# Clinical Usefulness of the Combination of T-Wave Alternans and Late Potentials for Identifying High-Risk Patients With Moderately or Severely Impaired Left Ventricular Function

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Ventricular tachyarrhythmia (VT) is an independent risk factor for an increased overall mortality in patients with impaired left ventricular (LV) function, but there is not an established noninvasive tool to detect such patients. The present study aimed to clarify the most useful noninvasive approach for identification of patients with moderately or severely impaired LV function complicated by VT. Sixty-seven patients in New York Heart Association (NYHA) classes I–III with an LV ejection fraction (LVEF) less than 40% and an LV end-diastolic dimension (LVDD) of at least 55 mm on echocardiography were enrolled. Impaired LV function was caused by either ischemic (n=30) or nonischemic dilated cardiomyopathy (n=37). T-wave alternans (TWA), QT dispersion (QTD), and late potentials (LP) on signal-averaged electrocardiography were sequentially determined without using antiarrhythmic drugs. VT was defined as more than 6 consecutive ventricular ectopic beats. The mean NYHA class was 1.9±0.7, mean LVEF was 31±8%, and mean LVDD was 65±10 mm. A history of VT was present in 26 of the patients (39%). Univariate and multivariate logistic analysis showed that TWA and LP were closely related to VT, whereas NYHA ≥III, LVEF <30%, LVDD ≥70 mm, and QTD ≥90 ms were not. The combination of TWA and LP had the most significant value (p=0.0004, odds ratio=8.44) by univariate analysis, and only this combination had significant value in multivariate analysis (p=0.04). Therefore, the combination of TWA and LP could be a useful index for identifying those patients with impaired LV function who are at risk for VT. (*Jpn Circ J* 2001; 65: 649–653)

**Key Words:** Left ventricular ejection fraction; QT dispersion; Signal-averaged electrocardiography; T-wave alternans; Risk stratification

**D**espite recent advances in therapies, which have improved exercise tolerance and survival, patients with impaired left ventricular (LV) function still have a poor long-term prognosis, with annual mortality rates as high as 50%![1,2] Arrhythmias are the probable cause of heart failure and 35–65% of the deaths from heart failure are sudden deaths within 1 h of onset[3] Therefore, arrhythmia is an important factor in the prognosis and various noninvasive tests, such as signal-averaged electrocardiography (ECG), QT dispersion (QTD), the grade of ventricular arrhythmia by Holter ECG monitoring and the LV ejection fraction (LVEF)[4–11] have been used to identify high-risk patients. Recently, microvolt-level T-wave alternans (TWA) was reported to be associated with an increased risk of ventricular arrhythmias![12–18] However, the clinical value of all these noninvasive markers has not established in patients with impaired LV function.

The present study evaluated the usefulness of TWA and aimed to clarify the most useful noninvasive approach for identifying those at risk for ventricular tachyarrhythmia (VT) in patients with moderately or severely impaired LV function.

## Methods

### Patient Population

A total of 67 consecutive patients with impaired LV function who were referred to the Toho University Ohashi Hospital were screened between May 1997 and January 2001. Patients were eligible for the study if they met the following criteria: (1) symptoms (New York Heart Association (NYHA) class I–III); (2) an LVEF <40% and an LV end-diastolic dimension (LVDD) ≥55 mm on echocardiography; and (3) ischemic or nonischemic dilated cardiomyopathy (ICM or NICM, respectively). Patients with evidence of the following conditions were excluded: (1) persistent atrial fibrillation, (2) frequent ventricular or atrial extrasystoles, (3) wide QRS complex including bundle branch block, or (4) exercise intolerance. None of the patients took antiarrhythmic drugs (other than β-blockers) for at least 7 days before or during the noninvasive tests. Patients who had been treated with amiodarone did not participate into this study because of the long period required for washout of its antiarrhythmic efficacy.

The diagnosis was ICM if the patient had complete occlusion or ≥75% stenosis of the major coronary arteries