Adenotonsillectomy Improves Sleep, Breathing, and Quality of Life But Not Behavior

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Objective To obtain parental perspectives on changes in sleep, breathing, quality of life (QOL), and neurobehavioral measures after adenotonsillectomy.

Study design This retrospective cohort study comprised otherwise healthy children evaluated for obstructive sleep apnea syndrome (OSAS) from 1993 to 2001. We compared those children who underwent adenotonsillectomy with those children who did not. The parents of 473 children (292 boys) 2 years of age and older were sent questionnaires to evaluate QOL and clinical and behavioral changes. For 94 children 3 years of age and older, behavioral changes were evaluated using the Conners' Parent Rating Scale-Revised (CPRS-R) for three different periods: pre-operatively/pre-polysomnography, postoperatively/postpolysomnography, and recently.

Results One hundred and sixty-six questionnaires were returned (35%), 138 of which were complete with written consent provided. Compared with parents of unoperated children, parents of children who had adenotonsillectomy were more likely to report improvements in sleep, breathing, and QOL but not improvements in concentration, school performance, and intellectual or developmental progress. Both short and long term, there were no significant effects of adenotonsillectomy on any of the CPRS-R behavior subscales.

Conclusion From a parental perspective, adenotonsillectomy frequently improves sleep, breathing, and QOL but does not often improve neurobehavioral outcomes. *(J Pediatr 2007;150:540-6)*

Obstructive sleep apnea syndrome (OSAS) is a relatively common problem in childhood, having a prevalence of 0.7% to 3%.[1,2] OSAS in children is a disorder of breathing during sleep characterized by upper airway obstruction that disturbs sleep and disrupts normal respiratory gas exchange.[3-5] Adenotonsillar hypertrophy is the most common etiology of OSAS in children. For most children, complete resolution of OSAS is achieved with adenotonsillectomy. When a diagnosis of OSAS is not recognized or remains untreated, serious sequelae may ensue, including cor pulmonale and failure to thrive.[4-8]

Over the past 10 years a number of studies have reported adverse behavioral and developmental consequences of OSAS. Several studies have reported a relationship between sleep disordered breathing and neurobehavioral and cognitive deficits.[9-19] A few studies have evaluated neurobehavioral outcomes[20-23] and quality of life(QOL)[24-28] in the months following adenotonsillectomy. As parents have the opportunity to observe their child's behavior and development over prolonged periods, it is important to understand what parents can tell us about responses to medical and surgical interventions.

We hypothesized that, several years after adenotonsillectomy, parents would report improved sleep, breathing, QOL, and neurobehavioral and cognitive deficits in children with OSAS, as compared with children who did not have adenotonsillectomy. Furthermore, we expected that the improvement would be sustained and that the greatest improvements would be in the children with the most severe OSAS. To test these hypotheses, we sent questionnaires to parents of children who were evaluated for possible OSAS with subsequent treatment with adenotonsillectomy (the intervention group) and to parents of those who did not have adenotonsillectomy (the comparison group).

ADHD	Attention deficit hyperactivity disorder	MOAHI	Mixed obstructive apnea/hypopnea index
ANOVA	Analysis of variance	OSAS	Obstructive sleep apnea syndrome
CPRS-R	Conners' Parent Rating Scale-Revised	QOL	Quality of life

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METHODS

Study Population

The study cohort consisted of children between 2 and 17 years of age at the time of polysomnography who were evaluated for possible OSAS between January 1993 and December 2001. Subjects with asthma were included, but we excluded children with other significant lung diseases, and those with neuromuscular, cardiac, craniofacial, or genetic disorders. We also excluded children evaluated in the sleep laboratory for reasons other than diagnosis of OSAS (ie, neuromuscular weakness, Continuous Positive Airway Pressure (CPAP) titration, or central hypoventilation). Our Institutional Review Board granted ethical approval for the study.

Questionnaires and informed consent forms were sent to each child's parent or legal guardian in the spring of 2002. We sent reminders and follow-up questionnaires to those parents who had not returned the questionnaires. We did not include in our study any questionnaire responses that were returned after June 1, 2002. We collected the following for each patient: (1) cardiorespiratory data from nocturnal polysomnography; (2) pre-polysomnography parental questionnaire[8]; and (3) follow-up parental questionnaire designed for the current study.

Polysomnography

Overnight polysomnography was conducted either in our sleep laboratory or at the subject's home using our home polysomnography montage.[29-31] Our home polysomnography system, which includes calibrated respiratory inductive plethysmography, pulse oximetry, and audiovisual recordings, has been shown to give results equivalent to those from laboratory polysomnography for mixed/obstructive apnea/hypopnea index, desaturation index, and respiratory arousal index. Sleep efficiency and the total sleep time were slightly higher in the home compared with the laboratory.[29] Laboratory polysomnography followed the 1996 American Thoracic Society standards.[3]

Scoring of polysomnography was performed manually by 30-second epochs.[32] An obstructive apnea was defined as a reduction in the sum signal on calibrated respiratory inductance plethysmography to $<20\%$ of baseline for ≥ 3 seconds, paired with paradoxical movements of the ribcage and abdomen. Obstructive hypopnea was scored as a reduction in the sum signal to 20% to 50% of baseline for ≥ 3 seconds, associated with a drop in SaO_2 of $\geq 4\%$. The desaturation index was defined as the number of drops in SaO_2 of $\geq 4\%$ per hour. The respiratory arousal index was defined as the number of respiratory-related arousals per hour of total sleep time. The mixed obstructive apnea/hypopnea index (MOAHI), calculated as the number of mixed obstructive apneas and hypopneas per hour of total sleep time, was used to define OSAS when there was at least one event per hour.[33,34]

Pre-polysomnography Questionnaire

At the time of the initial clinical referral to the Sleep Laboratory, each parent or guardian had completed a validated sleep laboratory questionnaire.[8] In this first questionnaire, parents were asked to provide demographic data and information about their child's past medical and surgical history, as well as information regarding snoring frequency and loudness, difficulties breathing awake or asleep, and excessive daytime sleepiness. Parents were also asked to report any problems with behavior and/or development. Based on information about snoring, difficulty breathing during sleep, and apneas, an OSA score was calculated.[8]

Follow-up Questionnaire (OSAS Outcomes and Neurobehavioral Assessment)

The questionnaire mailed to the parents consisted of two parts: one focusing on OSAS outcomes and the other addressing neurobehavioral outcomes, using the Conners' Parent Rating Scale-Revised (CPRS-R).[35,36]

Sleep, breathing, and quality of life outcomes. In the first part of the follow-up questionnaire, parents provided demographic details and information about what treatment, if any, their child received following the initial assessment. Because our primary hypothesis concerned outcomes after treatment, we divided our subjects into two groups: those who had undergone adenotonsillectomy and those who had not. We asked before-after questions to assess for changes in the months following adenotonsillectomy, or following the polysomnography if no surgery had been performed. The questions covered several dimensions: QOL, daytime and sleep breathing, loudness of snoring, asthma, bedwetting, excessive daytime sleepiness, and neurobehavioral/cognitive functioning. The parental responses were based on a 4-point scale: "improved," "no change," "worsened," and "not sure." We recoded the latter three responses into one group ("not improved"), for comparison with the "improved" group. We asked parents to inform us if their child has been diagnosed with attention deficit hyperactivity disorder (ADHD) by a physician and, if so, if the child was on any treatment for ADHD (medication, behavioral treatment, psychological treatment, or no treatment).

Neurobehavioral outcomes. For children 3 years of age or older at the time of initial polysomnography, we asked parents to complete a questionnaire based on the CPRS-R, a widely used, validated measure of child behavior for children 3 to 17 years of age. Twenty-seven questions were used to evaluate behavior in three time periods: (1) "In the months before sleep study/surgery"; (2) "In the months after sleep study/surgery"; and (3) "In the past few months." The 27 questions were reported by parents/guardians using a 4-point scale ("not true at all," "just a little true," "pretty much true," and "very much true"). The CPRS-R permits evaluation of four subscales: Oppositional, Cognitive/Inattention, Hyperactivity, and ADHD index. The scores were tabulated and