INSOMNIA IN CHILDREN WITH ATTENTION DEFICIT HYPERACTIVITY DISORDER (ADHD) AND AUTISM SPECTRUM DISORDER (AUTISM SPECTRUM DISORDER)

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Epidemiology
Insomnia is the most commonly reported sleep difficulty reported to pediatric health care providers, and is frequently noted among children with a range of neurological conditions including headache and epilepsy. Rates of insomnia are particularly high among children with neurodevelopmental disorders including ADHD and ASD.

Clinical features
International Classification of Sleep Disorders (ICSD) defines insomnia as one or more of the following: difficulty initiating sleep, difficulty sleeping without caregiver, bedtime resistance, difficulty maintaining sleep, and/or waking earlier than desired. Additionally, the ICSD requires a daytime consequence of these sleep difficulties in the child and/or family: daytime fatigue/sleepiness, limitations to academic/occupational functioning, impaired cognitive capabilities, mood disturbances, and/or behavior problems. In chronic insomnia, sleep disturbances must occur for at least 3 days per week and for at least 3 months; short-term insomnia is present for <3 months per ICSD classification. Underlying the diagnosis of insomnia is the assumption that the child has sufficient time and an appropriate environment to sleep. For example, children with neurodevelopmental disorders commonly use media (TV, computer, videogames, hand-held devices) at night which disrupt their sleep patterns and reduced total sleep time.

There is a wealth of literature describing associations between insomnia and emotional dysregulation, depression, suicidality, and externalizing behavior problems such as hyperactivity. More disrupted sleep in children with ASD is associated with poorer verbal and socialization skills and adaptive functioning. Likewise, correlations between sleep problems and externalizing behaviors, oppositional behavior, and depressive symptoms exist among children with ADHD.

Pathophysiology
The pathophysiology of insomnia is unknown but one salient theory is that it reflects a hyper-aroused state. This theory postulates that autonomic, somatic, and cortical arousal associated with factors such as stress or predisposing conditions increase sensory processing and results in insomnia. Adolescents with insomnia demonstrate increased beta activity (15-35 Hz) during sleep onset and NREM sleep suggesting that this hyper-aroused state can be present early in the lifespan. Two small studies using qualitative EEG analysis of sleep among children with ADHD and ASD did not show differences in power spectra in NREM sleep compared to controls, but this may be an area of future research in larger cohorts.

Diagnosis
While the diagnosis of insomnia is based on clinical history from both the child and caregiver/parent; clinical providers may not always routinely screen for sleep problems in the

office setting. Many pediatric sleep questionnaires are available for clinical use but one commonly used instrument is the Children’s Sleep Habits Questionnaire (CSHQ). The CSHQ includes domains of bedtime problems, excessive daytime sleepiness, awakenings at night, habitual sleep duration and timings, presence of snoring, parasomnias and has been validated for healthy children ages 4-10 years of age; however, it has been used in a number of research studies with children with ASD and ADHD. A sleep log or diary kept for a period of 2 consecutive weeks that includes bedtime, estimated sleep onset time, timings of awakenings during the night, rise time, and naps can be a very helpful diagnostic tool. Lastly, actigraphy (a wristwatch-like monitoring device that captures and stores movement data using validated computer algorithms to generate approximations of sleep-wake patterns over time) can provide objective assessment of sleep-wake parameters. Consumer wearable sleep monitoring devices do not show reliable or valid sleep data, though newer technology may be promising.

Treatment

Behavioral counseling is the foundation of managing insomnia in children. Sleep hygiene recommendations can be found on the website for the National Sleep Foundation; effective recommendations for caregivers of children with ASD are also available through the Autism Speaks, Autism Treatment Network website. Two recent randomized controlled trials did not find any short or long-term negative effects on any of the cognitive, emotional, stress-related, or attachment parameters measured in either children or caregivers following behavioral interventions. Cognitive behavioral therapy for insomnia (CBT-I) has also been shown to be effective in a recent randomized controlled trial for adolescents with insomnia. There are no hypnotic/sedative medications approved in the United States to treat insomnia in children. Nonetheless, medication management for insomnia is common and systematic reviews of commonly used medications for pediatric insomnia are referenced here. Table 1 is a list of sleep medications studied in children with neurodevelopmental disorders and is adapted from one of these reviews. Ultimately, it is critical for practitioners to recognize that these sleep medications are an adjunct to good sleep hygiene and behavioral strategies to improve refractory insomnia.
<table>
<thead>
<tr>
<th>Medication</th>
<th>Group Studied</th>
<th>Dosing</th>
<th>Use</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron</td>
<td>ASD</td>
<td>1-3 mg/kg/day Upto 6 mg/kg</td>
<td>Restless sleep, PLMS, RLS</td>
<td>Dosman CF 2007</td>
</tr>
<tr>
<td>Melatonin</td>
<td>SMS, Angelman, Rett, ASD</td>
<td>1-3 mg typical Max dose 10 mg</td>
<td>Sleep onset</td>
<td>Goldman SE 2014, Cortesi F 2012, Wasdell MB 2008</td>
</tr>
<tr>
<td>Ramelteon</td>
<td>ASD</td>
<td>2-8 mg</td>
<td>Sleep onset, maintenance</td>
<td>Stigler KA 2006</td>
</tr>
<tr>
<td>Clonidine</td>
<td>ASD, DD</td>
<td>0.05-0.1 mg</td>
<td>Sleep Maintenance</td>
<td>Ingrassia A 2005</td>
</tr>
<tr>
<td>Gabapentin</td>
<td>Refractory insomnia</td>
<td>5-15 mg/kg</td>
<td>Sleep onset and maintenance</td>
<td>Robinson AA 2013</td>
</tr>
<tr>
<td>Clonazepam</td>
<td>Williams syndrome</td>
<td>0.25-0.75 mg</td>
<td>Sleep maintenance, PLMS</td>
<td>Arens R, 1998</td>
</tr>
<tr>
<td>Zolpidem</td>
<td>ADHD</td>
<td>2.5-10 mg</td>
<td>No benefit</td>
<td>Blumer JL 2009</td>
</tr>
<tr>
<td>Trazodone</td>
<td>OMS</td>
<td>25 mg-100 mg</td>
<td>Sleep maintenance</td>
<td>Pranzatelli MR 2005</td>
</tr>
<tr>
<td>Mirtazapine</td>
<td>ASD</td>
<td>7.5-25 mg</td>
<td>Sleep Maintenance</td>
<td>Posey DJ 2001</td>
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</tbody>
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Table 1: Sleep Medications used to Treat Insomnia in Children with Neurodevelopmental Disabilities.9


