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0300

EARLY LIFE SLEEP FRAGMENTATION IMPAIRS HIPPOCAMPAL-DEPENDENT LEARNING AND SLEEP-DEPENDENCY IN HIPPOCAMPAL CALCIUM TRANSIENTS

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Introduction: Sleep deprivation impairs hippocampal-dependent memory, and hippocampal-dependent memory impairments occur in some dementias, including Alzheimer's disease. As our population continues to age, understanding the molecular basis for memory impairments is increasingly important. We hypothesized that early life sleep fragmentation would result in lasting increases in hippocampal calcium transient activity.
Methods: B6 mice were randomized to 12wk of sleep fragmentation or rested control conditions at age 8wk. Mice were microinjected with AAV9-CamKII-GCamp6F into the hippocampus and later implanted with a GRIN Lens into CA1 secured to a baseplate along with chronic EEG/EMG electrodes and recording connector. Calcium recordings were obtained two to three months after injection and recordings were obtained across sleep-wake cycles>4mins of wake and NREM sleep. Individual cells across animal were combined into sleep fragmented (n = 521 cells) or rested (n = 443 cells) groups during wake or sleep. Average FFx was analyzed by group and condition by T-tests, paired for within and unpaired across groups. A spatial object recognition assay was also performed on all mice (n=16 for both groups) and performance across group was analyzed by paired T-tests.
Results: Rested mice showed normal spatial object recognition (n = 16, $p<0.05$). In contrast, SF mice showed impaired spatial object recognition (n = 16, N.S.). There were no differences across sleep conditions in calcium transient FFx for waking ($p>0.05$). However, in sleep, cells in SF mice had significantly higher average FFx values than cells in rested mice ($p<0.0001$).
Conclusion: Early-life sleep fragmentation has long-lasting impacts on memory. Since spatial memory is dependent on hippocampal function, the calcium transient FFx data suggests that a driver of this hippocampal memory impairment may be higher firing rates in sleep and/or greater calcium exposure in hippocampal CamKII neurons in sleep, both of which may perturb microglial maintenance of synapses. Understanding the molecular drivers behind this calcium dysfunction will be essential in our understanding of neurodegeneration, dementia, and Alzheimer's disease.
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0301

DOES OREXIN INFLUENCE SLEEP FRAGMENTED BRAIN INFLAMMATION? A PILOT STUDY

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Introduction: Fragmented sleep occurs when there are repetitive, short interruptions of sleep, resulting in less than six hours of sleep per day. Overall, however, in the United States, sleep fragmentation is reported by 30% of employed adults. Sleep fragmentation may be a risk factor for Alzheimer's disease, and orexin reduction appears effective in reducing amyloid plaque formation in mice with transgenic Alzheimer's disease. Orexin is a neuropeptide that regulates arousal, wakefulness, and appetite. Thus we hypothesized that loss of orexin might also be protective against sleep disruption injury in non-Alzheimer's mice. This study aims to combine sleep fragmentation with orexin loss to see if brain health is severely reduced.
Methods: The 24 mice in this study were split into four groups: B6 rested, B6 sleep fragmented, orexin knockout rested, orexin knockout sleep fragmented. The sleep fragmented mice were placed on a shaker table for 10½ weeks to initiate chronic sleep loss. The mice were all perfused within five to eight months of birth, and then the brains were cryopreserved and sliced. These sections were immunolabeled with different protein antibodies using immunohistochemistry techniques. The stained brains were either analyzed through microscope stereology counts or computer image analysis.
Results: Two-way ANOVA analysis for tyrosine hydroxylase, ionized calcium binding adaptor, and vesicular acetylcholine transporter had $p<0.05$ for the sleep fragmentation variable, showing differences in these antibodies for rested and sleep loss mice. ANOVA for cluster of differentiation 68, cofilin, postsynaptic density protein, and RanBP had $p<0.05$ for the genotype variable, showing differences in these antibodies for knockout and normal orexin mice. ANOVA for glial fibrillary acidic protein and amyloid-beta had $p<0.05$ for both variables, showing differences for sleep and orexin levels. There was no ANOVA significance for synapsin.
Conclusion: Our results show that knocking out orexinergic neurons causes hippocampal tissue damage, dampens the functioning of synapses, and diminishes the ability of the brain to adapt through plasticity and memory. Sleep fragmentation, however, increases phagocytic activity, and harms the acetylcholine and norepinepherine neurotransmitter pathways. When combined, cell communication worsens and the blood brain barrier loses function, resemblant of neurodegenerative diseases.
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0302

RECOVERY SLEEP IN UNIVERSITY STUDENTS

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Introduction: Poor sleep hygiene is common in American college students, with the majority reporting insufficient sleep. Previous studies suggest that many students extend sleep during the weekend to recover sleep debt accrued during the week. In the current study we objectively measured sleep to determine if weekend catch-up sleep was practiced. We also provided students with a 9h sleep opportunity in order to observe how an extended sleep period affected sleep architecture.
Methods: Students (N=36, 20 women, 19.9±1.7 years) participated in the study from September 2019-March 2020. Sleep-wake behavior was assessed for two weeks using wrist actigraphy and a twice-daily diary. During this two-week period, participants wore at-home polysomnography (PSG) on two non-consecutive nights. For these two nights, in counterbalanced order, participants were instructed to follow their typical sleep pattern or to extend their sleep opportunity to 9h. Within-subjects ANOVA were used to compare sleep between week (Sunday-Thursday) and weekend (Friday and Saturday) nights as well as between typical and 9h PSG nights.