

Letter to the Editor

Heart rate variability during nap sleep

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Dear Sir,

Drs Schmid et al¹ reported the association between obesity and heart rate variability in young men. Their study was conducted during daytime (8 am–1 pm), and the information relating to sympathoinhibition during sleep is also important for exploring the physiological mechanism of change, although experimental situations during overnight sleep become complicated. As a preliminary baseline study, by substituting nap sleep for all-night sleep, information on the physiological state of heart rate variability during nap would contribute to understanding sympathoinhibitory status during sleep.

Twenty-two healthy male students underwent 3 hours of polygraphic study during daytime nap. Their mean age and standard deviation were 22.6 and 1.6 years, respectively, and their body mass index was categorised into normal range. An electroencephalogram telemetry system (Polymate AP1000, TEAC, Tokyo) was used to judge the sleep stage according to the standard method,² assisted by the automatic sleep stage scoring system (Night Owl Professional, NoruPro Light Systems Inc., Tokyo). Sleep stages were categorised into three groups: stage 2, deep sleep (stages 3 and 4), and rapid eye movement sleep. Electrocardiogram was monitored with electrodes at the lateral clavicle areas. Heart rate interval was detected and instantaneous heart rate value was calculated (Night Owl Professional bio-signal detection, NoruPro Light Systems Inc., Tokyo). The Friedman test and Wilcoxon's signed-rank test were used for statistical analysis by SPSS 16.0J for windows.

The mean value and standard deviation of coefficient of variation of instantaneous heart rate in stage 2, deep sleep, and rapid eye movement sleep were 2.5, with a standard deviation of 0.64; 1.9, with a standard deviation of 0.47; and 3.1, with a standard deviation of 0.69, respectively. There was a significant difference in the mean value of coefficient of variation of instantaneous heart rate among rapid eye movement

sleep, stage 2 and deep sleep ($p < 0.01$). Rapid eye movement sleep was significantly higher than those in stage 2 and deep sleep ($p < 0.01$), and there were also significant differences in the coefficient of variation of instantaneous heart rate between stage 2 and deep sleep ($p < 0.01$).

Heart rate is suppressed during sleep. In general, heart rate drops from wakefulness to light sleep, and it becomes lower in deep sleep. In turn, heart rate increases in rapid eye movement sleep with relatively higher variability.³ Furthermore, heart rate during sleep differs in respiratory condition,⁴ and heart rate during the same sleep stage is sometimes affected by sleep cycle.⁵ Several indicators on heart rate variability using heart rate interval have been derived initially from time domain measurement and then mainly derived from frequency domain measurement using spectral analysis.⁶ Although indicators on heart rate variability by time domain measurement were derived by calculating variance of heart rate interval as a standard method, the author used instantaneous heart rate, which is calculated by $60/\text{heart rate interval}$, as a basic data for heart rate variability. Information on heart rate variability during sleep is limited,⁷ and the author presented coefficient of variation of instantaneous heart rate to elucidate heart rate variability for each stage during nap sleep.

In our study, heart rate variability during nap sleep was largest in rapid eye movement sleep, and it was smallest in deep sleep of young students in this study. Ventilation during sleep was most suppressed during rapid eye movement sleep in normal subjects,⁸ which is partly explained by the suppression of muscle movement of the thorax. Increase of heart rate variability in rapid eye movement sleep during nap sleep, which reflects sympathetic nerve activity, might not be explained by normal respiratory function. The author speculates that the degree of obesity would modify the effect of respiratory function on heart rate variability during sleep. Nevertheless, studies concerning sympathoinhibition during sleep should also be checked precisely for preventive cardiology in the young.

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