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Title : Myocardial work index is a non-invasive marker of contractility in rat model of pressure-overload-induced heart failure
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Compared to traditional functional parameters, speckle-tracking echocardiography (STE)-derived global longitudinal strain (GLS) is considered to be a more sensitive marker of left ventricular (LV) function. Nevertheless, it is still significantly influenced by loading conditions. Myocardial work index (MWI) is a non-invasive novel parameter, that normalizes LV deformation to afterload, which may overcome this important limitation of GLS.

Accordingly, our aim was to examine the relationship of GLS and MWI with load-independent markers of LV contractility in rat model of pressure overload-induced heart failure.

Male Wistar rats underwent transverse aortic constriction (TAC) to induce severe LV pressure overload. On the control group we performed sham procedure. Following 16 weeks, we obtained echocardiography loops to determine relative wall thickness (RWT) and STE-derived GLS and MWI. Pressure-volume analysis with transient occlusion of the inferior vena cava was carried to calculate preload recruitable stroke work (PRSW), as a load-independent „gold-standard” parameter of LV contractility.

Pressure overload resulted in typical concentric-type LV hypertrophy (RWT: 0.51 ± 0.05 vs. 0.70 ± 0.07 , $p < 0.001$). LV GLS was significantly lower in TAC compared to control ($-6.8 \pm 2.3\%$ vs. $-12.3 \pm 1.7\%$; $p < 0.001$). MWI was also significantly reduced in TAC, however to a much lesser extent (748 ± 393 Hgmm% vs. 1231 ± 105 Hgmm%; $p < 0.001$). While LV GLS did not show relationship with PRSW ($r = -0.02$; $p = 0.91$), MWI showed significant correlation with it ($r = 0.46$; $p < 0.05$).

LV GLS is significantly influenced by loading conditions, therefore, in the case of severe pressure overload it is not a reliable marker of LV contractility. MWI, which examines LV deformation normalized to afterload correlates with LV contractility, therefore, it may be a reliable marker of LV performance in altered loading conditions as well.