

Respirations

Spring 2007

Hooray! We have made it through another respiratory viral season. Although it seemed to me that there were more cases of RSV bronchiolitis than in recent years, I felt more optimism in treating these infants. Based on the immunomodulatory effects of clarithromycin and montelukast I shared in the last *Respirations*, perhaps we will see less recurrent wheezing and asthma development.

In celebration of a new season, I thought we would focus on a different aspect of our practice. Many of you already utilize our dedicated Pediatric Sleep Laboratory at St. John's Mercy Medical Center to assess children with snoring for possible sleep-disordered breathing. However these children likely represent only a small proportion of those with potential sleep problems. Since a comprehensive review of childhood sleep disorders is not possible in two pages, I chose a few important points to highlight while John discusses a child with an unusual cause of daytime somnolence. LCK (choolr@stlo.mercy.net)

Pediatric Sleep Medicine – A brief overview

There are few pediatric health issues that are more common or have a more significant impact on health and well-being than childhood sleep disorders. Approximately 25% of all children experience some type of sleep problem, ranging from difficulty falling asleep and night wakings to more serious primary sleep disorders such as sleep apnea or narcolepsy. The consequences of sleep disorders in children are serious, and range from cardiovascular problems and failure to thrive to significant behavioral concerns and academic failure.

Sleep requirements and architecture change throughout childhood. At one extreme is the newborn infant who requires between 16 - 20 hours of sleep per day and at the other is the adolescent who requires 9 – 9½ hours but may be only getting 7 – 7¼ hours/night. Larger quantities of rapid eye movement (REM) sleep during early neonatal (50% – 80%) life with its subsequent fall to adult levels (20%- 25%) throughout the first several years suggest an operative role in early human development. REM sleep plays an important role in memory, emotions and the immune system. The neurocognitive and behavioral complications of childhood obstructive sleep-disordered breathing is likely a consequence of REM sleep disruption. It is therefore prudent to consider the REM suppressive effects of several medications used to treat attention deficit (hyperactivity) and mood disorders. Non-REM, in particular slow wave sleep is critical in the restoration of somatic tissue.

Screening for sleep problems is easily incorporated into routine health maintenance visits by asking a few simple questions. “*Does your child's sleep pattern cause a problem for you or him/her?*” should raise

any concerns regarding behavioral sleep problems. For sleep disordered breathing, “*Are you ever concerned about your child's breathing during sleep?*” and “*Does your child snore?*” are good screening questions. Many parents and even physicians have been desensitized to accept snoring as normal. An affirmative answer to the latter question should immediately spawn follow-up questions. It is also important to recognize behavioral problems and learning difficulties as potential manifestations of insufficient or poor quality sleep.

Most childhood sleep disorders can be sorted into three main groups based upon the presenting complaint: bedtime resistance/prolonged sleep-onset, night wakings, and daytime sleepiness. In the absence of other medical disorders such as gastroesophageal reflux, difficulty falling asleep in the preschool child is likely caused by (1) a **negative sleep association** such as a baby falling asleep with a bottle or pacifier/ a child with the television on (2) **poor limiting-setting** – lack of bedtime routine and parents giving into child's “one more” plea or (3) **bedtime fears** – frightening home environment. On occasion a (4) **circadian rhythm disorder** (phase shift) may exist where a toddler is not tired at bedtime. This is often a consequence of long daytime naps or naps that go into the late afternoon. Circadian rhythm disorders are more commonly seen in adolescents.

Wakings at night occurs in more than 80% of children. Night wakings are only problematic when the child cannot return to sleep on his or her own. Sleep association disorder may also manifest in this manner. Often parents fail to recognize that the manner they are putting the child to sleep at the beginning of the night is the primary cause of the problem. In most cases, proper parental instruction that enables the child to develop the ability to self-soothe and to fall asleep on his or her own rectifies the problem within a couple of weeks. Confusional arousals, night terrors, sleep-walking, and somniloquy fall into the category of parasomnias or disorders of arousals. Parents are more likely to complain about confusional arousals and night terrors as they are understandably more dramatic in presentation and disruptive to the rest of the household. Characteristically, parasomnias tend to occur during the first few hours of falling asleep while the child is in non-REM slow wave sleep. Sleep deprivation increases the proportion of slow wave sleep experienced, so it is important to look for reasons of either insufficient sleep quantity or poor sleep quality in these children. Researchers from Tucson showed a higher incidence of parasomnias in children with sleep-disordered breathing¹ while Stanford investigators showed clinical improvement in parasomnias after treatment of co-morbid sleep-disordered breathing and restless leg syndrome (RLS)².

Insufficient sleep is probably the most common cause for daytime sleepiness in children as well as adults. After ensuring that the sleepy child is getting a sufficient amount of sleep, evaluation for sleep-disordered breathing, RLS and narcolepsy should follow. Though previously viewed as more adult disorders, RLS and narcolepsy are now known to occur even in preschool children. Sleep consultation before overnight polysomnography may therefore be helpful in cases of excessive sleepiness to adequately tailor the study (e.g. multiple sleep latency test, extended EEG montage). LCK

References:

1. BMC Med 2004; 2: 14
2. Pediatrics 2003; 111(1): e17-25

Illustrative Case

BH is a 10 yr old boy with ADHD, allergic rhinitis, and complaint of restless sleep. He also has difficulty falling asleep and was taking melatonin. He underwent an adenotonsillectomy at age 5 for suspected obstructive sleep apnea. There was an improvement in his snoring and witnessed apnea; however, his restless sleep persisted. A sleep study had not been obtained before or after his surgical procedure. Typical bedtime is between 8:30-9:00 pm and he wakes for school at by 6:20 am. Sleep hygiene was appropriate. Mom described restless nights with rhythmic movement of both his arm and legs all night long. BH also describes the desire to move his arms and legs while awake but denied any pain or fatigue.

On physical exam, he had some boggy and edematous nasal turbinates. His lungs were clear. Neurological evaluation was normal with no focal deficits. Overnight sleep study revealed numerous periodic leg movements (PLMS) with an index of 36.4 events/hour (normal is <5 events/hour). He had ninety-two arousals that were preceded by PLMS. Nocturnal seizures were not seen and there was no evidence of sleep-disordered breathing.

The patient was initially tried on clonazepam but developed mood swings within one week. He was subsequently started on pergolide (dopamine agonist). The dose was titrated for clinical effect with close monitoring for side-effects of dyskinesia, hallucinations, insomnia, and dizziness. A repeat sleep study done after three weeks on pergolide showed a decrease in his PLMS index to 3.7 events/hour.

Discussion— PLMS were originally described as nocturnal myoclonus and are usually measured during an overnight sleep study or more extended actigraphy. PLMS were first documented in RLS but can be seen in obstructive sleep apnea, narcolepsy, insomnia, and hypersomnia. PLMS can also be seen in association with the common pediatric conditions: ADHD^{1, 2} and “growing pains³.” Before

diagnosing RLS, it is important to rule out secondary causes of abnormal movements such as sleep-disordered breathing, anemia (especially iron-deficiency anemia), uremia, nocturnal seizures, or other neuropathies.

RLS is relatively rare in childhood and most of the clinical features, diagnostic criteria, and treatment strategies are extrapolated from the adult literature. Four essential diagnostic criteria for RLS includes: (1) Patient’s need or desire to move his/her legs along with uncomfortable and unpleasant sensations (2) The urge to move legs or these unpleasant sensations occur while at rest (3) The urge to move or unpleasant sensation are relieved by movement (simple walking, standing, or even stretching) (4) The urge to move or unpleasant sensations are typically worse in the evening hours. Non-diagnostic but common features to RLS include: family history (first-degree relative with RLS), positive response to dopaminergic therapy, sleep disturbance, and a normal physical exam⁴. JFS

References:

1. *J Child Neurol* 1998; 13:588-594
2. *Mov Disord* 1999; 14:1000-1007
3. *Acta Soc Med Uppsala* 1960; 65:185-201
4. *Sleep Med* 2003; 4:101-119

Diagnostic Tool Talk

A common diagnostic challenge is the evaluation of the child with exercise-induced dyspnea. While treadmills and cycle ergometers have traditionally provided the exercise stimulus in the laboratory setting, these modalities often fail to adequately simulate a child’s specialized athletic activity such as swimming or skating.

Eucapnic Voluntary Hyperventilation (EVH) is a powerful tool for the evaluation of possible exercise-induced asthma. With a mouth-piece attached to a 5% carbon dioxide source, the subject is asked to breathe rapidly and as deeply for approximately six minutes. A decrease in forced expiratory volume in one second (FEV₁) of ≥10% from baseline is considered consistent with exercise-induced asthma. Having been evaluated in recent summer and winter games, EVH is the preferred modality for the demonstration of exercise-induced asthma by the International Olympic Committee. We are very pleased to announce that our Pediatric Pulmonary Function Laboratory now offers this service.

Nurse Joan’s Corner

If used on a daily basis, most corticosteroid inhalers contain only a month’s supply. Parents should be advised to get a new inhaler on the same day each month to ensure consistent drug delivery. Note that inhalers may continue to release a visible spray that contains mostly propellant after the stated number of doses is gone. ☺

