The Effects of Traumatic Brian Injury on Sleep in Mouse Models of Alzheimer's Disease

PRESENTER:

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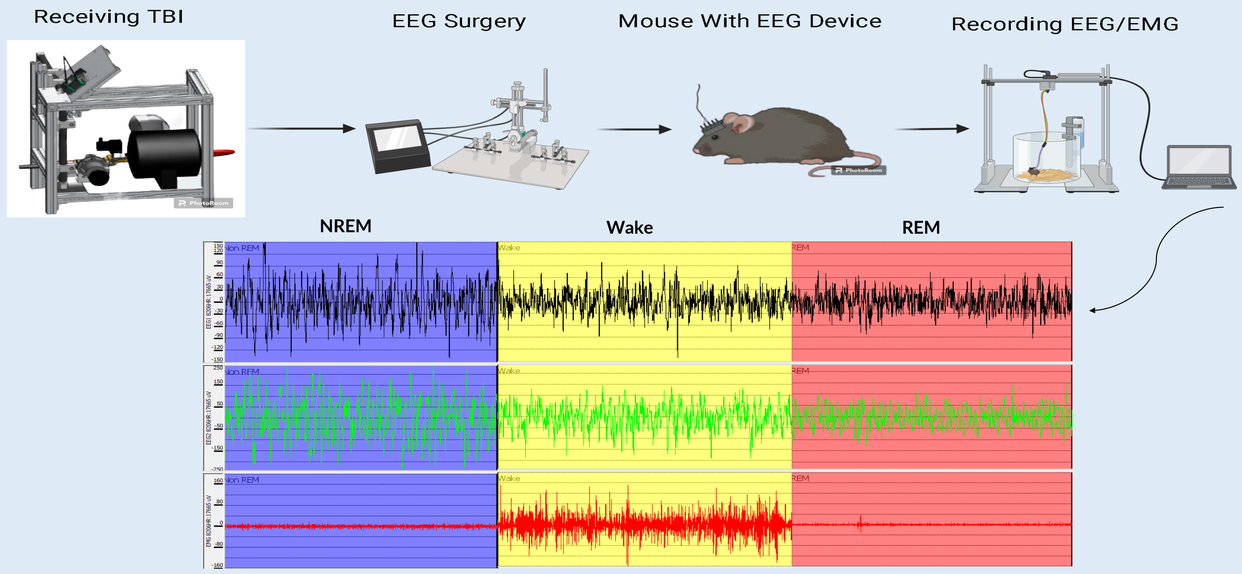
Background

Many patients with mild TBI develop sleep-wake disturbances as well as neurodegenerative diseases after their injury. Research shows that chronic sleep disruption may contribute to the development of neurodegenerative diseases such as Alzheimer's disease. This study investigates changes in sleep pattern after TBI. The findings of this research can be useful for clinical purposes, prediction and prevention of neurodegenerative diseases.

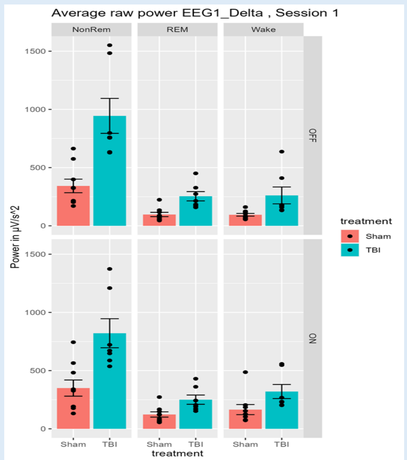
Methods

1. Male and Female APP^{NL-F} transgenic mice (n=18) received three mild TBIs 48 hours apart at 12 months of age.
2. CHIMERA was used to replicate the impact of TBI.
3. After three months the brain electrical activity was recorded using an EEG device with cortical electrodes.
4. The sleep-wake cycle was divided into three stages: rapid eye movement (REM), non-rapid eye movement (NREM), and wake based on the EEG activity and muscle activity (EMG).

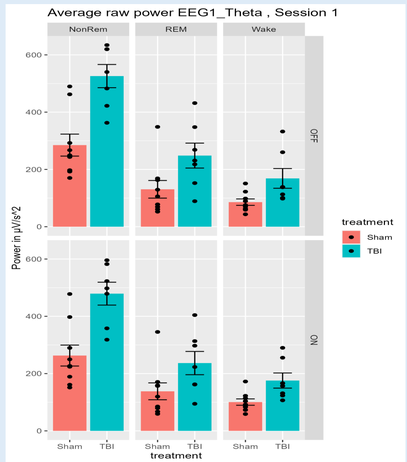
Methods



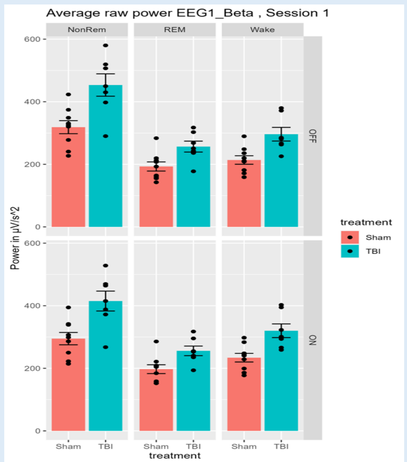
Results



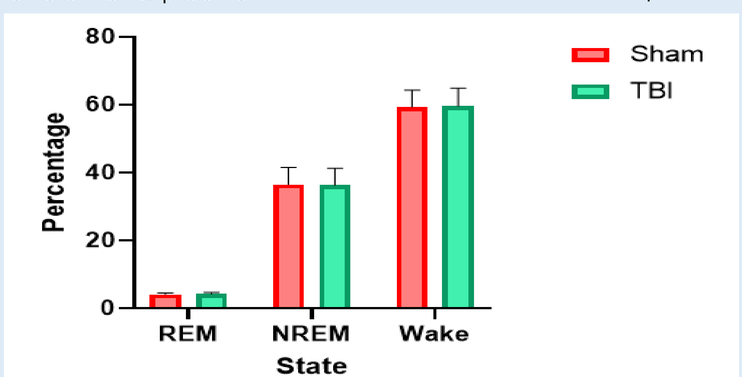
Delta
Pairwise t-test with Bonferroni correction
Non-Rem OFF Sham vs TBI: p=0.0011
Non-Rem ON Sham vs TBI: p=0.0123



Theta
Pairwise t-test with Bonferroni correction
Non-Rem OFF Sham vs TBI : p=0.0092
Non-Rem ON Sham vs TBI : p=0.0249



Beta
Pairwise t-test with Bonferroni correction
Non-rem OFF Sham vs TBI: p=0.0341
Non-rem ON Sham vs TBI: p=0.0449
REM OFF Sham vs TBI: p=0.026



Time spent in each vigilance
This graph shows the time spent in each vigilance stage for TBI and Sham in percentage.

Discussion

No significance difference between TBI and Sham mice were found in the total amount of sleep or wake time. However, TBI mice showed a significantly higher power in the delta, theta, ad beta frequency bands during NREM sleep. These results suggest that even though time spent asleep did not change after the repetitive mild TBIs, there were quantitative changes in EEG activity that could impact sleep quality and AD disease progression.

References

Korthas, H. T., Main, B. S., Harvey, A. C., Buenaventura, R. G., Wicker, E., Forcelli, P. A., & Burns, M. P. (2022). The Effect of Traumatic Brain Injury on Sleep Architecture and Circadian Rhythms in Mice—A Comparison of High-Frequency Head Impact and Controlled Cortical Injury. *Biology (Basel, Switzerland), 11*(7), 1031. https://doi.org/10.3390/biology11071031

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