

# Prediction of Arrhythmias in Primary Prevention ICD Patients: Resting versus Exercise ECG

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**Introduction.** Left ventricular ejection fraction (LVEF) lacks specificity to select patients for primary prevention implantable cardioverter-defibrillator (ICD) therapy. T-wave alternans (TWA), often measured in an exercise ECG (xECG), and depolarization/repolarization variables in the resting ECG (rECG) are promising additional noninvasive risk estimators.

**Methods.** We compared the predictive value of xECGs and the immediately preceding rECG in 58 primary prevention ICD patients. During follow-up (4.2±1.8 years) 29 patients (cases) had, and 29 patients (controls) had no ventricular arrhythmia. The depolarization/repolarization characteristics in the rECGs were determined by the vectorcardiographically-oriented program LEADS (Leiden, NL), while TWA in the xECGs was computed in all leads by using the adaptive-matched-filter method (Ancona, IT). Statistical analysis was done with unpaired t- and chi-square tests and by discriminant analysis.

	Mean±SD Cases (N=29)	Mean±SD Controls (N=29)
QRS (ms)	131±26	104±22
QTc (ms)	449±44	419±41
T <sub>V1</sub> (µV)	238±202	91±155
T <sub>V2</sub> (µV)	432±409	233±294
T <sub>V3</sub> (µV)	393±375	207±286
T <sub>V4</sub> (µV)	311±307	115±281
∫T (mV·ms)	78±42	57±26
∠QRS-T (°)	139±26	114±41
TWA <sub>V1</sub> (µV)	21±15	13±6
TWA <sub>V2</sub> (µV)	25±14	17±10
TWA <sub>V3</sub> (µV)	32±27	20±10
TWA <sub>V4</sub> (µV)	26±16	18±9
TWA <sub>X</sub> (µV)	16±11	11±5
TWA <sub>Y</sub> (µV)	22±9	17±9
TWA <sub>Z</sub> (µV)	20±12	12±5
Only variables shown with P<0.05		

**Results.** Patient characteristics (sex, age, BMI, etiology, NYHA, LVEF, medication) differed not significantly between cases and controls. In the rECG, QRS and QTc duration, T amplitude in V1-V4, T integral and spatial QRS-T angle, and in the xECG TWA in leads V1-V4, X, Y and Z differed significantly (P<0.05) between cases and controls (Table). Discriminant analysis yielded an index of merit of 71% for rECG, with equations:

$$\text{case} = 0.12 * \angle \text{QRS-T} + 0.22 * \text{QRS} - 23.46$$

$$\text{control} = 0.09 * \angle \text{QRS-T} + 0.18 * \text{QRS} - 15.32$$

For xECG this index was 66%, with equations:

$$\text{case} = 0.25 * \text{TWA}_Z - 3.23$$

$$\text{control} = 0.15 * \text{TWA}_Z - 1.56$$

Combined analysis did not improve the results. **Conclusion:** This pilot comparison of the predictive value of rECG and xECG variables suggests that the rECG may contain even more information than the xECG for the prediction of life threatening arrhythmias in heart failure patients who meet the current ICD implantation criteria for primary prevention. Further research is required to corroborate these findings.