

# T-wave Alternans in Partial Epileptic Patients

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Epilepsy is a chronic neurological disorder, hallmark of which is unpredictable seizures. The leading cause of death in people with uncontrolled seizures is the sudden unexpected death for epilepsy (SUDEP), which is believed to share genes with sudden cardiac death (SCD). T-wave alternans (TWA), consisting in an abnormal alternation of the electrocardiographic (ECG) T-wave amplitude and/or morphology, is an index of SCD. Still, very few studies have investigated the occurrence of TWA in epileptic patients. Aim of the present work was to evaluate TWA occurrence in proximity of epileptic seizures. To this aim, seven 1-to-4 hour ECG recordings from five partial epileptic patients constituting the “Post-Ictal Heart Rate Oscillations in Partial Epilepsy Database” by Physionet were analyzed for automatic TWA identification by the heart-rate adaptive match filter (HRAMF). Onsets and offsets of epileptic seizures occurring during ECG recordings were annotated. ECG windows starting 10 min before seizures and ending 10 min after seizures were extracted and further processed to characterize trends of heart rate (HR), mean TWA (meanTWA) and maximum TWA (maxTWA) in seizure proximity. Specifically, HR, meanTWA and maxTWA occurring 10-to-9 min before seizure onsets, during seizures, and 9-to-10 min after seizure offset, were quantified and compared. Overall, TWA was analyzed in proximity of 9 epileptic seizures (seizure duration:  $1.3 \pm 0.5$  min). Results are reported in the Table. HR and TWA measures were higher during seizures than before or after, but only HR reached statistical significance. In all cases, TWA levels remained significantly ( $P < 0.05$ ) higher than what previously observed in healthy subjects, in both seizure and non-seizure conditions. In conclusion, in proximity of epileptic seizures, our partial epileptic patients show increased levels of TWA and thus are at increased risk of SCD, possibly associated with SUDEP.

HR and TWA in epileptic patients.

Feature	Before seizure	During seizure	After seizure
HR (bpm)	70[64;72]	96[81;115]*.§	70[67;75]
meanTWA ( $\mu$ V)	31[25;62]	46[25;59]	30[26;63]
maxTWA ( $\mu$ V)	54[45;84]	105 [64;120]	66[40;96]

\*.§P<0.05 comparison during seizure against before and after, respectively. (50<sup>th</sup> [25<sup>th</sup>;75<sup>th</sup>] percentiles)