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Reverse remodeling after cardiac resynchronization therapy is associated with improvement of contractile asymmetry in the area of left ventricular lead position

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Background: One third of patients receiving cardiac resynchronization therapy (CRT) do not respond to the treatment, possibly due to suboptimal lead position and persistent dyssynchronous left ventricular (LV) contraction.

Purpose: To assess the influence of LV lead position on improvement of contractile asymmetry and its significance for LV reverse remodeling after CRT.

Methods: Patients with heart failure and left bundle branch block undergoing CRT implantation were studied retrospectively. Assessment of mechanical delay within the LV was assessed using a recently developed index of contractile asymmetry (ICA). ICA was calculated as standard deviation of differences in systolic strain rate in the opposing LV walls derived from curved anatomical M-mode plots. LV was divided into 12 equally sized 30-degree sectors. Spline interpolation was used to estimate ICA in six opposing sector pairs permitting quantification of regional contractile asymmetry in the entire LV. Position of LV lead tip was assessed by thoracic computed tomography (CT). Response to CRT was defined as a reduction of LV end-systolic volume (ESV) ≥15% after 6 months.

Results: Study population (n= 26) consisted of 65.4% males, 68 ± 10 years, ischemic etiology in 42.3%, LV ejection fraction 24.1 ± 5.8%, QRS duration 171 ± 22 ms. CRT response was present in 18 (69.2%) patients. Pre-implantation ICA in the LV sector containing LV lead was 0.75 ± 0.24 s-1 in responders vs. 0.46 ± 0.16 s-1 in non-responders (p = 0.003). Reduction of ICA in the LV sector with LV lead was directly correlated with reduction of LV ESV after CRT (r = 0.46, p = 0.02) (Figure 1). ICA reduction in the LV sector with LV lead was -0.24 ± 0.28 s-1 in responders and -0.05 ± 0.16 s-1 in non-responders (p = 0.03). Meanwhile, reduction of ICA in the LV sectors located 60 degrees clockwise and 60 degrees counterclockwise away from the LV sector with LV lead (remote LV sectors) did not differ significantly between responders and non-responders: -0.12 ± 0.15 s-1 vs. -0.06 ± 0.1 s-1 (p = 0.28). Likewise, no significant correlation between reduction of ICA in remote LV sectors and LV ESV reduction was observed (p = 0.11).

Conclusion: Pre-implantation contractile asymmetry in the LV lead target area is associated with a positive response to CRT. Simultaneously, the degree of LV reverse remodeling after CRT seems to correlate with the magnitude of improvement of contractile asymmetry specifically in the region of LV lead location.

Abstract Figure 1