

Common sleep disorders in children: assessment and treatment

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ABSTRACT

اضطرابات نوم الأطفال شائعة، خاصة عند الأطفال الذين يعانون من إعاقات موجودة مسبقًا، وحالات عصبية، واضطرابات في النمو العصبي. تختلف العواقب والتي قد تترافق اضطرابات النوم مع قصور في الأداء الإدراكي العصبي وفشل النمو. زيادة الوعي باضطرابات النوم بين أطباء الأطفال سيحسن التشخيص المبكر لهذه الاضطرابات وعلاجها. تصف هذه المراجعة أنماط النوم الطبيعية عند الرضع والأطفال وتقدم مستجدات حديثة لاضطرابات النوم الشائعة والتي تعمل على تحسين تشخيص وعلاج الأطفال الذين يعانون من اضطرابات النوم.

Pediatric sleep disorders are a common, mainly among children with pre-existing disabilities, neurological conditions, and neurodevelopmental disorders. The consequences are variable, and sleep disorders may be associated with deficits in neurocognitive performance and growth failure. Rising awareness about sleep disorders among pediatricians will improve the early diagnosis and management of these disorders. This review describes normal sleep patterns in infants and children and provide a recent update on common sleep disorders that improve the diagnosis and treatment of children with sleep disorders.

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Pediatric sleep disorders are common; their prevalence ranges from 10–28%.^{1,2} Children with pre-existing disabilities, neurological conditions, and neurodevelopmental disorders may be at a higher risk: up to 80% of children with epilepsy, 83% with autism

spectrum disorder, and 73% with attention deficit hyperactivity disorder have comorbid sleep problems.³ An increased incidence of sleep problems has been observed following the coronavirus disease 2019 (COVID-19) pandemic and the use of electronic media devices has been observed.^{4,5}

Sleep plays a crucial role in children's brain development and growth, learning, memory processes, school performance, and general health. The consequences of sleep disturbances include daytime sleepiness, deficits in neurocognitive performance, poor school/academic performances, and growth failure.^{6,7}

Pediatricians should be familiar with normal childhood sleep patterns and common sleep disorders. This review describes normal sleep patterns in infants and children and provides a recent update on common sleep disorders to improve awareness, diagnosis and treatment of children with sleep disorders.

Normal sleep patterns in infants and children.

Sleep patterns and structure changes with age during the first years of life. Neonates do not have circadian rhythm, and require the greatest total sleep time. The circadian rhythm (active; rapid eye movement [REM], and quiet; non-rapid eye movement sleep [NREM]) begins to emerge at 10-12 weeks. NREM sleep is further subdivided into three stages from stage 1, the lightest sleep, to stage 3, deepest sleep. When children grow older, sleep time declines.^{8,9} Table 1 shows the approximate sleep needs at various age.¹⁰ Every child has unique sleep requirements; therefore, these are global norms based on age. The cultural milieu and environment are also important for understanding and evaluating child sleep duration and patterns.

Clinical assessment. Obtaining a detailed history, followed by comprehensive general and neurological physical examinations, appear to be a cornerstone for diagnosing pediatric sleep problems. The sleep history obtained from the parent/caregiver or child should focus on bedtime and rise time, sleep environment (e.g., child's bed or parents' bed), sleep-onset time, sensation of discomfort in the extremities, snoring, apneic events

that occur during sleep, restless sleep, unusual nighttime events such as sleepwalking or confusion, daytime sleepiness, mood disturbances, alcohol, caffeine, and medications. The history should also focus on the developmental milestones, the assessment of cognitive function, and any pre-existing neurological conditions, such as cerebral palsy or neurodevelopmental disorders, like autism. Physical examination should focus on the height, weight, body mass index, blood pressure, clubbing, cyanosis, dysmorphic features, craniofacial anomalies, tonsillar or adenoid hypertrophy, examination of the upper airway and nasal passages, auscultation of the lungs and heart, and neurological examination.

Specific sleep disorders in children and adolescents.

Pediatric chronic insomnia. Insomnia is defined as a persistent difficulty with sleep initiation, duration, consolidation, or quality that occurs despite adequate opportunities and circumstances for sleep.¹¹ Pediatric insomnia is common, with prevalence ranging from 10–40%. There is a high risk in children with pre-existing neurodevelopmental, or chronic medical conditions.¹² Insomnia can be divided into 3 groups: transient sleep disturbances, psychophysiological insomnia, and behavioral insomnia which is the most important in childhood. The role of genetic and epigenetic influences is also gaining interest.¹³ Untreated chronic insomnia has potentially detrimental consequences, including neurobehavioral developmental problems, inattentiveness, hyperactivity impulsivity, emotional symptoms, poor school performance, and academic underachievement.¹⁴

The diagnosis of chronic insomnia in children is clinical. Polysomnography is rarely indicated.

The first step in the treatment of chronic insomnia is based on behavior interventions and good sleep practice.¹⁵ Pharmacological treatments mainly include hypnotic drugs (melatonin and sedating antihistamines) (Table 2). Several meta-analyses support melatonin as the safest choice for children, including children with neurodevelopmental disabilities such as autism spectrum disorders.¹⁶⁻¹⁸ The recommended dose of melatonin is 3 to 5 mg, 30 min before bedtime.

Obstructive sleep apnea (OSA). The OSA occurs in

1 to 5% of children,¹⁹ and is characterized by partial or complete upper airway collapse or obstruction despite thoracic and abdominal respiratory effort, which disrupts normal sleep patterns and ventilation. Obstruction is primarily due to hypertrophied tonsils and adenoids. Other etiological factors include obesity, neuromuscular disorders, Down syndrome, vitamin D deficiency, and malformations of the upper airway.¹⁹

Snoring and apneas are the classic signs of OSA. Primary snoring is the mildest form of OSA, occurring in 8% of children. The nocturnal symptoms of childhood OSA include habitual snoring, unusual sleeping positions (e.g., hyperextended neck, seated with open mouth), sleep-related paradoxical breathing, bed wetting, and morning headaches. Clinical manifestations of OSA during daytime include decreased attention, poor school performance, hyperactivity, and sleepiness.²⁰ Patients with untreated OSA may develop metabolic syndrome, systemic hypertension, failure to thrive, or pulmonary hypertension.²⁰

With a full history and physical examination, nocturnal polysomnography is the gold standard test to confirm OSA and its severity.²¹ Newer methods such as overnight pulse oximetry data can diagnose OSA. Home sleep apnea tests are not recommended for diagnosis of OSA in children.²² Other tests to evaluate children with OSA may include chest x-ray, cardiac evaluation, iron studies, and vitamin D level.

Management options of pediatric OSA includes medical treatments and surgical interventions, depending on the severity of the OSA. For mild to moderate OSA, intranasal corticosteroids at bedtime, usually in combination with leukotriene inhibitors, are the first line of treatment.^{23,24} If there is adenotonsillar hypertrophy, adenotonsillectomy is the mainstay of treatment.²⁵ Other surgical options, such as supraglottoplasty, have limited data.²⁶ Continuous positive airway pressure (CPAP) breathing device or bilevel PAP (in patients with neuromuscular disorders) should be considered for residual OSA.²⁷ Any risk factor such as obesity or allergic rhinitis must be treated aggressively. In patients with residual OSA, rapid maxillary expansion (which is applied through orthodontic appliances, in which pressure is directly applied to the maxillary suture via anchor teeth) and myofunctional therapy, which consists of isotonic and isometric exercises targeted to oral and oropharyngeal structures, should be discussed.^{28,29}

Narcolepsy. Narcolepsy is a chronic neurological disorder characterized by excessive daytime sleepiness, cataplexy, hypnagogic and hypnopompic hallucinations,

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Table 1 - The average sleep needs at various age.

Age	Hours of sleep	Nap
0-2 months	12-18 hours a day	6-8 naps 10 min to 4 h a day
4-12 months	14 to 15 hours a day	2 naps of 2 to 4 h a day
1-2 years	12 to 14 hours a day	1 nap of 1 to 3 h a day
3-5 years	11 to 13 hours a day	May or may not include a nap during the day
6-12 years	9 to 11 hours a day	Most children no longer needs nap (if occurs, usually short 30 min)
13-18 years	8 to 10 hours a day	Most children no longer needs nap

Table 2 - Pediatric sleep disorders pharmacotherapy.

Disease / Drug	Potential side effects
Chronic insomnia	
Melatonin	Headache, dizziness, bed-wetting
Antihistamines (diphenhydramine)	Dizziness, increase in the thickness of lung secretions
Narcolepsy	
Methylphenidate	Loss of appetite, suppression of growth, exacerbation of anxiety, nervousness,
Dextroamphetamine, amphetamine- dextroamphetamine mixture	Loss of appetite, suppression of growth, exacerbation of anxiety, nervousness
Modafinil, armodafinil	Headache, precipitation of Stevens-Johnson syndrome, decreases the potency of concurrently administered oral contraceptives
Sodium oxybate	Tremor, constipation, bed-wetting, exacerbation of sleep apnea, weight loss, exacerbation of depression
Cataplexy	
Sodium oxybate	Tremor, constipation, bed-wetting, exacerbation of sleep apnea, weight loss, exacerbation of depression
Venlafaxine, protriptyline, clomipramine	Drowsiness, weight gain, tremor
Fluoxetine, sertraline	Nervousness, insomnia, increased risk of suicidal thoughts
Restless leg syndrome	
Elemental iron	constipation and abdominal discomfort
Gabapentin	Drowsiness, nausea
Clonazepam	Drowsiness, tolerance
Obstructive sleep apnea	
Mild to moderate OSA: intranasal corticosteroids plus leukotriene inhibitor (montelukast).	Nasal irritation Nausea, headache, dizziness
Non-REM sleep parasomnias	
Clonazepam	Drowsiness, tolerance
L-5-hydroxytryptophan	Nausea
Circadian sleep-wake disorders	
Melatonin	Headache, dizziness, bed-wetting

and sleep paralysis.³⁰ It is further divided into 2 types according to the 3rd edition of the International Classification of Sleep Disorders (ICSD-3): type I, with cataplexy and/or deficient hypocretin-1 in cerebrospinal fluid; and type II, with normal hypocretin-1 levels with an absence of cataplexy.¹¹ Cataplexy is characterized by a sudden and transient loss of skeletal muscle tone; the consciousness is preserved. It is generally triggered by emotions.³¹

It is estimated that approximately 1 in 2000 individuals are affected by narcolepsy; children with

attention deficit hyperactivity disorder are at higher risk.^{32,33} Interestingly, up to 50% of individuals with narcolepsy are undiagnosed.³² Narcolepsy may present with a wide range of manifestations explaining, partly, its misdiagnosis, and include mainly excessive daytime sleepiness, sleep paralysis, and sleep disruption. Other possible symptoms include depression, aggression, and hallucinations.³⁰

The ICSD-3 recommends polysomnography followed by the multiple sleep latency test to establish a diagnosis of narcolepsy.¹¹ In narcolepsy type 1,

hypocretin-1 is low in the cerebrospinal fluid, and can be used as diagnostic tool.³⁰

The management options for children with narcolepsy include counseling and pharmacological treatment (Table 2). The patient and family should be informed that there is no cure for narcolepsy. Behavioral, lifestyle changes, avoiding of alcohol, and regular physical activity are important components of the treatment.^{34,35} Pharmacologic therapy for narcolepsy depends mainly on the dominant symptoms that impair the quality of life of the child.^{34,35} First-line treatment for excessive daytime sleepiness include methylphenidate, amphetamine, or modafinil. Conversely, if cataplexy is more predominant, sodium oxybate (+-hydroxybutyrate) is recommended.³⁶ Tricyclics, selective serotonin reuptake inhibitors, and serotonin-norepinephrine reuptake inhibitors are also effective against cataplexy with dysphoria.^{34,35}

Restless leg syndrome (RLS). The prevalence of RLS in childhood is approximately 7.7% of persons referred to a sleep center.³⁷ It occurs equally among boys and girls. RLS is multifactorial; iron deficiency, vitamin D deficiency, medications, diabetes Mellitus, sleep instability, and genetic susceptibility are the main causes.^{38,39}

The RLS is characterized by frequent recurrent movements during sleep, involving large muscle groups, and is described by parents as frequent repositioning or disruption of bed sheets. Essential diagnostic criteria according to International Restless Legs Syndrome Study Group are the following (1) duration of symptoms more than 3 months; (2) movements during sleep that occur for at least 3 nights/week; (3) video polysomnography showing five or more large body movements per hour; (4) presence of symptoms, which include sleepiness, behavioral concerns, or cognitive deficits; and (5) exclusion of other conditions that might cause restless sleep. The physical examination is usually normal.⁴⁰

The first line treatment of childhood RLS is the correction of systemic iron deficiency (ferritin levels below 30 ng/ml) which may take weeks or months, together with correction of vitamin D deficiency.^{39,41} It is also crucial to avoid medications that tend to trigger or worsen RLS, such as risperidone and antiemetics. Low doses of gabapentin at bedtime may help relieve discomfort and pain symptoms associated with RLS. Evening light exercise is advised. The use of dopaminergic agents such as ropinirole, pramipexole, or rotigotine skin patches in adolescents, is mainly empiric.³⁸

Parasomnias. Parasomnias affect up to 50% of children.⁴² Sleepwalking (somnambulism), confusional arousals, sleep-talking, and sleep terrors are the most

common parasomnias in children. Parasomnias that happen during NREM sleep include sleepwalking, sleep-talking, and sleep terrors, whereas nightmares are REM-related parasomnias that happen more during the second part of the night. Common triggers for parasomnias include obstructive sleep apnea, sleep deprivation, gastroesophageal reflux, and medication.^{11,43}

In sleepwalking, the child usually sits up in the bed and opens the eyes, and/or crawls around the bed, or develops more complex and agitated episodes, leaving the house or becoming violent. The child typically has no memory of the event. Sleep terrors are characterized by sudden arousal accompanied by autonomic (tachycardia, sweating, and mydriasis) and behavioral manifestations of intense fear. The child is not responsive, agitated, with complete amnesia. Nightmares are characterized by vivid and terrifying well-remembered dreams; associated with negative emotions such as anxiety or fear, anger but are not as intense as sleep terrors. Nightmares seems very real for children.⁴³

Differential diagnoses of parasomnias include certain types of sleep-related epilepsy such as frontal lobe or temporal lobe epilepsy. Overnight electroencephalogram may be indicated.⁴⁴

The treatment of parasomnias is mainly based on reassurance, reduction of precipitating factors, and increase in total sleep time. Parents must be aware that parasomnia is a neurodevelopmental phenomenon that often resolves spontaneously during adolescence. Healthy sleep habits are important; adolescents should avoid caffeine. Preventive measures to secure a safe home must be taken to prevent patients from hurting themselves. During the event, parents must avoid awakening the child because this might scare her/him. Instead, they can gently guide the child back to the bed. Pharmacological treatment of parasomnias may be indicated in children who exhibit violent or harmful behaviors. Benzodiazepines are usually used as the first-line treatment.⁴⁵ In the case of non-response, tricyclic antidepressants may be used (Table 2). L-5-hydroxytryptophan may be helpful in sleep disorders.⁴⁵ Treatment for nightmares involves reassurance and behavioral therapy, if necessary.

Circadian rhythm sleep-wake disorders. Circadian rhythm sleep disorders are prevalent in pediatric population, including in children with neurodevelopmental disorders. There are different forms of the disorder, including delayed sleep-wake phase disorder, advanced sleep-wake phase disorder, and shift work disorder. Delayed sleep-wake phase disorder is the most frequent sleeping disorder during adolescence, as

it affects up to 16% of adolescents.⁴⁶ Patients typically report difficulties in initiating sleep and/or with waking in the morning.^{46,47} The therapy usually starts with modifying life style such as no daytime naps, regular bedtimes and wake times during the week and weekends, no stimulating drinks or food in the evening, and no electronics in the bedroom. If this fails, chronotherapy is indicated, where bedtime is gradually delayed until the desired hour of falling asleep is reached. Melatonin, administered 3 to 5 h before bedtime, can sometimes help to reset the sleep-wake cycle.⁴⁷

Conclusion. Pediatrics sleep problems are common and can compromise social, academic, and neurobehavioral functioning. Therefore, the concept of sleep medicine should be integrated into pediatric practice. The pediatrician has a major role in identifying children's sleep problems in order to improve management and prevent impact on cognitive outcomes.

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