## Sleep Problems in Children with Autism Spectrum Disorders

**Overview**

- Sleep needs
- Prevalence of sleep problems in ASD
- Neurobiology
- Impact
- Types of sleep disorders
- Diagnosis
- Treatment

**Biology of Sleep**

- Governed by two biological systems:
  1. **Sleep/wake homeostasis**: the drive to sleep that increases the longer we are awake
  2. **Circadian rhythms**: the internal clock in our brain that regulates when we feel sleepy and when we are alert

**Sleep patterns**

- **REM (rapid eye movement)**: active sleep phase with more irregular breathing and heart rate, eye move back and forth but no body movement; dreaming occurs
- **NREM (non-REM)**: several stages stage I and II wake easily stages III and IV very deep sleep with difficulty waking; relaxed muscles
Impact of sleep deprivation

- Lower stress threshold
- Impaired memory and trouble concentrating
- Decreased optimism and sociability
- Impaired creativity and innovation
- Increased resting blood pressure
- Increased food consumption and appetite
- Increased risk of cardiac mortality

Sleep disturbances

- Prevalence of sleep disorders in children: 20 to 30% in infants, toddlers and young children
- Often transient and treatable
- Types of sleep disorders: difficulty falling asleep, nighttime wakenings most common
- Others: night terrors, sleep walking, obstructive sleep apnea

Prevalence of Sleep Problems in ASD

- 50% to 80% of children with autism have sleep problems
- Sleep problems similar across cognitive abilities and subtypes of autism
- Correlation of sleep problems with aggression, anxiety and developmental regression
- Higher than rate of sleep problems for general population of children or those with developmental delay
Neurobiology

- ASD characterized by neurobiologic changes in sleep-wake cycle
- Neurotransmitters that are likely involved include: Gamma-aminobutyric acid (GABA), serotonin and melatonin
- Genes implicated in ASD (neurologins and neurexins) influence GABA synaptic function
- Serotonin is a precursor to melatonin and platelet serotonin levels have been abnormal in some studies of ASD

Impact of sleep problems in ASD

- Sleep disturbances contribute to stress and parental sleep disruption
- Sleep problems associated with behavioral issues, inattention and hyperactivity
- In ASD, sleep problems seem to be correlated with increased repetitive behaviors and insistence on sameness
- Short sleep duration associated with higher autism severity scores, social skills deficits

Role of sleep in learning

- Sleep plays important role in optimizing cognition, memory, behavioral regulation and learning
- Slow wave component of sleep plays critical role in memory consolidation
- Rapid eye movement (REM) sleep critical in processing memories with emotional overlay
- Sleep is essential for behavioral regulation and affective impulses

Types of Sleep Disorders: Insomnia

- Most common of sleep problems in ASD
- Includes difficulty falling asleep, increased nighttime wakenings, decreased efficiency of sleep
- Medical conditions such as epilepsy and GERD may contribute to insomnia
- Medications (antiepileptics, psychotropics) may also play a role
Comorbid conditions such as ADHD and anxiety may also contribute.
Behavioral concerns can create problems in setting bedtime routine.
Limited communication skills may also play a role.

Types of Sleep Disorders: OSA

- Obstructive sleep apnea is caused by airway obstruction and results in disordered breathing during sleep.
- Often characterized by loud snoring.
- Can be the result of enlarged tonsils/adenoids, obesity; hypotonia can contribute.

Types of Sleep Disorders: Parasomnias

- Non-rapid eye movement arousal disorders.
- Include night terrors, sleep walking and confusional arousals.
- Usually occur during first half of night during deep, slow wave sleep.
- Some studies report increased parasomnias in ASD.

Types of Sleep Disorders: movement disorders

- Restless Legs Syndrome is characterized by urge to move legs; occurs at bedtime and relieved by movement.
- Periodic Limb Movements in Sleep are defined by repetitive stereotypic movements of the limbs during sleep.
- RLS often responds to iron supplements if iron levels low.

Sleep history

- Bedtime, time of sleep onset.
- Mood and energy level upon waking.
- Daytime napping, attention, mood.
- Activities in hours preceding bedtime.
- Technology available in child's room.
- Medications.
- Anxiety or depression.

Questionnaires

- Children's Sleep Habits Questionnaire (35 items, ages 4 to 10, parents complete).
- Family Inventory of Sleep Habits.
- Pediatric Daytime Sleepiness Scale.
- Child Behavior Checklist.
**Sleep diary**
- Sleep latency
- Total sleep time
- Night waking
- Response to treatment

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**Actigraphy**
- Involves use of a portable device (usually wrist band) that records movement over extended periods of time
- Measures sleep patterns and total sleep time
- Can be helpful in characterizing circadian rhythm patterns
- May also be useful in determining response to treatment

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**Polysomnography**
- Overnight study that records brain waves (EEG), measures oxygen level, heart rate and breathing, as well as eye and leg movements.
- Noninvasive and painless, but may be difficult for children with ASD to tolerate
- Gold standard for detecting OSA, PLMD, parasomnias, etc.

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**Treatment**
- Medical treatment of sleep disrupting conditions
- OSA, RLS
- Epilepsy
- GI problems (GERD, constipation, abdominal pain, etc.)
- Anxiety, depression
- Medication changes if disruptive of sleep

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**Treatment**
- Implementation of appropriate sleep practices
- Daytime habits: attention to quantity and timing of exercise; light exposure; dietary choices; naps; bedroom use
- Evening habits: “wind-down” activities; minimizing light exposure; bedtime routine and consistency of bed time

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**Treatment**
- Behavioral interventions
- Use of visual schedule for each step of bedtime routine
- Social stories about bedtime
- Fading
- Use of Bedtime Pass
Melatonin

Meta-analysis of studies of children with ID found melatonin safe and effective in short term

Retrospective study of 107 children with ASD found improvement in sleep onset and minimal side effects

Start with 1 mg 30 minutes before bedtime; can go up fairly rapidly; usually no more than 10 mg studied

Clonidine: retrospective study showed improved sleep onset

Others: trazodone, mirtazepine, atypical antipsychotics

Sleep problems are very common in children with Autism Spectrum Disorders

Insomnia is the most common sleep disorder in ASD

Other sleep problems include sleep disordered breathing, sleep movement disorders and parasomnias

Sleep diaries and questionnaires are helpful in diagnosis
Conclusions

- Objective measures include actigraphy and polysomnography
- Treatment includes: 1) medical treatment of sleep disrupting conditions 2) establishing appropriate sleep practices 3) behavioral interventions and 4) melatonin/pharmacology

References