CHEST

Pediatric Insomnia

Kelly M. Brown, MD; and Beth A. Malow, MD

Insomnia in children is complex and frequently multifactorial. This review discusses the major categories of insomnia as well as common causes. The consequences of insomnia, including issues with mood, behavior, and cognition, are discussed. Sleep disorders are much more prevalent in certain pediatric populations, such as children with autism spectrum disorders. The evaluation of insomnia in children includes a focused history and examination and occasionally actigraphy or polysomnography. Behavioral and pharmacological therapies are discussed, as are future directions for research and clinical practice. CHEST 2016; 149(5):1332-1339

KEY WORDS: actigraphy; cognitive behavioral therapy; melatonin; obstructive sleep apnea

Sleep problems are highly prevalent in infants and children and, if not properly treated, can become chronic, lasting for many years.[1] Although many sleep disorders result in adverse daytime outcomes, insomnia in children and adolescents is common, affecting approximately one-third of children, and can be distressing to families. Insomnia has been defined as repeated difficulty with sleep initiation, duration, consolidation, or quality that occurs despite age-appropriate time and opportunity for sleep and results in daytime functional impairment for the child and/or family.[2] Children who sleep less or have poorer sleep quality have lower test scores in cognitive tasks.[3] Insomnia in older children contributes to increased behavioral problems and difficulty with concentration.[4] Insomnia in infants and preschool-aged children has been linked to parents' poor general health and psychological distress, even in mothers with no history of depression.[5] Behavioral sleep interventions can improve, in particular, infants' sleep and maternal mood.[6] Therefore, interventions to improve sleep in children can benefit both the child and the entire family.

Types of Pediatric Insomnia

There are multiple types of insomnia in childhood. For the purpose of this review, insomnia is defined as sleep-onset delay more than 30 min per night, on average, or short sleep duration, less than 8 h, occurring 3 or more nights per week, by parent report. These values are derived from normal values for sleep in children.[7] For more detail, including a variety of sleep parameters in different age groups, see the comprehensive paper by Montgomery-Downs.[7] Behavioral Insomnias of Childhood (BIC) are the most commonly encountered causes of insomnia in children. These insomnias, thought to result largely from ineffective sleep training or difficulties with limit-setting by parents or caretakers, can cause difficulty with sleep onset and sleep maintenance.

ABBREVIATIONS: AHI = apnea-hypopnea index; ASD = autism spectrum disorders; BIC = behavioral insomnia of childhood; CSHQ = Children's Sleep Habits Questionnaire; FISH = Family Inventory of Sleep Habits; GABA = gamma-aminobutyric acid

AFFILIATIONS: From the Sleep Disorders Division, Department of Neurology, Vanderbilt University School of Medicine, Nashville, TN.

CORRESPONDENCE TO: Kelly M. Brown, MD, Vanderbilt University Medical Center, 1161 21st Avenue South, Room A-0116, Nashville, TN 37232-2551; e-mail: kelly.m.brown@vanderbilt.edu

DOI: http://dx.doi.org/10.1378/chest.15-0605

Sleep-maintenance insomnia refers to difficulty maintaining sleep (eg, night wakings), which affects daytime functioning. According to the *International Classification of Sleep Disorders* (3rd ed.),[8] these insomnias have been classified and are defined as outlined next.

BIC, sleep-onset association type, is characterized by the child's dependency on specific stimulation, objects, or settings for initiating sleep or returning to sleep following an awakening. In the absence of these conditions, sleep onset is delayed. One example is an infant who needs a pacifier to fall asleep and to return to sleep after a nighttime awakening. Another example is a child who needs his or her mother present to fall asleep or to return to sleep after a nighttime awakening. The conditions can become increasingly demanding. These children may have an inability to self-soothe back to sleep in the night. Factors that detract from children's ability to fall asleep on their own include parental presence while falling asleep, intentional cosleeping, or feeding at sleep onset.[9]

BIC, limit-setting type, is characterized by bedtime stalling or bedtime refusal that is the result of inadequate limit-setting by a caregiver. Examples include a refusal to go to bed or repeated demands at bedtime for a drink or to use the bathroom. This type of insomnia is characterized by prolonged sleep onset but not necessarily by awakenings overnight and typically occurs in children who are of preschool or school age.

BIC, mixed type, is characterized by features of both sleep-onset association insomnia and bedtime resistance and represents a third subtype within this diagnostic category.

Psychophysiological insomnia is characterized primarily by heightened arousal and learned sleep-preventing associations that result in insomnia. Children with this type of insomnia may sleep more easily in settings other than their own bedroom. They also may have an easier time falling asleep when they are not trying to fall asleep, which is known as paradoxical intention. These children may excessively focus or worry about their sleep. They may have excessive cognitive and somatic arousal.

A different category of sleep disorders, termed circadian rhythm abnormalities, can also contribute to insomnia. A common example, particularly in adolescents, is delayed sleep-wake phase disorder, which is characterized by a tendency for a late bedtime and difficulty waking in the morning. There can be genetically determined variations to the typical circadian rhythm, and sorting out whether adolescents who prefer a later bedtime are motivated by environmental factors (eg, social events, screen time, homework) from biological/genetic factors is challenging. Sleep is felt to be best when the timing of sleep practically matches the person's internal or biological circadian rhythm. There are frequent misalignments between the timing of sleep for children and adolescents and their optimal circadian timing of sleep, based on social requirements such as school. These children may also have difficulty maintaining alertness during the day, particularly in the morning, if they have a delayed sleep phase. Irregular sleep/wake circadian rhythm disorder, and other circadian disorders, can be seen in children with developmental disabilities.[10]

Prevalence

Studies have reported a range of prevalence rates for insomnia in children, varying from 10% in Vietnam and Thailand to 25% to 30% in United States and Australia to as high as 75% China and Taiwan.[9] Cross-sectional studies on a variety of cultures have shown fairly consistent prevalence rates between 20 and 30% for bedtime problems or insomnia for infants, toddlers, and preschoolers.[11] The prevalence when reported by parents of normally developing children is 11% to 37%.[12,13]

Consequences of Pediatric Insomnia

There are many consequences of insomnia for infants, children, adolescents, and their families. The primary consequences are related to issues with mood and behavior, cognition, and relationships within the family (which can be negatively affected by the child's insomnia). Limited or poor-quality sleep may cause prefrontal cortical dysfunction and can cause issues with executive functioning, such as with working memory, emotional regulation, and behavioral inhibition, leading to issues with attention in school.[14]

Bedtime resistance has been associated with a higher incidence of hyperactivity and conduct problems in school. Hyperactivity has also been associated with longer sleep duration during weekends. Therefore, better limit-setting and earlier weeknight bedtimes may be helpful for mood and behavioral issues.[14] Bedtimes need to be individualized to the particular child; however, as in other cases, a too-early bedtime may interfere with sleep onset.

Sleep deprivation has been shown to have a negative impact on student learning ability and academic