Postoperative Respiratory Complications after Adenotonsillectomy in Children with Obstructive Sleep Apnea

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Abstract

Objective: To determine if otherwise healthy children age ≥3 years with an apnea-hypopnea index (AHI) < 24 on overnight polysomnography (PSG) can be safely discharged on the same day of surgery.
Methods: Case series with chart review of children age < 18 years with positive PSG (AHI > 2) who underwent adenotonsillectomy (T&A) between January 2013 and August 2019.
Results: Of the 560 children, mean (SD) age was 6.4 (3.7) years, 318 (56.8%) were male, 438 (78.2%) were African American, 243 (43.4%) were obese, 16 (2.9%) had Down Syndrome and 12 (2.1%) had sickle cell disease. Median (range) AHI was 12.3 (2-145). Fifteen children (2.7% [95% CI 1.3, 4.0]) had an intraoperative or postoperative respiratory complication. Minor complications occurred in 9 patients and did not prolong the planned ambulatory or hospital stay. Of the 6 children with more severe complications, all were planned admissions based on age, severe sleep study indices (AHI ≥ 24 or oxygen saturation nadir < 80%) or underlying medical condition. Of the 166 otherwise healthy children age ≥ 3 with AHI ≥ 10 but < 24, 113 (68.1%) were discharged home on the same day of surgery without additional respiratory sequelae.
Conclusions: This study demonstrates a low risk of respiratory complications after T&A. Otherwise healthy children with AHI < 24 may be considered for ambulatory discharge.

Introduction

Children with obstructive sleep apnea (OSA) are considered high risk for post-operative respiratory complications and require overnight inpatient monitoring in a setting where signs of respiratory distress and airway obstruction can be promptly recognized and treated. After T&A, postoperative respiratory complications have been reported to occur in 5.8% to 26.8% of children with documented OSA compared to 1.3% to 2.4% of children from the general pediatric population [1-5].
There are no validated severity scales for PSG in children and opinions differ regarding the PSG criteria that suggest the need for post-operative admission. Guidelines from the American Academy of Otolaryngology-Head and Neck Surgery recommend overnight admission for children with an apnea-hypopnea index (AHI) of 10 or greater or an oxygen saturation nadir < 80% on overnight PSG [3]. This contrasts with guidelines from the American Academy of Pediatrics (AAP) published in 2012 that recommend overnight admission for children with an AHI of 24 or greater, an oxygen saturation nadir < 80% or peak end tidal CO2 of 60 mm Hg or greater on PSG [6]. Since publication of the AAP guidelines, the senior author of the present study started discharging children with a preoperative AHI < 24 on the same day of surgery after 4 hours of post-operative observation without any noticeable increase in post-operative respiratory complications requiring revisit to the hospital.
We reviewed children with OSA who underwent T&A at our institution over a 6 ½- year period to evaluate the incidence of post-operative respiratory complications to help determine the PSG criteria for inpatient admission. Our hypothesis was that healthy children age ≥ 3 years with an AHI < 24 could be safely discharged on the same day of surgery.

Methods

- Case series with chart review of consecutive children aged < 18 years who underwent T&A or tonsillectomy between 1-1-2013 and 8-30-2019 at the State University of New York (SUNY) Downstate University Hospital of Brooklyn and for treatment of OSA as determined by positive pre-operative PSG (AHI > 2).
- Subjects were excluded if surgery was performed for indications other than OSA, without preoperative PSG or normal preoperative PSG and if undergoing airway reconstruction or tracheotomy at the time of surgery.
- Data collected included patient age, sex, race, height, weight, preoperative PSG results, past medical history including comorbidities, surgery and additional procedures, technique of tonsillectomy and adenoidectomy, case length, anesthetic management, intraoperative complications and management, admission length from recovery room start time to discharge, in-house post-operative respiratory complications, post-operative pain medications administered including narcotics, in-house non-respiratory complications and post-discharge complications.
- The percentages of healthy children age ≥ 3 years who were discharged on the day of surgery at various PSG AHI and oxygen saturation nadir cutoffs were calculated.

Characteristic	n	Result
Age, y, mean (SD)	560	6.4 (3.7)
Gender, No. (%)	560	
Boys		318 (56.8)
Girls		242 (43.2)
Race/Ethnicity, No. (%)	560	
African American		438 (78.2)
Caucasian		99 (17.7)
Asian		9 (1.6)
Hispanic		2 (0.4)
Other		12 (2.1)
Body Mass Index Percentile, No. (%)	560	
Underweight, < 5th		37 (6.6)
Healthy, ≥ 5th and < 85th		220 (39.3)
Overweight, ≥ 85th and < 95th		60 (10.7)
Obese, ≥ 95th		243 (43.4)
Past Medical History, No. (%)	560	
Asthma		134 (23.9)
Prematurity		58 (10.4)
Seizure Disorder		18 (3.2)
Down Syndrome		16 (2.9)
Cardiac Disease[a]		15 (2.7)
Sickle Cell Disease		12 (2.1)
Craniofacial Syndrome[b]		4 (0.7)
Neuromuscular/Cerebral Palsy[c]		6 (1.1)
Hypertension		4 (0.7)
Polysomnography Results		
Apnea-Hypopnea Index, median (range)	560	12.3 (2-145)
Obstructive index, median (range)	136	8.95 (0-64.7)
Respiratory Disturbance Index, median (range)	89	11.5 (2-87.7)
Apnea Index, median (range)	46	13.1 (0.3-109.6)
Lowest oxygen saturation, %, median (range)	479	83 (21-99)
% of time with oxygen saturation < 90%, median (range)	124	6.2 (0-76.4)
Preoperative nasal continuous positive airway pressure, No. (%)	560	10 (1.8)

Table 1. Demographics, Medical History and Polysomnography Results.

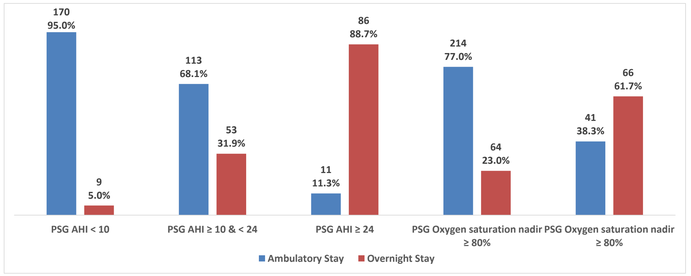

Figure 1. Ambulatory Stay versus Overnight Monitoring following Tonsillectomy and Adenoidectomy for Subjects Age ≥ 3 years and Otherwise Healthy.

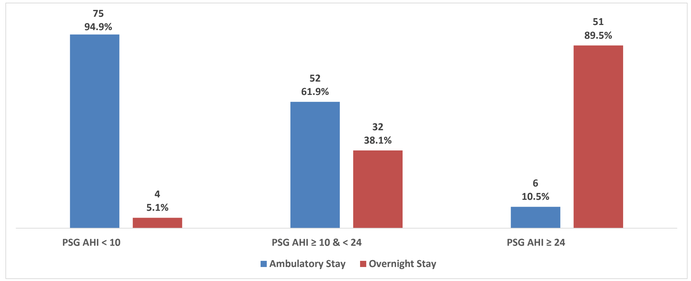

Figure 2. Ambulatory Stay versus Overnight Monitoring following Tonsillectomy and Adenoidectomy for Subjects Age ≥ 3 years, Obese but Otherwise healthy. Obese subjects are also included in Figure 1.

Results

- 560 subjects met the inclusion criteria with sufficient records available for review (Table 1).
- The median (range) length of stay was 6 (1.25- 115.0) hours. 298 (53.2%) cases were ambulatory and 262 (46.8%) were overnight admissions.
- **15 children (2.7% [95% CI 1.3, 4.0]) had an intraoperative or postoperative respiratory complication.**
- **Intraoperative respiratory complications** occurred in 6 patients and included desaturation, bronchospasm and laryngospasm: 3 patients were treated in the operating room and symptoms resolved; one child with laryngospasm continued to have stridor during her overnight admission and one child with bronchospasm required continued treatment with intravenous steroids, intravenous furosemide, albuterol and oxygen overnight in the intensive care unit.
- **Postoperative respiratory complications** occurred in an additional 9 patients at a median (range) of 10.5 (1.4 – 20.9) hours. 7 children had desaturation secondary to continued apnea or atelectasis: 6 resolved with oxygen, positioning and additional medical therapies but one child required the initiation of nasal continuous positive airway pressure. One child developed a croupy cough and a child with sickle cell disease developed tachypnea, tachycardia and fever requiring intravenous antibiotics.
- Of the 15 overall complications, 9 were minor and did not prolong the planned ambulatory or hospital stay, one was major but did not prolong the planned overnight admission, and 5 were major and required hospital stays of 2 to 4 nights. Of the 6 children with more severe complications, all were planned admissions based on age < 3, severe sleep study indices (AHI ≥ 24 or oxygen saturation nadir < 80%) or underlying medical condition.
- Respiratory complications occurred in 5 (5.3%, [95% CI 0.8, 9.9]) children under 3 years of age and 10 (2.1%, [95% CI 0.8, 3.5]) children aged 3 and above. One (8.3% [95% CI -7.3, 24.0) child with sickle cell disease had a respiratory complication, but no complications occurred in the children with Down syndrome, craniofacial disorders, neuromuscular diseases/cerebral palsy or cardiac disease. 5 (3.7%, [95% CI 0.5, 6.9]) children with asthma had a complication. The median (range) AHI of children with respiratory complications was 17.4 (6.9 – 65.0) and the median (range) lowest oxygen saturation was 82% (36-88).
- Variables examined for potential association with respiratory complications were age, sex, race/ethnicity, BMI percentile, initial versus completion tonsillectomy, PSG AHI, PSG lowest oxygen saturation, prematurity, asthma, pre-operative respiratory infection and narcotic use. Only race/ethnicity was significantly associated with the occurrence of a complication as 2 of 9 (22.2%) Asian children developed a complication (P= .003).
- Ambulatory vs. overnight admissions in relation to PSG indices in otherwise healthy and otherwise healthy obese children age ≥ 3 years are presented in Figures 1 and 2.

Discussion and Conclusion

Our rate of respiratory complications in children with OSA after T&A was 2.7% [95% CI 1.3, 4.0]. Our rate of complications is lower than the published literature. Due to the small number of respiratory complications in our subjects, there were no significant associations between any of the expected risk factors and the occurrence of a complication.

All children who developed a severe respiratory complication were planned overnight admissions based on severe sleep study indices, age or medical co-morbidities. Overall, 68.1% of the healthy children age ≥ 3 with an AHI ≥ 10 but < 24 were sent home successfully without the occurrence of additional respiratory complications. There were no additional complications amongst the subset of obese children.

Intraoperative and post-operative respiratory complications in children with OSA after T&A were uncommon. By following accepted guidelines regarding age and medical co-morbidities as criteria for post-operative admission, children who developed complications were in-house so the complications could be managed. Our study suggests that the AAP guidelines recommending in-house observation for children with a PSG AHI ≥ 24 and oxygen saturation nadir < 80% are appropriate cutoffs for admission for otherwise healthy children age 3 and above.

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