

The Outcomes of Tonsillectomy in Obese Pediatric Patients with Obstructive Sleep Apnea

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Introduction

Pediatric obstructive sleep apnea (OSA) is characterized by obstruction of the upper airway during sleep leading to inadequate ventilation. There are serious health consequences of OSA in children including attention problems, a reduced quality of life, increased sympathetic tone and cardiovascular abnormalities. OSA is a common disorder, occurring in 1-4% of young children.

Studies have shown a correlation between overweight/obese children and OSA severity. Over the last two decades, the increase in childhood overweight and obesity has compounded the problem.

The first line treatment for OSA in children is a tonsillectomy (with or without adenoidectomy or T&A.) However, the rate of resolution of OSA (tested by polysomnography [PSG]) after T&A is not as high as expected in obese children.

Methods

Electronic medical records (EPIC ® production) and the Polysmith database at Children's Medical Center were used to generate a cohort of 226 children.

Inclusion criteria:

- Pre-operative PSG showing OSA (AHI > 1)
- T&A performed for OSA
- Post-operative PSG performed
- Aged 2-18

Exclusion criteria:

- Significant comorbidities i.e. Trisomy 21, craniofacial, neuromuscular abnormalities
- BMI < 5th percentile

Table 1 – Demographics

	Non-Obese N=117	Obese N=109	P value ^a	Demographic data was collected from the EMR. Children were grouped into two categories: obese (BMI≥95%) and non-obese (BMI<95%). Obese patients were older, gained more weight, and were more likely to have severe OSA.
Age in years, mean (SD)	5.8 (4)	8.0 (4)	<0.001	
Male, N (%)	66 (56)	64 (59)	0.726	
Ethnicity, N (%)				
White	15 (13)	9 (8)	0.079	
Black	28 (23)	42 (39)		
Hispanic	71 (61)	54 (50)		
Other	4 (3)	4 (4)		
Initial weight in kg, mean (SD)	24 (18)	52 (31)	< 0.001	
Weight gain in kg, mean (SD)	4.9 (4)	8.8 (7)	< 0.001	
Percent weight change (%)	20.4	16.9		
Severe OSA, N (%)	89 (77)	97 (89)	0.027	
Asthma, N (%)	15 (13)	24 (22)	0.067	
Allergic Rhinitis, N (%)	27 (23)	27 (25)	0.765	
3/4+ Tonsils	91 (78)	80 (73)	0.443	

^a – p values based upon ANOVA

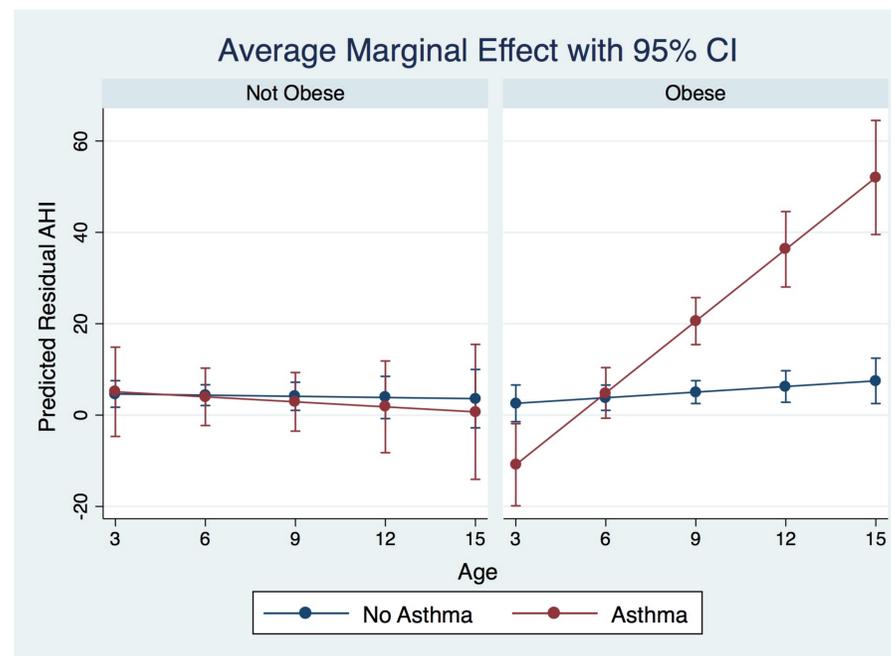
Abbreviations – SD, standard deviation; N, number; kg, kilograms; OSA, obstructive sleep apnea

Table 2 – Mean Polysomnographic Findings

	All N=226	Non-Obese N=117	Obese N=109	P value
Preoperative Polysomnogram				
Sleep Efficiency	81 (14)	82 (15)	81 (13)	0.729
NREM%	72 (9)	72 (8)	72 (10)	0.632
REM%	17 (9)	19 (11)	15 (7)	0.002
Total Arousal Index	24 (20)	21 (14)	28 (24)	0.003
CAI	1.7 (3.3)	1.3 (2.1)	2.0 (4.2)	0.100
AHI	30 (30)	25 (26)	36 (34)	0.004
SpO2 Nadir	81 (11)	82 (9)	79 (12)	0.025
CO2 > 50mmHG	14 (24)	15 (24)	13 (24)	0.595
Postoperative Polysomnogram				
Sleep Efficiency	85 (12)	86 (9)	84 (15)	0.121
NREM%	71 (9)	71 (10)	72 (9)	0.555
REM%	19 (6)	20 (6)	18 (7)	0.035
Total Arousal Index	13 (10)	12 (7)	14 (13)	0.084
CAI	0.61 (1.0)	0.75 (1.3)	0.45 (0.68)	0.028
AHI	5.6 (13)	3.7 (6)	7.6 (17)	0.027
SpO2 Nadir	88 (6)	89 (6)	88 (6)	0.611
CO2 > 50mmHG	7.6 (19)	11 (23)	4.2 (13)	0.008

Abbreviations – NREM%, percent of sleep in non-rapid eye movement; REM%, percent of sleep in rapid eye movement; CAI, central apnea index; AHI, Apnea-Hypopnea Index; SpO2 Nadir, lowest hemoglobin oxygen saturation; CO2>50mmHG, highest end-tidal CO2 pressure

Figure 1 – The Effect of Asthma on Residual AHI



Key findings

Table 1

1. Obese patients were older than non-obese (8 years vs. 5.8 years)
2. Obese patients gained more weight than non-obese post-T&A (8.8 kg vs. 4.9 kg)
3. Obese patients were more likely to have severe OSA (AHI>10)

Table 2

1. Pre-operatively, there was a statistical difference with obese patients having worse scores in the following PSG measures: REM%, Total Arousal Index, AHI, SpO2 Nadir
2. Post-operatively, there was a statistical difference with obese patients having worse scores in the following PSG measures: REM%, CAI, AHI, CO2 > 50 mmHG

Figure 1

1. In non-obese patients, asthma does not affect residual AHI
2. In obese patients, patients with asthma have a lower residual AHI at age 3, no difference at age 6, and have a higher residual AHI the older they get after 7

Discussion

Previous studies have shown that outcomes of T&A are worse in obese children with OSA, but have not yet shown a predictive model of residual AHI. This study shows that clinicians should consider counselling weight loss in older obese patients with asthma before performing a T&A.

Our findings suggest that residual AHI in obese patients can be predicted by age and by the presence of asthma. Residual AHI is higher after T&A in asthmatic children over 6 years of age.

We recognize some limitations to our study. Our population is comprised of patients who were referred to a tertiary pediatric care center. Additionally, our study design includes only patients that were able to get a pre-op and post-op PSG. Also, the population is a consecutive cohort not controlled for age and therefore the obese patients are older than the non-obese. Nonetheless, this study shows important possible predictors clinicians can use in deciding the treatment plan for pediatric OSA.

Conclusions

The first-line treatment of pediatric OSA in children is a T&A. Unfortunately, the rate of resolution of OSA after T&A is not as high as expected in obese patients. This study shows that age and asthma can be used to predict residual AHI in obese patients.

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