient ischemia detection.

Table 1

	HRE	NRE	p
Δ-2D ejection fraction	5.0 (4.0; 7.0)	10.0 (8.0; 12.5)	<0.0000001
Δ-3D ejection fraction	8.25 (4.0; 8.25)	8.24 (8.15; 11.65)	0.09
Wall motion abnormalities on exertion	46.34%	1.8%	<0.00001
Wall motion score index	1.0 (1.0; 1.18)	1.0 (1.0; 1.0)	0.00013
GLS on exertion	-21.0 (-22.0; -19.0)	-24.0 (-26.5; -23.0)	<0.0000001
ΔGLS	0.0 (-1.0; 2.0)	4.0 (2.0; 6.0)	<0.0000001
STE-TIME SD-IMPOST	42.0 (35.0; 53.0)	35.0 (27.5; 45.0)	0.012

Left ventricle systolic function and dyssynchrony in two groups.
Abstract Figure 1.

Adequate BP response

Hypertensive BP response