Influence of diabetes mellitus on T wave and QRS complex alternans during stress ECG testing

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Background: Microvolt 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.

Aim: To evaluate the influence of diabetes mellitus (DM) on wave alternans during stress ECG testing.

Methods: Principal component analysis, combined with 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 (128 RR intervals), were used in combination for detection of TWA&QRSA. Seventy patients (age of 64 ± 11 years, 44% male) were included in the study. DM was present in 39% of them. Fifty percent of patients had angiographically significant coronary artery disease (AS_CAD).

Results: The 2 groups of patients (with and without DM) were entirely comparable with each other regarding demographic characteristics, risk factor distribution, prevalence of AS_CAD and stress ECG test result (induction of myocardial ischemia at the achieved workload). Nevertheless patients with DM had significantly greater QRSA during stress test compared to patients without DM (1.6 ± 1 and 1.1 ± 0.8, respectively, $p = 0.026$); TWA values did not differ significantly between these groups. As we have previously found, patients with positive stress ECG tests had significantly higher TWA&QRSA compared to those with negative stress tests (2.3 ± 0.5 and 1.5 ± 0.6, $p < 0.001$ for TWA and 1.8 ± 0.9 and 1.1 ± 0.8, $p = 0.001$ for QRSA) and that result was independent of the presence or absence of DM. In the subgroup of patients with negative stress ECG test, diabetics had significantly higher values for TWA (1.7 ± 0.5 and 1.1 ± 0.5, $p = 0.001$). With positive stress test this difference was no longer present and there appeared a significant difference between diabetics and non-diabetics in QRSA, but only in those patients with AS_CAD (2.2 ± 0.9 and 1.5 ± 0.7, $p = 0.04$).

Conclusions: DM had an influence on wave alternans during stress ECG testing. In general patients with DM had higher TWA&QRSA values (predominantly QRSA) compared to those without DM. With negative stress ECG test diabetics demonstrated higher TWA values, while in the presence of positive stress ECG test and AS_CAD patients with DM had significantly higher QRSA values, as compared to non-diabetics.