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Role and evolution of the right ventricle in heart failure patients treated with cardiac resynchronization therapy delivered by left ventricle pacing alone

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Background: Cardiac resynchronization therapy (CRT) is an effective treatment for patients with heart failure (HF) with reduced ejection fraction. Biventricular pacing is the most common mode of delivering CRT. However, several studies have demonstrated non-inferiority of LV pacing alone. There are several trials about the role and evolution of right ventricle (RV) systolic function in CRT patients delivered by biventricular pacing showing that RV function is an independent predictor of long-term outcome following CRT, and improvement in RV function after CRT.

Purpose: To examine if RV function and dimensions prior to CRT could have an impact on CRT response and assessment of the evolution of RV function after 1 year follow up in patients with LV pacing alone.

Methods: 22 patients with a mean age of 63 ± 10.6 years including 9 (40.9%) females and 13 man (59.1%), with HF (EF < 35%, LBBB > 120 ms, or non-LBBB > 150 ms, with NYHA II to IV) were enrolled and underwent CRT implantation LV pacing alone. Each patient benefited from standard two dimensional (2D) echocardiography, tissue Doppler imaging, with assessment of Left ventricular (LV) end-diastolic (LVEDV), and end-systolic volumes (LVESV), ejection fraction, RV maximum basal (RVD basal), TAPSE, fractional area change (FAC), and tricuspid lateral annular systolic velocity (S'), RV TEI index, RV systolic pressure using Bernoulli equation, at inclusion before CRT and 12 \pm 2 months after CRT implantation. Patients presenting with reductions of LVESV of >15% were termed volumetric responders for further statistical analysis and patients with reduction of NYHA class were termed clinical responders.

Results: 14 patients (63.63 %) cases were volumetric responders and 21 patients were clinical responders showing an improvement in NYHA class at one year. 1 patient died. Among echocardiographic parameters of RV: RVD basal, TAPSE, FAC, TEI index, RV systolic pressure ($p < 0.01$) were good predictors for volumetric response proving that a dilated RV with poor systolic function may be a predictor for non response to CRT even in patients with LV alone pacing. TAPSE and FAC have the best AUC for prediction of response to CRT therapy. We proposed cutoff values for predicting response versus non response to CRT therapy TAPSE 16.6mm (AUC 0.827, 95% CI, $p < 0.05$, sensibility 100%, specificity 71.4%) and FAC 36% (AUC 0.826, 95%CI, $p < 0.05$, specificity 91%, sensibility 66%) and RVD basal 37.5mm (AUC 0.805, 95%CI, $p = 0.03$, sensibility 63%, specificity 85%). In volumetric non-responders, RV function improves at one year follow up with an increase in TAPSE ($p = 0.008$) and a decrease of RV TEI index ($p = 0.04$).

Conclusions: LV pacing alone CRT improves RV systolic function and may account for clinical benefit in patients without LV function improvement at one year follow-up. RV systolic function and dimensions before CRT implantation could predict response to LV pacing alone CRT therapy.