Effects of adenotonsillar hypertrophy corrective surgery on nocturnal enuresis of children

Shahin Abdollohi-Fakhim, Arefeh Talebi1, Mohammad Naghavi-Bezhad2-3, Reza Piri4, Mohammad Sadra Nazari5

INTRODUCTION

Enuresis which is defined as involuntary urinary passage during sleeping is considered a common urological complaint, especially among children. Enuresis incidence may reach up to 15% in 5-year-old children.1-5 There are many suggested mechanisms for enuresis related to bladder, kidney, and nervous system defects but there is an ongoing debate about association of nocturnal enuresis with respiratory obstructive disease which may resolve after corrective operation for obstructive airway disease (OAD).6-13 According to the literature, improvement of nocturnal enuresis after resolving of airway obstruction may be complete or partial, where the rate of improvement may be up to 64%.14-16 It seems that this resolving effect would be more prominent with nocturnal enuresis being monosymptomatic (without involvement of other defecation system).14-16

Adenotonsillar hypertrophy is one of the most common etiologies of OAD, which is caused by excessive lymphoid
tissue proliferation in tonsils. This proliferation might lead to obstruction of airways especially nasal airway obstruction due to adenoid hypertrophy which results not only in dentofacial growth anomaly in young ages but also in obstructive sleep apnea and its devastating consequence. The main surgical process of relieving this obstruction is adenotonsillectomy, which involves tonsils being cauterized, curetted, lasered, or otherwise ablated.

Adenotonsillectomy as a corrective surgery for adenotonsillar hypertrophy as one of the most common causes of OAD to relieve the obstruction is accepted worldwide. Hence, in this study, in order to reveal the relationship between OAD and nocturnal enuresis, in a cross-sectional study, it was tried to find out the prominent demographic features of patients with significant upper OAD, and then the effects of corrective surgery were investigated on nocturnal enuresis. Further, in this study, it was tried to estimate the cure rate of corrective surgery after 3 and 6 months of follow up.

MATERIALS AND METHODS

In this longitudinal study, 184 children with 5–8 years who had OAD were candidated for adenotonsillectomy, the corrective surgery of upper airway obstructive disease mainly due to adenotonsillar hypertrophy with symptoms such as snoring, sleep apnea, difficulties in fall to sleep, deformed face (adenoid face), and failure to thrive, were studied. All other conditions with similar symptoms had been ruled out. All patients had no history of renal failure or structural renal diseases such as polycystic renal disease, urinary tract infection, or other voiding problems such as daily urinary incontinence, polyuria (diabetes insipidus), encopresis, or any urological issue needing surgical intervention. All patients were selected among patients attending Clinical-Educational centers of Tabriz University of Medical Sciences. Patients' demographic information was recorded and tonsillar hypertrophy grade was calculated based on Brodsky scale [24] (Table 1); grades 3 (moderate obstruction) and 4 (severe obstruction) were considered obstructive. Children with adenotonsillar hypertrophy were divided into two groups of patients with nocturnal enuresis and patients without nocturnal enuresis, and then demographic characteristics were compared and the severity of adenotonsillar hypertrophy was evaluated in relation to nocturnal enuresis.

Patients underwent a 6-month follow-up to evaluate how much the obstruction had diminished, and then their answers about the changes in enuresis pattern or possible relief were recorded.

All patients had entered the study after writing a written consent. This study was confirmed by Tabriz University of Medical Sciences Ethics Committee and is based on Helsinki’s declaration.

Statistical analyses

Results were expressed by ratio and percent; the Student’s t-test and Chi-square test were used to compare parameters. Wilcoxon test was used to evaluate enuresis, and Kruskal-Wallis test was used to evaluate the relationship between adenotonsillar hypertrophy grade and nocturnal enuresis occurrence or response to therapy. Statistical Package for the Social Sciences TM version 15 (SPSS Ltd., Chicago, IL, USA) was used for statistical analyses. P < 0.05 was considered statistically significant.

RESULTS

Of all 384 patients, 184 children (Group 1) suffering upper OAD due to adenotonsillar hypertrophy aged over 5 and 200 children (Group 2) with same age and without any obstructive airway disease such as allergy, asthma, or adenotonsillar hypertrophy were included in study who were selected from patients attending Clinical-Educational centers of Tabriz University of Medical Sciences. The prevalence of nocturnal enuresis in Group 1 was more than that of Group 2 (26% vs. 17%); however, this difference was not statistically significant (P = 0.1). Constipation was not different between two groups (20% in Group 1, 19% in Group 2). There was no statistically significant difference between two groups considering age, gender distribution, and family history (concerning nocturnal enuresis) [Table 2]. Children with adenotonsillar hypertrophy were divided into two groups of patients with nocturnal enuresis and patients without nocturnal enuresis. The severity of adenotonsillar hypertrophy was evaluated in relation to nocturnal enuresis, which there was no statistically significant relation between adenotonsillar hypertrophy severity and nocturnal enuresis prevalence (P = 0.6). The comparison of two groups with and without nocturnal enuresis based on some characteristics is shown in Table 3. There was no statistically significant difference in mean age of patients with and without nocturnal enuresis (7 ± 2 years vs. 7.5 ± 2, P = 0.1).

Six months after corrective surgery, these patients were asked about nocturnal enuresis relief for failure in response to operation which has been shown in Table 4. Of all

| Grade | Description |
|-------|-------------|
| 0     | Palatine tonsils located inside the tonsillar fossa |
| 1     | Tonsils located beyond the tonsillar fossa, occupying <25% of oropharyngeal space |
| 2     | Tonsils occupying >25 and ≤50% of the oropharyngeal space |
| 3     | Tonsils occupying >50 and <75% of the oropharyngeal space |
| 4     | Tonsils occupying >75% of the oropharyngeal space |
46 patients with nocturnal enuresis before operation, 42 patients could be followed 6 months later, of which 30 (71%) of them were free of symptoms; all patients with moderate obstruction and 60% of the patients with severe OAD (P = 0.3). The prevalence of nocturnal enuresis among children with OAD who had undergone adenotonsillectomy after 6 months of follow-up was more than control group (29% vs. 15%, P = 0.04).

**DISCUSSION**

Adenotonsillar hypertrophy is one of the main causes of upper airway obstruction which can be associated with nocturnal enuresis.25,26 The mechanism of nocturnal enuresis may be due to some neurohormonal changes such as serum levels of atrial and brain natriuretic peptide.27 In the present study, prevalence of enuresis among children with adenotonsillar hypertrophy was 26%. Prevalence of enuresis had no statistically significant relationship with adenotonsillar hypertrophy severity. In a study by Aydil et al. about obstructive upper airway problems and nocturnal enuresis relationship in pediatric patients, of all patients suffering nocturnal enuresis, 65.6% had obstructive upper airway which consisted of etiologies such as adenotonsillar hypertrophy and septal deviation; 3 months after corrective surgery, 40% of patients were free of enuresis.7 Although results of this study might be similar to the results of the present study, this study has included patients with nocturnal enuresis and investigated upper airway diseases, while in the present study patients with adenotonsillar hypertrophy was included and prevalence of nocturnal enuresis was investigated.

In another study estimating prevalence of adenoid hypertrophy and nocturnal enuresis in primary school children by Aydin et al., it was concluded that there was no statistically significant relation between adenoid hypertrophy and enuresis prevalence.8 This study is similar to the present study, but this study had just compared prevalence of adenoid hypertrophy and nocturnal enuresis instead of investigating prevalence of nocturnal enuresis in two different groups of patients with and without adenoid hypertrophy which could have been a better substitute.

In a study by Cinar et al. investigating prevalence of nocturnal enuresis among patients with adenotonsillar hypertrophy, it was concluded that 35% of patients with adenotonsillar hypertrophy had nocturnal enuresis, and 3 months after corrective surgery, 63% of prior patients were free of symptoms.19 The results of this study are similar to the present study.

In a study by Kalorin et al. about the effects of tonsillectomy on enuresis, it was concluded that not only there was no significant difference between tonsillectomy and control group (patients undergoing nonrelevant surgery such as inguinal hernia) in terms of nocturnal enuresis prevalence but also nocturnal enuresis cure prevalence was not different significantly between two groups.28 Although the first part of this study is similar and the second part is in contrast with present study, there was a significant difference between populations of two groups (257 vs. 69) which might cast shadow on results of this study.

In a study similar to the present one by Basha et al., which investigated effectiveness of adenotonsillectomy in the resolution of nocturnal enuresis secondary to obstructive sleep apnea, it was shown that of all patients who had undergone tonsillectomy or adenotonsillectomy 32.8% had positive history of nocturnal enuresis, and also 61% of patients who had undergone tonsillectomy or adenotonsillectomy with positive history of nocturnal enuresis were free of enuresis after the follow-up period.9 The results of the study are similar to the present study.

In a study by Jeyakumar et al. reviewing the association between sleep-disordered breathing and nocturnal enuresis in children, preoperative statistics showed

**Table 2: Demographic characters of control and case group**

| Character                  | Case group | Control group | P   |
|----------------------------|------------|---------------|-----|
| Age (year)                 | 7±1±2      | 7±1±2         | 0.7 |
| Gender (female/male)       | 86/114     | 84/116        | 0.8 |
| Familial history* (%)      | 22         | 24            | 0.7 |
| Nocturnal enuresis (%)     | 26         | 17            | 0.1 |
| Constipation (%)           | 20         | 19            | 1   |

*Familial history of nocturnal enuresis

**Table 3: Demographic characters of patients with adenotonsillar hypertrophic divided into two groups of patients with and without enuresis**

| Character                  | Patients with enuresis | Patients without enuresis | P     |
|----------------------------|------------------------|---------------------------|-------|
| Age (year)                 | 6±1±5                  | 7±1±2.5                   | 0.004 |
| Gender (female/male)       | 0.33                   | 0.5                       | 0.05  |
| Familial history (%)       | 39                     | 15                        | 0.03  |
| Snoring (%)                | 87                     | 90                        | 0.6   |
| Allergy (%)                | 16                     | 19                        | 1     |
| Constipation (%)           | 20                     | 17                        | 0.7   |

**Table 4: Characteristics of followed-up patients after corrective surgery (adenotonsillectomy)**

| Character                  | Responded to corrective surgery | Not responded to corrective surgery | P   |
|----------------------------|---------------------------------|-------------------------------------|-----|
| Partial or complete        | 30                              | 12                                  | 0.03|
| adenotonsillectomy         |                                 |                                     |     |
| Gender (female/male)       | 0.29                            | 0.66                                | 0.5 |
| Age (year)                 | 6±1±2                           | 6±1±2                                | 0.9 |
| Snoring (%)                | 90                              | 60                                   | 0.1 |
| Allergy (%)                | 20                              | 0                                    | 0.5 |
| Constipation (%)           | 30                              | 0                                    | 0.2 |
| Familial history (%)       | 25                              | 80                                   | 0.1 |
that 31% of patients undergoing adenotonsillectomy suffered nocturnal enuresis, but after corrective surgery, prevalence of nocturnal enuresis was 16%, which indicates a statistically significant difference and supports effectiveness of aforementioned surgery.\textsuperscript{29} Results of this study are similar to the present study.

Kovacevic \textit{et al.} in a study evaluating effectiveness of OAD corrective surgery on nocturnal enuresis showed that 24% of patients with adenotonsillar hypertrophy had nocturnal enuresis, which 49% of them responded to corrective surgery after 1-year follow-up,\textsuperscript{30} which is similar to the present study. In another part of this study, it was shown that having family history of nocturnal enuresis was associated with less probability of response to corrective surgery, which is in contrast with the current study.

Although most of the aforementioned studies supported effectiveness of corrective surgery for OAD, some recent studies have suggested administration of intranasal steroids to subside OAD symptoms such as sleep disorders.\textsuperscript{31,36} Although some preliminary studies have confirmed the association between allergy and enuresis more studies are needed to prove this association\textsuperscript{36} at present, no statistically significant relation was detected between allergy and nocturnal enuresis among patients with adenotonsillar hypertrophy.

To mention limitations of the present study, as far as this study was designed in a cross-sectional setting, it is difficult to consider this study a main study for guidelines, but present study may be useful to form an outline for further studies with higher class of evidence. One of the other limitations of the present study was using subjective questions about symptoms such as nocturnal enuresis, constipation, and allergy which might not be accurate enough.

**CONCLUSION**

Nocturnal enuresis occurrence due to upper airway obstruction or adenotonsillar hypertrophy in case group commonly occurs 1.5 times more than that in control group, and it is cured near 70% by elimination of obstruction. There are some factors that predict nocturnal enuresis in upper airway obstruction such as family history of nocturnal enuresis, male gender, and lower age while responding occurs in children with family history, and in 6 months, this response was more prominent in moderate obstruction than severe form of upper airway obstruction.

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**Conflicts of interest**

There are no conflicts of interest.

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