High frequency power of heart rate variability as a prognostic tool for seizure control in patients with epilepsy

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Background and Objective: Impairment of cardiovascular regulation from the autonomic nervous system has been reported in human and animal models of epilepsy. This dysregulation has been positively correlated with long-term morbidity and mortality in epileptic patients. The risk of sudden unexpected death in epileptic patients (SUDEP) is about 40 times higher than healthy people. Previous studies of heart rate variability (HRV) have implied that the risk of SUDEP probably comes from a higher inter-ictal sympathetic activity coupled with an ictal surge in sympathetic activity. Most studies of HRV in epilepsy patients are limited to temporal lobe epilepsy. We performed this longitudinal study in patients with extra-temporal epilepsy to investigate their sympathetic and parasympathetic regulations.

Methods: Twelve patients who were diagnosed as suffering from extra-temporal epilepsy by EEG were enrolled and followed up for more than 12 months. At the end of follow-up, 6 subjects each were placed in the non-refractory and refractory groups based on their seizure diary. Lead I ECG of 5 minutes duration were carried out at enrollment (pre-treatment) and at end of follow-up (post-treatment). These were taken during daytime in wakeful restful inter-ictal state, with the patient lying head up at 30-45 degree. Frequency-domain analysis of HRV was performed using a nonparametric method of fast Fourier transformation. Each power spectrum was subsequently converted to standard frequency-domain measures, including R-R interval (RR), high frequency power (HF; 0.15-0.45 Hz), low frequency power (LF; 0.04-0.15 Hz), and LF/(HF+LF) expressed in normalized units (LF%). The HF component is thought to represent vagal (parasympathetic) regulation of heart, and the fraction LF% to reflect sympathetic regulation. None of the patients had arrhythmia or diabetic neuropathy, and none were using carbamazepine or other agents known to affect autonomic function, such as vasopressors and vagolytic medicines. Values are expressed as means $\pm$ SD. Data between pre- and post-treatment were compared with paired *t*-test and between two groups using Student's *t*-test. Differences were considered statistically significant at $p<0.05$.

Results: In the non-refractory group, there were significant increases in RR and HF that accompanied a significant decrease in LF% when the pre-treatment and post-treatment data were compared. There was a significant decrease in HF found between pre- and post-treatment in the refractory group. A comparison of the two groups showed significantly higher RR, LF and HF at the time of post-treatment for the non-refractory group.

Discussion and Conclusion: With seizure control, increasing parasympathetic and decreasing sympathetic regulations were demonstrated in patients with extra-temporal epilepsy. On the other hand, reduction of parasympathetic regulation was noted between pre- and post-treatment in patients with refractory epilepsy. Thus, when assessing seizure control among patients with extra-temporal epilepsy, HF, as indicator of parasympathetic regulation, is probably a better prognostic tool than LF%, indicator of sympathetic regulation.

References

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