

Effect of Diurnal Rhythm on RR Interval Correlations of Long QT Syndrome Patients

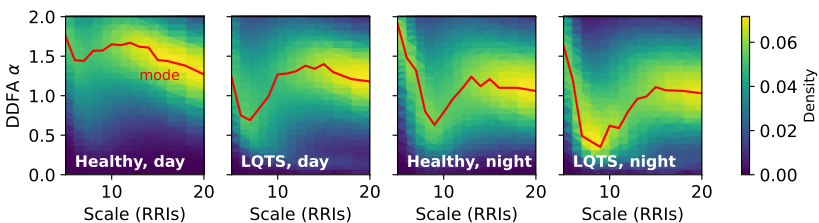
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Aims: We studied the effect of diurnal rhythm in RR interval (RRI) correlations of long QT syndrome (LQTS) patients. In particular, we analyzed how the previously observed reduction in RRI correlations of LQTS patients varied between the day and the night. As RRIs can be easily measured compared to QT intervals with, e.g., wearable devices, it is worthwhile to explore the potential of RRI analysis to evaluate the risk of LQTS.

Methods: We used 24-hour Holter recordings from *Telemetric and Holter ECG Warehouse* with 130 healthy controls and 114 genetically confirmed LQTS patients (LQT1 = 66, LQT2 = 33, others = 15). The data was split into daytime (hours 15–19) and night-time (00–04). We assessed the RRI correlations with dynamical detrended fluctuation analysis (DDFA) by time- and scale-dependent scaling exponents $\alpha(t, s)$. Beta blocker (BB) treatment was controlled for.

Results: We observed reduced diurnal variability in the RRI correlations of LQTS patients, resulting in greater divergence from healthy controls during the day. The most prominent differences were at the scale of 6 RRIs (Welch's t -test p -value $< 10^{-16}$, ROC-AUC score 0.80), which was shifted to 7 RRIs at night with diminished distinguishability ($p < 10^{-7}$, ROC-AUC 0.69). The effect was increased in the BB-treated subgroup (ROC-AUC up to 0.85), but the results persisted in the absence of BBs (ROC-AUC up to 0.78). No statistically significant differences ($p > 0.1$) were found between different LQTS genotypes. In conclusion, the overall reduction in both the RRI correlations and their diurnal variability could potentially be exploited in QT-free risk assessment of LQTS.



Mean densities of DDFA-2 scaling exponents and their modes as a function of the scale during the day and the night for healthy controls and LQTS patients.