Changes Of Electrical QRS Axis Electrocardiogram After Cardiac Resynchronization

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Introduction

Cardiac resynchronization therapy (CRT) usually improves symptoms in patients with heart failure, left ventricular dysfunction and wide QRS. It has been reported that responders have significant higher frequency of left electrical axis compared to non-responders (i.e 75 vs 29% p=0.04) and responders had a change in QRS axis from left to right (69% vs 13% p<0.001). These have been independent predictors of response to CRT.

Objective

To determine if the absolute magnitude of change in electrical axis predicts response to CRT-D or CRT-P.

Methods

Retrospective observational study from 2003 to 2013 in adult patients treated with CRT-D or CRT-P. Measure of QRS axis and T wave axis were made before and after CRT implant. Clinical (NYHA) and echocardiography criteria (left ventricular fraction ejection LVFE, end diastolic volume) were assessed 6 months after CRT implant. Improvement of at least 1 functional class (NYHA) and 10% increase of LVEF were established as a responder to CRT. A categorical variable as responder was created and the likelihood of responding to CRT was determined according to the change of electrical axis

Results

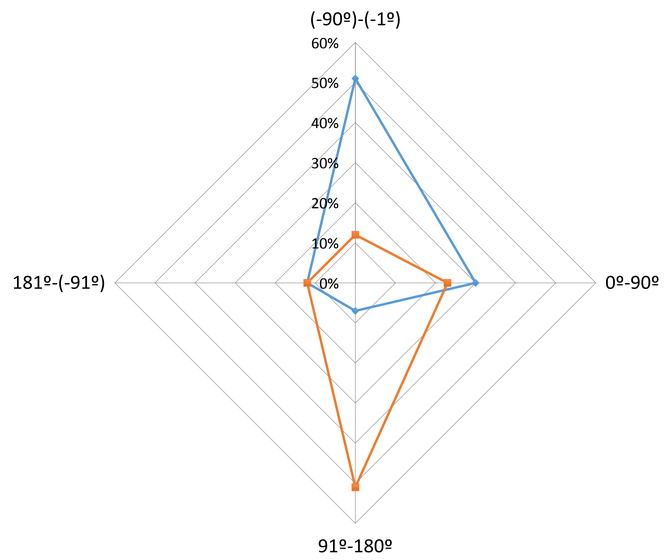
259 patients underwent to CRT-D or CRT-P between 2003 to 2013. Of these 45 had records of QRS axis pre and post-procedure. The mean age was 61 years (SD 11.9), 69% males. The main cause of heart failure was ischemic (51%) and the mean LVEF was 20% (IQR 16-25%). Functional class was class IV in 29%, III in 62% and II in 9%. Basal ECG was sinus rhythm 73%, atrial fibrillation 15% and AV block in 12%

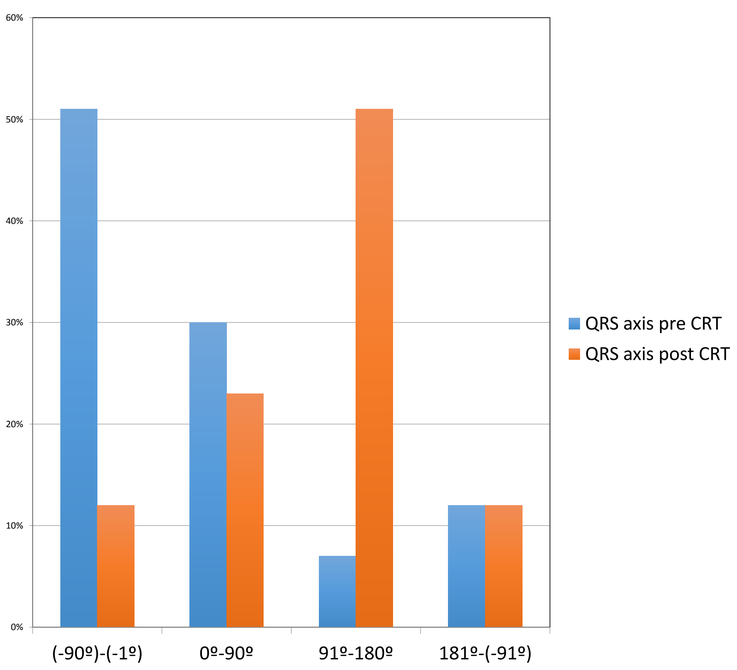
The mean QRS axis change after cardiac resynchronization was 106° (SD 60°). The change of ≥140°, independent if left or right direction, had a sensitivity of 64%, specificity 76%, LR + 2.40 LR – 0.49, to determine clinical response to cardiac resynchronization (ROC 0.66 95% CI 0.46 to 0.85).

Table 1. Characteristics of patients with heart failure and cardiac resynchronization therapy.

Characteristics	(N =45) N (%)
Age (y)*	62 (57-71)
Female	14 (31.0)
Male	31 (69.0)
HF etiology	
Dilated	15 (35.1)
Ischemic	23 (51.4)
Tachycardia	2 (4.2)
Valvular	3 (5.4)
No information	2 (4.4)
LVEF (%)**	20(16-25)
NYHA	
II	4 (9%)
III	28 (62%)
IV	13 (29%)
Electrocardiogram	
Rythm	
Sinus	33 (72.9)
Atrial Fibrillation	6 (13.5)
Ventricular Arrhytmia	1 (2.7)
AV block	8(18.8)

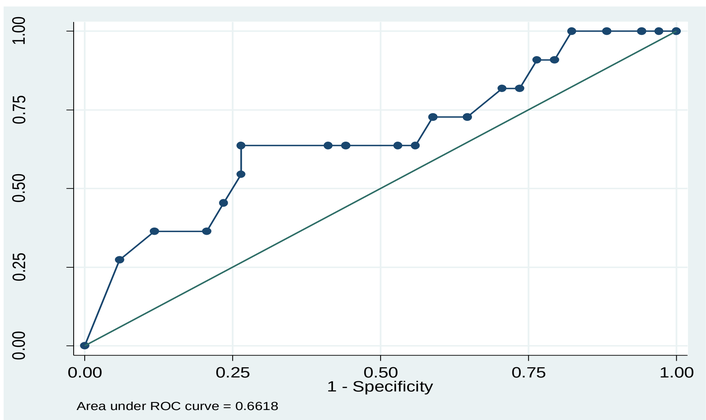
HF: Heart Failure, LVEF: Left Ventricle Ejection Fraction, NYHA: New York Heart Association, AV atrial-ventricle





Results

Table 2. Sensitivity and Specificity at different cutpoints of QRS axis change after cardiac resynchronization therapy.



Cutpoint	Sensitivity	Specificity	Youden
≥0°	100	0	0
≥15°	100	11,76	11,76
≥60°	81,82	29,41	11,23
≥90°	72,73	35,29	8,02
≥120°	63,64	47,06	10,7
≥140°	63,64	73,53	37,17
≥150°	54,55	73,53	28,08
≥180°	27,27	94,12	21,39
>180°	0	100	0

Conclusions

Change of QRS axis equal or greater than 140° could be a predictor of response to CRT, Other studies using larger population samples are needed.

References

1. Hsu JC, Solomon SD, Bourgoun M, McNitt S, Goldenberg I, Klein H, et al. Predictors of Super-Response to Cardiac Resynchronization Therapy and Associated Improvement in Clinical OutcomeThe MADIT-CRT (Multicenter Automatic Defibrillator Implantation Trial With Cardiac Resynchronization Therapy) Study. Journal of the American College of Cardiology. 2012;59(25):2366-73.
2. Lecoq G, Leclercq C, Leray E, Crocq C, Alonso C, de Place C, et al. Clinical and electrocardiographic predictors of a positive response to cardiac resynchronization therapy in advanced heart failure. Eur Heart J. 2005;26(11):1094-100.
3. Lin H, Zhou Y, Xu G. Predictors for Cardiac Resynchronization Therapy Response
The Importance of QRS Morphology and Left Ventricular Lead Position. International Heart Journal. 2014;55(3):256-63.
4. Sweeney MO, van Bommel RJ, Schalij MJ, Borleffs CJW, Hellkamp AS, Bax JJ. Analysis of Ventricular Activation Using Surface Electrocardiography to Predict Left Ventricular Reverse Volumetric Remodeling During Cardiac Resynchronization Therapy. Circulation. 2010;121(5):626-34.
Barold SS, Herweg B. Usefulness of the 12-lead electrocardiogram in the follow-up of patients with cardiac resynchronization devices. Part I. Cardiol J. 2011;18(5):476-86.
5. Takaya Y, Noda T, Nakajima I, Yamada Y, Miyamoto K, Okamura H, et al. Electrocardiographic Predictors of Response to Cardiac Resynchronization Therapy in Patients With Intraventricular Conduction Delay. Circulation Journal. 2014;78(1):71-7.
6. Brenyo A, Rao M, Barsheshet A, Cannom D, Quesada A, McNitt S, et al. QRS axis and the benefit of cardiac resynchronization therapy in patients with mildly symptomatic heart failure enrolled in MADIT-CRT. J Cardiovasc Electrophysiol. 2013;24(4):442-8.

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