Quantitative Evaluation of Right Ventricular Myocardial Function Changes in Patients with Atrial Septal Defect Before and After Occlusion by Noninvasive Right Ventricular Pressure-Strain Loop

Huanhuan JIANG1, Hongling Ran1, Pan Xu1, Jia Hu1, Yu XIAHOU1, Xiling ZHOU1, Ming Liu1, and xin yuan1

1Nanchang University

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Abstract

Objective: The non-invasive right ventricular pressure-strain loop (PSL) represents a novel method for the quantitative assessment of right ventricular myocardial function. Given that atrial septal defect (ASD) is a prevalent congenital heart anomaly associated with right ventricular volume overload, this study aims to quantitatively assess the myocardial function of the right ventricle in ASD patients pre- and post-occlusion by noninvasive right ventricular PSL. Methods: This study included thirty-six patients diagnosed with secundum atrial septal defect (ASD group) and thirty healthy adults (control group). We compared conventional right ventricular echocardiographic parameters, right ventricular strain, and myocardial work in the ASD group before occlusion, two days post-occlusion, and three months post-occlusion, with those in the control group. Results: Prior to and two days following occlusion, the ASD group exhibited higher right ventricular global work index (RVGWI), right ventricular global wasted work (RVGWW), and right ventricular global constructive work (RVGCW) compared to the control group (P < 0.05). Within the ASD group, post-occlusion, RVGWI, RVGCW, and RVGWW values were significantly reduced compared to pre-occlusion values (P < 0.001). Furthermore, RVGWI and RVGCW showed a significant decrease three months after occlusion compared to two days post-occlusion (P < 0.05). Multivariate regression analysis identified ASD diameter and pulmonary artery systolic pressure (PASP) as independent predictors of RVGWI (β = 0.405, P < 0.001; β=2.307, P=0.037) and RVGCW (β=0.350, P<0.001; β=1.967, P=0.023). Conclusions: The non-invasive right ventricular PSL effectively demonstrates the alterations in right ventricular myocardial function in ASD patients, pre- and post-occlusion. The metrics of right ventricular myocardial work (RVMW) offer a novel indicator for evaluating right ventricular myocardial function in these patients. Moreover, ASD diameter and PASP emerge as independent determinants of RVGWI and RVGCW.

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Authors: Huanhuan JIANG1, MD, Hongling RAN1, MD, Pan Xu1 MD, Jia Hu1 MD, Yu XIAHOU1 MD, Xiling ZHOU1 MD, Ming Liu1 MD, xin yuan1 MD