

Abstract

Cardiac resynchronization therapy (CRT) is an established treatment of patients with heart failure with reduced ejection fraction associated with QRS complex prolongation. However, about 30% of patients do not respond to CRT favorably, more so patients with shorter QRS duration and QRS morphology other than typical left bundle branch block. Echocardiography plays a crucial role in management of all those patients.

Echocardiographic assessment of myocardial mechanics can quantitate myocardial deformation and find myocardial segments that are latest mechanically activated in a dyssynchronously contracting left ventricle. Left ventricular (LV) lead placement in this area is associated with clinical response to CRT. On the other hand, lead placement within a scar has been associated with bad prognosis.

The aim of this work was to investigate whether left ventricular lead placed close to the site of latest mechanical activation is beneficial especially in patients with shorter QRS durations or atypical QRS morphology. This has been done by analyzing data of the randomized trial STARTER, which compared echo-guided LV lead navigation to routine empirical lead placement.

The STARTER trial proved clinical benefit of echo-guided LV lead placement towards the site of latest mechanical activation. In our analysis we have shown that a well-placed LV lead plays an important role especially in patients with shorter QRS duration and/or its atypical morphology: in patients with QRS duration < 150 ms a discordant placement of the LV electrode was associated with significantly worse prognosis in terms of heart failure hospitalizations or death (HR 5.45; [95%CI 2.36 – 12.6]; $p < 0.001$; $p = 0.028$ for interaction compared to QRS ≥ 150 ms) and in terms of overall mortality, heart transplant or need for left ventricular assist device implantation (HR 9.35; [95%CI 3.8 – 28.4]; $p < 0.001$; $p = 0.014$ for interaction compared to QRS ≥ 150 ms).

This benefit was seen also in long term follow-up, where patients with QRS < 150 ms with echo-guided LV lead implantation had prognosis comparable to patients with QRS ≥ 150 ms, but patients with QRS < 150 ms and routine LV lead placement had the worst prognosis. Apart from the site of latest activation, LV lead location away from myocardial scar, as assessed by deformation analysis, was additive to the benefit of placing the lead towards the site of latest mechanical activation.

The results of our work support the hypothesis that echo-guided LV lead implantation is crucial in CRT patients with shorter QRS durations and/or atypical QRS morphology.