

# Potential Pro-arrhythmic Effect of Cardiac Resynchronization Therapy.

## Abstract:

**Objective:** Despite the advances in pharmacological therapy for patients with heart failure, cardiac resynchronization therapy (CRT) remains an important adjunct treatment for that group of patients. However, experimental studies proved that epicardial left ventricle (LV) pacing, through causing reversal of electrical activation sequence, increase QT interval duration resulting in dispersion of the ventricular repolarization and leaving patients at greater risk for ventricular arrhythmias. Our study aims at investigating this alleged pro-arrhythmic effect of CRT using surface electrocardiogram (ECG) markers of pro-arrhythmia.

**Methods:** 75 patients (with mean age  $57 \pm 11.6$  years, 63 (84%) were males & 12 (16%) were females) in NYHA class III-IV heart failure and left bundle branch block (LBBB), who received CRT via LV epicardial pacing, were assessed by 12-lead surface ECG. Manual measurement of the variables associated with the cardiac ventricular repolarization; corrected QT interval (QTc), Tpeak-end (Tp-e) interval, and QT dispersion (QTD) (QTmax - min), in addition to Tpeak-end dispersion (Tp-e max - min), during baseline rhythm and during applying atrial-biventricular pacing, with special attention to patients developing arrhythmias post CRT recorded from 24 hours Holter, or pacemaker programmer event recorder.

**Results:** QTc interval showed significant prolongation after CRT ( $498.9 \pm 50.8$  vs.  $476.2 \pm 41.6$  in non-paced,  $p = 0.0001$ ), though this prolongation is more prominent in patients showing prolonged QRS duration when compared to patients who showed decreased or fixed QRS duration after CRT pacing ( $508.75 \pm 28.62$  vs.  $497.9 \pm 52.8$ ,  $p = 0.5$ ). As regarding QTd and Tpeak-end dispersion, both showed insignificant rise after biventricular pacing, also this rise is more prominent in patients showing prolonged QRS duration when compared to patients who showed decreased or fixed QRS duration after CRT pacing with QTd being the only parameter showing significance when compared to patients with fixed or decreased QRS width post CRT ( $40 \pm 15.1$  in former group versus  $30.59 \pm 16.59$  in latter group,  $p = 0.04$ ), while Tp-e interval showed insignificant decrease after CRT, however this decrease was more prominent in patients showing fixed or decreased QRS width post CRT when compared to patients showing prolonged QRS duration ( $87.83 \pm 16.24$  vs.  $91.25 \pm 9.9$ ,  $p = 0.19$ ). In patients showing arrhythmogenic events; major arrhythmogenic events (MAE) and those developing increased frequency of premature ventricular contractions (PVCs) post CRT and when compared to those with no-arrhythmias, there was a significant prolongation of the QTc interval ( $527 \pm 63.29$  msec. vs.  $496.95 \pm 45.2$  msec.,  $p \text{ value} = 0.043$ ) and the Tp-e interval ( $94.16 \pm 9$  msec. vs.  $87.41 \pm 16.37$  msec.,  $p \text{ value} = 0.049$ ), while there was an insignificant decrease in QTD and Tpeak-end dispersion in the former group versus the latter group.

**Conclusion:** We consider that the electrocardiographic variables obtained with the use of the surface ECG, namely, the QTc and Tp-e intervals seem as a potential predictor of occurrence of MAE and less serious arrhythmogenic events (PVCs) in CRT patients. It seems also that patients with increased QRS duration post CRT showed more positive markers toward arrhythmogenic events when compared to patients showing fixed or decreased QRS duration post CRT (increased QTc, QTd, Tp-e and Tp-e dispersion), with QTd being the parameter of significance in this context. Though, relatively larger study population number maybe needed to achieve more statistical significance.

**Key words:** heart failure, dilated cardiomyopathy, cardiac resynchronization therapy, ventricular repolarization, pro-arrhythmia.