Sleep and Epilepsy: Pediatric population

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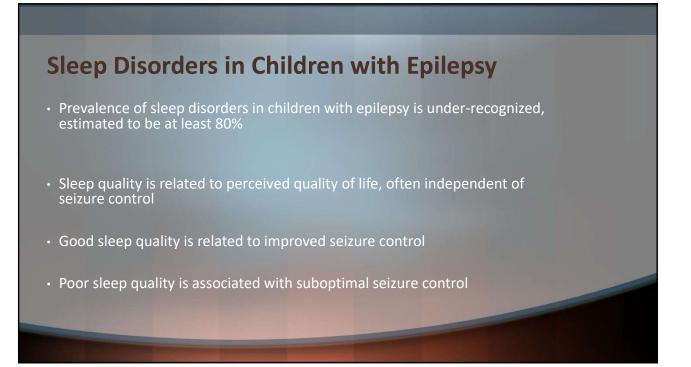
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Topics we will cover

- Prevalence of sleep disorders in children with epilepsy
- Physiology of sleep and epileptic networks
- Sleep-related epilepsies in children



Sleep Disorders in Children with Epilepsy

- Higher incidence of sleep-related anxiety among children with epilepsy and their parents
 - Co-sleeping or parental presence at sleep onset reported to be higher among children with epilepsy
- Parents also report disturbed/aberrant daytime behavior, poor quality sleep

Sleep Disorders in Children with Epilepsy

- Factors associated with increased incidence of sleep disorders
 - Nocturnal seizures
 - Polytherapy
 - Refractory/poorly controlled seizures
 - Epileptic encephalopathies

Sleep Disorders in Children with Epilepsy

- Broad spectrum of sleep disturbances in children with epilepsy
- PSG has demonstrated the following:
 - Decreased total sleep time
 - Poor sleep efficiency
 - Decreased REM sleep
 - Disturbed sleep architecture
 - Increased sleep latency
 - Increased spontaneous arousals and sleep fragmentation
 - Sleep disordered breathing

Sleep Disorders in Children with Epilepsy

- Also increased incidence of the following sleep disorders:
 - Frequent daytime drowsiness
 - Increased incidence of parasomnias
 - Higher incidence of OSA
 - Higher incidence of RLS
 - Higher incidence of PLMS

Sleep Disorders in Children with Epilepsy

- Good seizure control improves sleep while good consolidated sleep improves seizure control
 - Sleep disorders associated with increased fragmentation (i.e. OSA) are associated with worsened seizure control
- Good sleep is associated with reported better behavior and health-related quality of life
 - >50% of children with epilepsy have reported behavioral problems

Physiology

- Epileptic networks most commonly involve brain structures involved in sleep plastic functions
 - Thalamocortical system
 - Hippocampal-limbic-frontal system

Physiology

- NREM sleep is potently associated with activation of epileptic activity (interictal and ictal), and represents a state of synchronization between the brainstem reticular activating system and thalamocortical circuits
- In contrast, REM sleep inhibits thalamocortical synchronization and inhibits spread of epileptiform discharges

Physiology

- Sleep transitions are associated with increased incidence of seizures as well as increased interictal epileptiform activity
 - This is felt to be due to changes in synchronicity as well as changes in concentrations of inhibitory neuromodulators such as adenosine
 - Adenosine levels drop during transition from wakefulness to sleep

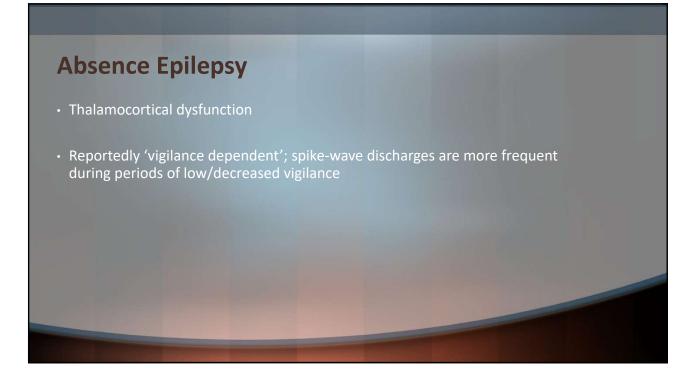
Physiology

- Frequent epileptiform discharges during NREM sleep are postulated to interfere with memory consolidation
 - High frequency oscillations (HFOs) have been associated with epileptogenesis and are more frequent during slow wave sleep
- Discharges involving the thalamocortical network and the perisylvian network are often associated with cognitive dysfunction
- The degree of cognitive dysfunction seems to parallel the burden of interictal epileptiform discharges present during slow wave sleep



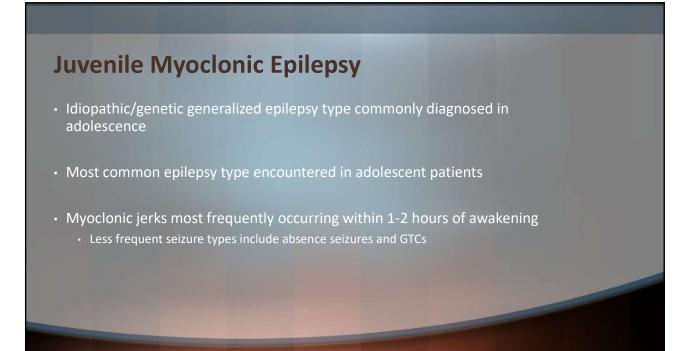
Absence Epilepsy

- Most common idiopathic/generalized epilepsy of childhood
- Absence seizures are characterized by brief periods of behavioral arrest/cognitive impairment lasting seconds



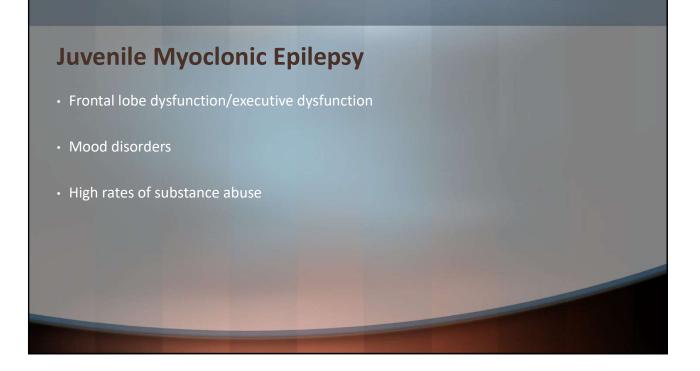
Absence Epilepsy

- Cognitive, behavioral, and emotional disorders common
 - Anxiety/depression
 - ADHD
 - Decreased language and verbal memory scores



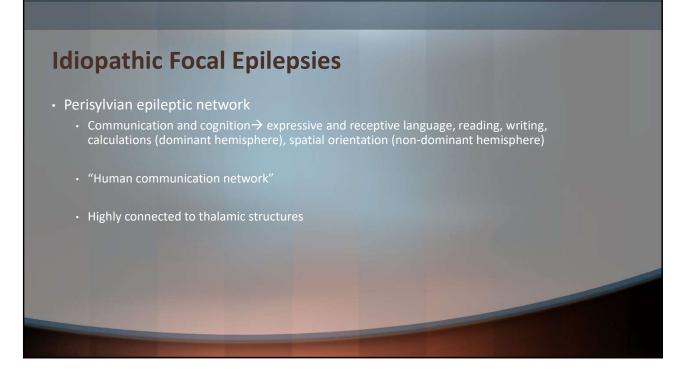
Juvenile Myoclonic Epilepsy

- Reduced sleep efficiency
- Increased sleep latency
- Increased total NREM sleep
- Epileptiform discharges may increase with arousal sleep phenomena (K complexes, vertex waves)



Idiopathic Focal Epilepsies

- Affect 15-20% of children <15y of age w/epilepsy
 - Centrotemporal (Rolandic) Epilepsy- most common
 - Occipital (Panayitopoulos) Epilepsy



Epileptic encephalopathies

- During certain developmental windows epileptic activity in sleep 'hijacks' normal physiologic systems and hinders function and hence subsequent cognitive development
 - Infantile spasms/West syndrome
 - Lennox-Gastaut syndrome
 - Electrical status epilepticus of sleep
 - Landau-Kleffner
 - Dravet syndrome

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Melatonin and Epilepsy

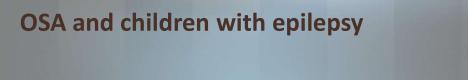
- Conflicting reports on effects on seizure control
- Reported to enhance hippocampal excitability at high doses, though may have antiepileptogenic effect at low doses
- Data indicate that individuals with refractory epilepsy have lower baseline melatonin levels

Melatonin and Epilepsy

- Mechanism by which it may improve epilepsy could be via its effect on improving sleep
 - Improves sleep efficiency
 - Decreases sleep latency
 - May reduce sleep fragmentation

OSA and children with epilepsy

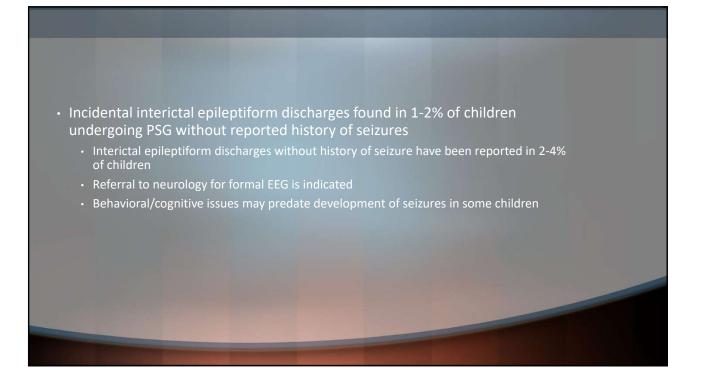
- Compared to children with OSA without epilepsy, the following has been reported in children with epilepsy and OSA:
 - Longer sleep latency and higher arousal index than children with OSA without epilepsy
 - Lower AHI though more significant desaturations with lower nadir



- Poorly controlled or undiagnosed OSA has been associated with refractory seizure control and increased epileptiform activity
- Adult studies have shown that treatment of OSA may improve seizure control
- VNS may worsen OSA in children with epilepsy

OSA and children with epilepsy

- Special circumstance: Vagal nerve stimulator (VNS)
 - Affects respiration during sleep
 - Associated with worsening pre-existing OSA
 - Increases the AHI
 - Some suggest obtaining PSG prior to VNS implantation in children with epilepsy



Summary

- Sleep disorders in children with epilepsy are very common though are underreported and under-recognized
- Poor sleep is related to poor quality of life, independent of seizure frequency
- Poor sleep is associated with increased seizure and interictal epileptiform burden
- Improving sleep improves neurobehavioral comorbidities and can improve seizure control
- AEDs can impact sleep and polypharmacy is associated with increased incidence of sleep disturbances
- Patients with incidental epileptiform discharges identified on PSG should be referred to neurology for EEG

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