

Initial Reference Values of Electrocardiographic Alternans by Enhanced Adaptive Matched Filter

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Electrocardiographic alternans (ECGA), indicating an ABAB fluctuation of the electrocardiogram (ECG), may manifest as P-wave alternans (PWA), QRS-complex alternans (QRSa) and T-wave alternans (TWA). ECGA acts as cardiovascular risk index of arrhythmia predisposition. ECGA measurements may depend on the automatic method used to identify it, and identification of a risk condition requires availability of normal ranges. Normal reference values for the recently proposed enhanced adaptive matched filter (EAMF) method are not available yet. Thus, the present study aims to provide an initial reference ECGA values by analyzing ECGA in a healthy population.

The EAMF was used to characterize ECGA (in terms of: amplitude, μV ; area, $\mu\text{V}\times\text{ms}$; and duration, number of beats) in 15-lead, 64-beat ECGs from 52 healthy subjects (39/13 male/female), all belonging to the PTB Diagnostic ECG Database from PhysioNet.

Median ECGA values over leads and subjects were: $2 \mu\text{V}$, $200 \mu\text{V}\times\text{ms}$, and 17 beats for PWA; $1 \mu\text{V}$, $80 \mu\text{V}\times\text{ms}$, and 8 beats for QRSa; and $7 \mu\text{V}$, $1300 \mu\text{V}\times\text{ms}$, and 49 beats for TWA.

ECGA in females (PWA: $4 \mu\text{V}$, $350 \mu\text{V}\times\text{ms}$, and 22 beats; QRSa: $1 \mu\text{V}$, $80 \mu\text{V}\times\text{ms}$, and 11 beats; TWA: $10 \mu\text{V}$, $2000 \mu\text{V}\times\text{ms}$, and 49 beats) was higher (* $P<0.05$) than ECGA in males (PWA: $2 \mu\text{V}$ *, $200 \mu\text{V}\times\text{ms}$ *, and 16 beats*; QRSa: $1 \mu\text{V}$, $80 \mu\text{V}\times\text{ms}$, and 7 beats; TWA: $6 \mu\text{V}$, $1150 \mu\text{V}\times\text{ms}$, and 48 beats).

Eventually, ECGA was lead-dependent. Maximum values of amplitude, area and duration were observed in the fundamental leads (PWA: $4 \mu\text{V}$, $400 \mu\text{V}\times\text{ms}$, and 28 beats; QRSa: $2 \mu\text{V}$, $160 \mu\text{V}\times\text{ms}$, and 12 beats; TWA: $10 \mu\text{V}$, $2000 \mu\text{V}\times\text{ms}$, and 48 beats).

Although the observed initial reference ECGA values found here appears reliable since statistically lower than corresponding ECGA values previously observed in pathological subjects, analysis of wider datasets are needed to confirm them.