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Enuretic children with obstructive sleep apnea syndrome: Should they see otolaryngology first?

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Received 28 September 2011; accepted 28 December 2011

Available online 27 January 2012

KEYWORDS

Adenotonsillectomy;
Enuresis;
Obstructive sleep
apnea syndrome;
Children

Abstract *Objectives:* To study: (1) the prevalence of diurnal urinary incontinence (DI) and nocturnal enuresis (NE) in children with obstructive sleep apnea syndrome (OSAS) who underwent surgery for their upper airway symptoms, (2) the postoperative rate of enuresis resolution, and (3) factors that may predict lack of improvement post surgery.

Patients and Methods: An observational, pilot study of children 5–18 years of age with OSAS and NE who underwent tonsillectomy and/or adenoidectomy (T&A) between 2008 and 2010 was performed. Study consisted of a phone interview and chart review. Severity of NE and DI, frequency, arousal and sleeping disturbances were assessed pre and post T&A. Factors associated with failure to respond were analyzed using a logistic regression model.

Results: Among the 417 children who underwent T&A, 101 (24%) had NE (61 males, mean age 7.8 ± 2.5 years), and of these 24 had associated DI (6%). Mean postoperative follow-up was 11.7 months. Of the 49 whose NE responded to T&A (49%), 30 resolved within 1 month postoperatively. DI resolved in 4 children (17%). There was a statistically significant difference between responders and non-responders regarding the presence of prematurity, obesity, family history of NE, type of enuresis, enuresis severity, and ability to be easily aroused.

Conclusion: NE was present in about one fourth of children with OSAS undergoing surgery, and resolved in about half. Lower response rate was associated with prematurity, obesity, family

Abbreviations: DI, diurnal urinary incontinence; NE, nocturnal enuresis; OSAS, obstructive sleep apnea syndrome; T&A, adenotonsillectomy; HIC, Human Investigation Committee; ENT, ear–nose–throat; BMI, body mass index; ICCS, International Children's Continence Society; ADHD, attention deficit hyperactivity disorder; STROBE, Strengthening the Reporting of Observational Studies in Epidemiology; Non-MNE, non-monosymptomatic NE; MNE, monosymptomatic NE; PNE, primary nocturnal enuresis; ANP, atrial natriuretic peptide.

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history of NE, presence of non-monosymptomatic NE, severe NE preoperatively, and arousal difficulties.

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Background

Nocturnal enuresis (NE) is a common childhood condition, present in about 5–7 million children in the United States. It occurs more commonly in boys, and in children with a family history of enuresis, lower socioeconomic status, and black ethnicity. The prevalence of NE decreases but the severity increases with age. [1]. It is reported in about 15–20% of 5 year olds, 5–7% of 10 year olds, and 1–2% of 15 year olds, reaching a plateau of approximately 0.5–1% in adulthood.

There is ongoing debate regarding the relationship between obstructive sleep apnea syndrome (OSAS) and NE. While NE has been reported in 8–47% of children with OSAS caused by adenotonsillar hypertrophy [2–4], the prevalence of OSAS in children with NE is unknown. Consequently, the role of OSAS in causing or maintaining enuresis is not clear. Release of upper airway obstruction by tonsillectomy and/or adenoidectomy (T&A) has been associated with complete resolution of NE in 31–76% of children within months of surgical intervention [5–8]. If airway obstruction is the possible etiology for NE in these children, it is not clear why enuresis persists post T&A in some, since the postoperative release of upper airway obstruction is demonstrated in almost all patients. To our knowledge no study has addressed this question. Others have found no association between tonsillar hypertrophy and urinary incontinence before or after T&A [9]. Due to the existing controversies, we sought to analyze the prevalence of NE in children with OSAS and the response to T&A in a large cohort. The study also identified factors associated with lack of response after T&A.

Patients and methods

Children 5–18 years of age who underwent T&A for relief of their upper airway obstruction due to adenoid and/or tonsillar hypertrophy between September 2008 and September 2010 at our medical center, were screened for the presence of NE by the use of a phone questionnaire that has not yet been validated. All patients were seen in the Ear, Nose and Throat (ENT) Department and did not undergo a urological evaluation at our institution. Parents of enuretic children completed the phone interview, and their charts were reviewed in detail.

The study protocol was approved by the Human Investigation Committee. Initially, an Institutional Review Board approved informative letter and a copy of the phone questionnaire were mailed to the parents of all children who had T&A done for upper airway obstruction release. Telephone consent was obtained by the urology staff from parents of the participating children. Parents were given the opportunity to opt-out.

Parents were queried regarding their child's birth, past medical and family history, current medical conditions and

medications. Also identified were age at toilet training, presence of daytime urinary symptoms (such as urgency, increased urinary frequency, etc.), past or current use of an alarm and/or medications to treat NE, and fluid restriction at bedtime. Symptoms suggestive of OSAS (such as snoring, mouth breathing/drooling, apnea), as well as the ability to wake up at night were assessed pre and post T&A. The number of weekly wet days and nights, and daily voids were compared pre and post T&A. Parents were also asked whether their child had ever experienced a dry period of at least 6 months.

Only patients with NE before T&A were selected for chart review to obtain the following information: gender, race, growth (height, weight) at the time of T&A, perinatal history (prematurity), past medical history (chronic conditions, medication), presenting symptoms prior to surgery, degree of tonsillar and adenoid hypertrophy (assessed by the ENT surgeon during the clinic visit), indication for surgery, age at the time of surgery, and sleep study results. Body mass index (BMI) was calculated as weight (kg) divided by height (m²). A child was considered overweight if the BMI exceeded the 85th percentile on curves generated by age and sex. [10]. BMI values were compared to parental assessment of weight. NE was defined in accordance with the International Children's Continence Society (ICCS) standardized terminology [11]. OSAS was defined as abnormal breathing during sleep causing sleep disruption, and identified by the presence of snoring, intermittent pauses, snorts, and/or gasps.

Patients were grouped by age (Group 1, 5–8 years; Group 2, 9–18 years), NE severity prior to T&A (mild 1–2 nights/week, moderate 3–4 nights/week, and severe 5–7 nights/week), and degree of tonsil or adenoid hypertrophy (mild \leq 50% obstruction, moderate 50–75%, severe \geq 75%). Patients were divided into two categories based on their enuresis response after T&A: responders had complete resolution or decreased enuresis episodes to less than 2 nights a week, and non-responders had no change or 3 or more wet nights a week.

Statistical significance of comparisons of continuous and categorical variables was assessed by Student's *t*-test and Fisher's exact test, respectively. Analysis of covariance was used to examine mean differences in the number of weekly wet nights pre and post T&A between responders and non-responders. Postoperative mean number of weekly wet nights was the dependent variable, study group was held as the factor variable, and pre-surgery mean number of weekly wet nights represented the covariate. Normality and homogeneity of variance were checked using Levene's test. A Bonferroni post-hoc correction was used to control Type I error.

Variables found to be significantly associated with failure to respond in a univariate fashion were then examined using logistic regression. Estimated odds ratios and their 95% confidence interval (CI) are reported. All tests were two-tailed, and statistical significance was considered

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