Electrophysiological and structural heart features in patients with heart failure and response to cardiac resynchronization therapy

Authors:
M Utsumueva1, O Stukalova1, N Mironova1, S Kashtanova1, T Malkina1, G Tarasovsky1, V Kiktev1, S Gaman1, S Ternovoy1, S Golitsyn1, 1Russian Cardiology Research and Production Complex - Moscow - Russian Federation,

Topic(s):
Cardiac Resynchronization Therapy

Citation:
Introduction. As a significant number of patients with heart failure (HF) does not respond to cardiac resynchronization therapy (CRT), a lot of research has deservedly focused on optimization, and better patient selection. The ideal resynchronization depends on different factors, from device programming to heart features and left ventricle (LV) lead position. Analysis of the 12 lead electrocardiogram (ECG) is the most simple method which can provide important information on LV lead location, presence of scar at LV pacing site, and fusion of intrinsic activation or RV pacing with LV pacing.

Purpose. To analyze the electrophysiological and structural heart features and their correlation with the ECG pattern during biventricular (BV) pacing in patients with HF and CRT devices.

Methods. The study included 47 patients (mean age 62,3±8,9 yrs) with LBBB, QRS=130 ms, LV ejection fraction (LVEF) = 35%, heart failure (HF) NYHA II-IV despite optimal pharmacological therapy during 3 months. All patients had undergone CRT-D implantation. Late-gadolinium enhancement-cardiovascular magnetic resonance, 12 lead ECG, non-invasive cardiac mapping (NICM) (with obtaining the zone of late LV activation were undertaken prior to CRT devices implantation. NICM with cardiac CT and evaluation of LV lead position, ECG pattern during BV pacing (#1 - fusion complex with increased or dominant R wave, independent of QRS duration, #2 - QS pattern with QRS duration normalization, and #3 - QS pattern with increased QRS duration) were undertaken after CRT devices implantation. 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. CRT was effective in 28 patients (59,5%). According to the results of NICM, zone of late LV activation more often was located at 5,6,11,12 segments, and LV pacing site – at 6,7,12 segments of LV. In the "response" group overlap of scar zone and zone of late LV activation was observed (p=0,005). The presence of scar tissue in the LV pacing site was associated with CRT non-response (p<0,001), and the pacing zone of late LV activation resulted in the best CRT response (p<0,001). The distance from the LV electrode to the zone of late LV activation was less in the "CRT response" group (33 [20;42] mm vs 83 [55;100] mm, p<0,001). The most beneficial ECG pattern during BV pacing was #2, which found more often found in case of pacing zone of late LV activation. Configuration #3 was more often observed in the group "CRT non-response"; #1 was intermediate between ECG patterns #2 and #3.

Conclusions. A comprehensive examination, including the study of the structural and electrophysiological heart features is important for the optimal positioning the LV lead and subsequent CRT device programming. The simple analysis of the QRS pattern during BV pacing can show whether biventricular pacing is adequately performed and can reveal inadequate CRT programming and LV lead positioning.