

P933

Peak left atrial systolic strain as a marker of left ventricular diastolic dysfunction in patients with ischemic heart failure with depressed ejection fraction after STEMI: pilot study

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Background: Echocardiographic assessment of diastolic dysfunction and left ventricular (LV) filling pressures is a complex and challenging process, requiring a multiparameter analysis. In recent years strain imaging has been emerging as a promising method for evaluation of left atrium (LA) function, being correlated with LV systolic dysfunction.

Purpose: We sought to evaluate LA mechanics in a cohort of patients with ischemic heart failure (HF) at one month after ST elevation myocardial infarction (STEMI)

Material and methods: 40 patients were enrolled in this study: 30 consecutive patients with ischemic HF after STEMI, with LVEF < 50% and 10 healthy age- and sex-matched controls. All patients had standard echocardiographic examination; also LA strain curves were obtained using speckle tracking with measurement of peak LA systolic strain. Categorization of diastolic dysfunction severity into 3 grades was realized according to 2016 guidelines.

Results: 2D and 3D LVEF (33% vs 55%, $p = 0.00$), LV global strain (-10 vs -19, $p = 0.00$) and peak LA systolic strain (16 vs 33, $p = 0.00$) were significantly reduced in HF patients compared to controls. In both groups LA strain correlated with the following parameters: 2D EF ($p = 0.024$), 3D EF ($p = 0.02$), LV global strain ($p = 0.00$), E/A ($p = 0.05$), septal e' ($p = 0.00$), lateral e' ($p = 0.00$), E/septal e' ($p = 0.006$), E/lateral e' ($p = 0.003$), E/mean e' ($p = 0.014$), LA volume ($p = 0.014$) and LV filling pressures ($p = 0.001$). Peak LA systolic strain (PALS) values progressively decreased with worsening of diastolic function showing significant differences between all diastolic dysfunction grades. Using ROC analysis we identified 3 PALS thresholds to distinguish between normal diastolic function and the 3 diastolic dysfunction grades. The optimal cut off values were as follows: between normal diastolic function and grades 1-3 with PALS cut off value of 26.5 (Sb 90%, Sp 87%), AUC 0.963, CI 95%, $p = 0.00$; between grades 0-1 and grades 2-3 with peak LA strain cut off value of 17.2 (Sb 75%, Sp 93%) AUC = 0.828, CI 95%, $p = 0.002$; between grade 0-2 and grade 3 with peak LA strain cut off value of 11 (Sb 85%, Sp 93%), AUC 0.942, CI 95%, $p = 0.00$.

Also, PALS value differed significantly between patients with normal vs high LV filling pressures. Using ROC analysis we determined a cut off value for LA of 15.1 to differentiate between the two subgroups with excellent discrimination power AUC 0.902, CI 95%, $p = 0.00$, Sb 88.9%, Sp 83% thus making LA strain an accurate surrogate estimate of LV filling pressures.

Conclusions: Global peak LA systolic strain is significantly correlated with LV systolic and diastolic function. PALS is a feasible option for detection and categorization of diastolic dysfunction in patients with HF and depressed LVEF after STEMI. Incorporating LA strain into noninvasive assessment of LV diastolic dysfunction may improve the detection of elevated LV filling pressures. Further large scale studies are needed to validate this data.