Background: Heart failure patients with non-left bundle branch block (non-LBBB) QRS pattern have limited response rate to biventricular pacing (BVP).

Objective: A personalized cardiac resynchronization therapy (CRT) implantation approach guided by real-time electrocardiographic imaging (ECGi) was studied.

Methods: Twenty patients with left ventricular ejection fraction (LVEF) \( \leq \) 35\%, QRS duration \( \geq \) 120ms and non-LBBB (13 right bundle branch block and 7 intraventricular conduction delay) were recruited. During CRT implantation, right atrial, right ventricular, coronary sinus, His-bundle and/or Left-bundle leads were inserted. The total activation time (TAT) with different pacing combinations were measured real-time during implantation by ECGi. The configuration producing shortest TAT would be chosen. Clinical response was defined as \( \geq 1 \) New York Heart Association (NYHA) class improvement. Echocardiographic response was defined as LV end systolic volume reduction \( \geq 15\% \) and/or LVEF improvement \( \geq 10\% \) at 6-months.

Results: After ECGi guided CRT implantation, LVEF improved from 26\( \pm \)6\% to 34\( \pm \)11\% (both \( p < 0.01 \)) and NYHA class improved from 3.0\( \pm \)0.5 to 2.0\( \pm \)0.6 (\( p < 0.01 \)). Both clinical and echocardiographic response rates were 70\%. ECGi approach resulted in better acute electrical resynchronization over BVP as measured by TAT reduction (40\% vs 14\%, \( p < 0.01 \)). Percentage of TAT reduction was found to be a strong predictor for echocardiographic response (AUC for ROC curve 0.91, 95\% CI 0.78 – 1.00). A strong positive correlation between percentage TAT reduction and percentage LVEF improvement (Pearson R 0.70, \( p = 0.001 \)) was found.

Conclusions: ECGi guided CRT implantation in non-LBBB patients generates superior acute electrical resynchronization compared with BVP and is associated with favorable clinical and echocardiographic outcomes.
Total Activation Time at baseline, during biventricular pacing and final configuration.

ECGi guided CRT implantation resulted in significantly shorter total activation time than routine biventricular pacing in both RBBB and IVCD patients, suggesting better acute resynchronization.

Correlation between %TAT reduction with % LVEF changes