Total isovolumic time, a marker of global left ventricular dyssynchrony, optimizes patient's selection for cardiac resynchronization therapy

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Background and Aim: Cardiac resynchronization therapy (CRT), based on broad QRS duration has proved successful for patients in late stage heart failure (HF), however almost 30% do not respond. Standard segmental Doppler echocardiographic measures of ventricular dyssynchrony are controversial in predicting response. The aim of this study was to assess potential additional value of markers of global LV dyssynchrony in predicting CRT response in such patients.

Methods: We included 103 HF patients (mean age 67 ±12 years, 82.5% male) who fulfilled the guidelines for CRT treatment; NYHA class III-IV, despite full medical therapy, QRS duration >120 ms and LV ejection fraction (EF) <35%. All patients had full clinical assessment, NT-proBNP and Doppler echocardiographic examination. Global LV dyssynchrony was assessed by total isovolumic time - t-IVT in s/min [calculated as: 60 - (total ejection time + total filling time)], and Tei index (t-IVT/ejection time). Based on a reduction in the NYHA class and NT-proBNP after CRT, patients were divided into responders (R) and non-responders (NR).

Results: Sixty-one (50.2%) of 103 patients were responders, who proved to have longer QRS duration (p=0.01), faster heart rate (p=0.001), longer t-IVT (p=0.001), higher Tei index (p<0.01) and lower peak tricuspid regurgitation pressure drop - TRPD (p=0.03) before CRT compared with NR. All other clinical and echo parameters were not different between groups. In multivariate analysis, prolonged t-IVT [0.878 (0.802-0.962), p=0.005], long QRS duration [0.978 (0.960-0.996), p=0.02] and high TRPD [1.047 (1.001-1.096), p=0.047] independently predicted response to CRT. A t-IVT 11.6 s/min was 67% sensitive and 62% specific (AUC 0.69, p=0.001) in predicting CRT response. Respective values for a QRS 151ms were 66% and 62% (AUC 0.65, p=0.01). Combining the two variables had a sensitivity of 67% but higher specificity of 88% in predicting CRT response.

Conclusion: Combining prolonged total isovolumic time, a marker of global LV dyssynchrony, and the conventionally used broad QRS duration has a significantly higher specificity in identifying patients likely to respond to CRT.

KEYWORDS: cardiac resynchronization therapy, heart failure, echocardiography, total isovolumic time.
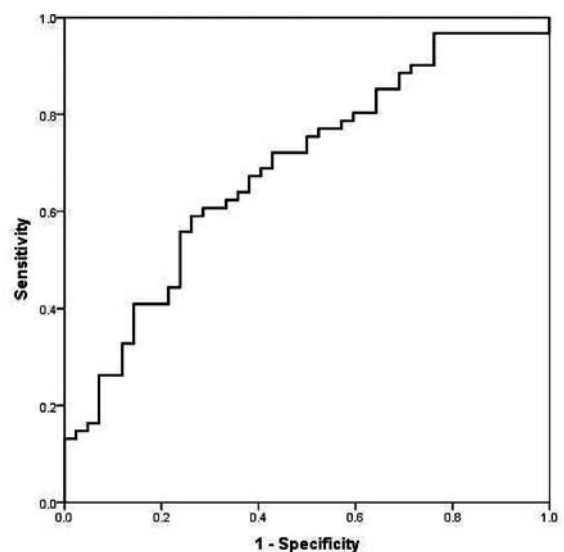
Figure 1. ROC-curve of t-IVT in predicting CRT response.

Literature

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