Obstructive sleep apnea in children: the when, how and why of screening

Kirsten Jewell, BSc, BPHE (Meds 2012)
Faculty Reviewer: Dr. Murad Husein, Department of Otolaryngology, UWO

Obstructive sleep apnea syndrome (OSAS) is part of the spectrum of sleep disordered breathing (SDB) and is estimated to occur in about 2% of the pediatric population,1 whereas 2-5% of adults are affected.2 The peak incidence of OSAS is in pre-schoolers, when tonsillar hypertrophy is most common.3 Like adult OSAS, pediatric OSAS is caused by periods of complete or partial upper airway collapse during sleep, disrupting normal sleep patterns and resulting in intermittent hypoxia during apneic and hypopneic episodes. It is believed that OSAS results from a combination of anatomic abnormalities resulting in decreased space and increased pressure in the upper airway, and neuromuscular or functional abnormalities that cause decreased muscle tone while sleeping and lead to periodic airway collapse.3,4

There is an increasing awareness about the prevalence and consequences of OSAS in the adult population among primary care physicians, allowing for improved screening, diagnosis and treatment.3 However, the recognition of this disorder in the pediatric population is much more difficult, and current screening among primary care physicians is inadequate.5 Children with OSAS present with different symptoms, have different risk factors, different pathophysiology, and require different management strategies than in adults.4,5,7

CLINICAL IMPORTANCE
OSAS in children has been shown to contribute significantly to childhood morbidity with consequences seen in multiple systems. The severity of sleep apnea has a dose-dependent relationship with decreased left ventricular function leading to congestive heart failure and cor pulmonale.1 Plasma C-reactive protein levels, a marker of inflammation with an important role in atherogenesis, have also been shown to be elevated in children with SDB,8 and fasting insulin levels also seem to correlate with the disease severity, independent of BMI.9 Failure to thrive and a low weight index have been noted in children with OSAS, possibly due to changes in hormonal release during apneic episodes.10

It is known that OSAS in adults results in daytime hypersomnolence and psychological sequelae such as disturbed concentration and memory,2 however in children the deficits in neuropsychological and behavioural functioning caused by untreated OSAS can severely affect development, interfere with learning, and cause symptoms that may be diagnosed as attention-deficit hyperactivity disorder (ADHD). In one well-known study, it was found that 33% of children with ADHD exhibited symptoms of SDB while only about 10% of children without ADHD in the study exhibited such symptoms, with the authors postulating a causal relationship.11 This hypothesis has been strengthened by the finding that symptoms of inattention and hyperactivity predictably improve after surgical treatment for OSAS.12

DIAGNOSIS
RISK FACTORS
Obesity is a common risk factor in both adults and children, as increased fatty tissue in the neck results in increased upper airway resistance.13 However in children, OSAS is still most commonly related to adenotonsillar hypertrophy.3,7 Obstructive sleep apnea is also associated with other medical disorders such as Down syndrome, anatomic craniofacial abnormalities such as micrognathia, neuromuscular disease including cerebral palsy, and conditions such as sickle cell disease and laryngomalacia.1 Children with any of these conditions should be seen as high-risk and carefully screened.

HISTORY
A thorough sleep history should be taken from the parents, asking specifically about 1) snoring, 2) apneic episodes, 3) laboured mouth breathing, and 4) restlessness.3 Habitual (nightly) snoring is the most sensitive indicator, as OSAS is rarely seen in its absence.1 However, snoring occurs in up to 12% of children and therefore has poor specificity.1 Differentiating between primary snoring and OSAS can be difficult based on history alone. Note that the loudness of snoring does not necessarily correlate to the degree of obstruction.11

Daytime symptoms may include excessive daytime sleepiness, or more commonly, hyperactivity with attention and concentration problems, possibly resulting in behavioural difficulties and learning problems. The Canadian Paediatric Society and College of Family

| Table 1. Differences in the Clinical Presentation of OSAS between Children and Adults |
|--------------------------------------|------------------|------------------|
| Most Common Risk Factor              | Children         | Adults           |
| Tonsillar hypertrophy                | Obstructive sleep apnea syndrome (OSAS) is part of the spectrum of sleep disordered breathing (SDB) and is estimated to occur in about 2% of the pediatric population, whereas 2-5% of adults are affected. The peak incidence of OSAS is in pre-schoolers, when tonsillar hypertrophy is most common. Like adult OSAS, pediatric OSAS is caused by periods of complete or partial upper airway collapse during sleep, disrupting normal sleep patterns and resulting in intermittent hypoxia during apneic and hypopneic episodes. It is believed that OSAS results from a combination of anatomic abnormalities resulting in decreased space and increased pressure in the upper airway, and neuromuscular or functional abnormalities that cause decreased muscle tone while sleeping and lead to periodic airway collapse.

There is an increasing awareness about the prevalence and consequences of OSAS in the adult population among primary care physicians, allowing for improved screening, diagnosis and treatment. However, the recognition of this disorder in the pediatric population is much more difficult, and current screening among primary care physicians is inadequate. Children with OSAS present with different symptoms, have different risk factors, different pathophysiology, and require different management strategies than in adults.

CLINICAL IMPORTANCE
OSAS in children has been shown to contribute significantly to childhood morbidity with consequences seen in multiple systems. The severity of sleep apnea has a dose-dependent relationship with decreased left ventricular function leading to congestive heart failure and cor pulmonale. Plasma C-reactive protein levels, a marker of inflammation with an important role in atherogenesis, have also been shown to be elevated in children with SDB, and fasting insulin levels also seem to correlate with the disease severity, independent of BMI. Failure to thrive and a low weight index have been noted in children with OSAS, possibly due to changes in hormonal release during apneic episodes.

It is known that OSAS in adults results in daytime hypersomnolence and psychological sequelae such as disturbed concentration and memory, however in children the deficits in neuropsychological and behavioural functioning caused by untreated OSAS can severely affect development, interfere with learning, and cause symptoms that may be diagnosed as attention-deficit hyperactivity disorder (ADHD). In one well-known study, it was found that 33% of children with ADHD exhibited symptoms of SDB while only about 10% of children without ADHD in the study exhibited such symptoms, with the authors postulating a causal relationship. This hypothesis has been strengthened by the finding that symptoms of inattention and hyperactivity predictably improve after surgical treatment for OSAS.

DIAGNOSIS
RISK FACTORS
Obesity is a common risk factor in both adults and children, as increased fatty tissue in the neck results in increased upper airway resistance. However in children, OSAS is still most commonly related to adenotonsillar hypertrophy. Obstructive sleep apnea is also associated with other medical disorders such as Down syndrome, anatomic craniofacial abnormalities such as micrognathia, neuromuscular disease including cerebral palsy, and conditions such as sickle cell disease and laryngomalacia. Children with any of these conditions should be seen as high-risk and carefully screened.

HISTORY
A thorough sleep history should be taken from the parents, asking specifically about 1) snoring, 2) apneic episodes, 3) laboured mouth breathing, and 4) restlessness. Habitual (nightly) snoring is the most sensitive indicator, as OSAS is rarely seen in its absence. However, snoring occurs in up to 12% of children and therefore has poor specificity. Differentiating between primary snoring and OSAS can be difficult based on history alone. Note that the loudness of snoring does not necessarily correlate to the degree of obstruction.

Daytime symptoms may include excessive daytime sleepiness, or more commonly, hyperactivity with attention and concentration problems, possibly resulting in behavioural difficulties and learning problems.

Table 1. Differences in the Clinical Presentation of OSAS between Children and Adults

<table>
<thead>
<tr>
<th>Most Common Risk Factor</th>
<th>Children</th>
<th>Adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tonsillar hypertrophy</td>
<td>Obesity</td>
<td></td>
</tr>
<tr>
<td>(Obesity is secondary)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daytime Symptoms</td>
<td>Hyperactivity/Inattention</td>
<td>Daytime sleepiness</td>
</tr>
<tr>
<td>Epidemiological Distribution</td>
<td>1:1 Males to Females</td>
<td>2:1 Males to Females</td>
</tr>
<tr>
<td>Polysomnograph Findings</td>
<td>Awakening during REM sleep</td>
<td>Awakening during slow-wave sleep</td>
</tr>
<tr>
<td></td>
<td>Fewer arousals</td>
<td>More arousals</td>
</tr>
<tr>
<td>Most Common Treatment</td>
<td>Surgery (adenotonsillectomy)</td>
<td>CPAP</td>
</tr>
</tbody>
</table>
Physicians of Canada endorse the Greig Health Record which recommends asking about sleep habits, daytime somnolence as well as concentration and irritability at all periodic health visits for children ages 6–17.

The ‘BEARS’ screening questions, a user-friendly tool that encourages obtaining sleep information from pediatric patients, has been shown to increase the likelihood of identifying sleep problems in a primary care setting, although it has not been validated to specifically identify OSAS.

**PHYSICAL EXAM**

Adenotonsillar hypertrophy may be suspected on physical exam by the observation of mouth breathing, hyponasal speech, or direct visualization on examination of the oropharyngeal cavity, although visual inspection may give a false impression of tonsillar size and is therefore not a reliable method of diagnosis. Referral to an otolaryngologist will allow closer visualization of the tonsils, adenoids, tongue base, and soft palate through flexible laryngoscopy, and may detect subtle structural abnormalities in the airway.

Recognition of risk factors for OSAS such as craniofacial abnormalities or obesity on physical exam may also increase the clinician’s suspicion of the diagnosis.

**FURTHER TESTING**

Audiotapes or videotapes taken by the parent of the sleeping child may sometimes be used by healthcare teams to listen and watch for observable apneic episodes. Studies examining the reliability of this method of testing have found mixed results with generally poor predictive values. While this is a non-invasive and available means of screening and may be of some use to clinicians, if the results are negative and you are still suspicious of OSAS in a patient, they should be referred for a sleep study.

The gold standard for diagnosis of OSAS is a sleep study, or polysomnography. It will reliably differentiate between primary snoring and OSAS, and can determine the severity of the syndrome. Results must be interpreted based on age-adjusted criteria, as OSAS affects sleep patterns in children differently than in adults. Children with OSAS experience greater obstruction during REM sleep, and have fewer arousals associated with apneic episodes. Children also experience greater desaturation during apneic episodes. The duration of obstruction required for a definition of apnea and the threshold number of apneic episodes for a diagnosis of a disorder must be adjusted due to the increased respiratory rate seen at baseline in children, and it is common to see hypoxia due to prolonged partial obstruction rather than the cyclical complete obstruction seen in adults. This is known as obstructive hypoventilation.

Worldwide, the demand for polysomnography is high but provision is limited and is costly. Therefore it is often difficult to obtain this test in a timely fashion. In the absence of an easily accessible sleep lab, night oximetry testing may be considered, measuring episodes of desaturation throughout the night with an O2 saturation probe on the child’s finger. This test generally has a good positive predictive value, but if it is negative the patient should still undergo polysomnography to rule out OSAS.

**MANAGEMENT**

Adenotonsillectomy is usually the most appropriate therapy for children with OSAS. In children with documented adenotonsillar hypertrophy, 75 to 100% will have symptom resolution as well as normal polysomnograph results after surgery. Patients with obesity or uncorrected craniofacial abnormalities may see poorer results on post-operative polysomnography.

Studies have repeatedly shown dramatic improvements in quality of life scores, behavioural symptoms, depression, hyperactivity and somatization for children with OSAS after adenotonsillectomy. Interestingly, children with milder forms of sleep disordered breathing also show similar improvements after the surgery.

As with all therapies, the risks of the procedure must be considered. The most serious risks of adenotonsillectomy include respiratory complications, and it is thought that patients with more severe OSAS on polysomnography pre-op are more likely to experience respiratory compromise post-op. Therefore these patients should be hospitalized overnight and monitored carefully post-operatively.

For patients with incomplete resolution of symptoms after surgery, or for those patients who are not surgical candidates, continuous positive airway pressure (CPAP) therapy has been shown to be effective. However, it is often not tolerated in the younger population and must be frequently adjusted to fit the growing child, resulting in poor compliance.

It is also important to assess for and treat behavioural sleep disturbances in children diagnosed with OSAS, especially those that continue to have daytime symptoms. Behavioural sleep disturbances including bedtime resistance, problematic sleep associations, and prolonged nocturnal awakenings, have a high co-morbidity with OSAS in children, and independently put the child at an increased risk for neurocognitive and behavioural issues. Therefore it is important to implement behavioural interventions while concurrently investigating and treating for OSAS.

**SUMMARY**

Primary care physicians have an important role to play in the identification and diagnosis of OSAS in children. However, sleep disorders are underdiagnosed in primary care practices, primarily because physicians do not ask parents about the symptoms of disordered sleep. In general, it is difficult to accurately diagnose OSAS on history and physical examination alone. However, primary care physicians should be performing regular screening for symptoms of OSAS, as recommended by American Academy of Pediatrics. Snoring is the most sensitive indicator. If clinical suspicion is high based on risk factors and/or history and physical examination, the child should be referred to an otolaryngologist or directly to polysomnography for further testing. Complex patients, including infants and those with congenital abnormalities, should be referred to an otolaryngologist. It is important to identify and treat pediatric OSAS early in order to prevent serious morbidity, including neurobehavioural sequelae such as symptoms of inattentiveness and hyperactivity.

**REFERENCES**