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Echocardiographic assessment of the right ventricle in chronic heart failure with focus on patients with atrial fibrillation

E. Majos[1], A. Kraska[1], I. Kowalik[1], E. Smolis-Bak[1], H. Szwed[1], P. Lipiec[2], J. Kasprzak[2], R. Dabrowski[1]

[1]Institute of Cardiology, 2nd Department of Ischaemic Heart Disease, Warsaw, Poland; [2]Medical University of Lodz, Lodz, Poland

Background: Assessment of the right ventricle (RV) in heart failure (HF) is challenging and requires applicable methods and parameters. Atrial fibrillation (AF) is a common and clinically significant arrhythmia in 30–50% of HF patients. Assessment of the RV function in patients with AF is problematic. Still little is known about RV function in HF and AF patients. The aim of the study was to assess RV function in HF with focus on AF patients.

Methods: Patients with HF of ischemic etiology, NYHA II-III, LVEF $\leq$40%, with AF and sinus rhythm (SR), underwent two- and three- dimensional echocardiography (2DE and 3DE) for assessment of the RV with use of multiple parameters. The RV was examined for: linear dimensions, end-diastolic and end-systolic areas adjusted to body surface area (RV EDA and RV ESA/BSA) and end-diastolic and end-systolic volumes adjusted to lean body mass (RV EDV and RV ESV/LBM) to reflect volume overload and in terms of right ventricular pressure (RVSP) as an index of pressure overload. RV systolic function was assessed with 2DE: tricuspid annular plane systolic excursion (TAPSE), right ventricular fractional area change (RV FAC), tricuspid lateral annular systolic velocity (s') and 3DE parameters: right ventricular ejection fraction (RVEF) and free wall right ventricular longitudinal strain (FW RVLS). Also, TAPSE/RVSP parameter was included.

Results: The study included 126 patients: 94 with AF and 32 with SR. Within the AF group 28 patients were treated medically, 41 had RV pacing (pacemaker or an implantable cardioverter-defibrillator, ICD) and 25 had cardiac resynchronisation therapy (CRT). In comparison with SR group AF patients had: larger RV inflow tract dimension (4.49±0.85 vs. 3.95±0.72 cm; p=0.0017), RV EDA/BSA (12.7±3.9 vs. 11.1±3.0 cm^2/m^2; p=0.0358) and RV ESA/BSA (8.0±3.0 vs. 6.7±2.4 cm^2/m^2; p=0.0226). Similarly, patients with AF had greater RV volumes in 3DE than patients with SR: RV EDV/LBM (1.82±0.60 vs. 1.61±0.38ml/kg, p=0.0267) and RV ESV/LBM (1.11±0.40 ml/kg vs. 0.81±0.28, p<0,0001). Also, in patients with AF right ventricular systolic pressure (RVSP) was higher (40.8±10.2 vs. 34.0±8.1 mmHg, p=0,0010). No differences in TAPSE and RVFAC were found but the relation TAPSE/RVSP was higher in AF than in SR group (0.51±0.21 vs. 0.65±0.24 cm/mmHg; p=0.0046). Also, in AF patients in comparison to SR group some parameters had worse values: s' (9.7±2.31 vs. 12.1±3.83, p=0.014), RVEF (37.2±7.3 vs. 48.2±7.5, p<0.0001 and FW RVLS (–18.3±4.6 vs. –23.9±4.23%, p<0,0001). Within the AF group no significant differences in studied variables depending on RV pacing or CRT were found.

Conclusions: Larger volumes and higher pressure overload of the RV were observed in patients with AF in comparison to SR. Systolic function of the RV seems to be more depressed in AF compared to SR patients with systolic heart failure. Further research in larger groups is required to identify the most applicable and valuable methods of RV evaluation.