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Pressure-volume relationship by cardiovascular magnetic resonance: feasibility and clinical implications

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Background: The variation between rest and peak stress end-systolic pressure-volume relation (ESPVR; the Suga index) is easily obtained during routine stress echocardiography and has been established as a reasonably load-independent index of myocardial contractile performance that provides prognostic information above and beyond regional wall motion.

Purpose: This is the first study assessing the delta rest-stress ESPVR (DESPVR) by stress Cardiovascular Magnetic Resonance (CMR).

Methods: Eighty-five consecutive patients (19 females, main age 62.99±9.26 years) who underwent dipyridamole stress-CMR in a high volume CMR Laboratory were considered. The ESPVR was evaluated at rest and peak stress from raw measurement of systolic arterial pressure by cuff sphygmomanometer and end-systolic volume by biplane Simpson method.

Results: Mean ESPVR index at rest and peak stress was, respectively, 4.52±2.26 mmHg/mL/m^2 and 4.62±2.32 mmHg/mL/m^2 and mean DESPVR was 0.11±1.19 mmHg/mL/m^2.

DESPVR was not associated to age or sex.

An inverse relationship between rest left ventricular end-diastolic volume index (LVEDVI) and both rest and peak ESPVR was present (R=-0.805 P<0.0001 and R=-0.795 P<0.0001, respectively), but it was absent when the DESPVR was considered (R=0.170 P=0.121).

An abnormal stress CMR was found in 22 patients and the DESPVR was comparable between patients with normal and abnormal stress exam.

During a median follow-up of 60.62 months (IQ range 36.78 months), 27 cardiovascular events occurred: 3 deaths, 1 ventricular arrhythmias, 9 coronary syndromes, 14 heart failure hospitalization. At receiver-operating characteristic (ROC) curve analysis, a DESPVR<0.009 predicted the presence of future cardiac events with a sensitivity of 0.70 and a specificity of 0.64 (P=0.049).

Conclusions: We showed for the first time that dipyridamole stress CMR can be used for the assessment of DESPVR. DESPVR was shown to be independent from chamber size and, as a consequence, can be used for a comparative assessment of patients with different diseases. DESPVR by CMR can provide a prognostic stratification and the optimal cutoff for relevant events was 0.009.