

Effects of Vagus Nerve Stimulation on Heart Rate Variability in Children with Epilepsy

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Objectives: Vagus nerve stimulation (VNS) is a non-pharmacologic antiepileptic therapy for patients with refractory epilepsy who are not candidates for resective surgery or who have had resective surgery with unsatisfactory results. Although some studies have shown that VNS treatment is safe, well tolerated and effective in seizure reduction, there are only a few reports concerning effects of VNS on cardiac autonomy. The aim of this study was to investigate the effects of VNS on heart rate variability (HRV) in patients with refractory epilepsy.

Methods: Twenty patients (mean age 11.7 ± 4.2 years) with refractory epilepsy were evaluated in terms of interictal heart rate variability with 24-hour ECG recordings before, after 6 and 12 months of VNS treatment for each patient. We analyzed heart rate, pulse interval, frequency-dependent parameters including total power, low-frequency (LF), high-frequency (HF), LF/HF ratio, time-dependent parameters including SDNN, SDNN index, SDANN, RMMSD, PNN50 and triangular index. HRV at both daytime and night were separately investigated for diurnal rhythm. The results were compared to age and gender matched healthy controls.

Results: The minimum and mean HR were increased, pulse interval was narrowed in patients before treatment compared to control group ($p < 0.05$). HRV was depressed in patients before treatment in all frequency and time-dependent parameters compared to control group ($p < 0.05$) (Table 1). It was observed that, cardiac autonomic system is under the effect of sympathetic system especially at daytime, when increased LF/HF ratio was taken in to account, in patients before treatment ($p < 0.05$). However, these differences between pre and post VNS implantation were seen especially at 6 months of treatment ($p < 0.05$) and there were no significant additional changes at 12 months of treatment. Even so, these parameters were still significantly different at 12 months of treatment than control group ($p < 0.05$). There was also significant seizure reduction (almost 50%) after VNS treatment ($p < 0.05$).

Conclusions:

A significant improvement was observed in all HRV parameters after VNS therapy. Interestingly, maximum improvement was seen at 6 months of treatment and then no further improvement was observed. It can be explained by tolerability or adaptation of the autonomic system to the treatment.