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Sleep Problems in Children with Autism Spectrum Disorders

Overview

- Prevalence
- Neurobiology
- Impact
- Types of sleep disorders
- Diagnosis
- Treatment

A good laugh and a long sleep are the best cures in the doctor's book.

gadel.info

Irish proverb


Without Sleep,
we become
tall
two year olds.

How Much Sleep Do You Really Need?

Age	Sleep Needs
Newborns (0-2 months)	12-18 hours
Infants (3 to 11 months)	14 to 15 hours
Toddlers (1-3 years)	12 to 14 hours
Preschoolers (3-5 years)	11 to 13 hours
School-age children (5-10 years)	10 to 11 hours
Teens (10-17)	8.5-9.25 hours
Adults	7-9 hours

Source: National Sleep Foundation

Prevalence

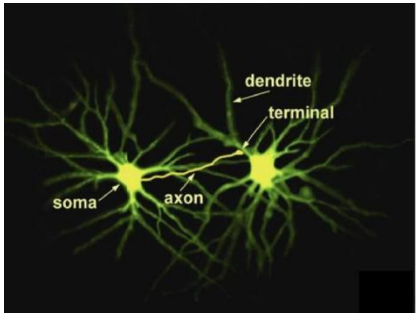
- 50% to 80% of children with autism have sleep problems
- Sleep problems similar across cognitive abilities and subtypes of autism
- Correlation of sleep problems with aggression, anxiety and developmental regression
- Higher than rate of sleep problems for general population of children or those with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

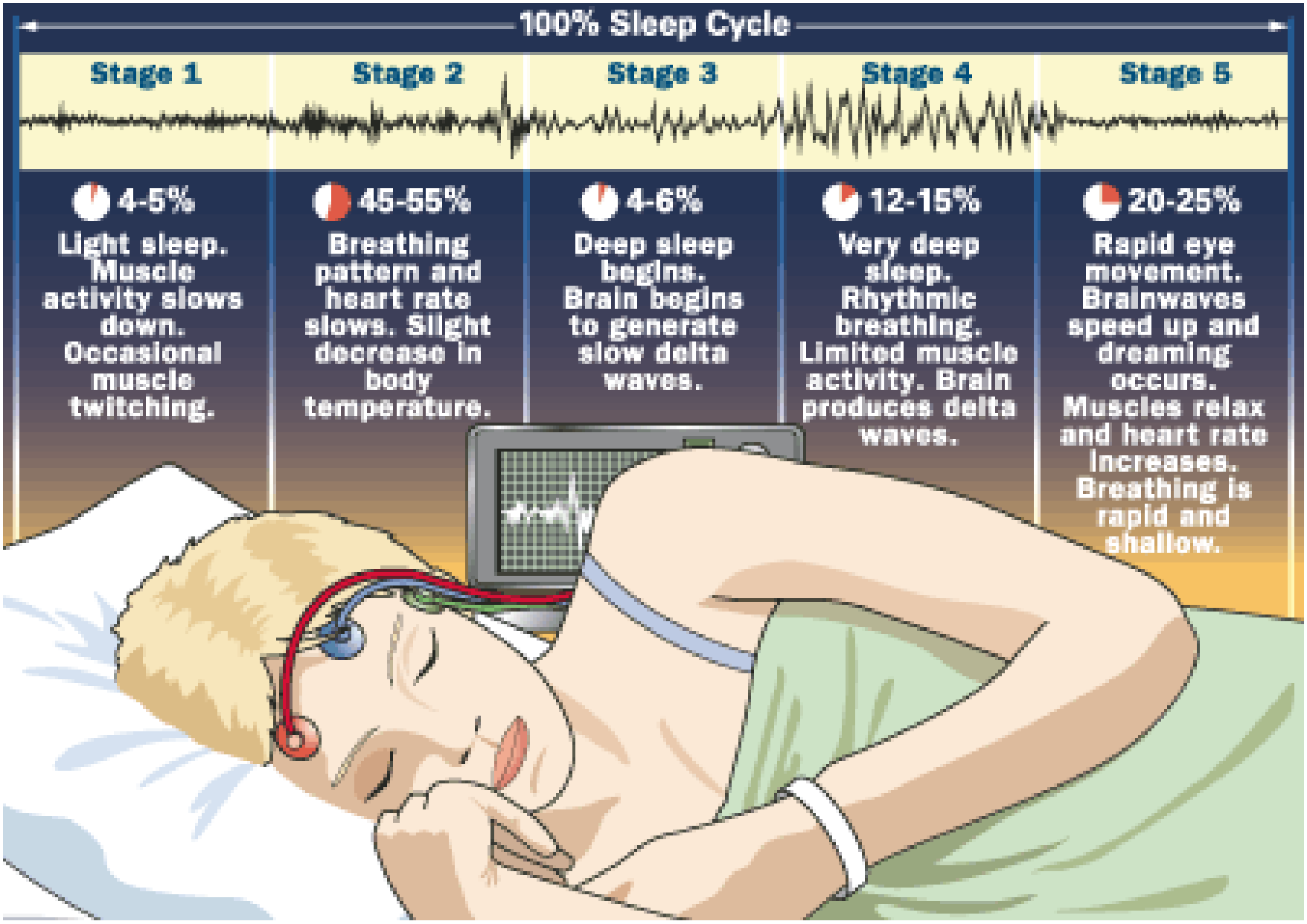
Neurobiology

- Children with ASD have reduction in in GABA receptors in anterior and posterior cingulate cortex and fusiform gyrus
- Difficulties with sleep onset and maintenance may be influenced by social emotional and face processing deficits regulated by the cingulate gyrus in children with ASD
- Melatonin secretion may be reduced or undergo altered time release in ASD



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


100% Sleep Cycle
Stage 1
Stage 2
Stage 3
Stage 4
Stage 5
4-5%
Light sleep. Muscle activity slows down. Occasional muscle twitching.
45-55%
Breathing pattern and heart rate slows. Slight decrease in body temperature.
4-6%
Deep sleep begins. Brain begins to generate slow delta waves.
12-15%
Very deep sleep. Rhythmic breathing. Limited muscle activity. Brain produces delta waves.
20-25%
Rapid eye movement. Brainwaves speed up and dreaming occurs. Muscles relax and heart rate increases. Breathing is rapid and shallow.

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

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

Insomnia

- 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

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

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.

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

Treatment

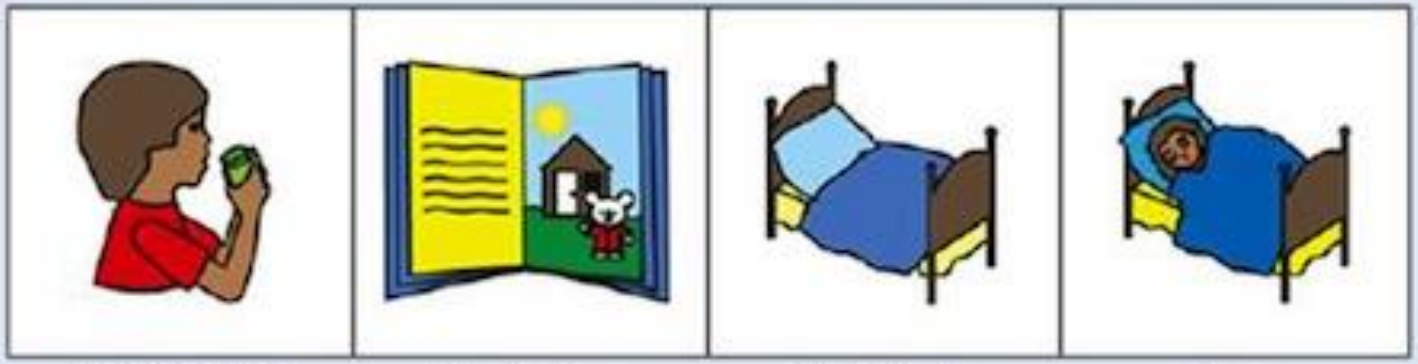
- Implementation of appropriate sleep practices
- Daytime habits: attention to quantity and timing of exercise; light exposure; dietary choices; naps; bedroom use
- Evening habits: “wind-down” activities; minimizing light exposure; bedtime routine and consistency of bed time

Treatment

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

Example Bedtime Routine & Visual Schedule

Put on pajamas | Use toilet | Wash hands | Brush teeth



Drink water | Read story | Go to bed | Sleep

Make the routine ***calming, short, predictable,*** & ***expected***.

Treatment

- 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 6 mg studied

Other medications

- Clonidine: retrospective study showed improved sleep onset
- Others: trazodone, mirtazepine, atypical antipsychotics

Resources

- Autism Speaks Toolkit: Strategies to Improve Sleep in Children with Autism Spectrum Disorders, A Parent's Guide
- Sleep and Autism: Helping Your Child (National Autistic Society – UK)
- Establishing Positive Sleep Patterns for Children on the Autism Spectrum (Autism Society)

Strategies to Improve Sleep in Children with Autism Spectrum Disorders

A Parent's Guide

AUTISM SPEAKS™
ATN
Autism Treatment Network

AIR-P
Autism Intervention Research Network on Physical Health

Conclusion

- 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

- Malow B et al. (2012) A Practice Pathway for the Identification, Evaluation and Management of Insomnia in Children and Adolescents with Autism Spectrum Disorders, Pediatrics 130: S106-S124.
- Reynolds A, Malow M. (2011) Sleep and Autism Spectrum Disorders, Pediatric Clin N Am 58: 685-689,
- Kotaga S, Broomall E. (2012) Sleep in Children with Autism Spectrum Disorder, Pediatric Neurology 47: 242-251.
- Guenole F et al. (2011) Melatonin for disordered sleep in individuals with Autism Spectrum Disorders: Systematic Review and Discussion, Sleep Medicine Reviews 14:379-387.
- Richdale A, Schreck K. (2009) Sleep problems in autism spectrum disorders: Prevalence, nature and possible biopsychosocial etiologies, Sleep Medicine Reviews 13: 403-411.