

Right ventricular function in acute pulmonary embolism: a three-dimensional strain study

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Introduction: Pulmonary embolism (PE) is a common and serious life-threatening disease. Mortality is related to right ventricular (RV) dysfunction secondary to the increased RV afterload. RV function assessment is challenging and limited using 2D ultrasound.

Purpose: To study 3D global and regional right ventricular strain in patients with acute PE and at 1 month, as compared to a control population.

Methods: We conducted a longitudinal prospective study, including 23 consecutive intermediate-risk PE patients. All patients underwent 2D and 3D transthoracic echocardiography at baseline (within 12 hours of PE diagnosis) and 1-month after hospital discharge. A control group was recruited, consisting of healthy volunteers, matched on age and sex with PE patients. 3D RV echocardiographic sequences were analyzed by a commercial RV-specific software and output meshes were post-processed to extract regional deformation. One-month 3D echocardiographic follow-up was only available in 18 patients.

Results: During acute PE, area strain was substantially altered in the RV free wall (except in the right ventricular outflow tract) and within the trabecular septum. PE patients initially had RV dysfunction using 2D and 3D parameters, with, on average, 1-month normalization of 2D parameters. However, at 1-month, RV area and circumferential strains remained altered as compared to the control group. Acute PE seems to affect preferentially the circumferential rather than the longitudinal strain. The presence of a McConnell sign was identified in 83% of patients and was associated with reduced apical and global RV area strain.

Conclusion: 3D RV strain study demonstrates an incomplete recovery of area and circumferential strain, 1 month after an episode of intermediate-risk acute PE, despite normal 2D parameters. Further studies are required to assess the prognostic role and the implications of this residual RV strain impairment after PE. Moreover, in our study, the Mc Connell sign is related to the intensity of RV strain impairment during the acute phase of PE. This sign may be explained by a mechanical traction of the RV apex by the left ventricle, rather than by an increased apical function.

