Pre- and post-operative evaluation of the frequency of nocturnal enuresis and Modified Pediatric Epworth Scale in pediatric obstructive sleep apnea patients

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Outline

- Introduction/Background
- Method/Material
- Result/Statistical analysis
- Discussion/Conclusion
- Case example
- Take home message

Pediatric Obstructive Apnea(OSA)

- Diagnostic criteria

Apnea-Hypopnea Index(AHI)(events/hr)	Definition
<1	Normal
≧1	Pediatric OSA
1-5	Mild
5-10	Moderate
>10	Severe

Pediatric OSA

- Prevalence: 1~4%
  - Commonly affects children between 3 and 7 years of age.
- Definition: childhood disorder in which there is upper airway dysfunction causing complete or partial airway obstruction

Pediatric OSA

- Causes
  - **Adenotonsillar hypertrophy (Most common)**
  - Craniofacial anomalies
  - Nasal obstruction
- Symptoms
  - Habitual snoring
  - **Nocturnal enuresis(NE)**
  - Apnea during sleep
  - Inattention
  - **Daytime sleepiness**

Nocturnal Enuresis(NE)

- Involuntarily unsuitable wetting at night for children over 5 years old
- It is the second most common chronic pediatric condition, with a prevalence of approximately 5%–10% among otherwise healthy 7-year-old children.

Nocturnal enuresis and OSA

Clinical Investigation | Published: 08 September 2014

Nocturnal enuresis is associated with moderate-to-severe obstructive sleep apnea in children with snoring

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Pediatric Research **76**, 555–559 (2014) | Cite this article

5852 Accesses | **62** Citations | **3** Altmetric | Metrics

Pediatric Research

Table 1 Subjects' characteristics and statistical comparisons of children with and without nocturnal enuresis (NE)

Variables	Children with NE ($n = 355$)	Children without NE ($n = 170$)	P value
Age, years	7.6 ± 2.3	7.3 ± 2.1	NS
Gender, female (%)	154 (43.4)	70 (41.2)	NS
BMI z score	1 ± 1.2	0.1 ± 1.3	<0.01
Obesity (%)	123 (34.6)	16 (9.4)	<0.01
Tonsillar hypertrophy (>2+) (%)	228 (64.2)	118 (69.4)	NS
Obstructive apnea-hypopnea index, episodes/hour	1.8 (0.5–8)	2.1 (0.4–5.9)	NS
Respiratory arousal index, episodes/hour	0.8 (0.1–4)	0.8 (0–2.9)	NS
Oxygen desaturation (≥4%) of hemoglobin index, episodes/hour	2.3 (0.5–10.9)	2.5 (0.5–9.8)	NS
Oxygen saturation of hemoglobin nadir, %	90 (84–93)	90 (84–93)	NS
Subjects with apnea-hypopnea index >5 episodes/hour, %	68 (19.2)	19 (11.2)	<0.05

Continuous variables are expressed as mean ± SD or median (10th–90th percentiles).

Among children with snoring who underwent polysomnography (PSG), up to 67.6% had nocturnal enuresis.

Table 2 Associations of moderate-to-severe OSA (obstructive AHI >5 episodes/hour) with history of NE and other variables

Variables	Children with obstructive AHI >5 episodes/hour ($n = 87$)	Children with obstructive AHI ≤5 episodes/hour ($n = 438$)	Adjusted OR (95% CI)[a]	*P* value
NE				
Yes	68 (78.2)	287 (65.5)	1.92 (1.08–3.43)	0.03
No	19 (21.8)	151 (34.5)	Reference	
Tonsillar hypertrophy				
Yes	69 (79.3)			
No	18 (20.7)			
Obesity				
Yes	31 (35.6)	108 (24.7)	1.62 (0.96–2.74)	0.07
No	56 (64.4)	330 (75.3)	Reference	
Female gender				
Yes	30 (34.5)	194 (44.3)	0.70 (0.43–1.15)	0.16
No	57 (65.5)	244 (55.7)	Reference	
Age, years (mean ± SD)	6.8 ± 1.9	7.6 ± 2.3	0.82 (0.72–0.93)	<0.01

Children with nocturnal enuresis had an approximately 1.92-fold increased risk of moderate-to-severe obstructive sleep apnea compared with children without nocturnal enuresis.

AHI, apnea-hypopnea index; CI, confidence interval; NE, nocturnal enuresis; OR, odds ratio; OSA, obstructive sleep apnea.
Data in parentheses are percentages.
[a]Multivariate logistic regression analysis was applied to adjust OR of each independent variable by all other variables.

- Amongst children with snoring who are referred for polysomnography by primary care physicians, **those without NE are less likely to have moderate-to-severe OSA relative to subjects with NE**.

Why Caused Nocturnal Enuresis?

- Increased level of atrial natriuretic peptide(ANP)
  - Upper airway obstruction → increased intrathoracic pressure
- Insufficient antidiuretic hormone(ADH) production
- Insufficient arousal response

Method/Material

- **Aim of the study**
  - investigate the **beneficial effect of adenotonsillectomy(AT) on NE in children with adenotonsillar hypertrophy and evaluate the Modified Pediatric Epworth Scale (MPES).**

Method/Material

- **Study design**
  - **Prospective** pre- and post-operative observational study
  - Pre- and post-operative comparison
- Study period&setting
  - January 2015- January 2016, tertiary ENT center in Turkey

Method/Material

- **Population**:
  - 84 pediatric patients 5-16 years of age
  - Diagnosed with OSA who had not undergone AT
    - Based on clinical evaluation and AAO-HNS guidelines
    - **Polysomnography(PSG) not available**
  - Adenotonsillar hypertrophy (Grade 4)
  - Appropriate indication for adenotonsillectomy surgery
- **Exclusion criteria**
  - Secondary enuresis
  - Craniofacial anomalies
  - Nasal obstruction
  - Neurologic or developmental disorders affecting bladder control

Method/Material

- Assessment tools:
  - **Nocturnal enuresis (NE)** evaluated using a parent-reported questionnaire (based on Turkish enuresis guidelines).
  - **Daytime sleepiness** evaluated using the **Modified Pediatric Epworth Scale (MPES)**.

Modified Pediatric Epworth Scale(MPES)

0=would never doze or sleep
1=slight chance of dozing or sleeping
2=moderate chance of dozing or sleeping
3=high chance of dozing or sleeping.

Circle the most appropriate number for each situation:

1. Sitting and reading	0	1	2	3
2. Watching television	0	1	2	3
3. Sitting inactive in a public place (for example, a movie theater or classroom)	0	1	2	3
4. As a passenger in a car for an hour without a break	0	1	2	3
5. Lying down to rest in the afternoon when circumstances Permit	0	1	2	3
6. Sitting and talking to someone	0	1	2	3
7. Sitting quietly after lunch	0	1	2	3
8. Doing homework or taking a test	0	1	2	3

Method/Material

- **Intervention:** Surgical treatment for OSA (primarily adenotonsillectomy).
- **Evaluation time points:**
  - Preoperative baseline
  - Postoperative 1 month
  - Postoperative 3 month
- **Outcome measures:**
  - Presence and frequency of nocturnal enuresis(NE)
  - Changes in MPES scores before and after surgery

Results

Table 2
Statistical distribution of patients.

	NE+	NE-	
	1st group	2nd group	p
	N = 19	N = 65	
	Mean ± SD	Mean ± SD	
Age	6.9 ± 2.6	6.8 ± 2.6	0.796
Body Mass Index(BMI)	19.6 ± 5.3	20.1 ± 5.1	0.484

Results

Table 3
Statistical results of Modified Pediatric Epworth Scale (MPES).

		1st group	2nd group	p
		N = 19	N = 65	
Epworth Score	Preoperative	3.37 ± 2.79	3.51 ± 2.54	0.670
	Postoperative	0.74 ± 0.99	1.54 ± 1.80	0.121
	Gap Mean ± SD	2.63 ± 2.59	1.97 ± 1.9	0.482
	%95 CI	(1.39–2.88)	(1.50–2.44)	
	Effect size dz	1.07	0.87	
	p	< 0.001	< 0.001	

Results

Table 4
Statistical results of Nocturnal Enuresis (NE).

		Patient (n = 19)
		Mean ± SD
Night bedwetting per week	Preoperative	3.68 ± 2.43
	postoperative 1st month (mth)	1.95 ± 2.22
	postoperative 3rd mth	1.47 ± 1.93
	p	< 0.001

Subgroup analysis

		Gap Mean ± SD	%95 CI	Effect size dz	Patient P
Night bedwetting per week	Postop. 1st mth - Preop	0.47 ± 0.51	(0.23–0.72)	0.74	< 0.001
	Postop 3rd mth - Preop	0.53 ± 0.51	(0.28–0.77)	0.99	< 0.001
	Postop 3rd mth - Postop 1st mth	0.05 ± 0.23	(-0.06-0.16)	0.23	0.024

Bonferroni correction p < 0.017.

Results

Table 5
Statistical results of daytime enuresis.

		Patient (n = 10)
		Mean ± SD
Daytime enuresis	preoperative	3.670 ± 2.87
	postoperative 1st mth	1.40 ± 2.80
	postoperative 3rd mth	0.50 ± 1.58
	p	0.001

Subgroup analysis					
		Gap Mean ± SD	%95 CI	Effect size dz	Patient P
Daytime enuresis	Postop. 1st mth - Preop	2.50 ± 1.41	(1.32–3.68)	0.80	0.007
	Postop 3rd mth - Preop	3.00 ± 1.41	(1.82–4.18)	1.27	0.005
	Postop 3rd mth - Postop. 1st mth	0.50 ± 1.07	(-0.39-1.39)	0.37	0.109

Bonferroni correction $p < 0.017$.

Results

Table 6
Relation between Nocturnal enuresis, Daytime Enuresis and Modified Pediatric Epworth Scale (MPES).

		MPES Preop		MPES Postop	
		rho	p	rho	p
Preop Night bedwetting per week	19	−0.075	0.761	−0.164	0.502
Postop. 1st month	19	−0.097	0.692	−0.137	0.577
Postop 3rd month	19	−0.099	0.688	−0.162	0.506
Preop Daytime enuresis	10	0.511	0.131	0.166	0.647
Postop. 1st month	10	0.257	0.473	−0.051	0.888
Postop 3rd month	10	0.530	0.115	0.332	0.349

Results

- **Preoperative findings**
  - 19 out of 84 children (≈27%) had nocturnal enuresis preoperatively.
  - No significant differences in **age or BMI** between NE and non-NE groups
- **Postoperative improvement in NE**
  - Approximately **52% of children with preoperative NE experienced complete resolution** after surgery.
  - Remaining patients showed a **significant reduction in frequency** of bedwetting
- **MPES results**
  - MPES scores significantly decreased postoperatively, indicating improvement in daytime sleepiness.

Results

- **Time-course analysis**
  - Significant improvement from **pre-op → 1 month post-op**
  - Significant improvement from **pre-op → 3 months post-op**
  - **No significant difference between 1st and 3rd postoperative months**
- **Daytime enuresis**:
  - Also significantly decreased after surgery (**p = 0.001**)

Bias

- Lack of Control Group / Confounding Bias
- Lack of Objective Diagnostic Bias

Non-severe pediatric OSA with NE after adenotonsillectomy

Randomized Controlled Trial > JAMA Otolaryngol Head Neck Surg. 2021 Oct 1;147(10):887-892.
doi: 10.1001/jamaoto.2021.2303.

Evaluation of Nocturnal Enuresis After Adenotonsillectomy in Children With Obstructive Sleep Apnea: A Secondary Analysis of a Randomized Clinical Trial

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Affiliations + expand

PMID: 34499109 PMCID: PMC8430902 DOI: 10.1001/jamaoto.2021.2303

JAMA Otolaryngology–Head & Neck Surgery

Aim of the study

- Compare the effectiveness of AT surgery versus watchful waiting for nocturnal enuresis in children with **nonsevere OSA**.

JAMA Otolaryngology–Head & Neck Surgery

RCT: Effect of Adenotonsillectomy on Nocturnal Enuresis in Children With Obstructive Sleep Apnea

POPULATION

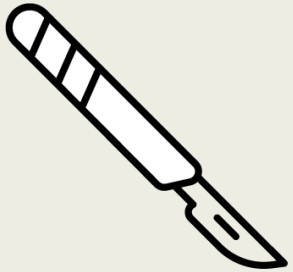
192 Boys, 201 Girls

Children aged 5-9 y with nonsevere obstructive sleep apnea (OSA)

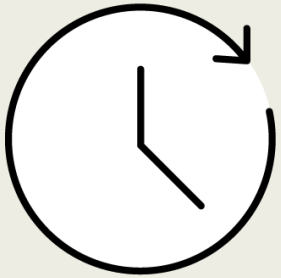
Mean (SD) age, 6.5 (1.4) y

INTERVENTION

393 Participants randomized and analyzed



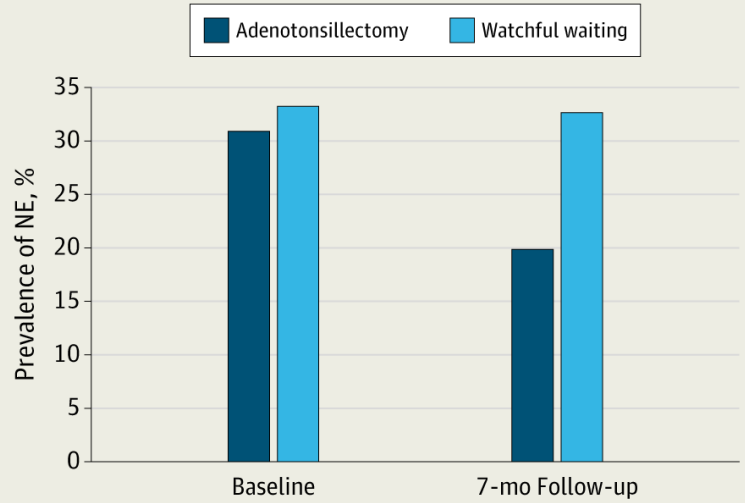
192 Adenotonsillectomy
Adenotonsillectomy performed following baseline assessment for nocturnal enuresis (NE)



201 Watchful waiting
Watchful waiting for 7 mo following baseline assessment for NE

FINDINGS

Children with nonsevere OSA randomized to adenotonsillectomy had significantly greater reductions in nocturnal enuresis prevalence at 7-mo follow-up than those randomized to watchful waiting



Change in NE prevalence from baseline to 7-mo follow-up
Adenotonsillectomy: -11% (95% CI, -16.3% to -5.7%)
Watchful waiting: -0.5% (95% CI, -6.4% to 5.4,%)

SETTINGS / LOCATIONS

6 Tertiary care children's hospitals in the US

PRIMARY OUTCOME

Prevalence of NE, defined by parental response "yes" to the Pediatric Sleep Questionnaire (PSQ) bed-wetting item, and assessed at baseline and 7-mo follow up

Snow A, Vazifedan T, Baldassari CM. Evaluation of nocturnal enuresis after adenotonsillectomy in children with obstructive sleep apnea: a secondary analysis of a randomized clinical trial. *JAMA Otolaryngol.* Published online September 9, 2021. doi:10.1001/jamaoto.2021.2303

Case1 陳X瑄 8y Female

- Chief complaint
  - Frequent tonsillitis
  - Snoring at night
  - Nocturia
- Examinations
  - Hypertrophic tonsils, grade III
  - Home Polysomnography: AHI:10.6/hr
- Plan: tonsillectomy on 11/29

Take Home Message

- **Strong Correlation:** A significant association exists between pediatric Obstructive Sleep Apnea (OSA) and Nocturnal Enuresis (NE). **NE should be viewed as a common comorbidity of OSA**.
- **Effective Intervention:** Adenotonsillectomy (AT) provides a **dual benefit**, leading to a statistically significant improvement in: **Daytime Sleepiness** and **Enuresis Frequency** (up to 52% complete resolution).
- **Independent Mechanisms:** The improvement in NE appears to be *independent* of the improvement in daytime sleepiness (MPES scores showed no correlation with NE frequency, $P>0.05$).
- **First-Line Surgical Option: For children with NE and confirmed OSA, Adenotonsillectomy should be considered a first-line therapy,**

Reference

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Thank you!