



PRESENTATION TIME:



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Hippocampal Spindle Rates Correlate with Cognitive Functions in Pediatric Patients with Epilepsy

Maltseva M,^{1,2} Čabounová P,^{1,3} MacAllister W,¹
Lachner-Piza D,¹ Carolina Piaullino A,¹ Jacobs J¹

¹Alberta Children's Hospital, Calgary, Alberta, Canada

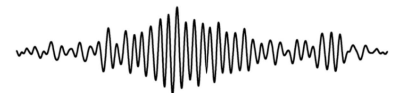
²Epilepsy Center Frankfurt Rhine-Main and Department of Neurology, Goethe-University, Frankfurt am Main, Germany

³Second Faculty of Medicine, Charles University, Prague, Czech Republic

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Introduction

- There is only little evidence from spindles recorded directly from the hippocampus via sEEG
- Hippocampal spindles occur during N2 and N3 sleep with a frequency between 9 and 16 Hz
- Hippocampal spindles are seen as a physiological phenomenon and could be a separate marker for hippocampal-related information transfer, e.g., memory consolidation
- Their expression might be diminished in epilepsy
- No data exists on hippocampal spindles in pediatric population
- Pediatric patients with therapy refractory epilepsy are prone to have cognitive decline
- **Aim to test hypotheses:**
 - Can hippocampal spindles be disrupted through epileptic activity which interferes with sleep homeostasis and healthy memory consolidation and thus contributes to epileptic encephalopathy in children?



Example of a hippocampal spindle

Source: Frauscher et al. SLEEP, Vol. 38, No. 12, 2015

Neuropsychological testings

Child and Adolescent Memory Profile™ (ChAMP™) – assesses visual and verbal memory in children and young adults

Rey Complex Figure Test and Recognition Trial (RCFT) – measures visuospatial ability and visuospatial memory

Full-Scale Intelligence Quotient (FSIQ)

California Verbal Learning Test® CVLT®-C – assess verbal learning and memory

Continuous Performance Test™ (CPT™) measures sustained and selective attention

Immediate recall = “Can you remember it right now?” → focuses on attention/encoding

Delayed recall = “Can you remember it later?” → focuses on consolidation/retrieval



Methods

- To analyze the correlation between cognitive functions and hippocampal spindles in pediatric patients with therapy refractory epilepsy
- Inclusion: Pediatric patients with drug-resistant focal epilepsy at the the Alberta Children's University Hospital undergoing sEEG with at least one electrode implanted in the hippocampus
- EEG selection: 1 h of sEEG during the first sleep cycle recording between 20:00 and 08:00, preferably sleep stage II
- Spindles were marked visually using a bipolar EEG montage on our custom desktop application *Elpi* (<https://www.elpi-biomarkers.com/start>)
- Spindle rates per minute were correlated with neuropsychological test scores from the presurgical assessment using Mann-Whitney U and Kruskal-Wallis test
- To unify test performance scores and increase comparability, the original test scores were transferred into Z-scores resembling the categories exceptionally high, above average, high average, average, low average, below average, and exceptionally low

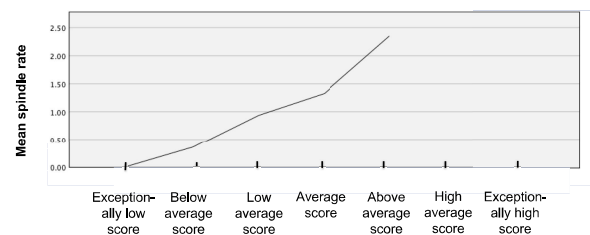
Results

- N=26 patients included
- Average age 11.0 years (Median 12; SD 4.2; range 2.0-17.0 years)
- Mean epilepsy duration 5.6 years (SD 3.1; range 1.0-15.0 years)
- Hippocampal spindle rates within the SOZ were not significantly lower compared to hippocampal spindle rates outside of was not part of the SOZ ($p=0.06$)
- FSIQ, CVLT, and CPT scores were not significantly correlated with hippocampal spindle rate

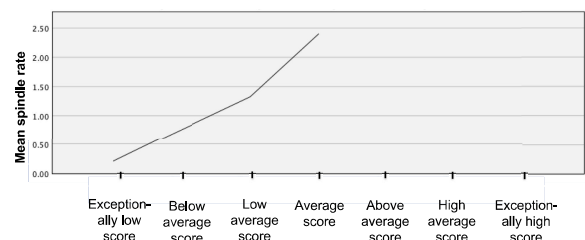
Conclusion

- First study to explore hippocampal spindle rates in context of cognitive performance
- Higher spindle hippocampal rates were correlated with better visual memory in both delayed and immediate recall as well as complex visual memory
- Hippocampal spindle rates were not correlated with verbal memory, intelligence quotient, or attention maintenance
- Hippocampal spindles should be further explored as a biomarker of cognitive functions

Hippocampal spindles were significantly correlated with a higher score in Rey Figure memory immediate recall ($Rho\ 0.701$; $p=0.024$) and Rey Figure delayed recall ($Rho\ 0.766$; $p=0.010$)



Hippocampal spindles were significantly correlated with a higher score in ChAMP Objects immediate recall ($Rho\ 0.560$; $p=0.019$) and ChAMP Objects delayed recall ($Rho\ 0.561$; $p=0.019$)



The correlation of Z-scores with spindle rates per minute. The x-axis shows the different Z-score categories. The y-axis shows the mean spindle rate per minute of each category.