

Images in Sleep Medicine

# EEG and vagal tone degradation during nocturnal sleep in abstinent alcohol dependence

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## 1. Introduction

Sleep is involved in the homeostatic regulation of the autonomic nervous system. Spectral analyzed heart rate variability measures have been used to characterize autonomic activity: the high-frequency component (HF; 0.15–0.4 Hz) is mediated by parasympathetic activity, the low-frequency component (LF: 0.04–0.15 Hz) is mediated by a combination of sympathetic and parasympathetic activity, and the LF/HF ratio refers to the degree of sympathovagal balance. As compared to wakefulness, non-rapid eye movement (NREM) sleep is associated with an increase of HF along with decreases in sympathetic output as measured by LF/HF ratio. Among persons with disordered sleep, such as persons with alcohol dependence, the nocturnal period is characterized by a higher LF/HF ratio and decreases of HF power, indicating sympathetic hyperactivity and/or vagal withdrawal as compared to controls. In this report, we display images of autonomic activity as measured by heart rate variability in an abstinent alcohol-dependent volunteer and control subject matched on the basis of age, gender, body mass index, and physical activity. Autonomic activity across nocturnal sleep was characterized along with visually scored sleep and spectral analyzed electroencephalogram (EEG) delta power.

## 2. Image analysis

See Figs. 1 and 2.

## 3. Discussion

1. Alcohol dependence is associated with an attenuation of delta sleep as measured by visually scored sleep and spectral analysis of EEG [1].
2. Along with decreases of delta sleep and delta power, alcohol dependence is associated with nocturnal increases in sympathovagal balance (i.e., ratio LF/HF) and decreases of vagal tone (i.e., HF power). Even with an increase in delta power, vagal tone remains low in alcohol dependence.
3. Sleep plays an important role in the regulation of sympathetic and parasympathetic activity, and loss of delta sleep is associated with nocturnal increases of sympathetic activity and/or withdrawal of vagal tone [2].

## References

- [1] Irwin M, Miller C, Gillin JC, Demodena A, Ehlers CL. Polysomnographic and spectral sleep EEG in primary alcoholics: an interaction between alcohol dependence and African-American ethnicity. *Alcohol Clin Exp Res* 2000;24(9):1376–84.
- [2] Irwin MR, Valladares EM, Motivala S, Thayer JF, Ehlers CL. Association between nocturnal vagal tone and sleep depth, sleep quality, and fatigue in alcohol dependence. *Psychosom Med* 2006;68(1):159–66.

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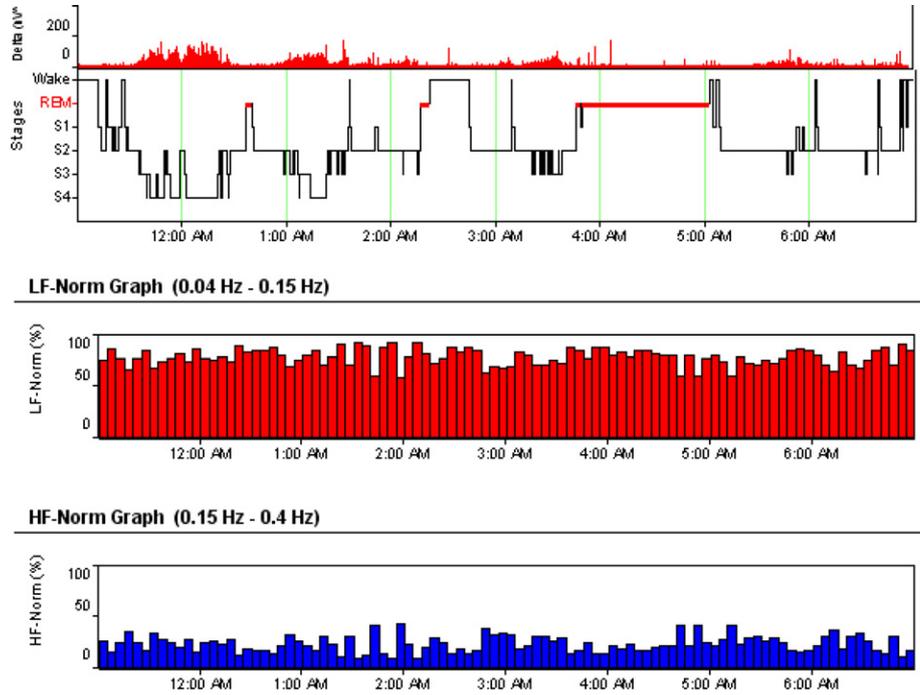


Fig. 1. EEG delta power, hypnogram, and autonomic characterization across nocturnal sleep for healthy alcohol-dependent male (25-year-old Caucasian). Autonomic characterization is composed of 5-min epochs from 2300 to 0700 h using the Somnologica software package (Medcare, Flaga, Iceland).

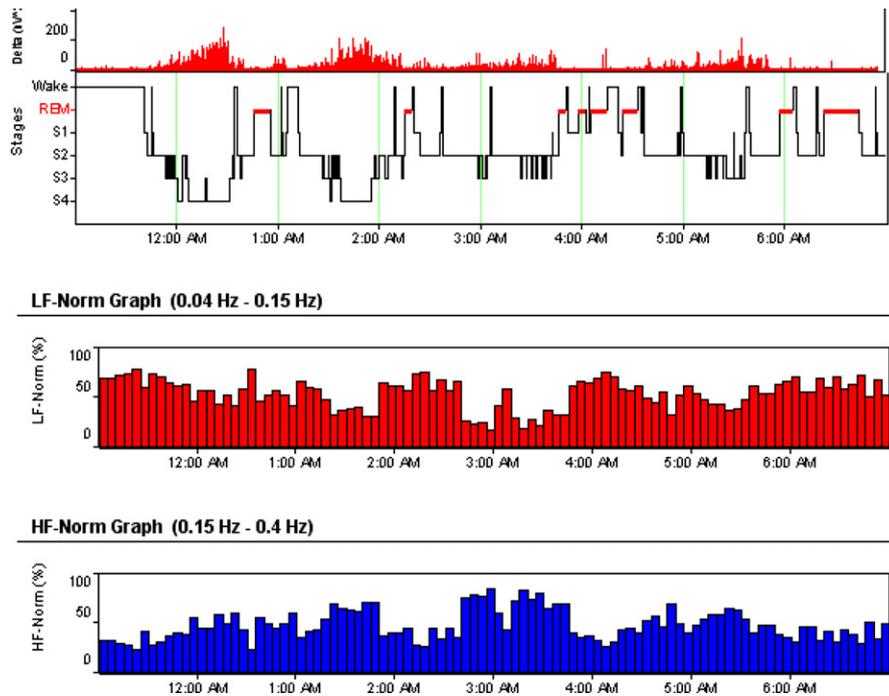


Fig. 2. EEG delta power, hypnogram, and autonomic characterization across nocturnal sleep for healthy male control (26-year-old Caucasian). Autonomic characterization is composed of 5-min epochs from 2300 to 0700 h using the Somnologica software package (Medcare, Flaga, Iceland).