

Using Questionnaire Tools to Predict Pediatric OSA outcomes

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Conflict of Interest

- SASM \$10,000 Grant
- NCH intramural/interdepartmental \$38,000

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- Dmitry Tumin, PhD
- Julie Rice, Heather Dellinger and entire research staff
- Red Cap
- SASM



Objectives

- Upon completion of this learning activity, the participant should understand how to use screening questions to help postoperative disposition of pediatric OSA patients
- Upon completion of this learning activity, the participant should understand, postoperative concerns of the pediatric OSA patient.

Background

- Pediatric obstructive sleep apnea (OSA) different and more complex than initially thought
- Adenotonsillectomy may not be cure all
- These children are not pre-identified prior to surgery
- Limited longitudinal studies regarding outcomes
- Sleep studies are gold standard
 - time consuming, cost, and may not identify Sleep disordered breathing

SDB versus OSA

- Sleep disordered breathing(SDB) is not the same as obstructive sleep apnea (OSA)
- Terms often interchanged
- **(SDB=OSA FALSE)**
- Many children have SDB but not OSA
- SDB can be clinical diagnosis; OSA is diagnosed by PSG

Gold Standard for OSA diagnosis

- Polysomnography (PSG): only 5-12% of patients get pre-operatively.





Screening Questionnaires

- Many pediatric sleep questionnaires
- At the same time, there is NO discrete screening tool
- At NCH, we have 900 patients who went through sleep studies who filled out our questionnaire and we measured neck circumference and BMI

Caregiver questionnaire

1 While sleeping, does your child snore more than half the time?

2 While sleeping, does your child always snore?

3 Have you ever seen your child stop breathing during the night?

4 Does your child occasionally wet the bed?

5 Did your child stop growing at a normal rate at any time since birth?

6 Is your child overweight?

OSA on PSG predicted at scores ≥ 2

Raman VT et al. Paediatr Anaesth 2016;26:655-64.

Pediatric Tonsillectomy & Adenoidectomy

- In the U.S., one of the most common surgical procedures performed.
- 30 years ago, 90% of tonsillectomies in children were done for recurrent tonsillitis; now 20% for tonsillitis and 80% for obstructive sleep problems (OSA).
- 5-10% of children have sleep-disturbed breathing, which increases to about 40% in obese children.
- Increasing evidence that SDB affects quality of life, child behavior (ADHD) and school performance.

Children with OSA at higher post-operative risk

- **Anesthetic agents lead to upper airway collapse by decreasing activity of pharyngeal dilator muscles**
- **Post-obstructive pulmonary edema**
- **Impaired ventilatory responses to CO₂**
- **Chronic cardiopulmonary consequences of OSA**
 - **Cor pulmonale**



Methods



Perioperative

- Asked parents 6 questions found to correlate to OSA plus some additional questions presenting for ambulatory surgery
- We measured their neck circumference and noted BMI
- Retrospectively pulled all data from operating room to PACU to hospital floor via red cap.

Caregiver questionnaire

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What did the questionnaire predict?

- Correlated with OSA
- Interesting point, out of >900 questionnaires distributed, only about 5% had moderate to severe OSA as defined >5
- Therefore 95% had mild to none
- BMI or neck circumference marginally improved results
- Caveat to that is BMI pertains to >2 yo and neck circumference is >6yo

What the questionnaire did not predict

- How much each question was weighted (there was no difference in the weightage of each question)
- Prediction of Postoperative disposition or outcomes



Preliminary Results

- 400+ patients in variety of ambulatory surgeries
- Our main question was will our 6 questions help risk stratify those who need extended monitored care after surgery
- We looked at patient demographics, anesthetic times, narcotic, drugs, vital signs

Patient characteristics in retrospective and ongoing prospective studies

Characteristic	Retrospective* (N=185)	Prospective, anesthesia time ≤1 h (N=124)	Prospective, anesthesia time >1 h (N=281)
Age (y; mean [SD])	8 (4)	12 (4)	12 (4)
Gender (F/M)	85/100	67/55	132/147
T&A (N [%])	109 (59%)	5 (4%)	3 (1%)
ASA status ≥3 (N [%])	65 (36%)	21 (17%)	63 (22%)
Predicted OSA (N [%])	122 (66%)	46 (37%)	84 (30%)

* Patients with preoperative PSG. Kako H et al. Int J Pediatr Otorhinolaryngol (epub 9/2017).

PACU outcomes according to predicted OSA on 6-item caregiver questionnaire

PACU outcomes	Procedures in patients with preoperative PSG*			All procedures ≤1 hour**		
	No OSA (N=63)	Predicted OSA (N=122)	P	No OSA (N=78)	Predicted OSA (N=46)	P
LOS >60 min	16 (25%)	39 (33%)	.29	13 (17%)	12 (26%)	.22
Suppl. O2	3 (5%)	26 (21%)	.003	34 (44%)	30 (65%)	.020
Narcotics	4 (6%)	14 (11%)	.31	9 (11%)	5 (11%)	.91

* Kako H et al. Int J Pediatr Otorhinolaryngol (in press). Retrospective study.

** Preliminary data from prospective study. No differences in study outcomes by predicted OSA status among 281 procedures with anesthesia time >1 hour.

Supplemental Oxygen

- There is a difference in supplemental oxygen this may be partially explained by manual extraction and more strict definition of oxygen need (i.e. nasal cannula) versus extraction of any oxygen delivery

Articles





Guidelines to decrease unanticipated hospital admission following adenotonsillectomy in the pediatric population



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ABSTRACT

Introduction: Tonsillectomy has become one of the most commonly performed surgical procedures in the pediatric-aged patient. Many of these children are diagnosed with obstructive sleep apnea (OSA). Although polysomnography is considered the gold standard, many practitioners rely on the clinical examination and parental history. Nationwide Children's Hospital recently instituted pediatric adenotonsillectomy guidelines for hospital admission to help determine which patients should be done in main hospital OR vs. outpatient surgery facility. The main goal was to decrease unanticipated admissions. The secondary goal was to determine areas for practice improvement.

Methods: Using databases for the hospital, operating room, and otolaryngology, all cases with CPT codes 42820, 42830, 42825, 42826, and 42821 were evaluated from October 2009 to August 2012 in the main operating room and 2 outpatient surgery centers. Data for each unanticipated admission were reviewed to determine whether the criteria were met according to the developed guidelines. Fisher's exact test was applied to the unplanned admission rate before and after the institution of the guidelines. Non-paired *t*-test and a Fisher's exact test were used for comparison of the demographic data between the two groups.

Results: Following the institution of the pediatric adenotonsillectomy guidelines, the number of unanticipated admissions decreased from an absolute number of 88 to 43. This represents a decrease from 2.38% to 1.44% ($p = 0.008$). Forty-two percent of the unanticipated admissions prior to establishing guidelines were in patients who would have met criteria for admission based on the guidelines. This decreased to 30% after establishing the guidelines.

Conclusion: We found that the institution of pediatric adenotonsillectomy guidelines for patients undergoing adenotonsillectomy significantly decreased the rate of unanticipated admission. However, there was still a significant percentage (30%) of unanticipated admissions due to non-compliance with the guidelines demonstrating the need for ongoing practice improvement.

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Table 1

Nationwide Children's Hospital Pediatric Adenotonsillectomy Guidelines.

Age	Less than 3 years old – adenotonsillectomy Less than 2 years old – adenoidectomy (exception is for patients with eustachian tube dysfunction, serous otitis, sinusitis as sole diagnosis)
Sleep study	AHI > 10 Pulse oximetry reading < 80% ETCO ₂ > 50 mmHg
Obesity	BMI > 95% (percentile for age)
Craniofacial syndromes	Yes (i.e. Downs syndrome, Pierre Robin, etc.)
Co-morbid conditions	Asthma (moderate/severe), cystic fibrosis, congenital heart disease, hematological disorders, diabetes mellitus, and hypotonia and other significant medical conditions.

AHI, apnea-hypopnea index; ETCO₂, end-tidal carbon dioxide; BMI, body mass index.

Table 3
Reasons for unplanned admissions.

	Pre-guidelines	Post-guidelines	Total
Total cases	3691	2990	6681
Planned admissions	1883 (51%)	1595 (53%)	3478
Unplanned admissions	88 (2.38%)	43 (1.44%)	131
Non-compliance with the guidelines	32 (42%)	13 (30%)	39 (30%)
BMI > 95%	19 (59%)	8 (62%)	27 (69%)
Patient post-operative factors			
Respiratory (oxygen requirement, oxygen desaturation, aspiration)	8 (9%)	0 (0%)	8 (6%)
Sleepy	1 (1%)	0 (0%)	1 (.07%)
Nausea/vomiting	5 (6%)	0 (0%)	5 (4%)
Postoperative bleeding	3 (3%)	0 (0%)	3 (2%)
Combination of factors ^a	5 (6%)	0 (0%)	5 (4%)
Other ^b	14 (16%)	1 (2%)	15 (11%)
Clerical error ^c	15 (17%)	11 (26%)	26 (20%)

^a Some of these cases were non-compliant with the guidelines.

^b Cases that were adherent to guidelines, but admission was for either surgeon reason or unknown.

^c Clerical error occurred if the patient was intended to be admitted postoperatively by the surgeon, but was scheduled as outpatient status on the schedule.

RESEARCH REPORT

Utility of screening questionnaire, obesity, neck circumference, and sleep polysomnography to predict sleep-disordered breathing in children and adolescents

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What is already known

- There is an increasing prevalence of obstructive sleep apnea (OSA) and sleep-disordered breathing in the pediatric population. Significant perioperative morbidity and mortality may occur in these patients.

What this article adds

- This article evaluates the potential use of clinical history combined with anthropometric measurements of neck circumference and body mass index to identify OSA without the need for polysomnography (sleep studies).
- Specific questions were identified which correlate well with findings on sleep studies, suggesting that development of a preoperative screening tool based on clinical history may be feasible.
- A six-item scale was identified using multivariable analysis, demonstrating good predictive value for moderate and severe OSA.

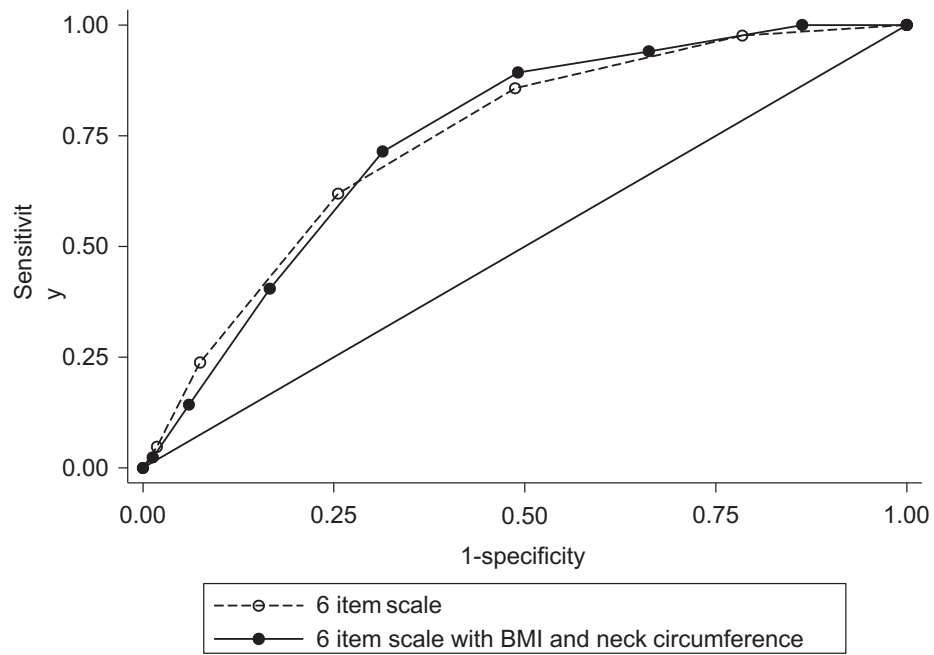


Figure 2 Six-item scale with and without BMI and neck circumference.

Caregiver questionnaire

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OSA on PSG predicted at scores ≥ 2

Raman VT et al. Paediatr Anaesth 2016;26:655-64.

Next step

- Looking at these kids who answered questionnaire, we retrospectively looked at who had a procedure within 1 year of their PSG and tried to see if our questionnaire could help predict postoperative issues in the PACU and beyond



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Utility of screening questionnaire and polysomnography to predict postoperative outcomes in children



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abstract

Introduction: The prevalence of pediatric obstructive sleep apnea (OSA) has increased concurrently with the increasing prevalence of obesity. We have previously validated a short questionnaire predicting the occurrence of OSA on polysomnography (PSG). This follow-up study assessed the utility of the questionnaire in predicting postoperative outcomes.

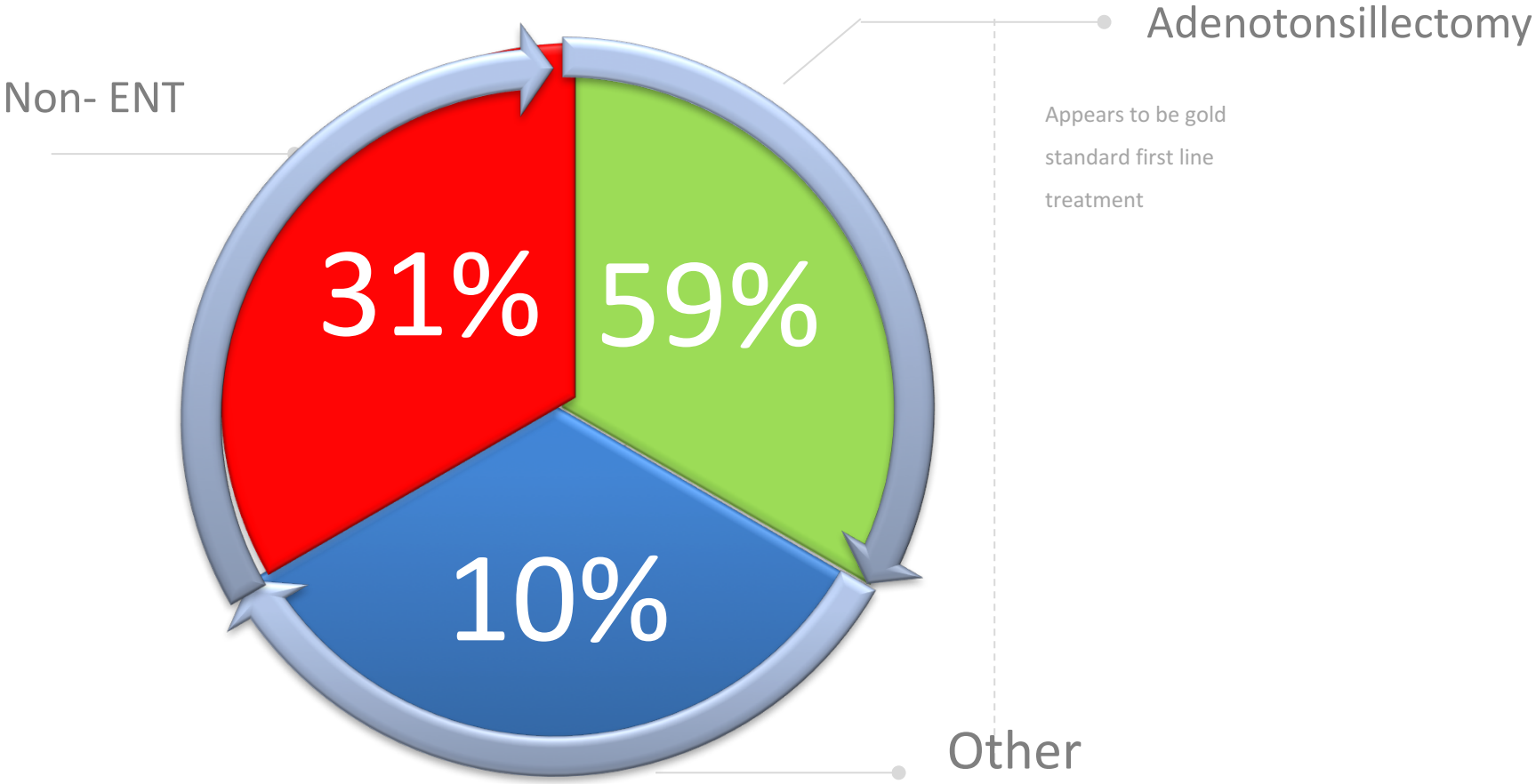
Methods: Children undergoing surgery and completing a sleep study were prospectively screened for OSA using a short questionnaire. Procedures within 1 year of PSG were included in the analysis. Questionnaires were scored according to a cutoff previously deemed optimal for predicting OSA (apnea-hypopnea index ≥ 5) on the sleep study. Postoperative outcomes included prolonged (>60 min) length of stay (LOS) in the post-anesthesia care unit (PACU) and oxygen requirement in the PACU.

Results: The study cohort included 185 patients (100/85 male/female) age 8 ± 4 years, undergoing adenotonsillectomy (n = 109), other ear, nose, and throat (ENT) procedures (n = 18), or non-ENT procedures (n = 58). There were 45 patients with OSA documented by PSG and 122 patients identified likely to have OSA according to questionnaire responses (89% sensitivity, 41% specificity). PACU LOS was prolonged in 55/181 (30%) cases and supplemental oxygen was used in the PACU in 29/181 (16%) cases. In separate multivariable models, supplemental oxygen use in the PACU was more common if a patient scored $\geq 2/6$ points on the short questionnaire scale (OR = 5.0; 95% CI: 1.3, 19.9; p = 0.023) or if the patient was diagnosed with OSA on PSG (OR = 4.6; 95% CI: 1.6, 13.5; p = 0.005). Neither OSA on PSG nor questionnaire score $\geq 2/6$ were associated with prolonged PACU stay.

Table 2: Patient characteristicsⁿ

Variable	Cases missing data	Mean (SD) or N (%)
Age (y)	0	8 (4)
Sex	0	
Male		100 (54%)
Female		85 (46%)
BMI-for-age percentile	4	
<5 (underweight)		9 (5%)
5-84 (normal weight)		81 (45%)
≥85 (overweight)		91 (50%)
ASA status	2	
1-2		118 (64%)
3		65 (36%)
Procedure	0	
Adenotonsillectomy		109 (59%)
Other ENT procedures		18 (10%)
Non-ENT procedures		58 (31%)
Preoperative midazolam	0	49 (26%)
Intraoperative narcotic dose (morphine equivalent mg/kg)	7	0.10 (0.13)
OSA on sleep study (AHI ≥5)	0	45 (24%)
Predicted OSA on questionnaire (score ≥ 2/6)	0	122 (66%)
Prolonged PACU LOS (>60 min)	4	55 (30%)
Supplemental oxygen given in PACU	0	29 (16%)
Albuterol given on the ward	0	36 (19%)
Racemic epinephrine given on the ward	0	3 (2%)

Pediatric surgical patients who had a PSG



Interesting points

- 24% who went to OR in the next year had moderate to severe OSA
- 50% were with increased BMI
- 30% stayed in our PACU longer



Table 3: Patient outcomes and disposition according to presence of predicted OSA on caregiver questionnaire or diagnosed OSA on sleep study

^a Data missing in 4 cases.

AHI = apnea-hypopnea index; LOS = length of stay; OSA = obstructive sleep apnea; PACU = post-anesthesia care unit

Variable	Predicted OSA (score $\geq 2/6$) on caregiver questionnaire			Diagnosed OSA (AHI ≥ 5) on sleep study		
	No (N=63)	Yes (N=122)	P	No (N=140)	Yes (N=45)	P
	N (%)	N (%)		N (%)	N (%)	
Prolonged PACU LOS (>60 min)^a	16 (25%)	39 (33%)	0.286	37 (27%)	18 (41%)	0.081
Supplemental oxygen given in PACU	3 (5%)	26 (21%)	0.003	15 (11%)	14 (31%)	0.001
Albuterol given on the ward	8 (13%)	28 (23%)	0.095	24 (17%)	12 (27%)	0.160
Racemic epinephrine given on the ward	0	3 (2%)	0.552	2 (1%)	1 (2%)	0.569

Something to think about

- As with Tait et al in previous studies, it appears as though PACU is the critical area
- Does pediatric OSA matter past that?
- How know which children need PICU or escalation of care?
- What are the long term outcomes for children with OSA or SDB?

