

Obstructive Sleep Apnea in Children

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Obstructive sleep apnea (OSA) is a syndrome of disordered breathing with a combination of intermittent partial or complete airway obstruction during sleep, with consequent hypoventilation including hypoxemia and hypercapnia as well as sleep disturbance.

Thirty to forty years ago, most tonsillectomies in the U.S.A. were done for recurrent infection. Then, the ratio was 2/3 infection: 1/3 obstruction. More recently, the ratio has reversed with at least 2/3's being performed for obstruction and the remainder for infection. A reason why the ratio may have reversed is that clinicians are more aware of obstruction and its consequences for children.

Epidemiologically, it is estimated that 1% to 4% of adults in the United States have OSA. In children, a conservative estimate is 1%. I suspect that number is significantly higher in the population I serve in metropolitan Chicago, Illinois, U.S.A.

OSA can be defined as the cessation of air flow with respiratory effort. OSA is distinguished from central apnea by the present of respiratory effort. In central apnea, while there is a cessation of airflow, there is no respiratory effort.

Airflow in obstructive apnea stops and then starts again with arousal. The respiratory effort is continual. If you observe a child with OSA sleeping or if you ask the parents what they see, chest wall motion would be observed, but there would be no airflow consistent with the obstructive episode. In contrast, while a child with central apnea may have the same cessation of airflow, there would be no chest wall motion. The adult definition of obstructive apnea requiring ten seconds without breathing is arbitrary, in my opinion, for children. I believe that the presence of apnea of any duration in a child is significant.

Ideally, every child should have a sleep study. However, we do not live in a perfect world. The decision to perform surgery can be made on the basis of history and physical exam. I will concentrate the rest of this article on the signs and symptoms of obstructive breathing.

Eating-Related

Many children with obstructive symptoms will not be able to eat solids well. They may gag or choke while taking solids. They may prefer softer food such as pudding, soft cereal, and yogurt, as opposed to harder foods such as chicken or meat. Literally, they are choking when they try to swallow the harder foods. Additionally, they may be very slow eaters, often the last to leave the table. At

times, they can be first to leave the table because they refuse to even try solids. These children would prefer drinking over eating. Some children will even leave the table with food in their mouth which they will chew for ten to twenty minutes and then spit the food out, after getting a taste of the food but being unable to swallow it without a sense of gagging.

If questioned specifically, some children may comment that they have a decreased sense of smell or hyposmia. Post-operatively, when questioned about their sense of smell, many children will articulate that they have an increased sense of smell. Some of these children become much better eaters post-operatively, in part because they have the olfactory pleasure of eating which was absent before the obstruction was removed.

In extreme cases, there can be failure to thrive because these children cannot get enough calories to grow.

Sleep symptoms

Many children will snore. These children are often restless while sleeping. If these children sleep sharing a bed with their parents on vacation or holiday, the parents will often comment that they get kicked all night as the child is extremely restless and thrashes in bed trying to get comfortable.

These children can sweat. They sweat because they are struggling to breathe and are having to work extremely hard. In fact, they are working at a time when they should be resting. They are burning up calories which they otherwise might use to grow. As a result of the difficulty in breathing, they get very poor quality sleep and may not grow well.

Enuresis

Enuresis, especially secondary enuresis, is common in children with obstructive apnea. If the child was dry and then starts bed wetting coincident with the onset of obstructive breathing, the obstructive problems are most likely the cause of enuresis. It is estimated that 60% to 70% of these children will resolve enuresis after T & A (tonsillectomy and adenoidectomy).

These children can sleep in unusual positions. Sometimes they can sleep with their neck hyperextended to open the airway. Some children may sleep on one or several pillows to prop up their head. Others will sleep sitting up, leaning over a stack of pillows to help them breathe.

These children can be very difficult to arouse in the morning. It can be a very unpleasant task trying to get these children up and going in the morning due to the fact that they have not slept well at all during the night.

Frequently, these children snore. I try to quantify the snoring by asking the parents how loud it is. Typically, the snoring is constant but may vary in loudness. Usually, the snoring is worse if the child is supine and better if the child is in a prone or lateral decubitus position. However, parents may not be able to describe the snoring changes by position as the child does not spend enough time in any one position for the parents to be able to detect a change.

I will ask the parents to quantify the snoring by asking how loud it is. Typically, I will ask if the snoring can be heard in the room, outside the door, down the hall, or down the stairs.

Many children have poor behavior secondary to OSA. I will question parents about exercise tolerance. Specifically, I ask if the child can keep up with her or his playmates. Children with significant obstruction may have to sit down to catch their breath. These children can be very irritable.

Because these children are chronically tired, there are definite effects on behavior. These children can be very irritable which can present as hyperactivity. Some of these children will be aggressive and pose major discipline problems.

These children tend to be constant mouth breathers. They may have adenoid facies with an elongation of the mid face secondary to chronic open mouth position. The chronic open mouth position can lead to orthodontic problems as the upper jaw or maxilla does not widen sufficiently due to the fact that the tongue is down and not in its normal position against the palate where it acts as an expansile force as the child breathes when the mouth is closed.

Sleep deprivation can be a cause of **poor academic performance**.

Rarely, some children can present with a headache on arising in the morning.

Additionally, they can develop cor pulmonale or right heart failure. If I suspect cor pulmonale, I order an echocardiogram per pediatric cardiology. If the patient suspected of having cor pulmonale, I do the procedure on an inpatient basis as the child may require emergent re-intubation. However, most children can have the surgery performed on an outpatient basis.

I believe that most of the time a clinician can make the diagnosis of obstructive breathing based on history and physical exam. However, if the physical exam does not fit with the history, a polysomnogram (PSG) may be indicated.

I typically order a PSG when there is a strong history of obstructive apnea but an inconsistent physical exam. Frequently, the polysomnogram will demonstrate mixed apnea. Mixed apnea is central apnea succeeded by obstructive apnea. I rarely order polysomnograms as the cost is high. In metropolitan Chicago, a polysomnogram costs about US\$ 1,500.

The treatment for obstructive sleep apnea is usually tonsillectomy. The vast majority of children will be helped with this procedure.

It is rare in my practice to use continuous positive airway pressure (CPAP) pre tonsillectomy. CPAP is a pneumatic splint. It has been reported to be used successfully in children as young as 15 months. However, my CPAP experience in this young a child does not support its use. Very rarely, children may require CPAP post-tonsillectomy if they continue to have significant problems. In this situation, I would usually order a post-operative polysomnogram and request that CPAP be titrated to an appropriate level. Rarely would I consider a tracheostomy in a child as an alternative to tonsillectomy. However, a tracheostomy will very effectively relieve the airway obstruction by bypassing the problem.

I believe that tonsillectomy is effective in at least 90% of patients without craniofacial or neurological abnormalities. The more severe the degree of obstruction, the less effective the T & A may be. Post-operatively, most children sleep better, eat better, grow better, and perform better academically. Behavior can markedly improve when the children are no longer chronically tired.

Risk factors for postoperative obstruction include: age less than two, craniofacial anomalies, hypotonia, morbid obesity, and cor pulmonale.

In conclusion, the presence of obstructive apnea in a child is more important than the duration of apnea. The diagnosis can be made on the basis of history and physical exam. Rarely, a pre-operative polysomnogram would be indicated.

Tonsilloadenoidectomy remains the first line treatment for this problem.

Recommended readings

1. Maddern BR, Cotter, CS. Obstructive sleep disorders. *Pediatric Otolaryngology*, Fourth Edition, Vol 2, 1223-1233, 2003.
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3. Guilleminault C, Korobkin R., Winkle R. A review of 50 children with obstructive sleep apnea syndrome. *Lung* 158-275, 1981.
4. Koopman C, Moran W. Sleep apnea. *Otolaryngol Clin North Am* 23(4): 571, 1990.
5. Weider DJ, Hauri PJ. Nocturnal enuresis in children with upper airway obstruction. *Int. J Pediatr Otorhinolaryngol* 9:173, 1985.