Evaluation of Pediatric Sleep Disorders

Craig Canapari, M.D.
ccanapari@partners.org

Disclosure
• No relevant disclosures.

Learning objectives
• Understand the use of history, physical, and diagnostic testing in evaluating sleep disorders
• Briefly review the normal development of sleep
• Review the diagnosis and management of common pediatric sleep disorders.

Estimated Prevalence of Sleep Disorders in Children
• Insufficient sleep – 10% (higher in teens – up to 33%)
  – Behaviorally based - 25%
• Sleep related breathing disorders - 2%
• Narcolepsy – 0.05%
• Sleep/wake timing (delayed sleep phase) - 7% teens
• Partial arousals (parasomnias)
  – Night terrors 2 - 3%
  – Sleepwalking 5%
• Rhythmic movement disorder 3 -15%
• Restless leg syndrome 1% of children with moderate/severe symptoms 2 days/week

The primary tool of assessing these problems is the history you take in the office.

A useful screening algorithm is BEARS:
B = Bedtime problems
E = Excessive daytime sleepiness
A = Awakenings during the night
R = Regularity and duration of sleep
S = Snoring
Various tools are used in the assessment of sleep disorders in children:

- Sleep diaries
- Actigraphy
- Polysomnography

Subjective data about sleep wake patterns:

Objective data about sleep wake patterns:

Detailed cardiorespiratory, EEG, and leg movement data for ONE night.

Sleep patterns evolve from birth to a typical day/night cycle in 4-6 months.

Generally, parent reports of sleep duration reduce with time:

Sleep needs change with time:

- **Pre-school (3 to 5 years)**
  - Sleep needs: 11 to 12 hours per 24 hours
  - Naps: Decrease from one a day to none
  - Clinical issues: Sleep onset and sleep maintenance problems common in this age group
- **Pre-pubertal (6 to 12 years)**
  - Sleep needs: 9 to 11 hours per 24 hours
  - Naps: Daytime naps are NOT normal at this age
  - Delayed sleep-wake timing – later bed times
- **Teenagers**
  - Sleep needs: 8.5-9.5 hours
  - Further physiologic delay in sleep onset

Problems falling asleep are among the most common in pediatric practice:

The presentation varies with age and parent schedule.

### Developmental Overview of Common Sleep Problems

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Newborn/Young Infant</th>
<th>Older Infant &amp; Toddler</th>
<th>Pre-schooler</th>
<th>School Age</th>
<th>Teenager</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Usually normal</td>
<td>Difficulty settling</td>
<td>Night terrors</td>
<td>Insufficient sleep</td>
<td>Insufficient sleep</td>
</tr>
<tr>
<td></td>
<td>Developmental</td>
<td>Night terrors</td>
<td>Cardiorespitory</td>
<td>Bedtime resistance</td>
<td>Sleep onset</td>
</tr>
<tr>
<td></td>
<td>Self limited</td>
<td>Night terrors</td>
<td>EEG</td>
<td>Night terrors</td>
<td>Sleep onset</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bedtime resistance</td>
<td>Sleep walking</td>
<td>Sleep terrors</td>
<td>Sleep onset</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rhythmic movements</td>
<td>Sleep walking</td>
<td>Narcolepsy</td>
<td>Narcolepsy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bedtime fears</td>
<td>Sleep walking</td>
<td>OSA</td>
<td>OSA</td>
</tr>
<tr>
<td></td>
<td>Night wakings</td>
<td>Night terrors</td>
<td>Sleep walking</td>
<td>Enuresis</td>
<td>Enuresis</td>
</tr>
<tr>
<td></td>
<td>Enuresis</td>
<td>Night terrors</td>
<td>Narcolepsy</td>
<td>Narcolepsy</td>
<td>Narcolepsy</td>
</tr>
<tr>
<td></td>
<td>Narcolepsy</td>
<td>Night terrors</td>
<td>OSA</td>
<td>Narcolepsy</td>
<td>OSA</td>
</tr>
<tr>
<td></td>
<td>Narcolepsy</td>
<td>Night terrors</td>
<td>Narcolepsy</td>
<td>OSA</td>
<td>Narcolepsy</td>
</tr>
<tr>
<td></td>
<td>Narcolepsy</td>
<td>Night terrors</td>
<td>Narcolepsy</td>
<td>Narcolepsy</td>
<td>Narcolepsy</td>
</tr>
</tbody>
</table>
Physiologic awakenings are common at night. Normal sleep architecture shows that these awakenings occur at times of physiologic arousal, often requiring recapitulation of bedtime activities.

Inappropriate sleep onset association disorder is the classic pediatric behavioral disorder. It may present with bedtime difficulties, where bedtime may take an hour or more. Bedtime resistance and curtain calls are common in this subtype. Curtain calls are comprised of requests for attention, water, backrubs, etc.

Sleep is not generally disrupted once onset occurs in the pure limit setting type. Sleep onset can be assisted by extinction techniques. Extinction is very effective but challenging for parents to implement. Unmodified: Close the door and say goodnight. Graduated extinction: The Ferber method. Extinction with parental presence.

Bedtime modifications are also important and can help extinction succeed. Positive bedtime routines and bedtime fading both entail transiently moving bedtime later to allow increased sleep drive to help with sleep onset. The bedtime pass is a good first pass method for limit setting disorders. Reinforcement, e.g., sticker charts. Scheduled awakenings. "Camping out" can work as well with slow withdrawal of parental presence.
Why parents fail

Inconsistent reinforcement is very potent.

Parental inconsistency tends to reinforce the behaviors that they are trying to extinguish

Inconsistent reinforcement is very potent.

The extinction burst is a well described behavioral phenomenon where a behavior worsens before it ceases

The second night is frequently the worst, then things rapidly improve.

There is no evidence that sleep training harms children.

- AMH Price et al Pediatrics Sept 2012
- There was no evidence that children who had sleep training in infancy had more emotional or behavioral problems in the children who were not.
- There was no difference in the stress response (measured by cortisol) in the two groups.
- There was no benefit to sleep training at six years of age either
- For more on this: http://bit.ly/Q5qU2B

CASE VIGNETTES
Sleep onset association disorder

My 7 month old has started waking up more frequently in the last several weeks after a cold. For the last several months, she has slept through the night with only a single awakening at night. However, she recently had a cold and started waking up every 1.5-2 hours at night. Now the cold has resolved but she awakenings remain! She typically falls asleep at the breast every evening after her bedtime routine, which includes a bath, a story and some songs from her father before I nurse her. She awakens frequently the night and I nurse her back to sleep. These feedings are brief and I don't think she is getting very much milk. She has started wetting through her diapers, however. Her first awakening is about 2-3 hours but she awakens every 1 ½ hour for the rest of the night. She awakens in the morning around 7 AM and naps from 9-10 AM and 1-2:30 PM. Lately these naps have been shorter as well.

Bedtime resistance

Our 29 month old son usually would fall asleep about 20 minutes after lying down in his crib. Now, he is often falling asleep 1.5-2 hours after the desired bedtime of 8pm. He has found various and sundry ways to delay going to sleep. He would like a drink of water. He needs his blanket fixed. He wants to rock. He has a story to tell or a song to sing. Many of these are actually very endearing, but nonetheless I worry about him not getting enough sleep and admittedly become a little frustrated. On a particularly trying night, I made the mistake of bringing him into our bed to see if he would fall asleep. Fall asleep he did, but he now refuses to go to sleep any other way. Of course.

Pediatric RLS: Clinical features

- Attention sought for “growing pains”
- These present as:
  - Sleep onset problems
  - Sleep maintenance problems
- Daytime irritability and attention problems may occur, likely due to sleep deprivation
- Family history is positive for RLS
- Iron deficiency may play a role as in adults
- Restless leg syndrome 1% of children with moderate/severe symptoms 2 days/week

Pediatric RLS: Treatment

- Strict sleep hygiene is necessary to avoid sleep deprivation
- Limiting setting often required (day and at bedtime)
- Treatment of iron deficiency (ferritin <50 ng/mL)
- Medications:
  - Clonidine
  - Gabapentin
  - Ropinirole/pramipexole
  - Benzodiazepenes

Sleep onset prescription

1. Pick a quit date
2. Switch up the order of bedtime:
   - bath→story→song→nursing→bed
   - CHANGE TO nursing→bath→story→song→bed.
3. DROWSY BUT AWAKE
4. For feedings, continue as is but offer 2 oz water

Sleep resistance prescription

1. Pick a quit date
2. Playtime in room/bed
3. Bedtime should be brief, predictable
4. Bedtime fading vs. camping out
5. DROWSY BUT AWAKE
6. Avoid bringing him into bed
Inadequate sleep hygiene is most common in adolescents but may occur in small children in chaotic households.

Delayed Sleep Phase Syndrome is a common and under-recognized condition in teenagers.

Treatment of Delayed Sleep Phase Syndrome with Bright Light Exposure

Treatment of Adolescent Delayed Sleep Phase Syndrome

- Bright light exposure/exercise in the morning
- Darkness in the evening
- Pharmacologic treatment in the evening
  - Melatonin: 0.5 mg 4-5 prior to bedtime onset, 3-5 mg 30 min prior to bedtime
  - Hypnotics
- Chronotherapy
- CONSISTENT WAKE TIMES

Psychophysiological insomnia is characterized by anxiety about falling asleep.

- DDx includes mood disorders, anxiety
- Treatment includes
  - Stimulus control
  - Bedtime restriction
  - +/- medication
Problems during sleep are also common in children.

Medical issues must be considered (e.g. asthma, reflux, pain, fever)
Disorders of sleep fragmentation such as PLMs or OSA may be a factor.
Sleep onset association problems are a frequent cause.
Episodic behaviors emerging from sleep are called parasomnias.

OSA and Obesity: The future?

- Obesity and overweight are increasingly common (Ogden JAMA 2006)
- BMI > 95% 16.3%
- BMI > 85% 30.7%
- Obesity increases OSA is risk 4.5 times
- 1/3 of obese children have OSA
- >50% snoring obese children have OSA
- Obesity and OSA track into adulthood

Clinical Features

Nocturnal Symptoms
- Loud snoring
- Observed apneic pauses
- Snorting / gasping / choking
- Restless sleep
- Diaphoresis
- Paradoxical chest wall movement
- Abnormal sleeping position
- Secondary enuresis

Diurnal Symptoms
- Daytime somnolence
- Behavioral / school problems
- Difficulty awakening in AM
- Morning headaches
- Nasal congestion
- Mouth breathing

Anatomical causes of ↑ airway resistance

Courtesy of Dr. Eliot Katz
How well do current PSG parameters predict neurocognitive morbidity?

- Study of 113 children did not show that SDB measures predicted parent reported hyperactivity (Chervin RD et al. SLEEP 24: 2001)

When to get polysomnography


1. PSG recommended for children with complex medical conditions including obesity, Down syndrome, craniofacial disorders, sickle cell disease, or mucopolysaccharidoses AND
2. Children where the need for surgery is unclear e.g. there is a discrepancy between tonsil size and symptoms
3. Polysomnographic results should be communicated to anesthesiologist prior to induction
4. Children with age ≤3 OR AHI >10 OR SpO2 nadir <80 should be observed overnight.
5. Laboratory polysomnography is preferable.

Children age 3-6 with snoring and daytime symptoms should proceed directly to surgery.
How effective is adenotonsillectomy?

- Guilleminault prospectively studied 207 children who had TNA for OSA; 199 had follow up polysomnography.
- 94 had some degree of residual sleep apnea.
  - Correlates of residual disease included Mallampati 3 and 4, deviated septum, and enlarged nasal turbinates

A larger study of 578 patients also showed that OSA resolved in only 27.2% of patients

Positive Airway Pressure

Parasomnias are divided into NREM and REM subtypes

NREM parasomnias

- Arousals from NREM sleep
- First half of night, typically short duration
- Prolonged or multiple episodes may occur
- Confusion / automatic behavior
- Difficult to awaken during event
- Fragmented imagery
- Rapid return to sleep after event
- Amnesia of events
Sleepwalking

Clinical Characteristics

- Quiet wandering (injury unlikely)
- Agitated wandering (injury more likely)
- Behaviors of variable complexity
- Inappropriate behaviors
- Most sleepwalkers have few daytime effects

Sleep Terrors

- Peak age: 5-7 years
- Prevalence rate of 2.0 - 6.5%
- Many will later sleepwalk
- Usual duration in children: ~ 4 years
  - 50% end by age 8
  - 36% continue into adolescence

Disorders of Arousal: Familial Basis

- 60% of children have positive family history
- 10-fold increased prevalence in first-degree relatives of an affected individual

Disorders of Arousal: Evaluation

Video-PSG needed if:
- Spells have atypical features
- Spells are stereotyped
- Patients describe potentially injurious behavior or have injured themselves or others

PSG needed if:
- Obstructive Sleep Apnea is suspected

Disorders of Arousal: Treatment

- Allow episodes to run their course:
  - Interfere only to prevent injury
  - May try to lead the patient calmly to bed
- Emphasize sleep hygiene
- Secure the bedroom to prevent injury:
  - Consider ground floor bedrooms
  - Window and door locks, pad bedrails
  - Remove sharp objects or toys on bedroom floor
  - Alarms or barriers at door/stairs
- Benzodiazepines

REM based parasomnias

- Nightmares
- Sleep paralysis
- REM Sleep Behavior Disorder
Nightmares

- 75% of children experience nightmares
- 10 - 50% of children have nightmares severe enough to disturb their parents
- Proportion of children reporting nightmares reaches a peak around ages 6-10 years and decreases thereafter

Nightmares & Sleep Terrors

Nightmares
- REM sleep
- Most common parasomnia
- 2nd half of night
- Delayed return to sleep
- Easily comforted
- Detailed narrative description of episode
- Mild autonomic activity
- Alert upon awakening

Sleep Terrors
- NREM sleep
- 2.0 - 6.5% prevalence
- 1st half of night
- Rapid return to sleep
- Resists comforting
- Fragmented recall / amnesia
- Intense autonomic activity
- Confusion on waking

Reassurance is usually all that is necessary. Cognitive "revision" may be useful for troublesome dreams.

Excessive daytime sleepiness is a major issue, especially in teenagers

Insufficient Sleep

Fragmented Sleep

Excessive Daytime Sleepiness

Excessive sleep drive

Circadian Rhythm Disorders

Drowsy Driving and Auto Accidents

- The peak age for fall-asleep driving accidents is 20
- Drivers under 30 account for 2/3 of drowsy-driving crashes.
- The only "fixes" are naps and caffeine.

Although daytime sleepiness is common, primary disorders of increased sleep drive are rare
Narcolepsy

- Intrusion of sleep and REM sleep into wakefulness
  - Excessive daytime sleepiness
  - Cataplexy
  - Hypnagogic hallucinations
  - Sleep paralysis
  - Fragmented sleep
- Symptoms usually occur in the second decade
- Treatment includes stimulants, napping, and other medication

In summary, sleep problems in childhood represent a heterogeneous group of disorders with substantial daytime morbidity.

Most of the common issues can be addressed by the pediatrician.

Referral to a subspecialist may be helpful if the issues are complex or chronic.

Contact info:
ccanapari@partners.org
Twitter: DrCanapari
Google +: Craig Canapari
A PDF of slides and handouts available on my website:
drcraigcanapari.com

Questions?

Thank you & Happy Holidays!