

Characterization of the effects of right ventricular and left bundle branch area pacing on the QRS complex

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Introduction: Right ventricular pacing (RVP) has been the treatment of choice for patients with atrioventricular block and sinus node disease for the last decades. It is well known that RVP ventricular may cause ventricular dyssynchrony and could lead to left ventricular dysfunction in 20% of patients, and therefore could increase the risk of heart failure, atrial fibrillation and cardiovascular mortality. Left bundle branch area pacing (LBBAP) has recently emerged as a new physiological pacing modality that can circumvent the limitations of RVP. The purpose of this study was to compare changes induced by RVP and LBBAP in the standard 12-lead ECG by the analysis of QRS complex characteristics in order to assess ventricular dyssynchrony.

Methods: ECG recordings from 134 patients (82 LBBAP, 52 RVP) with indication for anti-bradycardia therapy were acquired before and after pacemaker implantation. Patients were grouped into narrow and wide baseline QRS using a threshold for the QRS duration of 120 ms. Median beats were calculated at baseline and 24 hours post-implantation states for each patient. ECG markers describing ventricular activation were measured, including: 1) QRS duration (QRSd) from QRS onset to QRS end; 2) QRS area (QRSa), computed from the individual areas in orthogonal X, Y and Z leads calculated using the Kors conversion matrix; 3) a new index QRS50 proposed to estimate the ventricular activation time from the first three components of the singular value decomposition of the median QRS complex.

Results: Note that the QRS characteristics showed similar values in baseline for both pacing techniques. In patients with narrow QRS, we found that paced QRS characteristics remained similar from the basal QRS in LBBAP group whereas in RVP group they worsened. The three markers, QRSd, QRSa and QRS50, increased after RVP by 34 ms, 68 μ Vs and 22 ms, respectively ($p < 0.001$). In patients with wide QRS, LBBAP significantly reduced QRSd, QRSa and QRS50 while RVP increased QRSa and QRS50 and left QRSd unchanged.

Conclusion: In patients receiving a pacemaker for anti-bradycardia therapy, LBBAP led to more synchronized ventricular activation than RVP measured from QRS duration- and area-related characteristics.

14.1 - Antibradycardia Pacing

