Right ventricular global work efficiency provides the highest prediction for improvements in right ventricle to left ventricle diameter ratio with acute pulmonary embolism treatments

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Introduction: In addition to standard echocardiographic measures, global longitudinal strain (GLS) with speckle tracking (ST) and myocardial work (MW) evaluation have been used in the assessment of right ventricle (RV) function in patients with acute pulmonary embolism (PE). In this study we aimed to compare echocardiographic measures, ST and MW in prediction of change in right ventricle (RV) to left ventricle (LV) diameter ratio (r) with treatments.

Methods: Our study comprised 83 consecutive patients (female \(54.6\%,\) age \(59\pm14.9\) years) who admitted to our hospital with diagnosis of acute PE and underwent evidence-based treatments. Echocardiographic evaluation including ST and MW were performed within first 24 hours of admission. NT-pro-brain natriuretic peptide (NT-proBNP), troponin, pulmonary embolism severity index (PESI) and Qanadli score, RV and LV global work index (GWI), global work efficiency (GWE), global constructive work (GCW) and global wasted work (GWW), and RV-GLS were evaluated. Primary end-point (PEP) of this study was the change in RV to LVr on computed tomography (CT), and generalized additive model (GAM) in addition to classical linear regression (LR) were utilized for prediction of change in RV/LVr with these measures.

Results: PESI score and RV/LVr at admission were 84.8\(\pm\)23.8 and 1.13\(\pm\)0.39, respectively. Unfractioned or low-molecular weight heparin were treatments of choice in patients. The change in RV/LVr after selected treatments were 0.356. Mean hospital stay and overall follow-up duration were 8.7\(\pm\)3.7 and 328.7\(\pm\)126.8 days, respectively. In-hospital and long-term mortality rates were 1.2% and 13.3%, respectively. Correlation co-efficients for intra- and interobserver agreement of MW measures varied from 0.85 to 0.96. The LR revealed that pulmonary arterial systolic, diastolic and mean pressure estimates, fractional area change and RV annular tissue velocity were significantly related with changes in RV/LVr (p values; 0.02, 0.01, 0.004, 0.03 and 0.03, respectively). Moreover, RV-GWE compared with RV-GLS showed a higher prediction for improvements in the RV/LVr (p value were \(<0.001\) and 0.049, respectively). Utilization of GAM increased R2 value (from 0.15 to 0.20), and decreased the complexity of model. RV-GWE showed a moderate correlation with RV-GLS (r=\(-0.56\)), RV-GWI (r = 0.42), RV-GCW (r=0.32), LV-GWW(r=-0.55), LV-GLS (r=-0.33), FAC (r=0.26), NT-proBNP (r=-0.38), troponin (r=-0.28) but not with other measures.

Conclusions: The RV GWE as a novel myocardial work parameter seems to provide a better prediction for improvements in the RV/LVr with acute PE treatments as compared to clinical, laboratory and other echocardiographic measures including GLS.
Figure 1: Relationship between RV-GWE, PESI score, age and the change in RV/LVr using generalized additive model.
Partial effect plot of the relationship between RV-GWE, PESI score, age and the change in RV/LVr

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