Optimal Target Heart Rate for Exercise-Induced T-Wave Alternans

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Objectives: This study was conducted to determine the optimal target heart rate (HR) for the use of exercise-induced T-wave alternans (TWA) as an index for risk of malignant ventricular tachyarrhythmias.

Background: Rate-dependent TWA is an index of vulnerability to ventricular tachyarrhythmias. However, false positive TWA was reported to occur in normal subjects at high HR.

Methods: Two groups were evaluated: Group I: 50 patients with malignant ventricular tachyarrhythmias, who received an implantable cardioverter-defibrillator (ICD); and Group II: 55 age-matched normal subjects. In both Groups, TWA was evaluated during symptom-limited bicycle exercise test.

Results: Peak HR during exercise test was 103 ± 17 beats/min in Group I, versus 124 ± 18 beats/min in Group II ($P < 0.001$). In Group I, 4 patients were excluded from analysis, due to high noise level or frequent ectopy during exercise. Out of the remaining 46 patients, TWA was present in 28 patients (61%), and absent in 18 (39%). In group II, TWA was present in four subjects (7%), and absent in 51 (93%). HR at the onset of TWA was 91 ± 11/min in Group I, and 119 ± 12/min in Group II ($P < 0.001$). Receiver operated characteristics curves demonstrated that a HR of 115 beats/min was the cutoff with the best sensitivity and specificity for TWA (100 and 96%, respectively). None of the patients in Group I developed TWA at HR > 115 beats/min, while two out of four in Group II had TWA at HR > 115/minutes. However, 13 patients in Group I who had no TWA were unable to exercise to a peak HR > 115 beats/min, compared to nine subjects in Group II.

Conclusions: A target HR of 115 beats/min was highly sensitive and specific for determination of exercise-induced TWA as an index of risk of malignant ventricular tachyarrhythmias. However, a significant number of patients may not be able to achieve this target HR, resulting in an indeterminate test. The value of pharmacologic testing in this group should be assessed.

A.N.E. 2001;6(2):123–128

alternans; electrocardiography; exercise test; ventricular arrhythmia

Alternans of the configuration and/or duration of the T wave, usually referred to as T-wave alternans (TWA) has been described in several clinical situations[1-4] and may reflect the presence of dispersion of ventricular repolarization, a recognized substrate for malignant ventricular tachyarrhythmias.[5]

Recently, digital processing techniques for detection of subtle degrees of TWA alternans, which may not be visible on conventional electrocardiographic (ECG) recordings, have been introduced.[6-8] Microvolt level TWA seems to correlate with vulnerability to ventricular tachyarrhythmias.[6,9-12]

Presented in part at the 71st Annual Scientific Session of the American Heart Association, Dallas, Texas, November 11, 1998.

Supported in part by a research grant from Cambridge Heart, Inc.

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