

Childhood Sleep Apnea May Affect Memory, IQ

BY BETSY BATES
Los Angeles Bureau

RANCHO MIRAGE, CALIF. — Obstructive sleep apnea in children is associated with profound deficits in IQ, verbal comprehension, perceptual reasoning, and working memory, according to preliminary results of a case-control study at the Pediatric Sleep Disorders Center of Johns Hopkins University, Baltimore.

Ann C. Halbower, M.D., medical director of the center, reported that extensive cognitive deficits and cerebral metabolite alterations were powerfully evident in children from inner city Baltimore who suffered from moderate to severe obstructive sleep apnea (OSA).

Thus far, 17 children aged 7-16 years with OSA and 10 matched controls have completed sleep studies, neuropsychological tests, and magnetic resonance spectroscopy. The average age in both groups is 10.

"Our kids with OSA were severely impacted, their IQ scores being 10 to 15 or more points below normal. We saw huge differences in memory, especially in visual spatial processing, which is a parietal lobe function that has not received a lot of press," Dr.

Halbower said at a conference on sleep in infancy and childhood sponsored by the Annenberg Center for Health Sciences.

Group differences in IQ were mostly explained by sharply defined deficits in working memory, nonverbal reasoning, and verbal comprehension among children with OSA.

Magnetic resonance spectroscopy determined that neuropsychological deficits in the children correlated with hippocampal metabolite alterations, low oxygen saturation, and body mass index (BMI).

The study is ongoing, although Dr. Halbower said she and her team are having trouble finding normal, nonsnoring obese controls who do not have sleep apnea. The average BMI among children with OSA was 29.3 and among controls, 19.1. African American children whose mothers completed about 12-14 years of education comprise the majority of the study cohort.

Subjects in the control group had significantly higher IQs than did those with OSA, but still not as high as controls enrolled in previous studies of sleep apnea. The mean full-scale IQ among controls was 101, and among children with OSA, 86. Children

with a working IQ below 75, a history of seizures or depression, or use of psychotropic medications were not enrolled.

Intriguingly, some of the neuropsychological functions most impacted by sleep apnea in adults were not significantly impaired in children with OSA. These included certain executive functions such as problem solving, planning, inhibitory control, sustained attention, and response preparation.

Motor speed and cerebellar perceptual/motor timing appeared unaffected as well.

When respiratory parameters were assessed, children with OSA had a mean oxygen desaturation time at less than 95% of 70 minutes, compared with 0 for controls. To capture small, brief, intermediate hypoxic events, the oxygen saturation nadir also was studied, and was 75 for children with OSA and 93 for controls, a statistical difference with a significance of 0.0002.

The apnea/hypopnea index

showed that children in the study had severe OSA, with a mean score of 29.1 compared with 0.3 for controls.

Researchers conducted two forms of magnetic resonance spectroscopy to attempt to pinpoint any cerebral metabolite changes that might be correlated with respiratory parameters and neuropsychological test results. A global brain assessment was conducted with general magnetic resonance spectroscopy imaging (MRSI) and a single voxel image was used to explore metabolites within the anterior hippocampus on the left side.

Just six children with OSA and six controls have completed these studies.

However, preliminary results identified a "very significant" decline in *N*-acetyl aspartate/choline (NAA/Cho) ratios and choline/creatine (Cho/Cr) ratios in the hippocampal regions of children with OSA compared with controls.

Both oxygen saturation nadir

and oxygen saturation time at less than 95% correlated with brain metabolite dysfunction, IQ deficits, and BMI.

The apnea/hypopnea index correlated with brain metabolite problems, IQ problems, parietal lobe function problems, and BMI; however, the arousal and awake index failed to correlate with brain metabolite dysfunction, IQ, or BMI, "indicating that hypoxemia may be involved in the mechanism of these alterations," said Dr. Halbower.

Of interest, high BMI correlated with IQ deficits and low neuropsychological scores, but not with brain metabolites.

The issue deserves further study, she said.

More subjects are being enrolled in the current investigation and researchers also are exploring possible reversibility of neurologic deficits with treatment of OSA.

"Obviously, the key question is, 'Can we fix this?'" Dr. Halbower said.

Future studies will include younger and older children to determine whether very young children are prone to OSA and whether there is a particular age of vulnerability to neurologic insults attributable to OSA. ■

Extensive cognitive deficits and cerebral metabolite alterations were evident in children with moderate to severe sleep apnea.

Reserve Polysomnography For High-Risk Sleep Apnea

BY ROBERT FINN
San Francisco Bureau

PORTLAND, ORE. — Polysomnography may be the gold standard in the diagnosis of obstructive sleep apnea, but in children it should be reserved for high-risk patients, Mark A. Richardson, M.D., said at a conference sponsored by the North Pacific Pediatric Society.

In children aged older than 3 years with no underlying condition, a history and a physical exam with findings of adenoid or tonsillar hypertrophy often provide the basis for recommending surgery, said Dr. Richardson of Oregon Health and Science University in Portland. This is especially true if the parents can provide supporting objective information about the child's snoring, such as a videotape or an audiotape.

"I think if you have an otherwise healthy patient with a consistent and chronic history of obstruction at night, that's probably all you really need to have," Dr. Richardson said.

Polysomnography has several disadvantages. It's expensive, it's unavailable in some areas, and the experience of being in a sleep lab overnight may affect the child's normal sleep. Polysomnography is also subject to false positives and false negatives, especially when an abbreviated "nap" study is used.

Furthermore, polysomnographic results

do not correlate well with the behavioral disturbances that about 40% of children with sleep disorders exhibit. Simple snoring and a positive pediatric sleep questionnaire, on the other hand, do correlate with those behavioral disturbances, which include attention-deficit hyperactivity disorder, conduct disorder, oppositional defiant disorder, and primary disorder of vigilance.

"To me, that suggests that somehow we are missing something on the polysomnography," Dr. Richardson said. "I don't know what that is, and we're trying to add a variety of measures to polysomnograms right now to see if we can identify that. Obviously, it must be fairly subtle in terms of arousals or partial arousals."

While clinical judgment is enough for a diagnosis of obstructive sleep apnea in many children, others will require more consideration of polysomnography, Dr. Richardson said. These include children aged under 3 years, those with neuromuscular or craniofacial disorders, and those with complicating medical conditions.

When there is clear evidence of enlarged tonsils or adenoids, adenotonsillectomy is the treatment of choice in children. About 80% will be helped by this surgery, Dr. Richardson said. This is in contrast to adults with obstructive sleep apnea, few of whom respond to adenotonsillectomy. ■

Sleep-Disordered Breathing May Lead to Irreversible Cognitive Deficits

BY SUSAN VOLKMAR
Contributing Writer

ATLANTA — Cognitive deficits in children treated for sleep-disordered breathing may not be totally reversible, Jane F. Gaultney, Ph.D., of the University of North Carolina-Charlotte, and her associates reported in a poster session at a meeting of the Society for Research in Child Development.

Fragmented sleep may impair cognition in children even more than in adults because children are experiencing rapid neurobehavioral development, they said.

In a study of 41 children seen by a pediatric sleep physician, overnight polysomnograms were done and medical histories were taken. Twenty-seven children were diagnosed with sleep-disordered breathing and 14 with sleep-disordered breathing and periodic limb movement. Most were treated with adenotonsillectomy.

The children also were given a battery of psychological tests, including one that estimates verbal IQ, on Saturday mornings at the pediatrician's office, and were retested several months later, after parents reported that their sleep disorder seemed to have resolved.

Verbal IQ was negatively associated

with measures of episodes of apnea and hypopnea (events in which breathing is restricted but does not stop completely). It also was negatively associated with the number of awakenings associated with those events and with minimal oxygen saturation during periods of REM sleep, although not with non-REM sleep periods.

The number of arousals associated with apnea or hypopnea significantly explained IQ variance beyond what was explained by minimal oxygen saturation level or the apnea/hypopnea index. This finding raises the question of whether it is the poor gas exchange associated with sleep-disordered breathing or the fragmented sleep patterns as indicated by arousals, which best explain decreased IQ scores, Dr. Gaultney and her associates said.

Apnea and hypopnea indices were obtained by averaging the number of events per hour over total sleep times recorded. A regression analysis was done, and the result was found to be significant. In the 15 children for whom data were obtained before and after treatment, cognition scores did improve, but the improvement was not statistically significant. This suggests that the deficits in cognition were not reversed. ■