San Francisco VA
Epilepsy Center of Excellence:

State-of-the-Art Diagnostic & Therapeutic Services

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Epilepsy and Sleep

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OVERVIEW

- SLEEP
- EPILEPSY AND SLEEP
  - Effects of Epilepsy on Sleep
  - Effects of Sleep on Epilepsy
- SLEEP APNEA
- OTHER SLEEP DISORDERS
- TAKE HOME MESSAGES
Sleep

- Sleep is a vital aspect of all of our lives
  - We spend up to 1/3 of our lives asleep.
    - 8 hours/day
    - 2688 hours/year

- There are many theories as to why we sleep:
  - Memory Consolidation and Learning
  - Physical Restoration and Energy Conservation
  - Immune function
How Do We Define Sleep

**Behavioral Criteria**
- Lack of Mobility
- Slow Eye Movements
- Species Dependent Posture
- Reduced Responsive to External Stimulation
- Increased Reaction Time
- Elevated Arousal Threshold
- Impaired Cognitive Function

**Physiological Criteria**
- EEG (Brain)
- EMG (Muscle)
- EOG (Eyes)
- Respiratory Patterns
Example of a Polysomnographic Record
According to the American Academy of Sleep Medicine, we classify sleep according to a staging system, with 4 primary stages:

- Non-REM (NREM) and REM
  - Non-REM is divided into 3 stages
    - Non-REM 1 (N1)
    - Non-REM 2 (N2)
      - Light Sleep
    - Non-REM 3 (N3)
      - Slow Wave Sleep
- REM Sleep is characterized by a loss of muscle tone and rapid eye movements.
  - This is often considered dream sleep
Throughout the night we cycle through these stages 4-6 times. SWS is more prominent in the first third of the night, while REM is more prominent in the last third.
Sleep is the result of multiple complex interactions.

- Multiple parts of the brain are involved
  - Cortex, Brainstem, Hypothalamus
- Multiple chemical neurotransmitters are involved
  - Ach, NE, 5-HT, Histamine, Substance-P, Adenosine....
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Epilepsy

- Seizure: discrete event due to transient, hypersynchronous, abnormal electrical activity of brain networks

- Epilepsy: disorder characterized by the tendency to have recurrent, unprovoked seizures

- Epilepsy/seizures can be classified as focal (arising from a certain focus) or generalized (arising diffusely).
Lobes of the brain

- Frontal lobe
- Parietal lobe
- Occipital lobe
- Temporal lobe

Central sulcus

Sylvian fissure
Effects of epilepsy on sleep

- In some patients epilepsy clearly worsens sleep.
- In general, patients with temporal lobe epilepsy have more disrupted sleep organization than those with frontal lobe or generalized epilepsy.
  - More nocturnal waking, decreased sleep efficiency, more light sleep, less slow wave sleep, more early morning awakenings.
Effects of Seizures on Sleep

- **Seizures** cause further disruption in sleep patterns:
  - Increased arousals and awakenings
  - Decreased REM sleep after either diurnal or nocturnal seizures of any variety.
  - Nocturnal convulsions decrease total sleep time and total REM and increase light sleep.
Conclusion

- Seizures worsen sleep.
- Some epilepsy syndromes appear to worsen sleep.
  - Not clear if this applies to all epilepsies
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Manifestation of Seizures at Night

- Like daytime seizures, sleep seizures vary:
  - Motor
    - Stiffening, shaking, jerking
  - Sensory experiences
    - Physical or Psychic sensations
  - Confusion
  - Arousals
  - Change in HR or breathing
  - Sleep walking
Focal (Partial) Seizures

- Up to 59% of patients have reported isolated or predominantly nocturnal seizures.
When Do Seizures Occur?
When Do Seizures Generalize?
Convulsive seizures

- 55% of convulsive seizures occur during sleep.
  - More commonly convulsions arise from temporal lobe epilepsy than frontal lobe epilepsy.
  - Up to 60% of patients have convulsions only during sleep.
Why do seizures happen more during sleep?

- Increased synchrony of brainwaves during NREM sleep
  - likely reflects increased connections of brain cells during sleep.
- This may allow abnormal electrical activity (seizures) to spread more easily.
  - Less spread during REM and waking, where there is less synchrony.
Conclusion

- Based on location, some seizures happen more frequently during sleep.
- Convulsions appear more frequently at night.
THE ROLE OF SLEEP DEPRIVATION
## How Much Sleep Do You Really Need?

<table>
<thead>
<tr>
<th>Age</th>
<th>Sleep Needs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newborns (1-2 months)</td>
<td>10.5-18 hours</td>
</tr>
<tr>
<td>Infants (3-11 months)</td>
<td>9-12 hours during night and 30-minute to two-hour naps, one to four times a day</td>
</tr>
<tr>
<td>Toddlers (1-3 years)</td>
<td>12-14 hours</td>
</tr>
<tr>
<td>Preschoolers (3-5 years)</td>
<td>11-13 hours</td>
</tr>
<tr>
<td>School-aged Children (5-12 years)</td>
<td>10-11 hours</td>
</tr>
<tr>
<td>Teens (11-17)</td>
<td>8.5-9.25 hours</td>
</tr>
<tr>
<td>Adults</td>
<td>7-9 hours</td>
</tr>
<tr>
<td>Older Adults</td>
<td>7-9 hours</td>
</tr>
</tbody>
</table>

From “How Much Sleep Do We Really Need” at http://www.sleepfoundation.org/
Average

http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5708a2.htm
Effects of Sleep Deprivation

- Short sleep duration is linked with:
  - Increased risk of motor vehicle accidents
  - Increase in body mass index – a greater likelihood of obesity due to an increased appetite caused by sleep deprivation
  - Increased risk of diabetes and heart problems
  - Increased risk for psychiatric conditions including depression and substance abuse
  - Decreased ability to pay attention, react to signals or remember new information
  - Increased risk of systemic Illness
  - Possible worsening of epilepsy.

From www.sleepfoundation.org
Sleep Deprivation and Epilepsy

- Clearly correlated with activation of the EEG
  - Suggests increased abnormal brain activity
- Patients with epilepsy often report that sleep deprivation can precipitate seizures.
- Studies show conflicting results, but seem to suggest that it may affect some patients more than others.
  - e.g. Temporal Lobe Epilepsy and JME
  - Possibly need additional factors of stress and fatigue, not just sleep deprivation.
Sleep Complaints in Epilepsy

- Up to 2/3 of epileptic patients reported poor quality of sleep.
  - 39% reported insomnia
  - 68% reported excessive daytime sleepiness
- Increased complaints in patients with partial epilepsy vs. generalized epilepsy
- Poor seizure control was associated with increased complaints
  - Increased nocturnal wakings
  - Increased early morning wakings
Insomnia

- This is the inability to sleep or to sleep an adequate amount.

- It may refer to either difficulty falling asleep (Sleep Onset Insomnia) or staying asleep (Sleep Maintenance Insomnia).

- Insomnia is a frequent co-morbidity in many medical conditions: including epilepsy, anxiety disorder and depression.
Causes of Insomnia

- There are numerous causes of insomnia
  - Medical Conditions
  - Psychological Conditions
  - Medications
  - Psycho-social factors
    - Stress, Poor Sleep Hygiene
  - Pain
  - Obstructive Sleep Apnea (OSA)
  - Restless Legs Syndrome
  - Periodic Limb Movement Disorder of Sleep
Causes of Insomnia in Epilepsy

- Poor sleep hygiene
- Depression
- Anxiety
- Medications?
- Sleep Apnea
- Voluntary (Insufficient Sleep Syndrome)
- Epilepsy
Treatment of Insomnia

- Treating underlying conditions
- Sleep Hygiene measures
- Cognitive Behavioral Therapy
- Medications
Excessive Daytime Sleepiness

- A significant number of patients with epilepsy complain of excessive sleepiness during the daytime.
- ESS elevated (>10) in 11-28% of epilepsy patients.
- Likely due to many reasons
  - Primary sleep disorders (OSA, RLS)
  - Seizures and Epilepsy
  - Seizure Medications
  - Depression
  - Insomnia
Conclusion

- Sleep complaints are very common in epilepsy.
- Many epileptics feel tired and many have difficulty sleeping.
- There are likely many reasons
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Obstructive Sleep Apnea

- Characterized by obstruction of the airway during sleep, leading to cessation of breathing
  - Associated with decreased muscle tone during the night causing the airway to close
- Affects 2-5% of the population
- Abbreviated OSA
Factors that Increase Risk for Sleep Apnea

- Being overweight
- Increased age
- Larger neck circumference
- Being a man
- Post-menopausal women
Signs and symptoms of obstructive sleep apnea:

**Nocturnal symptoms:**
- Loud snoring (often with a long history)
- Choking during sleep
- Cessation of breathing (apneas witnessed by bed partner)
- Sitting up or fighting for breath
- Abnormal motor activities (e.g., thrashing about in bed)
- Severe sleep disruption
- Gastroesophageal reflux causing heartburn
- Nocturia and nocturnal enuresis (mostly in children)
- Insomnia (in some patients)
- Excessive nocturnal sweating (in some patients)

**Daytime symptoms:**
- Excessive daytime somnolence
- Forgetfulness
- Personality changes
- Decreased libido and impotence in men
- Dryness of mouth on awakening
- Morning headache (in some patients)
- Automatic behaviour with retrograde amnesia
- Hyperactivity in children
- Hearing impairment (in some patients)
Consequences of Sleep Apnea

- Besides for the possible impact of sleep apnea on epilepsy, it also is associated with other conditions.
  - Cardiovascular
    - Hypertension, Arrhythmia, Heart Failure
  - Psychological
    - Depression, Anxiety
  - Endocrine
    - Diabetes
Diagnosis and Treatment

- We usually diagnose Obstructive Sleep Apnea with a Polysomnogram which allows us to measure respirations at night.

- The most common treatment is CPAP (Continuous Positive Airway Pressure), which keeps the airway open at night.
OSA and Epilepsy

- There is increasing literature suggesting that the relationship is more than casual.
  - 2-4% of the population have OSA
  - 5-63% of epileptics have OSA
- There is likely an increasing incidence of OSA with severity of epilepsy
  - Up to 30% of medically refractory epileptic patients may have OSA
- Possible explanation for abrupt worsening of epilepsy especially in older patients.
Why is there an increased prevalence of OSA in epilepsy?

- The short answer is it is unclear
  - Increased Weight
    - medications, inability to exercise, chronic illness
  - Role of medications
    - Muscle tone relaxation
    - Weight gain
    - Reduce respiratory center reactivity
- Epilepsy
  - Suggestion that seizures may worsen OSA
There is evidence that treating OSA can dramatically decrease or eliminate seizures in some patients.

Epilepsy surgery curing sleep apnea has also been reported.
SEIZURE MEDICATIONS
Seizure medications

- Sleepiness is a common side effect of seizure medications
  - Most increased sleepiness on Phenobarbital
    - Also Depakote, Carbamazepine (Tegretol) and Dilantin
    - BDZ can be used as sleeping pills

- Other Side Effects
  - Phenobarbital, Benzodiazepines and Dilantin may contribute to muscle relaxation worsening OSA.
  - Levetiracetam (Keppra), Lamotrigine (Lamictal), Felbamate and Zonisamide (Zonegran) associated with insomnia
Seizure Medications cont.

- Overall however, these medications are shown to have a good effect on sleep.
  - Increased sleep consolidation
  - Seizure control
  - Mechanism of action?
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Things that go Bump in the Night.

- Epileptic Seizures
- Parasomnias
- Nocturnal Panic Attacks
- Non-Epileptic Events (Psychogenic Non-Epileptic Seizures)
- Hypnogogic Phenomena
  - Hypnic Jerks (Sleep Starts)
Parasomnias

- These are events that characterized by abnormal movements or behaviors that occur while going into sleep or while sleeping.
- They are thought to be related to intrusion of sleep into waking.
- Like epilepsy, these may be episodic and rare or frequent and occur in clusters.
- These are subdivided into conditions that occur in Non-REM (NREM) sleep and those that occur in REM Sleep.
- Interestingly, these happen more frequently in patients with epilepsy and their families.
Parasomnias cont.

- There are a large number of described parasomnias, some of which can be easily confused with seizures.
  - NREM Arousal Disorders (usually arise from N3/4)
  - These are most common in childhood but in some they continue into adulthood
    - Confusional Arousals
    - Somnambulism (Sleep Walking)
    - Sleep Terrors
  - REM Behavior Disorder (RBD)
  - Nocturnal Panic Attacks*
Confusional Arousal

- These events are characterized by a sudden arousal from sleep with disorientation and confusion.
- +/- semi-purposeful behavior
- +/- speech which can be coherent.
- 1-10 minutes (or longer) in duration
- Difficult to wake while occurring.
Sleep Walking

- This is the most common of the arousal disorders.
- Characterized by patients getting out of bed and walking, often out of the bedroom.
- Can complete purposeful or semi-purposeful tasks.
  - dressing, eating, and at times driving.
- +/- speech (often non-sensical)
- Few minutes-30 minutes in duration
- Often return to bed at the end
Night Terrors

- Patients often wake from deep sleep with a blood-curdling scream and are extremely agitated.
- Often have fast heart rate and sweating
- Patients are inconsolable and hard to wake
- These last from minutes to longer.
- Amnestic to event afterwards
REM Behavior Disorder

- Characterized by acting out of dreams while asleep.
  - Often dreams are violent or persecutory in nature.
  - Caused by a loss of muscle relaxation during REM Sleep
  - Can usually be woken by others during event.
  - Often recall the dream in vivid detail afterwards.
- Increases with age
Nocturnal Panic Attacks

- Occur in 44-71% of patients who have daytime panic attacks.
  - Very rarely do they precede daytime attacks
- Described as feeling similar to daytime attacks
  - Feeling of fear/dread/anxiety
  - Heart racing
  - Shortness of breath/Sensation of choking
  - Sweating
- Usually last 2-8 minutes.
Symptoms Common with Seizures

- Abrupt Onset
- Confusion
- Disorientation
- Lack of recall of the event
How do we differentiate?

- History
  - Age
    - Parasomnias tend to appear earlier
      - Parasomnias can start at age 5
      - NFLE average age of onset 14
    - NREM Parasomnias often disappear in adolescence
      - 4% of adults have some confusional arousal
  - Clustering of events
    - Rare in parasomnias, often occur rarely.
    - Frequent in epilepsy (esp. Frontal Lobe Epilepsy)
Differentiating cont.

- Timing of Events
  - Parasomnias arise from deep sleep, often 90-120 minutes after falling asleep.
  - Seizures can occur anytime, but frequently arise out of light sleep (esp. N2), and seen within 30 minutes of falling asleep.
- Semiology
  - Most seizures are highly stereotyped in appearance.
    - Stiffening and posturing are rarely seen in sleep disorders.
    - More variability in sleep disorders than in epilepsy
Differentiating cont.

- Duration of events
  - Parasomnias frequently last >5 minutes
  - Most seizures last for < 2 minutes.
- Recall
  - Most arousal disorders are associated with a disconnect with surroundings and amnesia.
  - In many seizures, especially arising from the frontal lobe, there is often some recollection.
Video EEG/PSG

- Gold standard for differentiation
  - Looks at brain waves during events
  - Allows us to see from which stage events arise
  - Although it is not a perfect test, it may help us to treat you appropriately.
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Summary of What We Know About Sleep and Epilepsy

- Many patients with epilepsy have poorer sleep quality.
- Apnea may be more common and treatment may improve seizure control.
- Antiepileptic medications may worsen sleep and sleep related complaints.
Tips for better sleep

- Have a set time to go to bed and to wake up.
- Sleep in a dark, quiet environment.
- Make sure the temperature is comfortable.
- Try to make the bedroom for bed-related activities only.
  - ie, no reading, texting, surfing, TV or radio
- Avoid napping during the day
- Avoid caffeine, alcohol, tobacco before bed
Sleep, Epilepsy, and Alcohol

- Alcohol may increase chance of seizure (especially binge drinking)
- Alcohol significantly disrupts sleep
- Significant alcohol intake not good for seizure control or sleep
Final Thoughts

- Try to get a good nights sleep
  - This will help your epilepsy and potentially other medical conditions
  - Poor sleep may worsen epilepsy and epilepsy may exacerbate poor sleep.
- If you are excessively sleepy talk to your doctor, there may be many reasons for this.
- If you have a change in the pattern of your epilepsy, consider OSA.
- If you have a new type of event during sleep, please tell your doctor.
QUESTIONS?