# T Wave and QRS Complex Alternans During Standard Diagnostic Stress ECG Test

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Background: T wave and QRS complex alternans (TWA&QRSA) is an electrophysiological phenomenon associated with the change in the shape of the T wave and QRS complex, appearing in alternation on every other beat basis. These changes may be predictors of complex ventricular arrhythmias and sudden cardiac death. The objective of the present work is to study the presence of wave alternans during standard diagnostic stress ECG test. Methods: Principal component analysis, and wave amplitude computation on a combined lead, were used for TWA&QRSA quantification. The method successfully participated in the Physionet/CinC Challenge 2008. Global (entire record) and local intervals (64 RR) were used in combination for the detection of TWA&QRSA. Wave Alternans index was obtained (range from 0 to 4), and 3 classes were defined: negative ($<2$), borderline (2) and positive ($>2$). 44 patients (age of 63 $\pm$ 12 years, 21 male, 8 with a history of myocardial infarction, 2 with a history of ventricular tachycardia) have been considered for this study. Angiographically significant coronary artery disease (AS_CAD) was found in 17 patients. Digital 12-lead electrocardiograms (ECG) were acquired during stress ECG test using veloergometer (GE Marquette Stress PC ECG Application Version 4.312, Medset Medizintechnik GmbH) 2-min stages 25W incremental workload. Results: Stress ECG test was positive (evidence of inducible myocardial ischemia) in 16 patients (36%). Positive TWA was found in 7 patients (6 male, age 62 $\pm$ 10 years) and negative in 10 (3 male, age 67 $\pm$ 13 years). Positive QRSA was found in 4 patients (3 male, age 63 $\pm$ 3 years) and negative in 23 (11 male, age 66 $\pm$ 11 years). Patients with positive stress ECG test had significantly higher TWA&QRSA compared to patients with negative stress test (2.4 $\pm$ 0.6 and 1.7 $\pm$ 0.6, $p < 0.001$ for TWA and 1.8 $\pm$ 0.8 and 1.2 $\pm$ 0.9, $p = 0.03$ for QRSA). Patients with AS_CAD ( 50% stenosis of at least 1 epicardial coronary artery) had significantly higher TWA values compared to patients without such disease (2.22 and 1.77, $p = 0.037$); Conclusions: Both TWA&QRSA indices show statistical significant difference in patients with positive/negative stress ECG test, and TWA index in patients with/without AS_CAD.