Complex analysis of electrical and mechanical dissynchrony by electrocardiography, echocardiography and non-invasive epi-and endocardial mapping in predicting response to cardiac resynchronization therapy.

Introduction. Cardiac resynchronization therapy (CRT) improves prognosis in patients with heart failure (HF) and left bundle branch block (LBBB). However, a large number of patients does not benefit from CRT. The search of the reproduced markers of response on this therapy is an important problem.

Purpose. To assess the value of the complex analysis of electrocardiographic (ECG) and echocardiographic (echo) variants of LBBB and the ventricular myocardium activation pattern in predicting the success of CRT.

Materials and methods. The study included 53 patients (mean age 60,9±9,9years, 32 males/21 females) with LBBB, QRS duration ≥ 130 ms, left ventricular ejection fraction (LVEF)≤35%, heart failure (HF) NYHA II-IV despite optimal pharmacological therapy during 3 month. All patients had undergone CRT-D implantation. Depending on presence or absence of LBBB ECG-criteria, proposed by Strauss D.G., patients were divided into 2 groups: 1group - strict LBBB, proposed by Strauss D.G., and 2 group – other.

In addition to standard echocardiography, longitudinal 2-dimensional strain and LBBB contraction pattern were analysed. Also, patients were divided into 2 groups based on the presence of one of the echo patterns of LV dyssynchrony: "classical/typical LBBB" and "heterogeneous/atypical".

Non-invasive epi- and endocardial mapping (NIEEM) by the «Amycard 01C EP Lab» (EP Solutions SA, Switzerland) system with an analysis of epi- and endocardial ventricular electrical activation was performed in all patients. Ventricular electrical uncoupling (VEU) defined as the difference of duration between the mean LV and RV activation time duration spontaneous rhythm (in milliseconds). Response to CRT was estimated by echo and was defined as decrease in LV end-systolic volume by>15% after 6 months of follow-up.

Results. Within the group consisting of 53 patients, 34 patients (64%) responded to CRT. In the "response" group the morphology of the QRS complex more frequently met the LBBB-criteria, proposed by Strauss D.G (29 vs. 5, p <0,001), " typical" LBBB contraction pattern by echo (30 vs. 4, p<0.001). Initially, VEU was more pronounced in the "response" group (VEU 55 [51;59] ms in the "response" group vs 35 [14;47] ms in the "non-response" group, p<0,001). Moreover, in the "response" group 32 patients (94%) had VEU>40ms (the electrophysiological criterion complete LBBB).

Finally, we analyzed the sensitivity and specificity of these criteria in predicting the success of CRT. A complex of LBBB-ECG by Strauss D.G., " typical" LBBB contraction pattern by echo and VEU>40ms by NIEEM was demonstrated the best combination of sensitivity and specificity in comparison with each of parameters separately (AUC 0,897, sensitivity79.4%, specificity100%, p<0,001).

Conclusion. Complex analysis of electrical and mechanical dissynchrony by ECG, echo and NIEEM identify patients with delayed transseptal interventricular conduction due to complete LBBB, what is a good target for CRT