

Anesthesia and Obstructive sleep apnea

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in anesthesia

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التخدير فى مرضى إنقطاع النفس الإنسدادي النومي

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Abbreviations

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- ADHD: Attention Deficit Hyperactivity Disorder
- AHI: Apnea Hypopnea Index
- ANP: Atrial Natriuretic Peptide
- BiPAP: Bilevel Positive Airway Pressure
- CAD: Coronary Artery Disease
- COPD: Chronic Obstructive Pulmonary Disease
- CPAP: Continuous Positive Airway Pressure
- EDS: Excessive Daytime Sleepiness
- EEG: Electro Encephalo Graph
- FEV: Forced Expiratory Volume
- MI: Myocardial Infarction
- MSNA: Muscle Sympathetic Nerve Activity
- OSA: Obstructive Sleep Apnea
- PAH: Pulmonary Artery Hypertension
- PASP: Pulmonary Artery Systolic Pressure
- REM: Rapid Eye Movement
- SDB: Sleep Disordered Breathing
- SRBD: Sleep Related Breathing Disorders
- UA: Upper Airway
- UPPP: Uvulo Palato Pharyngo Plasty

Introduction

Abstract:

Obstructive sleep apnea (OSA) is an increasingly common sleep disorder, which is of particular concern to anesthesiologists because it is associated with increased perioperative morbidity and mortality.

Because OSA is undiagnosed in an estimated 80 percent of patients, it is necessary that anesthesia practitioners have adequate knowledge of the clinical presentation and diagnosis of OSA.

OSA has many predisposing factors, the most common and suspected factors are; obesity, body fat distribution, smoking, nasal obstruction, laryngeal obstruction, endocrine/metabolic and neuromuscular disorders .

There are many sequelae of OSA, the most important and threatening of them are cardiovascular (e.g.; hypertension, ischaemic heart disease, right heart failure) and pulmonary sequelae (e.g.; hypoxaemia, hypercapnea, pulmonary hypertension)

Patients with OSA are at a high risk of perioperative complications and pose several challenges to anesthesiologists including difficult tracheal intubation and increased postoperative complications (e.g.; respiratory obstruction after extubation or respiratory depression after opioid administration.)

The key to safe anesthetic care for these patients is a careful and meticulous preparation which begins with thorough preoperative assessment, a thoughtful and well executed anesthetic plan and extends well into the postoperative period.

keywords:

Obstructive sleep apnea, apnea hypopnea index, continous positive airway pressure, anesthetic plan, pathophysiology, pulmonary hypertension, hypoxia.

Chapter 1

Definitions and types of sleep related breathing disorders

Obstructive sleep-disordered breathing in children is a spectrum of disorders of breathing during sleep characterized by snoring and upper airway obstruction. In its most severe form, obstructive sleep apnea, prolonged complete upper airway obstruction occurs, disrupting normal ventilation and sleep patterns. The hallmark feature of the disorder is habitual and loud snoring. Adenotonsillar hypertrophy is the most common cause of obstructive sleep-disordered breathing. Left untreated, obstructive sleep-disordered breathing may lead to problems related to sleep disruption such as inattention, poor learning, behavioral problems, and attention deficit/hyperactivity disorder or may cause more serious morbidity, including growth failure and pulmonary hypertension.

Obstructive sleep-disordered breathing, a common problem in children of all ages, refers to a continuum that ranges in severity from primary or simple snoring, through upper airway resistance syndrome, obstructive hypopnea syndrome and, in its most severe form, obstructive sleep apnea syndrome (**Figure**). [1].

Frequent and loud snoring, the least severe form of sleep-disordered breathing, affects 10% to 12% of children ages 2 to 8 years. [2].

Obstructive sleep apnea syndrome, the most severe form of sleep-disordered breathing, has been estimated to affect about 2% of all children [1].

The American Thoracic Society (ATS) defines obstructive sleep apnea syndrome in children as a disorder of breathing during sleep that is characterized by prolonged partial upper airway obstruction and/or intermittent complete obstruction (obstructive apnea) that disrupts normal ventilation during sleep and normal sleep patterns.[1]

Obstructive hypopnea is defined as a decrease in airflow by 50% despite effort during the same time or breath cycles, associated with a desaturation or arousal.[2]

Major symptoms of obstructive sleep-disordered breathing include habitual snoring, pauses in breathing, mouth breathing, coughing, sweating, enuresis, and restless sleep.[1]. Excessive daytime somnolence may also be apparent, but is uncommon in very young children.[1]. Habitual snoring is the characteristic feature of sleep-disordered breathing that may or may not be associated with abnormal gas exchange.[1]

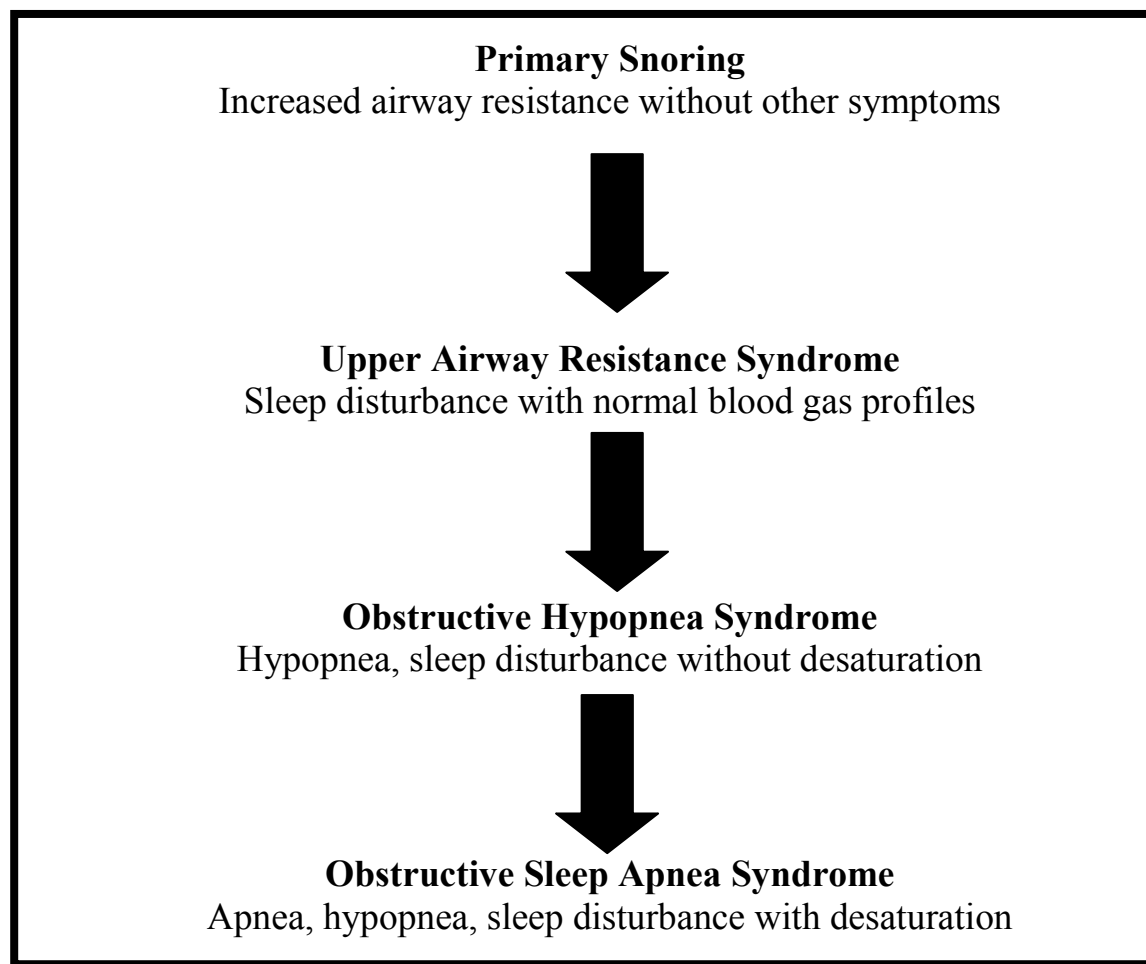


Figure. The continuum of obstructive sleep disordered breathing

Pediatric sleep disorders are common, affecting approximately 25% to 40% of children and adolescents [3]. Although there are several different types of sleep disorders that affect youth, each disorder can have a significant impact on daytime functioning and development, including learning, growth, behavior, and emotion regulation [4]. Although the relationship between sleep and psychiatric disorders has been established in adults, researchers are only beginning to uncover the interaction between sleep and psychiatric disorders in children and adolescents, including depression, attention-deficit/hyperactivity disorder (ADHD), and autism.

SLEEP IN CHILDREN

Parents often ask practitioners how much sleep their child needs. This can be a difficult question to answer as sleep needs not only change with developmental stages, but recent studies and surveys show that there is a large variability in both children's sleep need, especially in the first few years of life [3], as well as the actual amount of sleep that youth in America are getting [4].

Newborns (0 to 3 Months)

There is no clear sleep pattern in the first few weeks of life; however, most newborns sleep between 10 and 18 hours per day, although this may be longer if infants are premature. This total sleep time is divided into many short sleep periods across the 24-hour clock, with no differentiation between day and night.

Infants (3 to 12 Months)

Sleep patterns begin to consolidate by 3 months of age, with babies beginning to show a diurnal cycle of sleep at night and wakefulness during the day. Infants typically sleep approximately 10 to 12 hours at night and up to 3 or 4 hours during the day (divided into two or three daytime naps). At approximately 6 months of age, 90% of infants take only two naps, with their nighttime sleep progressively lengthening. It is important to keep in mind that with the onset of each developmental milestone (eg, pulling to standing or walking), children's sleep can become disrupted for several nights to weeks before and after the milestone occurs [5].

Toddlers (12 Months to 3 Years)

By 18 months of age, the majority of toddlers transition from two daytime naps to one and continue to sleep approximately 10 to 12 hours at night. Approximately 25% to 30% of toddlers have sleep problems [3], with bedtime resistance (behavioral insomnia of childhood, limit-setting type) and frequent night waking (behavioral insomnia of childhood, sleep-onset association type) the two primary disorders in this age group. In addition, daytime behavior is markedly worse in children who are poor sleepers.

Preschool-Aged Children (3 to 5 Years)

Sleep amounts in preschool-aged children decrease, mostly the result of the discontinuation of daytime naps. By the age of 5 years, 75% of children have given up their nap and sleep a total of 11 to 12 hours at night. As children develop language, cognitive reasoning, and imagination, they also can develop difficulties initiating sleep. Many children in this age group test limits at bedtime, making bedtime refusal a common sleep complaint by parents. In addition, many children develop fears of the dark and monsters, also resulting in bedtime resistance, and an increase in nightmares.

School-Aged Children (6 to 12 Years)

Almost all children in this developmental stage have a single sleep period at night, lasting 10 to 11 hours, and are alert and awake during the day, with rare naps. Recent surveys and data indicate that approximately one third of school-aged children experience sleep problems [6]. The most common complaints are bedtime resistance, difficulty initiating sleep because of anxiety, and daytime sleepiness. These symptoms may be a result of obstructive sleep apnea, insufficient sleep, poor sleep hygiene, and/or an anxiety disorder. Sleep restriction in this age group has been shown to be related to difficulties with attention, memory, learning, and behavior [7].

Adolescents (12 to 18 Years)

Although adolescents clearly have been shown to need 9 to 9.25 hours of sleep per night through studies conducted in a laboratory setting [13], most get only 7 hours of sleep each night [8]. This cumulative sleep debt has many causes and many consequences for daytime functioning.

Sleep-Disordered Breathing

Sleep-disordered breathing (SDB) in children can range from primary snoring to obstructive sleep apnea syndrome (OSAS) and is related to significant cognitive and behavioral sequelae, including learning, attention, concentration, hyperactivity, and aggressive behavior. The incidence of habitual snoring has been reported at 3% to 12% of the general pediatric population, with OSAS seen in 1% to 3% of children [9]. Although recent evidence suggests that snoring itself is related to negative neurobehavioral functioning [3], OSAS is a more serious disorder that poses significant risk for the developing brain [10].

The clinical presentation of OSAS differs from that in adults, where the typical presentation is obese individuals who snore and are excessively sleepy during the day. In contrast, children who have OSAS may or may not be obese; the typical cause of this disorder in children is enlarged tonsils and adenoids. Although snoring alone is not indicative of OSAS in children, the American Academy of Pediatrics recommends that all children who have habitual snoring should be evaluated for OSAS [10]. Additional symptoms of OSAS in children include restless sleep, sleeping in an upright position or with the neck hyperextended (to keep the airway open), noisy breathing, and frequent infections of the tonsils or inner ear [10]. Although children may present typical symptoms of daytime sleepiness (eg, difficulty waking in the morning, falling asleep in school, or frequent naps that are not age appropriate), some children actually may be hyperactive, especially as they get more tired. Neurobehavioral problems also may be present in children with OSAS, including

mood lability, aggression or other acting out behaviors, ADHD-like symptoms (eg, inattention or hyperactivity), and learning problems [3]. Studies find that academic functioning improves in children who have OSAS who have been treated with adenotonsillectomy compared with children who were not treated [3,4]. OSAS occurs in children of all ages and both genders, although the peak prevalence of this disorder is seen in preschool-aged children (3 to 5 years).

Children who have craniofacial abnormalities, down syndrome, or micrognathia are at increased risk for OSAS. In addition, with the rise in childhood obesity, increasingly more children are at risk for OSAS because of their weight, similar to adults.

For 70% of children, symptoms of OSAS are alleviated with a tonsillectomy and/or adenoidectomy [8,9]. A follow-up overnight sleep study post surgery is recommended. For children who are overweight, weight loss is the recommended treatment. Pharmacologic approaches may be indicated for children who have chronic nasal congestion that interferes with the quality of their breathing during sleep.

Finally, in children in whom a tonsillectomy or adenoidectomy is contraindicated or unsuccessful, nasal continuous positive airway pressure (CPAP) may be appropriate. CPAP can be a successful treatment for children and adolescents; however, young children and children who have developmental delays may have greater difficulty tolerating this treatment and may need to participate in systematic desensitization to improve compliance with wearing the CPAP during sleep [9].

Sleep-Related Breathing Disorders

SRBDs are highly prevalent in the United States, with an estimated 20% of adults with mild to asymptomatic disease and at least 5% of adults with significant disease [11]. Prevalences of 10% to 25% have been reported for primary snoring in children 3 to 12 years old [11,12], and the prevalence of obstructive sleep apnea has been found to be 1% to 3% in the general pediatric population [11]. The clinician should suspect obstructive sleep apnea syndrome or some other form of SRBD in any patient complaining of EDS, loud or chronic snoring, or unrefreshing sleep. Despite popular belief, obstructive sleep apnea syndrome is not confined to obese individuals.

Although its prevalence is greater in the obese white population, even greater prevalences are found in Asian and other populations [13]. Longitudinal data from the Wisconsin Sleep Cohort Study [39] showed that among patients with mild obstructive sleep apnea at baseline, a 10% increase in body weight is associated with a six fold increase in the risk of developing moderate or severe obstructive sleep apnea.