

Cardiac Variability and Heart-Rate Increment as a Marker of Sleep Fragmentation in Patients With a Sleep Disorder: a Preliminary Study

Emilia Sforza, MD, PhD(1); Vincent Pichot, PhD(2); Katerina Cervena MD(1); Jean Claude Barthélémy, MD, PhD(2); Frederic Roche, MD(2)

(1): Sleep laboratory, Department of Psychiatry, University Hospital, Geneva, Switzerland

(2): Service d'Exploration Fonctionnelle Cardiorespiratoire, University Hospital, Saint-Etienne, France.

Study Objectives

The ratio between the heart-rate increment to total power spectral density (%VLFI) has been introduced as a sensitive measure of sleep-related breathing disorders (SRBD). Since a complex interaction is present between sleep disorders and occurrence of arousals, we hypothesized that %VLFI and other indexes of heart-rate variability (HRV) measures reflect the degree of sleep fragmentation.

Methods

The high- and low-frequency peaks from spectral analysis (FFT) of R-R intervals, the HRV changes using wavelet transform (WT), the geometric and time domain HRV, and the %VLFI were measured in 336 sleep studies performed in patients with insomnia, SRBD and restless legs syndrome/ periodic limb movement disorder (RLS/PLMD). The ability of HRV measures to assess sleep fragmentation was examined by correlation analysis and from the area under the receiver operating characteristic (ROC) curve.

Results

The ratio of low frequency to high frequency (LF/HF ratio) at the FFT and WT and the %VLFI were higher in patients with SRBD and RLS/PLMD, compared with patients with insomnia. These measures were related to the arousal (MA) index as well as to the apnea-hypopnea index, oxygen desaturations, and periodic leg movement index ($p < .001$). The presence of a sleep fragmentation defined as an MA index > 20 was well detected by the %VLFI (ROC area: 0.66 ± 0.03) and the LF/HF ratio at WT (ROC area: 0.66 ± 0.03).

Conclusion

The %VLFI and LF/HF ratio provide indirect measures of sleep fragmentation, suggesting that HRV measures during sleep assess more the associated sleep fragmentation than the presence of a specific sleep disorder.