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INTRODUCTION

- Biventricular pacing for cardiac resynchronization therapy (CRT) to alleviate heart failure can be delivered with different RV-LV pacing offsets.¹
- There is heterogeneity in cardiomyopathy, scar distribution, lead locations and pacing latencies.
- Individually optimizing RV-LV offset may improve electrical resynchrony and clinical response to CRT.

OBJECTIVES

- To study impact of RV-LV pacing offsets on global ventricular activation with electrocardiographic imaging (ECGI).²
- To evaluate regular ECG as a surrogate for ECGI to identify optimal RV-LV pacing offset.

METHODS

- We studied RV-LV offsets in 20 ms decrements from +40 to -80 ms with ECGI & 12-lead ECG in 5 CRT recipients.
- We obtained ventricular electrical uncoupling (VEU) as the difference in mean activation times over RV and LV epicardium with ECGI.³
- We got paced QRS duration (QRSd) from ECG.
- We reconstructed vectorcardiogram in orthogonal x, y, z coordinates from ECG using Kors conversion matrix and obtained 3D QRS_{AREA} (root-mean-square of QRS area in x, y, z axes).^{4,5}
- In individual patients, we obtained correlation coefficients (r) of VEU and total activation time with QRSd and 3D QRS_{AREA} and compared them using Mann-Whitney U test.

RESULTS

- Progressive RV-LV offset resulted in progressive changes in VEU in all patients. (Figure 1)
- RV-LV offset with least absolute VEU was different in different pts. (See solid red curves in right panel)
- Absolute VEU correlated with 3D QRS_{AREA} [mean r 0.65 (range 0.29, 0.86)] but not QRSd [mean r 0.12 (range -0.33, 0.61)], p=0.03.
- Epicardial total activation time correlated with QRSd [mean r 0.95 (range 0.93, 0.98)] but not 3D QRS_{AREA} [mean r -0.11 (range -0.48, 0.45)], p=0.008.

CONCLUSIONS

- It is feasible to use ECGI for selecting RV-LV pacing offset to minimize ventricular electrical uncoupling (VEU) for maximizing electrical resynchrony.
- Paced 3D QRS_{AREA} (rather than paced QRSd) from ECG correlates with VEU and can be used as a surrogate for ECGI.

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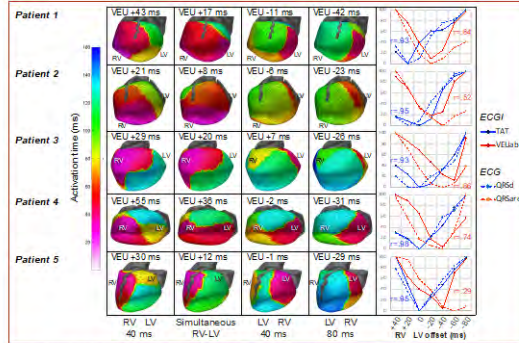


Figure 1. Ventricular activation with RV-LV pacing offsets. Each row represents a different patient. First 4 columns show ECGI activation maps with RV-LV offset +40, 0, -40 and -80 ms respectively. Local epicardial activation time referenced from onset of QRS is color coded (see legend) with early sites in pink and late sites in blue. Last column depicts the relative paced ECGI and ECG indices by RV-LV offsets. LV, left ventricle; QRSAREA, 3D QRS area; QRSd, QRS duration; r, correlation coefficient; RV, right ventricle; TAT, total epicardial activation time; VEU, ventricular electrical uncoupling; VEUabs, absolute value of VEU.

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