Self-dissimilarity of respiratory effort across sleep states and time

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0095
SELF-DISSIMILARITY OF RESPIRATORY EFFORT ACROSS SLEEP STATES AND TIME
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Introduction: Respiratory activity strongly associates with sleep states. For instance, respiration is more regular during deep sleep compared with wakefulness. When awake, the respiratory regularity and the measurement of respiratory effort would be influenced by motion artifacts or other external factors. We therefore tested the hypothesis that the self-dissimilarity of respiratory signal morphology within a subject differs between sleep states, which would in turn help separate them. Moreover, the self-dissimilarity between two periods of respiratory signals might be in accordance with their time difference, which was investigated for each state.

Methods: Continuous overnight respiratory effort signals (acquired with respiratory inductance plethysmography) of 48 healthy adults (age 41.3 ± 16.1 years) were analyzed. Sleep states were scored on 30-s epochs using polysomnography according to R&K rules. For each state, we computed the self-dissimilarity Ds between every two epochs of respiratory effort per subject. Ds was measured by a uniform-scaling distance between the subseries with same number of consecutive breaths (normalized to have zero mean and unit variance) of the corresponding two epochs. A larger Ds value (Ds ≥ 0) indicates a higher self-dissimilarity.

Results: The self-dissimilarity Ds was significantly different (Mann-Whitney test, p < 0.001) between wake (1.0 ± 0.29), REM sleep (0.95 ± 0.27), light sleep (0.83 ± 0.30) and deep sleep (0.70 ± 0.31) regarding respiratory effort. We also found that the longer time between two epochs the higher Ds between them.

Conclusion: Sleep states can be differentiated using respiratory self-dissimilarity expressing the signal morphology which is usually evoked by the autonomic activity, the alternation of ventilation control or other external factors such as will or body movements. The lower self-dissimilarity score in short term implies the inclusion of nonrandom components of respiration which might be explained by less influence of body movements, presence of consciousness or memory of breathing control.

0096
ROLE OF OREXIN IN RESPIRATORY AND SLEEP HOMEOSTASIS DURING UPPER AIRWAY OBSTRUCTION IN RATS
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Introduction: Chronic upper airway obstruction (UAO) elicits a cascade of complex endocrine derangements that affect growth, sleep, and energy metabolism. We hypothesized that elevated hypothalamic orexin has a role in maintaining ventilation during UAO, while at the same time altering sleep-wake activity and energy metabolism. Here, we sought to explore the UAO-induced changes in hypothalamic orexin and their role in sleep-wake balance, respiratory activity and energy metabolism.

Methods: The tracheae of 22-day-old Sprague-Dawley rats were surgically narrowed; UAO and sham-operated control animals were monitored for 7 weeks. We measured food intake, body weight, temperature, locomotion, and sleep/wake activity; magnetic resonance imaging was used to quantify subcutaneous and visceral fat tissue volumes. In week 7 the rats were sacrificed and levels of hypothalamic orexin, serum leptin, and corticosterone were determined. The effect of dual orexin receptor antagonist (almorexant 300 mg/kg) on sleep and respiration was also explored.

Results: UAO increased hypothalamic orexin mRNA and protein content by 64% and 65%, respectively. UAO led to 30% chronic sleep loss, excessive active phase sleepiness, decreased body temperature, increased food intake, reduction of the abdominal and subcutaneous fat tissue volume, and growth retardation. Administration of almorexant normalized sleep but induced severe breathing difficulties in UAO rats while it had no effect on sleep or on breathing of control animals.

Conclusion: In UAO animals, enhanced orexin secretion, while crucially important for respiratory homeostasis maintenance, is also responsible for chronic partial sleep loss, as well as considerable impairment of energy metabolism and growth.

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0097
INFLUENCE OF CHRONIC EXPOSURE TO RADIOFREQUENCY ELECTROMAGNETIC FIELD OF LOW INTENSITY ON SLEEP
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Introduction: Several studies showed that people living near a base station antenna reported sleep disturbances and discomfort but this remains questionable. These symptoms could be due to a possible effect of radiofrequency electromagnetic field (RF-EMF) on thermoregulatory processes since previous study has shown that chronic exposure to RF-EMF of low intensity induces a fall of skin temperature of the rat’s tail without any change of central temperature. The present study was thus undertaken to assess the changes in the thermal preference and in sleep stage distribution in young male Wistar rats.

Methods: 18 animals were divided into an exposed group to RF-EMF during 5 weeks and a control non exposed group. The thermal preference was assessed with an experimental chamber made of 3 interconnected compartments in which air temperature (Ta) was randomly set at 24, 28 and 31°C. Sleep was recorded by a telemetric system and the temperature of the surface of the tail by infrared thermography.

Results: Results pointed out that compared to the animals of the control group exposure to RF-EMF induced an increase of peripheral vascular tone. The animals of the exposed group prefer to sleep at Ta = 31°C whereas the controls prefer 28°C. In this condition, the sleep duration increased significantly (+23.3%) as a result of increases of Slow Wave Sleep (SWS: +18.9%) and of micro wakefulness (microW: +3.2%) as well as SWS and microW frequencies (+6.0 and +5.1 episodes h⁻¹, respectively). The duration and frequency of paradoxical sleep remained unchanged.

Conclusion: It is concluded that change in sleep state distribution can be determined by skin temperature inputs. The modulation of SWS more in terms of episode frequency that duration can be considered as a protective adaptation against RF-EMF exposure that preserves the maintenance of this sleep stage but also occurrence of PS episodes.

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