Parental History of Adenotonsillectomy Is Associated with Obstructive Sleep Apnea Severity in Children with Snoring

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Objective To test the hypothesis that history of adenoidectomy and/or tonsillectomy (AT) in at least 1 of the parents during childhood, is a risk factor for moderate-to-severe obstructive sleep apnea (OSA) (apnea-hypopnea index [AHI] >5 episodes/hour) in the offspring with snoring.

Study design Data of children with snoring who were referred for polysomnography over 12 years by primary care physicians were reviewed.

Results Data of 798 children without history of prior AT, neuromuscular, or genetic disorders or craniofacial abnormalities were analyzed. Of these children, 69.3% had tonsillar hypertrophy, 25.8% were obese, 26.8% had at least 1 parent with history of AT, and 22.1% had AHI >5 episodes/hour. Parental history of AT was significantly associated with moderate-to-severe OSA (logit model including sex, tonsillar hypertrophy, obesity, and physician-diagnosed wheezing; OR [95% CI], 1.70 [1.18-2.46]; $P < .01$). When significant variables from the logit model (tonsillar hypertrophy, obesity, parental history of AT) were considered independently or in combination, tonsillar hypertrophy combined with history of AT in at least 1 of the parents had high specificity (84.4%) and the highest positive likelihood ratio (1.78) for identifying children with AHI >5 episodes/hour.

Conclusions Among children with snoring who are referred for polysomnography by primary care physicians, those with tonsillar hypertrophy and parental history of AT have increased risk of moderate-to-severe OSA and represent 1 of the subgroups that should be prioritized for a sleep study in settings with limited resources. *(J Pediatr 2014;164:1352-7)*.

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Obstructive sleep-disordered breathing (SDB) in childhood represents an abnormal respiratory pattern during sleep resulting from increased upper airway resistance and/or pharyngeal collapsibility and manifested as snoring and increased work of breathing.[1] When apnea, hypopnea, and gas exchange abnormalities also occur, the term obstructive sleep apnea (OSA) is applied which is the most severe form of obstructive SDB.[2] Nocturnal polysomnography is the gold standard for the diagnosis of OSA, but fewer than 10% of children undergoing adenoidectomy and/or tonsillectomy (AT) for habitual snoring have a sleep study preoperatively to assess SDB severity because of the limited number of pediatric sleep laboratories in many health systems.[3]

Obesity, history of wheezing, prematurity, race, low socioeconomic status, and OSA diagnosed in first-degree relatives are clinical factors that predict severity of SDB in population-based studies and possibly contribute to the pathogenesis of the disorder either directly or indirectly.[1,4-7] For instance, history of AT in parents has been recognized as a risk factor for pharyngeal lymphoid tissue hypertrophy and habitual snoring in the offspring.[8] Because SDB is the most common indication for AT in childhood, especially during preadolescent years, parental history of AT can be used as a surrogate measure of clinically significant upper airway obstruction during sleep in the family.[9,10]

The primary aim of the current study was to assess the relationship between AT in parents and severity of OSA in children in an effort to make speculations about the pathogenesis of intermittent upper airway obstruction during sleep. Hence, we hypothesized that history of AT in at least 1 of the parents during their childhood was significantly associated with the presence of moderate-to-severe OSA (apnea-hypopnea index [AHI] >5 episodes/hour) in the offspring with snoring (>1 night/week). The secondary aim of this investigation was to evaluate the potential clinical usefulness of a positive parental history of AT for the recognition of patients with symptoms of SDB who are at risk of moderate-to-severe OSA given that requests for polysomnography should be

AHI	Apnea-hypopnea index
AT	Adenoidectomy and/or tonsillectomy
BMI	Body mass index
OSA	Obstructive sleep apnea
SDB	Sleep-disordered breathing

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prioritized in health systems with limited resources. It is important to recognize children with AHI >5 episodes/hour because they have low rate of spontaneous resolution of OSA, and they are at risk of cardiovascular morbidity, development of respiratory complications following AT, and persistent disease postoperatively.[2,11-13]

Methods

Data of children with snoring (≥1 night/week) referred for polysomnography to the Larissa University Hospital by their primary care physician from January 2001 to December 2012 for snoring were considered for analysis. Only data of subjects without history of AT, neuromuscular or genetic disorders, or craniofacial abnormalities were included in the analysis. This retrospective research protocol was approved by the Larissa University Hospital Ethics Committee.

Information regarding history and physical examination and results of polysomnography were recorded in a special hospital form (sleep record) and archived in an electronic database within 1 week following the sleep study. Any missing data in the database were completed during the follow-up clinic visit.

Since the establishment of the pediatric sleep laboratory in our hospital, all children arrive in late afternoon prior to polysomnography and parents undergo an interview with questions about their child's health including: (1) symptoms of SDB; (2) history of AT; (3) history of physician-diagnosed wheezing treated with inhaled medications over the past year; (4) history of any chronic disease; and (5) history of AT in parents during their childhood. All children have a physical examination with measurement of height and body weight and calculation of body mass index (BMI) z score.[14] Evaluation of tonsillar size by visual inspection of the oropharynx is completed by a single physician (E.A.) using a score ranging from 1+ to 4+.[15] During the study period, overnight polysomnography was performed (Alice 4 or 5; Healthdyne, Marietta, Georgia).

Polysomnography

During the study period, overnight polysomnography was performed using the Alice 4 or 5 computerized systems (Healthdyne), and the following variables were recorded: (1) electroencephalogram (C3/A2, C4/A1, O1/A2); (2) right and left oculogram; (3) submental and tibial electromyogram; (4) body position; (5) electrocardiogram; (6) thoracic and abdominal wall motion (piezoelectric transducers); (7) oronasal airflow (3-pronged thermistor and nasal pressure transducer); and (8) oxygen saturation of hemoglobin. Arousals and sleep stages were assessed using standard criteria.[16,17]

Obstructive apnea was defined as the absence of airflow for at least 2 breaths in the presence of chest/abdominal wall motion.[18] Apneas were considered of mixed type when there was both an obstructive and a central component. Hypopnea was defined as a reduction in the airflow signal amplitude of at least 50% compared with baseline in the presence of chest/abdominal wall motion and associated with oxygen desaturation of hemoglobin equal to or greater than 4%, or with an arousal. AHI was the mean number of obstructive and mixed apneas and hypopneas per hour of total sleep time. All polysomnographies were scored by a single physician.

Explanatory Variables of Interest and Outcome Variable

AHI >5 episodes/hour (moderate-to-severe OSA) was the main outcome variable and parental history of AT (history of AT in at least 1 of the parents during childhood) was the main explanatory variable. Paternal history of AT, maternal history of AT, tonsillar hypertrophy (tonsillar size >2+), obesity (BMI in the 95th percentile or greater), sex, and physician-diagnosed wheezing over the past year treated with inhaled medications[19] were other explanatory variables.

Statistical Analyses

Children without and with parental history of AT were compared in terms of demographic, clinical, and polysomnography variables. Children with both tonsillar hypertrophy and parental history of AT were also compared with all other participants regarding AHI and proportion of subjects with AHI >5 episodes/hour. Student t test was used for continuous variables that approached a normal distribution, Mann–Whitney U test for continuous variables that did not follow a normal distribution, and χ^2 test for categorical characteristics.

The association between moderate-to-severe OSA and each explanatory variable was tested using Fisher exact test. The magnitude of association was expressed as OR and the corresponding 95% CI was calculated using Woolf estimate.[20] Furthermore, the effect of parental history of AT and the other explanatory variables (sex, tonsillar hypertrophy, obesity, and physician-diagnosed wheezing) on OSA severity was assessed simultaneously by fitting a logit model.[21] The significance of each variable in the model was evaluated using the respective change in deviance and the goodness-of-fit of the model was assessed using the residual deviance after fitting all explanatory variables.[21] Two more logit models were fitted for evaluating the effect of paternal or maternal history of AT. The analysis was performed using R (www.r-project.com) and the logit models were fitted using GLIM 3.77 (Royal Statistical Society; London, United Kingdom).

Sensitivity, specificity, positive and negative predictive values, and positive likelihood ratio of all explanatory variables that were significant in the logit models for prediction of moderate-to-severe OSA were calculated. Positive likelihood ratio was equal to sensitivity/(1 − specificity). Similar calculations were carried out for combinations of parental history of AT with other significant explanatory variables.

Results

A total of 798 children with history of snoring (≥1 night/week) and without chronic disorders or prior AT underwent polysomnography during the study period. The median age of participants in the cohort was 5.8 years (range 2-15 years and IQR 4.5-7.7 years). Of all subjects, 553 (69.3%) had tonsillar hypertrophy, 206 (25.8%) were obese, and 214 (26.8%) had at least