



Assessment of adenotonsillar size and caregiver-reported sleep symptoms among 3–6 year old children undergoing adenotonsillectomy



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ABSTRACT

Introduction: Adenotonsillectomy remains the accepted first-line treatment for obstructive sleep apnea syndrome (OSAS) in children. Tonsillar size may be especially relevant in risk stratification as it may impact symptoms of sleep disordered breathing (SDB). This study assesses correlations among subjective tonsillar grading, measured tonsillar size, and degree of adenoid obstruction in patients age 3–6 years with caregiver-reported symptoms.

Methods: Children 3–6 years old undergoing adenotonsillectomy for OSAS were enrolled prospectively. The subjective tonsillar grade and degree of adenoid obstruction were recorded on physical examination by the otolaryngologist, and the objective tonsillar size was obtained from pathology reports. Spearman's rho was used to assess agreement among measures of tonsillar size and adenoid obstruction; and to correlate these measures with caregiver-reported SDB symptoms obtained from a pre-operative standardized questionnaire.

Results: The cohort included 103 boys and 97 girls of median age 4.8 (interquartile range [IQR]: 3.9, 5.9) years. Median subjective tonsillar grade was 3+ (IQR: 3+, 4+) while median tonsillar size was 2.7 cm (IQR: 2.5, 3) and median adenoid obstruction was 60% (IQR: 50%, 80%). The subjective tonsillar grade and measured tonsillar size were strongly correlated ($\rho = 0.31$, $p < 0.001$), whereas adenoid obstruction was uncorrelated with either subjective tonsillar grade ($\rho = 0.01$, $p = 0.860$) or measured size ($\rho = -0.05$, $p = 0.497$). Tonsillar grade was positively correlated with 3 common caregiver-reported SDB symptoms (loud snoring, trouble breathing at night, and daytime sleepiness). Objective tonsillar size was positively correlated only with difficulty organizing tasks or activities, and adenoid obstruction was positively correlated only with stopping breathing during sleep.

Conclusion: Subjective tonsillar grading by the otolaryngologist achieved better correlation than measured tonsillar size or degree of adenoid obstruction with caregiver-reported SDB symptoms in children 3–6 years of age undergoing adenotonsillectomy.

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1. Introduction

Adenotonsillectomy is one of the most frequently performed surgical procedures in children [1]. Hypertrophy of the tonsillar and

adenoidal tissue is thought to be one of the primary anatomical reasons leading to sleep-disordered breathing (SDB) and obstructive sleep apnea syndrome (OSAS) in the pediatric population [2]. As such, tonsillectomy with or without adenoidectomy, is considered the first-line treatment for pediatric patients with SDB and OSAS [2,3]. The American Society of Anesthesiologists (ASA) has proposed practice guidelines and recommended the development of risk scoring systems for the patients who undergo adenotonsillectomy [4]. Risk stratification is especially necessary in

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children with SDB or OSAS due to the possibility of complications in the post-operative period. Such risk stratification could be used to identify patients at risk for post-operative complications and determine the need for inpatient post-operative care.

Tonsillar size is routinely, subjectively assessed on physical examination by the otolaryngologist using the 0–4 scale described by Brodsky et al. [5]. This assessment is valuable as tonsillar size may be related to the symptom severity in OSAS [6,7]. In addition to the physician's examination of tonsillar size, caregiver reports are used in diagnosing SDB and the need for tonsillectomy. These anatomical and clinical scoring methods are being used more frequently in the clinical diagnosis of SDB and the need for tonsillectomy, as the use of formal sleep studies (polysomnography; PSG) is decreasing. Tonsil and adenoid size may be especially relevant risk factors for postoperative outcomes in the 3–6 year age range, as the adenoidal–nasopharyngeal space is narrowest at 4.5 years of age [8,9]. As tonsillar enlargement narrows the oropharyngeal space, a correlation between tonsillar size and caregiver-reported symptoms may be expected in OSAS patients.

The indication for adenotonsillectomy is generally based on caregiver-reported symptoms and the otolaryngologist's clinical assessment including a subjective evaluation of adenotonsillar size [9]. There is limited evidence validating the correlation between subjective and actual measures of tonsillar size, and assessing how well either measure of tonsillar size is correlated with SDB symptoms. The current study investigated the agreement among subjectively graded tonsillar size, objective tonsillar size, and degree of adenoid obstruction in children 3–6 years of age scheduled for adenotonsillectomy for SDB or OSAS. The secondary aim of the study was to determine which measure of tonsillar size, adenoid obstruction, or the combination of both was more closely associated with caregiver-reported SDB symptoms.

2. Methods

This prospective study was approved by Nationwide Children's Hospital Institutional Review Board with a waiver of individual consent. Caregiver reports of 10 SDB symptoms were collected prospectively in a questionnaire form, adapted from a previous study of patients with SDB [9]. Questions included snoring patterns, nighttime and daytime clinical symptoms, and other OSAS-related symptoms (Table 1). Patient demographic and clinical data were obtained by chart review, using the quality improvement database from the Department of Anesthesiology & Pain Medicine at Nationwide Children's Hospital (Columbus, Ohio), covering electronic medical records of 200 patients undergoing adenotonsillectomy between 2011 and 2012. Nationwide Children's Hospital is an urban, free-standing, 510 bed tertiary care children's hospital. During the study period, the standard of care included determining the need for postoperative admission to the hospital, based on caregiver-reported SDB symptoms and the surgeon's evaluation.

A total of 1905 surgeries were performed in 2011–2012. Patients were eligible for enrollment if they were 3–6 years of age, undergoing tonsillectomy with or without adenoidectomy (but not adenoidectomy alone), and diagnosed with OSAS or SDB by the otorhinolaryngologist or based on the results of polysomnography. The exclusion criteria were preoperative requirement for additional respiratory support; scheduling for concurrent surgery that would have increased the total anesthetic time; and recurrent adenotonsillitis as the sole indication for surgery. Enrollment depended on the research staff availability. All patients enrolled in the study were included in the analysis. Caregivers completed the form reporting SDB symptoms. To characterize the sample in which SDB symptoms were correlated with tonsillar grade, patients' height,

Table 1
Screening questionnaire for obstructive sleep apnea.

1. While sleeping, does your child:
a. Toss and turn >50% of the night ^a
b. Do they snore >50% of the night ^a
c. Snore loudly ^a
d. Have trouble breathing, gasp, or choke ^a
2. Has your child ever stopped breathing or paused in breathing during sleep for more than 3 s?^a
3. Does your child:
a. Tend to breathe through the mouth during the day or night ^a
b. Have a dry mouth on waking up in the morning ^a
c. Occasionally wet the bed ^a
4. Does your child wake up tired in the morning?^a
5. Is your child sleepy during the daytime?^a
6. Has a teacher or other child care provider stated that your child is sleepy during the daytime?^a
7. Is it hard to wake up your child in the morning?^a
8. Has your child stopped growing normally at any time since birth?^a
9. Is your child overweight?^b
10. Your child often:
a. Does not seem to listen when spoken to directly ^a
b. Has difficulty organizing tasks and activities ^a
c. Is easily distracted ^a
d. Fidgets with hands or feet or squirms in seat ^a
e. Is "on the go" or seems driven by motor ^a
f. Interrupts or intrudes on others ^a

^a 1 – yes; 2 – no; 3 – sometimes; 4 – unsure.

^b 1 – yes, 2 – no.

weight, and neck circumference were measured by a research nurse while. Differences in patient characteristics between groups were assessed by Kruskal–Wallis tests for continuous data and Chi-square tests for categorical data.

Data on tonsillar size and additional characteristics were retrospectively collected from the patients' pathologic examination records. The subjective tonsil grade and degree of adenoid obstruction were obtained from the patient records from the otolaryngologist's clinical examination during the pre-operative visit or at the time of surgery. Tonsillar size was subjectively graded using the assessment of oropharyngeal obstruction by Brodsky et al. [5]. This included grade 1 (<25%); grade 2 (26–50%); grade 3 (51–75%); and grade 4 (>75%). The degree of adenoid obstruction was assessed using flexible nasopharyngoscopy in the office setting or transoral visualization at the time of surgical intervention, and typically documented as a percent obstruction of the anterior-posterior dimension of the nasopharynx. The surgeon subjectively assessing tonsillar grade and degree of adenoid obstruction was blinded to the aim of the study.

The distribution of measured tonsillar size was graphed across subjective tonsillar grades using a kernel density plot. Subjective tonsillar grade, measured tonsillar size, and degree of adenoid obstruction were treated as ordinal variables in further analysis. Caregiver answers to questions regarding SDB symptoms were dichotomized as "yes" vs. any other response (no; sometimes; or unsure). Continuous and ordinal data are presented as medians with interquartile ranges (IQR). Spearman's rho was used to examine agreement among measures of tonsillar size and adenoid obstruction, as well as differences in these measures across questionnaire items. In a supplemental analysis, a combined scale of tonsillar grade and adenoid obstruction was created and scored as follows: 0 = tonsillar grade 1/2 and adenoid obstruction ≤50%; 1 = either tonsillar grade 3/4 or adenoid obstruction >50%, but not both; and 2 = tonsillar grade 3/4 and adenoid obstruction >50%. This combined scale was correlated with questionnaire items using Spearman's rho as described above. Analyses were performed in Stata/IC 13.1 (College Station, TX: StataCorp, LP). $P < 0.05$ was considered statistically significant.

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