# Biventricular pacing does not affect microvolt T-wave alternans in heart failure patients

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**BACKGROUND** Microvolt T-wave alternans (MTWA) is a valuable tool for stratification of patients at risk for sudden death and has recently been approved for this purpose by Medicare. Although right atrial (RA) pacing has been applied for MTWA testing, the effects of other pacing modalities on MTWA have not been systematically studied. Accordingly, it is unknown whether biventricular (BiV) pacing might influence MTWA test results.

**OBJECTIVE** This study sought to investigate effects of BiV pacing in comparison with other pacing modalities.

**METHODS** Congestive heart failure patients (n = 30) receiving cardiac resynchronization therapy were included, and a systematic step-up pacing protocol was performed via the implanted cardioverter-defibrillator.

**RESULTS** Of the overall 120 MTWA tests performed, 67 (56%) were nonnegative. Nonnegative MTWA test results were observed in 18 patients (60%) during RA stimulation, whereas 17 (57%), 15 (50%), and 17 test results (57%) were nonnegative during right ventricular (RV), left ventricular (LV), and BiV pacing, respectively. Seven (23%) patients were MTWA negative for all pacing sites. Results of MTWA assessment during RA pacing were concordant with results obtained with RV pacing in 25 (83%) patients ($\kappa = 0.66$, $P = .0003$), to LV pacing in 21 (70%) patients ($\kappa = 0.4$, $P = .025$), and to BiV pacing in 25 (83%) patients ($\kappa = 0.66$, $P = .0003$). Positive and negative predictive values of nonnegative MTWA test results obtained during RA pacing for a similar result obtained with RV pacing were 88% and 76%. Respective values were similar for other pacing modalities (80% and 60% for LV; 88% and 76% for BiV pacing).

**CONCLUSION** There is a high level of concordance between MTWA test results obtained during RA pacing and other pacing modalities, and MTWA assessment seems not to be influenced by BiV stimulation in congestive heart failure patients. In general, BiV pacing does not seem to affect an arrhythmogenic substrate as detected by MTWA testing.

**KEYWORDS** Cardiac resynchronization therapy; Heart failure; Sudden cardiac death; Risk stratification; T-wave alternans

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## Introduction

Detection of microvolt T-wave alternans (MTWA) is valuable for risk stratification of patients prone to sudden cardiac death.[1] The presence of MTWA at heart rates <100 beats/min during submaximal exercise testing is associated with impaired prognosis in individuals with ischemic cardiomyopathy (ICM) and dilative cardiomyopathy (DCM).[2–5] These patients often suffer from congestive heart failure (CHF) and are treated with cardiac resynchronization therapy (CRT) by means of biventricular (BiV) stimulation.[6] However, aside from the mechanical amelioration of left ventricular systolic function,[7] it is not known whether CRT improves the electrical properties of the heart. In fact, CRT may even have detrimental effects, as QT prolongation and torsades de pointes (TdP) tachycardia have been observed during BiV pacing in patients as well as experimental settings.[8]

Technical modalities for MTWA assessment comprise right atrial (RA) pacing in patients with intact atrioventricular (AV) nodal conduction or the use of submaximal bicycle exercise testing.[9] MTWA results obtained during exercise testing and RA pacing have been shown to yield similar results.[10] Recently, RA or RV pacing during electrophysiological (EP) studies yielded a high level of concordance between both stimulation modalities with respect to results of MTWA assessment.[11]

To date, no study has systematically compared the effects of various pacing modalities, particularly those of BiV vs RA, right ventricular (RV), or left ventricular (LV) stimulation on MTWA results. It remains unknown whether BiV stimulation might modify the arrhythmogenic substrate in patients with CHF, either in a positive or a negative way. Accordingly, we compared MTWA results obtained during RV, LV, and BiV stimulation in comparison with RA pacing in patients chronically implanted with CRT devices.

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