Myocardial work and left heart deformation parameters across mitral regurgitation severity

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Background: Myocardial work (MW) is estimated by pressure-strain loops using an implemented speckle tracking software. It has emerged as an index of LV contractile properties overcoming the load-dependency limit of left ventricular (LV) global longitudinal strain (GLS). This is particularly useful in clinical setting characterized by frequent hemodynamic variations, such as heart failure and valvular heart disease. However, the variation of MW parameters across different stages of primary mitral regurgitation (MR) and its impact on symptoms has never been investigated.

Objective: The aim of this observational study was to assess the variations of MW and deformation parameters of left heart chambers in mild, moderate and severe MR.

Methods: Consecutive patients with mild, moderate and severe MR were prospectively enrolled. Exclusion criteria were: chronic atrial fibrillation, valvular heart prosthesis, previous cardiac surgery.

Patients underwent clinical evaluation, blood sample tests, ECG and echocardiography. Speckle tracking analysis, completed by MW after inclusion of blood pressure values at the time of echocardiographic exam (Fig.1), was performed offline. Patients were then divided into groups first according to MR severity. Differences among the groups were analyzed by student T-test (or non-parametric tests for non-normally distributed variables) and predictors of symptoms (as NYHA class ≥ 2) were explored by logistic regression analysis and receiver operating characteristic (ROC) curves.

Results: Overall, 180 patients were enrolled (60 mild, 60 moderate, 60 severe MR). LV GLS and global PALS reduced according to MR severity. Global constructive work (GCW) and global wasted work (GWW) significantly improved in patients with moderate and severe MR, while global work efficiency (GWE) showed a trend towards reduction in patients with higher grades of MR. Global work index did not change significantly in the three groups (Fig.1). Among strain parameters, global PALS emerged as the best predictor of NYHA class (p<0.001; area under curve, AUC=0.75, Fig.2) These results are explained by the pathophysiology of MR, characterized by a mechanism of attempted LV compensation to volume overload with increased contractility parallel to the disease progress, although with low efficacy on increasing LV stroke volume and increased wasted work; while LA and diastolic function have an early reduction which is associated with the occurrence of symptoms.

Conclusions: myocardial deformation parameters of the left heart chambers vary accordingly to the pathophysiologic mechanisms of MR through increasing severity stages and are associate with the burden of symptoms.

Fig.1
Fig. 2

**ROC CURVE**

- **Global PALS**
  - AUC = 0.7

- **GW1**
  - AUC = 0.46
  - GCW AUC = 0.51
  - GWW AUC = 0.63
  - GWE AUC = 0.37

- **LAVI**
  - AUC = 0.68

- **E/E'**
  - AUC = 0.63