

Evaluation of the morphology and mechanics of the right ventricle using echocardiography before and after transcatheter balloon pulmonary angioplasty in patients with chronic thromboembolic pulmonary

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Introduction: Chronic thromboembolic pulmonary hypertension (CTEPH) leads to a progressive increase in pulmonary vascular resistance (PVR) and pulmonary artery pressure (PAP) with the development of severe dysfunction of the right heart and heart failure. Mortality for three years with an average pressure in the pulmonary artery (PA) of more than 50 mmHg is more than 90%. Balloon pulmonary angioplasty (BPA) has a significant advantage over other methods of surgical treatment, but it requires the determination of additional non-invasive markers of effectiveness. Transthoracic echocardiography (TTE) remains the main method for assessing the morphology and function of the heart.

Purpose: Compare different indicators reflecting the severity of CTEPH with TTE indicators before and after BPA. To evaluate the effectiveness of using BPA for the treatment of patients with CTEPH using routine TTE and speckle tracking mode.

Materials and methods: For 18 months 30 patients without concomitant cardiovascular pathology were subjected to several BPA sessions. Before treatment, 50% of patients belonged to the 3 CTEPH functional class (FC), 40% to 2 FC, 10% to 1 FC. The average number of sessions was 4.7 ± 1.3 . Before the first BPA and after the last, all the patients were performed: six-minute walk test (6MWT, metres), Borg scale (in points), test for NT-proBNP (pg/ml); TTE with assessment of the right ventricle (RV) and left ventricle (LV) including areas of the right atrium (aRA, cm²), mean pulmonary artery pressure (PUPM, mmHg), RV free wall strain (GLSFW, %), RV free wall strain rate (GLSRFW, sm/sec), RV free wall postsystolic shortening (PSSFW, %), tricuspid annular plane systolic excursion (TAPSE, sm), tricuspid annulus systolic velocity (TASV, sm/sec).

Results. Before the first BPA session, the 6MWT in the patient group averaged 315.9 ± 9.08 metres, after - 439.5 ± 11.45 m; the Borg from 5.4 ± 0.94 points decreased to 4 ± 1.01 points; NT-proBNP before the treatment was 1513 ± 13.01 pg/ml, after - 171 ± 6.09 ; according to TTE the ratio of RV/ LV before and after treatment was 1.31 ± 0.02 and 0.97 ± 0.04 ; aRA was 29.3 ± 4.87 and 22.3 ± 3.53 cm²; basal RV - 52 ± 5.11 and 44 ± 7.26 mm; PUPM decreased from 76.6 ± 7.65 to 31.3 ± 3.78 mmHg; GLSFW from -14.69 ± 2.33 came to 17.5 ± 3.45 %; GLSRFW with -0.9 ± 0.09 to -1.7 ± 0.11 cm/sec; TAPSE from 16.7 ± 1.87 to 18.2 ± 2.34 cm; TASV from 10.11 ± 1.45 to 12.25 ± 1.98 cm/s, PSSFW before treatment was -18.4 ± 1.2 %, after treatment in 66% of patients disappeared, in 34% became an average of 17.4 ± 0.9 %. The distribution of STEPH FC has also changed.

Conclusion. BPA leads to an improvement in the tolerance of physical activity, clinical indicators, and parameters of central hemodynamics in the pulmonary circulation, evaluated according to direct manometry, and leads to reverse remodeling of the RV in the long term. Performing a staged BPA leads to an improvement in the functional parameters of contractility of the RV.