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SCIENTIFIC INVESTIGATIONS

Adenoidectomy for Obstructive Sleep Apnea in Children

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Study Objective: Adenotonsillectomy is the recommended treatment for children with obstructive sleep apnea (OSA). Since adenoidectomy alone may be associated with significantly lower morbidity, mortality, and cost, we aimed to investigate whether adenoidectomy alone is a reasonable and appropriate treatment for children with OSA.

Methods: Five-hundred fifteen consecutive children diagnosed with moderate-to-severe OSA (apnea-hypopnea index > 5) based on polysomnography and who underwent adenoidectomy or adenotonsillectomy were reevaluated after 17–73 months (mean 41) for residual or recurrent OSA using a validated questionnaire (Pediatric Sleep Questionnaire, PSQ). Failure of OSA resolution was defined as a positive mean PSQ score ≥ 0.33. Contribution of age, obesity, tonsil size, and OSA severity at baseline to adenoidectomy or adenotonsillectomy failure was examined.

Results: Positive PSQ score occurred in 15% of the entire sample and was not influenced by age or gender. No difference in failure rate was observed between adenoidectomy and adenotonsillectomy for children who were not obese with apnea-hypopnea index < 10 and had small tonsils (< 3). Children with apnea-hypopnea index ≥ 10 and/or tonsil size ≥ 3 showed a higher failure rate after adenoidectomy compared to adenotonsillectomy (20% versus 9.8%, p = 0.028).

Conclusions: We suggest that subjective, long term outcomes of adenoidectomy are comparable to those of adenotonsillectomy in non-obese children under 7 years old with moderately OSA and small tonsils. Hence, adenoidectomy alone is a reasonable option in some children. Future prospective randomized studies are warranted to define children who may benefit from adenoidectomy alone and those children in whom adenoidectomy alone is unlikely to succeed.

Keywords: adenoidectomy, adenotonsillectomy, children, obstructive sleep apnea, Pediatric Sleep Questionnaire.

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INTRODUCTION

Obstructive sleep apnea (OSA) is a common pediatric disorder, characterized by recurrent events of upper airway obstruction during sleep, resulting in disruption of normal ventilation and sleep fragmentation. The "gold standard" investigation for OSA diagnosis is polysomnography (PSG).[1] Most OSA cases in children are secondary to adenotonsillar hypertrophy; hence the first line of treatment is adenotonsillectomy.[2,3] Regarding whether the procedure should routinely include the excision of the tonsils together with the adenoids, the textbook of pediatric pulmonology is determined and states that: "both tonsils and adenoids should be removed, even when one or the other seems to be the primary culprit."[2]

Compared to adenoidectomy, tonsillectomy is associated with a higher rate of complications including morbidity and mortality.[3] The estimation of post-tonsillectomy mortality from the United States and the United Kingdom is 1:10,000 to 1:35,000.[4–7] A survey among members of the American Academy of Otolaryngology-Head and Neck Surgery revealed that of 552 respondents, 51 reported incidents of post-tonsillectomy mortality, and four reported incidents of anoxic brain injury.[8] Post tonsillectomy bleeding rate is reported to range from 0.6% to 3%, occurring in the immediate perioperative period and up to two weeks postoperatively.[9–11] Since children are usually discharged within 24 hours after adenotonsillectomy, life-threatening bleeding might happen at home when immediate medical supervision is lacking. These complications can have a significant impact on the burden of care.

BRIEF SUMMARY

Current Knowledge/Study Rationale: Adenotonsillectomy is the recommended treatment for children with obstructive sleep apnea (OSA). Since adenoidectomy may be associated with significantly lower morbidity, mortality and cost, we aimed to investigate whether adenoidectomy alone is a reasonable and appropriate treatment for children with OSA.

Study Impact: In non-obese children with moderate OSA and smaller tonsils, adenoidectomy alone is a reasonable option. Future prospective randomized studies are needed.

In contrast, compared to adenotonsillectomy, the complications after adenoidectomy alone are very rare, and almost none are life-threatening.[12] Adenoidectomy is also associated with decreased morbidity, especially postoperative pain and eating difficulties, shorter hospitalization, and lower cost. Notwithstanding the advantages of adenoidectomy alone, the place of this reduced procedure has barely been studied, and comparison to adenotonsillectomy regarding the yield in resolution of OSA has never been performed.

We hypothesized that in a considerable portion of children, OSA may resolve after adenoidectomy alone. We therefore studied the outcome of OSA post-adenoidectomy using a validated pediatric sleep questionnaire (PSQ) for OSA and compared it to adenotonsillectomy.[13]

METHODS

The study protocol was approved by the local IRB (Helsinki Committee), and parental informed consent was obtained. This cohort study was based on all children referred for suspected OSA to the Pediatric Sleep Center at the Dana Children's Hospital, Tel Aviv, Israel, and underwent PSG between January 1, 2007, and September 16, 2013. Inclusion criteria were: (1) healthy children with PSG confirmed diagnosis of moderate-to-severe OSA (apnea-hypopnea index, AHI > 5) who underwent either adenoidectomy or adenotonsillectomy, (2) time from PSG to PSQ of ≥ 17 months, (3) time from surgery to PSQ of ≥ 6 months. Exclusion criteria were: children with underlying medical problems such as: craniofacial anomalies, pulmonary, cardiac, or neurological diseases, and children who underwent a repeated ENT surgery. Data was collected at 2 points: (1) the time of evaluation for OSA (baseline evaluation), and (2) follow-up (outcome evaluation). The following data were collected for all children at baseline: PSG results, tonsil size, age, gender, and body mass index (BMI) percentiles.

All children underwent a standard overnight PSG in the pediatric sleep laboratory in accordance with the American Thoracic Society guidelines.[14] Additional information on the methods used for PSG and scoring is presented in the supplemental material. Sleep architecture was assessed by standard techniques.[15] Arousals were defined as recommended by the American Sleep Disorders Association Task Force report using the 3-second rule.[16] Moderate-severe OSA was defined as AHI > 5 per hour of sleep.

Data on tonsils size was collected for each participant and graded using the 0-to-4 grade scale.[17,18] Tonsil size was evaluated by 3 experienced pediatric sleep physicians (YS, RT, MG). Data on height and weight were obtained for each participant, and the BMI percentiles were calculated. Obesity was defined as a BMI percentile > 95% according to the World Health Organization anthropometric BMI calculator and was adjusted for age and sex.[19]

Follow-up evaluation was performed by a telephone interview and the following information was collected: (1) whether the child stopped snoring after surgery, and whenever the answer was "yes," parents were asked whether the child started snoring again at any time after surgery, (2) 22 items of the PSQ, and (3) body weight and height. Children were divided into 2 groups according to the type of intervention: (1) children who had adenotonsillectomy, (2) children who had adenoidectomy alone. The decision which procedure to perform was decided by the ENT and parents together.

The PSQ is a 22-item sleep related breathing disorder validated questionnaire used to evaluate sleep-related breathing disorders in clinical research.[20–23] It contains 22 symptom items that have been shown to correlate with PSG confirmed OSA in children.[13] Responses are "yes'' = 1 point, ''no'' = 0, and ''don't know'' = missing. The mean response on non-missing items is the score varying from 0 to 1. A cutoff value of 0.33 is used to identify pediatric sleep-disordered breathing.[13] PSQ subscales include a 4-item snoring scale (items 1–4), a 4-item sleepiness scale (items 10–13), and a 6-item inattention/hyperactivity scale derived from the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) criteria for attention-deficit/hyperactivity disorder (items 17–22).[13,21–24]

The primary outcome measure was residual OSA by a positive PSQ score defined as a mean PSQ score ≥ 0.33, which was considered failure of OSA resolution following intervention. The data were also analyzed by subscales. Habitual snoring was defined as a positive answer to question 1 (does your child snore more than half of the week?).[23–25]

Data and Statistical Analysis

Comparisons of PSQ total, PSQ subscale scores, and failure rates (PSQ total ≥ 0.33) were conducted between children who underwent adenoidectomy and children who underwent adenotonsillectomy. In order to eliminate the effect of obesity, we further analyzed the data after excluding all obese children at the time of PSG (BMI percentile > 95%). The effect of tonsil size (< 3 and ≥ 3), disease severity (AHI), and age at baseline on PSQ score was also investigated. Statistical analysis was performed by a biostatistician with the use of SPSS version 22.

Categorical variables are reported as numbers and percentages. Continuous variables were tested for normal distribution using Kolmogorov–Smirnov test and histogram. Continuous variables are reported as medians (interquartile ranges [IQR]) and mean (standard deviation [SD]). Categorical variables were compared using χ^2 test or Fisher exact test and continuous variables by Mann Whitney test.

Univariate and multivariate logistic regression analyses were conducted to determine associations between the different variables after adjusting for potential covariates. p value < 0.05 was considered significant, with all p values being 2-tailed.

RESULTS

Seven hundred one children met inclusion criteria. One hundred eighty-six either refused to participate or were not located (response rate = 73.4%); hence, 515 children were studied. The mean time interval between PSG and telephone interview was 3.6 ± 1.33 years. The mean age of the cohort was 3.38 ± 2.61 years at PSG and 7 ± 3.03 at follow-up evaluation. Adenotonsillectomy was performed in 394 children (76.5%) and adenoidectomy in 121 (23.5%).

Demographics and clinical variables according to type of surgery are presented in **Table 1**. No significant differences were found in age, gender, and BMI percentiles at baseline between the adenoidectomy and adenotonsillectomy groups. As expected, children in the adenotonsillectomy group had higher AHI and tonsil size (p < 0.001).

The rate of positive PSQ in the entire sample was 15%; 16.7% of the subjects were obese at baseline evaluation and 16.4% were obese during the outcome evaluation. Positive PSQ was not influenced by age, gender, or obesity at baseline evaluation. However, there was a trend toward higher mean BMI percentile at outcome evaluation in children with positive

Table 1—Demographic and clinical parameters of children who underwent adenoidectomy and adenotonsillectomy.

	Adenoidectomy	Adenotonsillectomy	p
Number of subjects, n (%)	121 (23.5%)	394 (76.5%)	
Male, n (%)	79 (65.3%)	272 (69%)	0.44
Age at PSG #	2.62 (1.52–3.61)	2.6 (1.87–3.9)	0.23
Time interval between PSG and PSQ #	3.45 (2.54–4.55)	3.46 (2.46–4.76)	0.68
BMI percentile at PSG #	53.1 (11.4–88.2)	53 (15–86)	0.71
BMI percentile during PSQ #	60 (20–89.75)	67 (33–88.5)	0.182
Obesity at PSG (n = 473), n (%)	13 (12%)	66 (18%)	0.089
Obesity at PSQ (n = 421), n (%)	17 (17%)	52 (16.2%)	0.739
AHI #	8.4 (6.2–12.35)	11.1 (7.4–17.8)	**< 0.001**
Tonsils size ≥ 3, n (%)	41 (35%)	223 (60%)	**< 0.001**
Age at surgery*	3.45 ± 2.57	3.78 ± 2.73	0.185
Time interval between PSG to surgery, years #	0.2 (0.07–0.39)	0.18 (0.07–0.41)	0.57
Time interval between surgery and PSQ, years*	3.25 ± 1.22	3.29 ± 1.39	0.995

Median (IQR), *Mean ± SD. Signficant differences with p values < 0.05 appear in bold. AHI, apnea-hypopnea index; BMI, body mass index; IQR, interquartile range; PSG, polysomnography; PSQ, pediatric sleep questionnaire.

PSQ (64.42 ± 33.2) compared to children with negative PSQ (57 ± 32.7, p = 0.056). Correspondingly, the rate of obesity at outcome evaluation was higher in children with positive PSQ (26.2% and 14.6%, respectively, p = 0.04). For the entire cohort, a similar failure rate (positive PSQ) was observed between adenoidectomy and adenotonsillectomy groups (18% and 14%, respectively, p = 0.25).

Subgroup Analysis after Exclusion of Obese Children

Forty-two children with missing BMI data at baseline and 79 children who were obese at baseline evaluation were excluded from this analysis; hence, 394 non-obese children were analyzed. Three hundred forty of 394 children underwent adenotonsillectomy and 54 of 394 underwent adenoidectomy. No significant differences were found in age, gender, and BMI percentiles between the adenoidectomy and adenotonsillectomy groups. Children in the adenotonsillectomy group had higher AHI scores and larger tonsils at baseline than children in the adenoidectomy group (median AHI: 10.5 versus 9, p = 0.006 and median tonsil size: 2.5 versus 3, p < 0.001). Overall, a similar failure rate (positive PSQ) was observed in both groups (adenoidectomy: 17.9% versus adenotonsillectomy: 12.4%, p = 0.173). Subgroups analysis of non-obese subjects for the effect of AHI on the failure rate was performed using a cutoff of AHI = 10 (the median in our cohort). A higher failure rate (18.6%) was observed in children with AHI ≥ 10 who underwent adenoidectomy compared to patients who had adenotonsillectomy (18.6% and 8.0% respectively, p = 0.04). No such difference was found in children with AHI < 10 (17.3% and 17.6% respectively, p = NS).

Subgroup analysis for the effect of tonsils size on the failure rate using a cutoff level ≥ 3 found no effect of tonsil size on surgical outcome with only a trend towards an effect in children with relatively larger tonsils (tonsils size < 3: adenoidectomy = 18.3% versus adenotonsillectomy = 14.5%, p = NS; tonsil size ≥ 3: adenoidectomy = 18.2% adenotonsillectomy = 11.0%, p = NS).

Subgroup Analysis after Exclusion of Obese Children and Dividing into Clusters

In order to investigate the effect of both AHI and tonsil size on surgical outcome (PSQ score) we divided the non-obese subjects into the following clusters: (1) "lower risk": AHI < 10 and tonsils size < 3, n = 88 (2) "higher risk": tonsil size ≥ 3 and/or AHI ≥ 10, n = 295. A comparison of the demographic and clinical characteristics in the low risk cluster group according to type of surgery is presented in the **Table 2**.

No difference was found between these two risk groups for age, gender, BMI, and rate of obesity during the outcome evaluation, age of surgery, and time interval from surgery to the PSQ. As expected, more children in the "higher risk" cluster underwent adenotonsillectomy compared to adenoidectomy (79.7% and 62.5% respectively, p < 0.001). For the "lower risk cluster," the rate of positive PSQ score, was not different between the two groups (p = NS). In the "higher risk" cluster, a significantly greater rate of positive PSQ was observed in the adenoidectomy compared to adenotonsillectomy (20% versus 9.8%, p = 0.029). Data are presented in **Table 3** and **Figure 1**.

Using multivariable logistic regression analysis only for the "higher risk" cluster with the positive PSQ subgroup as a dependent variable and gender, age, and type of surgery as covariates, the type of surgery was the only predicting value with adenoidectomy being associated with higher probability of positive PSQ compared to adenotonsillectomy (OR = 2.35, CI: 1.1–5.5. p = 0.049). The same analysis for the "low risk" cluster revealed no difference in failure probability between the two types of surgery (OR = 0.58, CI: 0.16–2.05, p = 0.403).

DISCUSSION

The present study shows that the subjective outcome of adenoidectomy alone evaluated by PSQ in non-obese children with relatively smaller tonsils (< 3) and lower AHI (< 10) is comparable to adenotonsillectomy. However, in children categorized

Table 2—Demographic and clinical parameters of children who underwent adenoidectomy and adenotonsillectomy according to low risk cluster and high risk cluster.

	Low Risk Cluster (n = 88)		
	Adenoidectomy (n = 33)	**Adenotonsillectomy (n = 55)**	**p**
Age at PSG	2.58 (1.2–3.36)	2.62 (2.14–4.02)	0.104
BMI percentile at PSG	37.6 (4.9–78)	48.5 (23–76)	0.43
BMI percentile during PSQ	60 (17–82)	57 (33–82)	0.611
Apnea-hypopnea index	7.1 (6–8.3)	7 (6–7.9)	0.907
Tonsils size	2 (2–2.5)	2 (2–2.5)	0.44
Age at surgery	3 (1.5–4)	3 (2.5–4.5)	0.118
Time interval between PSG-surgery, y	0.26 (1–0.52)	0.23 (0.09–0.6)	0.695
Time interval between surgery-PSQ, y	3.3 (1.8–4)	2.95 (0.77–5.8)	0.515

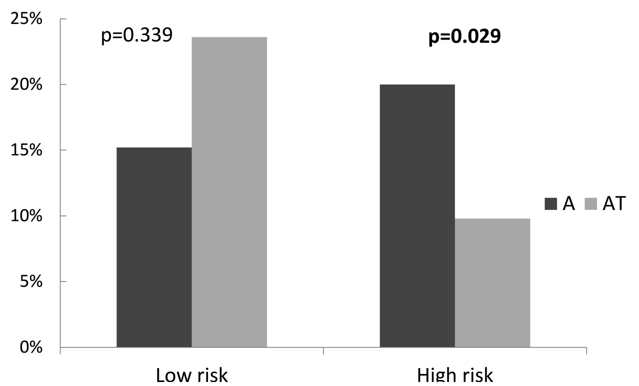
Data are presented as median (IQR).

Table 3—PSQ results and PSQ subscales of the non-obese children according to lower and higher risk cluster.

	Adenoidectomy	**Adenotonsillectomy**	**p**
"Low risk" (tonsil size < 3 and AHI < 10), (n = 88)			
Positive total PSQ	5/33 (15.2%)	13/55 (23.6%)	0.339
PSQ Question 1	6/33 (18.2%)	8/55 (14.5%)	0.652
PSQ – Snoring	0.22 ± 0.33	0.13 ± 0.26	0.16
PSQ – Sleepiness	0.19 ± 0.28	0.15 ± 0.24	0.42
PSQ – Behavior	0.13 ± 0.26	0.32 ± 0.36	**0.006**
"High risk" (tonsils size ≥ 3 and/or AHI ≥ 10), (n = 295)			
Positive total PSQ	12/60 (20%)	22/235 (9.8%)	**0.029**
PSQ Question 1	8/60 (13.3%)	24/235 (10.2%)	0.488
PSQ – Snoring	0.18 ± 0.29	0.1 ± 0.25	0.08
PSQ – Sleepiness	0.17 ± 0.25	0.13 ± 0.22	0.29
PSQ – Behavior	0.24 ± 0.322	0.22 ± 0.3	0.61

Positive total PSQ is presented as percentage of cases ≥ 0.33. PSQ total and subscales (snoring, sleepiness, and behavior) are presented as mean ± SD. Signficant differences with p values < 0.05 appear in bold. AHI, apnea-hypopnea index; PSQ, pediatric sleep questionnaire.

Figure 1—Positive PSQ score rates of adenoidectomy and adenotonsillectomy in non-obese subjects by the "low and high risk" clusters.



"Low risk": tonsil size < 3 and AHI < 10, "high risk": tonsil size ≥ 3 and/or AHI ≥ 10. A, adenoidectomy; AT, adenotonsillectomy.

to a "high risk cluster" (tonsils size ≥ 3 and AHI ≥ 10), adenoidectomy alone is associated with a higher failure rate than adenotonsillectomy. Recommendations by the UpToDate and the textbook suggest adenotonsillectomy for all children with OSA, not mentioning adenoidectomy as an option. The UpToDate series implies that obstructive symptoms and signs frequently persist after adenoidectomy alone for treatment of OSA, and that many children who undergo adenoidectomy are not spared tonsillectomy,[2–3,26] although a comparison between these two surgical approaches in regards to long-term resolution of OSA symptoms has never been performed. Gov-Ari et al. showed that patients undergoing adenoidectomy for upper airway obstruction are likely to be at an increased risk of subsequent tonsillectomy when compared with those who undergo adenoidectomy for other indications. Young age, female sex, and large tonsil size may further increase the risk for subsequent tonsillectomy.[27] Moreover, the American Academy of Pediatrics recommendation suggests that "adenoidectomy or tonsillectomy alone may not be sufficient, because residual lymphoid tissue may contribute to persistent obstruction."[3] Since the morbidity, rate of complications, and cost of adenotonsillectomy are substantially higher, it can be assumed that ENT surgeons would choose to perform adenoidectomy alone if supportive data, guidelines, and limitations were presented. Nevertheless, in spite of being one of the commonest surgical procedures in children, practically no data exist to allow for a structured decision-making process. It is reasonable to assume that major considerations for ENT surgeons are tonsil size, AHI, obesity, age, and literature recommendations. Accordingly, our study suggests that non-obese children with AHI < 10 and tonsil size < 3 might be appropriate candidates for adenoidectomy alone, since similar success rates were observed for the two types of interventions in regard to subjective long-term resolution of OSA symptoms. Nevertheless, in the other non-obese subjects, the success rate of adenotonsillectomy was significantly superior.

The prospective, randomized, multicenter, well-controlled childhood adenotonsillectomy trial (CHAT study) established that compared with watchful waiting, adenotonsillectomy reduced symptoms and improved secondary outcomes of behavior, quality of life, and PSG findings, but did not significantly improve attention or executive function. Normalization of PSG findings was observed in 79% of children in the early-adenotonsillectomy group compared to 46% of the watchful waiting group.[28] The CHAT study did not include children who underwent isolated adenoidectomy. Nevertheless, since watchful waiting results in resolution of OSA, it is reasonable to assume that adenoidectomy alone may also result in OSA resolution and probably with a better success rate. Indeed, our results imply that it might be appropriate to consider adenoidectomy alone as an option and that it should find its clinical slot. The present results also propose the subgroup of children who may be good candidates for randomized controlled studies that will prospectively assess the outcome of the reduced surgical procedure.

We used the PSQ to assess risk for OSA.[13] This questionnaire was developed by Chervin et al. in 2000 and was validated again in 2007.[29] The PSQ has since been used in pediatric research.[21–25] Three reviews of pediatric questionnaires by other groups concluded that the PSQ may be the best pediatric OSA instrument available apart from PSG for sleep-disordered breathing.[30–32] A recent publication showed that in contrast to PSG, PSQ better reflects subjective measures of OSA-related impairment of behavior, quality of life and sleepiness and predicts their improvement after adenotonsillectomy. As for OSA, the PSQ showed a sensitivity of 77% to 81% and a specificity of 87% compared to PSG.[13,33] Obviously, physiologic evaluation by objective PSG is needed to diagnose OSA and should be applied in future studies as the main outcome measure. Nevertheless, the symptoms obtained during office visit by the structured PSQ offer adjunctive insight into important comorbidities and likely surgical responses,[33] and hence may be used in addition.

Based on our PSQ results, the rate of positive PSQ in our entire sample was 15%. This matches the rates found in previous studies that showed that residual OSA after adenotonsillectomy ranged from 13% to 29%. This also further supports the validity of the PSQ methodology used in the present study as is the observation that residual OSA was more frequent in obese patients.[3,34–36] Thus, in spite of the fact that we did not use PSG for our second evaluation, we believe that the use of the PSQ as a subjective measure was valid.

Adenoid size may be a factor for ENT consideration whether to perform adenotonsillectomy or tonsillectomy. When adenoids are not enlarged or do not significantly obstruct the nasopharynx, the ENT physicians may choose to perform tonsillectomy alone. Also, when the adenoids are not enlarged, it may be anticipated that adenoidectomy would be inferior to adenotonsillectomy regardless of the tonsil size. This implies that adenoids size should also be considered in the decision-making process. In this study we did not apply adenoid size as a variable. This stems from the retrospective nature of the study and the fact that there is more than one way to evaluate adenoid size including radiography, awake endoscopy, sleep endoscopy, palpation and more; hence, no one "gold-standard" method exists. We suggest that future studies with prospective design will include adenoid size as a factor when comparing adenotonsillectomy to adenoidectomy using an accepted and objective assessment technique, especially if a multi-center study takes place.

Surprisingly, we found a trend towards a higher failure rate for adenotonsillectomy in the "lower risk" cluster (23.6%) compared to the "higher risk" cluster (9.8%, p was NS). The pathophysiologic components involved in OSA include (in addition to anatomical factors that reduce airway caliber) increased upper airway collapsibility and familial occurrence.[37] Hence, it may be that especially in children with lower tonsil size, the anatomical part of airway narrowing is less dominant, and removing adenotonsillar tissue in these subjects results in a relatively lower rate of OSA resolution compared to cases where the significantly enlarged tonsils play the major part causing obstruction.

The higher score that was observed in the behavior subscale in the lower risk cluster was probably an accidental and questionable finding, since the PSQ is a tool to assess sleep disorder breathing and not a behavioral outcome.

Obese children (BMI > 95th percentile) have a higher rate of persistent OSA despite adenotonsillectomy, probably due to anatomical and functional differences that have been demonstrated also by MRI.[38,39] Correspondingly, our study confirmed the higher failure rate in obese children during the follow-up evaluation. The rate of obesity in our cohort was 16.5%, which is lower than some related US studies, but is similar to others.[27,34,35,40]

This study has several limitations that may guide future prospective research. Above all, the decision to perform adenoidectomy or adenotonsillectomy depended on ENT and parental decision and not on designed randomization. Hence, a trend towards more cases of adenotonsillectomy in children with more severe OSA or larger tonsils was expected. Nevertheless, although this trend affected groups' sizes, it did not affect the assessment and results since we compared adenotonsillectomy to adenoidectomy within corresponding subgroups defined by AHI and tonsil size (comparison in between lower risk cluster and comparison in between higher risk cluster).

The time interval between the diagnosis and treatment to outcome assessment was variable, and theoretically, children who did not snore or did not have a positive PSQ at the outcome assessment point could have turned into "failures" if assessed at a later time. Furthermore, the mean age at follow-up was 7 ± 3 years. This is the upper limit of the typical age range for pediatric OSA (2–8 years), and some children might have spontaneously outgrown the problem. Conversely, if a long time interval between treatment and follow-up assessment was employed, considerable changes in degree of obesity, lymphoid tissue involution with age, and pubertal status may have affected the results. However, we showed similar time interval from PSG to PSQ in both groups. In addition, parental recall bias may have been introduced.

In summary, this study suggests that the indiscriminant approach to perform adenotonsillectomy for all children with OSA who undergo surgery may not be justified. We propose that subjective, long-term outcomes of adenoidectomy are comparable to those of adenotonsillectomy in non-obese children under 7 years old with moderate OSA and small tonsils. This reduced procedure exposes patients to less complications and lower mortality risk and is associated with lower cost and inconvenience. We advocate that future large scale randomized prospective and multicenter studies using a variety of outcome measures will be performed in order to investigate the role of adenoidectomy alone and to define those children in whom adenoidectomy may safely replace adenotonsillectomy. We hope that this study will indeed stimulate such research.

ABBREVIATIONS

A, adenoidectomy
AHI, apnea-hypopnea index
AT, adenotonsillectomy
BMI, body mass index
OSA, obstructive sleep apnea
PSG, polysomnography
PSQ, Pediatric Sleep Questionnaire

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