

## Change in QRS area by cardiac resynchronization therapy is associated with clinical outcomes and echocardiographic response

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**Background:** Cardiac Resynchronization Therapy (CRT) is the cornerstone of treatment in patients with dyssynchronous heart failure. Recently, baseline QRS area proved to predict outcomes after CRT better than QRS duration and morphology.

**Purpose:** It was the aim of the study to investigate whether the change in QRS area ( $\Delta$ QRS area) by CRT-pacing further improves the prediction of CRT outcomes.

**Methods:** We conducted a retrospective analysis on 1,299 patients, who were included in a CRT-registry from three Dutch University hospitals with both pre- (baseline) and post-implantation 12-lead ECGs.  $\Delta$ QRS area and  $\Delta$ QRS duration were defined as the decrease in their respective values after CRT. Optimal cut offs for  $\Delta$ QRS area and  $\Delta$ QRS duration by means of Youden indices were found at  $62\mu\text{Vs}$  and  $-11\text{ms}$ , respectively. Primary endpoint was a combination of all-cause mortality, heart transplantation, and left ventricular assist device implantation. Secondary endpoint was the relative reduction in left ventricular end-systolic volume (LVESV), and echocardiographic response being defined as  $\geq 15\%$  LVESV reduction.

**Results:** The primary endpoint occurred in 408 patients (31%).  $\Delta$ QRS

area was superior to  $\Delta$ QRS duration for the primary and secondary endpoints. Primary endpoint analysis showed a lower risk in the  $\Delta$ QRS area  $\geq 62\mu\text{Vs}$  than in the  $<62\mu\text{Vs}$  group (HR 0.43; 0.33–0.56,  $p < 0.001$ ). In the multivariable analysis, both baseline QRS area and  $\Delta$ QRS area remained significantly associated with both primary and secondary endpoints. Clinical outcome (left panel of figure) and echocardiographic response (right panel) were significantly worse in patients with baseline QRS area  $<109\mu\text{Vs}$  (group 3) than in those with QRS area  $\geq 109\mu\text{Vs}$ . Within the latter group, outcomes were significantly better in patients with  $\Delta$ QRS area  $\geq 62\mu\text{Vs}$  (group 1) as compared to  $\Delta$ QRS area  $<62\mu\text{Vs}$  (group 2) (figure). Baseline QRS duration and  $\Delta$ QRS duration were not independently associated with both clinical outcome and echocardiographic response.

**Conclusion:** The combination of baseline QRS area and  $\Delta$ QRS area has a stronger association with CRT response than baseline QRS area alone, and ( $\Delta$ )QRS duration. These results suggest that especially in patients with a good electrical substrate (large baseline QRS area) it is worthwhile to adjust CRT to achieve the largest decrease in QRS area.

