Disclosures

• None relevant
Objectives

I. Parasomnias

II. Sleep-Related Epilepsy

III. Parasomnias vs. Epilepsy
I. PARASOMNIA:
ABNORMAL MOVEMENT OR BEHAVIOR IN SLEEP

• International Classification of Sleep Disorders (ICSD), version 3
  • Non-REM Sleep
  • REM Sleep
  • Unrelated to Sleep Stage

• Sleeptalking (somniloquy) considered a common isolated symptom that can happen in any stage; abnormally (with parasomnia) or normally

• Some consider official ICSD-3 classified sleep-related movement disorders to fall under the category of parasomnia
  • Tend to occur in sleep stage transitions
NREM Parasomnias

- ‘Disorders of Arousal’ (DoA)
  - Asleep and awake are not mutually exclusive states
  - Incomplete arousal out of NREM sleep (usually N3)
  - Usually family history

- Examples
  - Confusional arousals / sleep drunkenness / sleep inertia / Elpenor Syndrome
  - Sleep-related abnormal sexual behavior / sexesomnia
  - Sleepwalking / somnambulism
  - Sleepeating / sleep-related eating disorder
  - Sleep terrors / night terrors / pavor nocturnus
Confusional Arousals

- Slow, bewildered, placid
- May appear awake with goal-directed behaviors
- No recollection
- Usually brief (up to 15 minutes)
- Triggered by sleep deprivation, medications, or sudden awakening

Also called sleep drunkenness / sleep inertia / Elpenor Syndrome
Sקסומניה

• Confusional arousal variant
  • Not placid
• Usually occur 1-2 hours after sleep onset
• May occur along with other parasomnias and/or sleep disorders (OSA)
• Most commonly implicated sleep disorder in criminal allegations involving sleep-related violence
Sleepwalking

• Starts as confusional arousal
  • But becomes more goal-directed
  • Not always placid (e.g. running, jumping, urinating in closet)
  • Self-injury not uncommon
• Usually spontaneously awaken somewhere else
  • Confused or agitated if aroused
• Usually some recollection
• Can recur multiple times a night
Sleep-Related Eating Disorder

• Variant of sleepwalking with involuntary eating
• Independent of daytime eating disorder
• Consumption of inedible or toxic products
• Associated with medications and other sleep disorders
Sleep Terrors

• Not placid
  • Frightened, confused, and difficult to awaken during terror

• Brief burst with eventual calm return to sleep
  • Sudden arousal screaming with intense autonomic activation
  • No recollection in children
  • Some recollection in adults (explosive bed departure)
DoA Management

• Prognosis is generally good!

• Diagnose and treat underlying or comorbid sleep disorder

• Lifestyle modification
  • Avoid triggers: sleep deprivation, sleep-wake cycle disruption, alcohol, medications (e.g. zolpidem)
  • Avoid injuries: pad room, floor futon, secure doors/windows, remove sharp items, lock fridge/pantry, bedpartner education

• Cognitive behavioral therapy

• Pharmacotherapy if severe or injury (2/3 do not need)
  • Clonazepam (80% respond to benzodiazepine)
  • Melatonin
REM Parasomnias

- Nightmare Disorder
- Isolated Sleep Paralysis

- REM Sleep Behavior Disorder
  - Parasomnia Overlap Disorder
Nightmare Disorder

- Complex visual dream in REM sleep
- Good recall of distress into awake
  - Appears placid during nightmare
  - Mild sympathetic activation
  - Frightened after nightmare
  - Nightmare may end with jolt (or scream)
- Consider RBD if more complex behaviors
  - Bed departure rare

Treatment: image rehearsal therapy, desensitization / muscle relaxation therapy, prazosin
Isolated Sleep Paralysis

• Intrusion of REM sleep atonia into awake
• Unable to move
• Unable to call for help
• Sense of impending doom
• Cannot flee
• Hallucinations of presence in room
• Related to physiologic sleep deprivation, or can be part of narcolepsy

Treatment: avoid sleep deprivation, cognitive behavioral therapy, TCA/SSRI
Parasomnia Overlap Disorder

• Variant of RBD with either:
  - Disorder of Arousal
  - Rhythmic Movement Disorder

• Up to 21% of RBD
  - Not risk factor for \( \alpha \)-synucleinopathy
  - Male predominant (but not as much as RBD)

• Up to 28% of sleepwalkers or sleep terrors

• Can be associated with variety of neurologic or psychiatric disorders
‘Other’ ICSD-3 Parasomnias

Unrelated to Sleep Stage:

- Exploding Head Syndrome
- Sleep-Related Hallucinations

- *Sleep Enuresis*
- *Due to Medical Disorder*
- *Due to Medication or Substance*
- *Unspecified*
Exploding Head Syndrome

- A.K.A. “episodic cranial sensory shock”
- Painless paroxysmal sensation of head explosion
  - Usually auditory (e.g. loud explosive, crashing waves, electric buzzing)
  - Perceived internal or external to ears
  - Can be flashes of light
- Can occur at sleep onset or arousal
- Associated fear, shock, palpitations
- Can be confused with thunderclap headache

Treatment: reassurance, stress reduction, address comorbid sleep disorders

Ng M and Gills K. Neurodiagn J, 2017;57:133-138
Sleep-Related Hallucinations

• Can also occur at sleep onset or arousal
  • May be REM-related if hypnagogic or hypnopompic

• Difficult to distinguish from vivid dreams or nightmares

• Complex images that persist when clearly awake
  • Silent distorted images of people or animals

Treatment: underlying cause
II. SLEEP-RELATED EPILEPSY

• Sleep can affect any epilepsy

• Seizures only in sleep = 10-15% of all epilepsy
  • 80% are focal epilepsies
    • By Location: Frontal > Occipital / Parietal / Temporal
    • By Syndrome (examples)
      • Childhood epilepsy with centrotemporal spikes (CECTS)
      • Panayiotopoulos syndrome
      • Self-limiting late-onset occipital epilepsy
      • Sleep-related hypermotor epilepsy (SHE)

• 10-30% initially sleep-“exclusive” seizures eventually intrude into wakefulness → 6% within first year
Sleep-Related Hypermotor Epilepsy (SHE)

- Used to be known as “nocturnal frontal lobe epilepsy” (NFLE)
  - But “NFLE” seizures are tied to sleep, not night
  - But “NFLE” seizures are often extra-frontal
  - Rather, seizures in “NFLE” are all explosively hyperkinetic

- Autosomal Dominant NFLE (“ADNFLE”) is just one heterogeneous subtype of SHE
  - Many different mutations: CHRNA4/A2/B2, CRH, KCNT1, DEDPC5P, etc.
  - Can be inherited or sporadic
  - Variable expressivity and penetrance
From SHE to Wake

Sleep/awake distribution of seizures

TOTAL Pts 165

Sleep-related seizures only 112

Sleep and awake/awake seizures 53

At onset

Median follow-up: 27 years

Lifetime

100% sleep 82 pattern 1: 49.7%

>75-99% sleep 28

50-75% sleep 2

pattern 2: 18.2%

100% sleep 3 pattern 3: 1.8%

>75-99% sleep 35

50-75% sleep 15

pattern 4: 30.3%

Lichetta L, et al. Epilepsia, 2019;60:e115-e120
The SHE Syndrome

• Seizures usually occur out of NREM sleep
• Ictal and interictal EEG can be negative

Semiology
• Brief (less than 2 minutes)
  • Longer duration, more likely extra-frontal
• Abrupt start and stop
• Stereotyped
• Clustered
• 4 main patterns

SHE Semiology Pattern 1

- Early **elementary** motor signs
  - Early clonus
  - Contralateral tonus (proximal/distal)
  - Contralateral version
  - Asymmetric tonic posture
- More posterior seizure onset zone

SHE Semiology Pattern 2

- **Unnatural** hyperkinetic movements
  - Proximal/axial tonic or dystonic posturing
  - Rotating movements of trunk
  - Ictal pouting

- Diffuse seizure onset zone within frontal lobe

SHE Semiology Pattern 3

- **Integrated** hypermotor movements
  - Kicking, rocking, pedaling
  - Distal stereotypies
  - Manipulation or utilization behaviors
- More anterior seizure onset zone

SHE Semiology Pattern 4

• Integrated gestural behaviors with:
  • Negative emotion/affect
  • Feeling of fear/anxiety/rage
  • Speech production
  • Epileptic wandering

• More anterior seizure onset zone

III. PARASOMNIA VS. EPILEPSY

• SHE and DoA may not be mutually exclusive
• Relatives of SHE patients have almost 5 times DoA as controls
• 1/3 of SHE patients have personal or family history of DoA
• Hypothetical shared cholinergic arousal mechanism


# The Frontal Lobe Epilepsy and Parasomnias (FLEP) Scale

<table>
<thead>
<tr>
<th>Clinical Feature</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age at onset</strong></td>
<td></td>
</tr>
<tr>
<td>At what age did the patient have their first event?</td>
<td></td>
</tr>
<tr>
<td>&lt;55 y</td>
<td>0</td>
</tr>
<tr>
<td>55 y</td>
<td>-1</td>
</tr>
<tr>
<td><strong>Duration</strong></td>
<td></td>
</tr>
<tr>
<td>What is the duration of a typical event?</td>
<td></td>
</tr>
<tr>
<td>&lt;2 min</td>
<td>+1</td>
</tr>
<tr>
<td>2-10 min</td>
<td>0</td>
</tr>
<tr>
<td>&gt;10 min</td>
<td>-2</td>
</tr>
<tr>
<td><strong>Clustering</strong></td>
<td></td>
</tr>
<tr>
<td>What is the typical number of events in a single night?</td>
<td></td>
</tr>
<tr>
<td>1 or 2</td>
<td>0</td>
</tr>
<tr>
<td>3-5</td>
<td>+1</td>
</tr>
<tr>
<td>&gt;5</td>
<td>+2</td>
</tr>
<tr>
<td><strong>Timing</strong></td>
<td></td>
</tr>
<tr>
<td>At what time of night do the events most commonly occur?</td>
<td></td>
</tr>
<tr>
<td>Within 30 min of sleep onset</td>
<td>+1</td>
</tr>
<tr>
<td>Other times (including if no clear pattern identified)</td>
<td>0</td>
</tr>
<tr>
<td><strong>Symptoms</strong></td>
<td></td>
</tr>
<tr>
<td>Are the events associated with a definite aura?</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>-2</td>
</tr>
<tr>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td><strong>Does patient ever wander outside the bedroom</strong></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>-2</td>
</tr>
<tr>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td><strong>Does patient perform complex, directed behaviors</strong></td>
<td></td>
</tr>
<tr>
<td>(e.g., picking up objects, dressing) during events?</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>-2</td>
</tr>
<tr>
<td>No (or uncertain)</td>
<td>0</td>
</tr>
<tr>
<td><strong>Is there a clear history of prominent dystonic posturing</strong></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>0</td>
</tr>
<tr>
<td>No (or uncertain)</td>
<td>-1</td>
</tr>
<tr>
<td><strong>Ionic limb extension, or cramping during events?</strong></td>
<td></td>
</tr>
<tr>
<td>No (or uncertain)</td>
<td>0</td>
</tr>
<tr>
<td><strong>Stereotypy</strong></td>
<td></td>
</tr>
<tr>
<td>Are the events highly stereotyped or variable in nature?</td>
<td></td>
</tr>
<tr>
<td>Highly stereotyped</td>
<td>+1</td>
</tr>
<tr>
<td>Some variability/uncertain</td>
<td>0</td>
</tr>
<tr>
<td>Highly variable</td>
<td>-1</td>
</tr>
<tr>
<td><strong>Recall</strong></td>
<td></td>
</tr>
<tr>
<td>Does the patient recall the events?</td>
<td></td>
</tr>
<tr>
<td>Yes, lucid recall</td>
<td>-1</td>
</tr>
<tr>
<td>No or vague recollection only</td>
<td>0</td>
</tr>
<tr>
<td><strong>Vocalization</strong></td>
<td></td>
</tr>
<tr>
<td>Does the patient speak during the events and, if so,</td>
<td></td>
</tr>
<tr>
<td>is there subsequent recall of this speech?</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td>Yes, sounds only or single words</td>
<td>0</td>
</tr>
<tr>
<td>Yes, coherent speech with incomplete or no recall</td>
<td>-2</td>
</tr>
<tr>
<td>Yes, coherent speech with recall</td>
<td>-2</td>
</tr>
</tbody>
</table>

**Total score**

![FLEP Score Chart](chart.png)
DoA Classification

- Simple Arousal Movements (SAMs)
- Complex Arousal Movements (CAMs)
- Rapid Arousal Movements (RAMs)

**SHE vs. DoA**

\[
\text{N3 Distribution Index} = \frac{n_{\text{first half TST}} - n_{\text{second half TST}}}{n_{\Sigma TST}};
\]

\( n = \text{number of N3 epochs} \)

\( \text{TST} = \text{total sleep time} \)
SHE vs. DoA Arousals

- Epileptic arousals (SPAs)
- Parasomniac arousals (SAMs)

<table>
<thead>
<tr>
<th>Arousal behavior</th>
<th>SPAs (SHE)</th>
<th>SAMs (DOA)</th>
<th>Healthy controls</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td></td>
</tr>
<tr>
<td>Bringing hands to face</td>
<td>38 (31)</td>
<td>53 (37)</td>
<td>5 (45)</td>
<td>.299</td>
</tr>
<tr>
<td>Chewing</td>
<td>4 (3)</td>
<td>5 (3)</td>
<td>3 (27)</td>
<td>1.00</td>
</tr>
<tr>
<td>Coughing</td>
<td>1 (1)</td>
<td>3 (2)</td>
<td>0 (0)</td>
<td>.626</td>
</tr>
<tr>
<td>Exploring environment</td>
<td>0 (0)</td>
<td>56 (40)</td>
<td>0 (0)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Eye opening</td>
<td>52 (42)</td>
<td>86 (61)</td>
<td>2 (18)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Grimacing</td>
<td>10 (8)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Frightened expression</td>
<td>1 (1)</td>
<td>17 (12)</td>
<td>0 (0)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Indifferent expression</td>
<td>71 (58)</td>
<td>37 (26)</td>
<td>6 (54)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Object manipulation</td>
<td>0 (0)</td>
<td>8 (5)</td>
<td>0 (0)</td>
<td>.008*</td>
</tr>
<tr>
<td>Speaking</td>
<td>3 (3)</td>
<td>32 (22)</td>
<td>0 (0)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Swallowing</td>
<td>11 (9)</td>
<td>9 (6)</td>
<td>0 (0)</td>
<td>.488</td>
</tr>
<tr>
<td>Wiping nose</td>
<td>8 (6)</td>
<td>19 (13)</td>
<td>0 (0)</td>
<td>.070</td>
</tr>
<tr>
<td>Yawning</td>
<td>2 (2)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>.214</td>
</tr>
</tbody>
</table>

# Epilepsy vs. Sexsomnia

<table>
<thead>
<tr>
<th>Clinical criteria</th>
<th>Epilepsy</th>
<th>NREM parasomnia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current manifestation of other accompanying symptoms</td>
<td>Other symptoms of epileptic seizures, such as stereotyped, vigorous,</td>
<td>Other NREM parasomnia behaviors, e.g. nonstereotyped sleep-walking, somniloquy</td>
</tr>
<tr>
<td>during/besides episodes of CSBS</td>
<td>hyperkinetic body movements in frontal seizures, or swallowing, lip</td>
<td>with beginning of these symptoms in childhood</td>
</tr>
<tr>
<td>Onset of any kind of paroxysmal sleep-related events</td>
<td>At any age</td>
<td>Usually in childhood</td>
</tr>
<tr>
<td>Time point of occurrence of events</td>
<td>Out of sleep and wakefulness</td>
<td>Solely out of sleep</td>
</tr>
<tr>
<td>Stereotypicity in the behavior pattern</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Interaction with the patient</td>
<td>Unarousability during event; no possibility of interruption or</td>
<td>Possibility for interruption by partner by waking up the patient</td>
</tr>
<tr>
<td></td>
<td>modulation by external stimuli</td>
<td>Yes, if not interrupted by bedpartner</td>
</tr>
<tr>
<td>Completion of intercourse</td>
<td>No, only beginning of a fragment of sexual behavior</td>
<td>High: the entirety of the well-directed behavior is consistent with the</td>
</tr>
<tr>
<td>Target orientation</td>
<td>Low: CSBS is just one part of a flood wave of emotional behavior and</td>
<td>attempt to achieve the specific goal</td>
</tr>
<tr>
<td></td>
<td>unspecific motor automatisms</td>
<td>Misinterpretation as willful act</td>
</tr>
<tr>
<td>Social consequences</td>
<td>Misinterpretation by observers as a psychic abnormality or mental</td>
<td>Hence possibly evoking allegations of sexual assault and legal charges</td>
</tr>
<tr>
<td></td>
<td>illness, with negative psychosocial consequences</td>
<td></td>
</tr>
</tbody>
</table>
SHE vs. RBD

- More abrupt arousal
- More raised head/trunk
- More eye opening
- More whole body movements
- More dystonic posturing
- Manipulated objects (not in an outward directed manner)
Summary

I. Parasomnias

- NREM
- REM

Unrelated to Sleep Stage

II. Sleep-Related Epilepsy

- Sleep-Exclusive vs. Predominant
- Frequent Epileptic Syndromes
- SHE
- ADNFLE

FLEP  Timing  Semiology
Questions?

Thank you for attending!