# Correlation between vectorcardiographic and echocardiographic parameters in patients with cardiac resynchronization therapy

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## Abstract

*Introduction*: Echocardiographic improvement of left ventricular (LV) contraction after cardiac resynchronization therapy (CRT) is an acute endpoint. However, small changes of CRT stimulation parameters may induce large variation of echocardiographic synchronism. Our aim was to investigate correlation between vectorcardiographic (VCG) parameters and echocardiographic parameters before and after CRT and whether VCG can be used as a marker of echocardiographic improvement. *Materials and methods*: Echocardiographic parameters of LV dyssynchrony, such as interventricular mechanical delay (IVMD), septal-to-posterior wall motion delay (SPMWD) and posterior wall contraction to mitral valve opening (Qpp-Qmi), were measured before and after CRT. Short term 12-lead electrocardiographic (ECG) recordings with 500 Hz sampling frequency and 1 microvolt sensitivity were acquired before and after CRT. MatLab R2018a software was used for signal processing and VCG measurement. Distributions were assessed for normality using Kolmogorov-Smirnow test and correlations were assessed using Pearson's or Spearman's test, accordingly. *Results*: A total of 14 patients were included. QRS area correlated with both IVMD (p=0.02, r=0.47) and Qpp-Qmi (p=0.01, r=-0.52), while difference of QRS area before and after the procedure correlated with difference of SPMWD (p=0.01, r=0.83). Similarly, area T azimuth correlated with both IVMD (p=0.0001, r=-0.82) and Qpp-Qmi (p=0.01, r=0.53), while difference of area T azimuth before and after the procedure correlated with difference of SPMWD (p=0.03, r=-0.76). Difference of peak QRS magnitude correlated with difference of SPMWD (p=0.03, r=0.66). QRS-T angle correlated with IVMD (p=0.002, r=0.62), while Wilson's spatial ventricular gradient correlated with Qpp-Qmi (p=0.002, r=-0.62). *Conclusion*: Recent studies reported that VCG is relevant in the context of cardiac resynchronization therapy (CRT) as it improves device optimization, patient selection and reduces rate of non-responders. Consistent with previous works, we reported that VCG parameters correlate with echocardiographic LV synchronism. VCG parameters, especially QRS area and area T azimuth, could be used as a marker of acute echocardiographic improvement of LV function following CRT.

## Keywords:

Biosignal Processing; Vectorcardiography; Echocardiography; Cardiac Resynchronization Therapy