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Assessment of myocardial electrical dissynchrony by noninvasive activation mapping and its role in achieving the success of cardiac resynchronization therapy

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Topic(s):
Cardiac Resynchronization Therapy

Citation:
Purpose. To assess and to compare the ventricular myocardium activation pattern obtained by non-invasive epicardial and endocardial mapping (NIEEM), as well as electrocardiographic (ECG) variants of left bundle branch block (LBBB) and to estimate the value of these data for the success of cardiac resynchronization therapy (CRT).

Materials and methods. The study included 51 patients (mean age 60.65±9.9 years, 30 males) 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. et. al, patients were divided into 2 groups: 1 group - strict LBBB, proposed by Strauss D.G. and 2 group – other ECG morphologies of LBBB.

NIEEM by the «Amycard 01C EP LAB» system with an analysis of epicardial and endocardial ventricular electrical activation was performed in all patients. Ventricular electrical uncoupling (VEU) (Fig.A) defined as the difference of duration between the mean left ventricular (LV) and RV activation times duration spontaneous rhythm (in milliseconds). A line of slow conduction (Fig.B) was recorded if the activation times of adjacent points on either side of this line differed by >50 ms. The zone of late LV activation (Fig.C) was defined as the latest area identified on the isochrones map. 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. LBBB ECG-criteria, proposed by Strauss D.G. et. al, was detected in 35 patients (69% of all included). According to the results of NIEEM, these patients had more pronounced ventricular electrical uncoupling (VEU) (?=0.033). Most often the line of conduction block was detected in the anteroseptal or posterolateral region of the LV. The zone of late LV activation, which is the most optimal position for the LV pacing electrode, was located in the basal and middle segments of the lateral and posterior walls. After 6 months of CRT 32 patients (63%) were included in the "response" group, the remaining 19 patients (37%) formed the "non-response" group according to echo criteria. In the "response" group the morphology of the QRS complex more frequently met the criteria, proposed by Strauss D.G., than other ECG variants of LBBB (28 vs. 4 respectively, p <0.001). Initially, VEU was more pronounced in the "response" group (VEU 55 [51;63] ms in the "response" group vs 35 [14;41] ms in the "non-response" group).

Conclusions. LBBB ECG criteria, proposed by Strauss D.G., identify patients with delayed transseptal interventricular conduction due to complete LBBB, what is a good target for CPT. Identification of individual ventricular activation properties may in patients with LBBB help to reveal responders to CRT and to further the response to CRT by improving a patient-specific lead placement and device programming.
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