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Effect of adenotonsillectomy on ADHD symptoms of children with adenotonsillar hypertrophy and sleep disordered breathing

Shahrokh Amiri [a], Shahin AbdollahiFakhim [b,*], Alireza Lotfi [c], Gholamreza Bayazian [d], Mojtaba Sohrabpour [e], Taghi Hemmatjoo [e]

[a] Associate professor of Psychiatry, Department of Psychiatry, Tabriz University of Medical Sciences, Iran
[b] Associate professor of Otolaryngology, Department of Otolaryngology-Head and Neck Surgery, Tabriz University of Medical Sciences, Iran
[c] Assistant Professor of Otolaryngology, Imam Reza hospital, Department of Otolaryngology-Head and Neck Surgery, Tabriz University of Medical Sciences, Iran
[d] Assistant Professor of Otolaryngology, Hazrat Rasool hospital, Department of Otolaryngology-Head and Neck Surgery, Iran University of Medical Sciences, Iran
[e] ENT Resident, Imam Reza hospital, Department of Otolaryngology-Head and Neck Surgery, Tabriz University of Medical Sciences, Iran

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ABSTRACT

Background: Adenotonsillar hypertrophy is the most common etiologic agent for the obstruction of the upper airways in children, which might be associated with attention-deficit hyperactivity disorder (ADHD), one of the most common psychiatric disorders of childhood. Despite the concurrence of these two conditions, i.e., obstruction of the airways and ADHD, no exact etiologic relationship has been established between adenotonsillectomy (AT) and ADHD symptoms. This study was undertaken to evaluate the effect of AT on the ADHD symptoms in children with adenotonsillar hypertrophy and sleep disordered breathing (SDB).

Methods: The design of the present study consisted of pre-test and post-test, followed by post hoc tests. Fifty-three children aged 3–12 were included in this study, selected from those referring to the Pediatric Hospital of Tabriz University of Medical Sciences, with SDB, adenotonsillar hypertrophy and ADHD based on DSM-IV criteria, by availability of the subjects undergoing adenotonsillectomy after evaluation of the severity of ADHD symptoms. The scores of ADHD symptoms were evaluated before AT and at 3- and 6-month postoperative intervals based on Conner's Parent Rating Scale-Revised (CPRS-R) Questionnaire. Repeated-measures ANOVA and Fisher's exact test were used for data analysis.

Results: AT resulted in a significant decrease in the severity of ADHD symptoms (oppositional behavior, cognitive disorders, inattention, hyperactivity and ADHD index) at 3- and 6-month postoperative intervals ($P < 0.001$), with more significant decreases at 6-month postoperative interval compared to 3-month interval ($P < 0.001$).

Conclusions: Based on the results of this pilot study, AT in children with SDB associated with ADHD resulted in a significant decrease in the severity of ADHD symptoms.

1. Introduction

Attention deficit hyperactivity disorder (ADHD) is one of the most common psychiatric conditions in children and adolescents, with symptoms and signs of hyperactivity, inattention and impulsivity based on diagnostic criteria. Children with ADHD have many problems at home, school and social environments [1]. In a review study, the prevalence of ADHD in children and adolescents was reported to be 6.8% [2]. The prevalence of ADHD in elementary schools of Tabriz, a city in the north-west of Iran, was reported to be 9.7% [3].

Considering the high prevalence of ADHD and a wide range of etiologic factors involved in it, different treatment modalities are applied for its treatment. It has been reported that children with ADHD experience more sleep disorders [4–6]. In this context, most children/parents of ADHD children have reported disturbed fragmentary sleep at night; complaints were motor restlessness

* Correspondence to: Department of Otolaryngology, Koodakan Hospital, Sheshgelan, Abbasi, Tabriz, Iran. Tel.: +98 411 5262250; fax: +98 411 5262250.
E-mail addresses: AmiriS@tbzmed.ac.ir (S. Amiri), abdollahifakhim85@hotmail.com (S. AbdollahiFakhim), alotfi@yahoo.com (A. Lotfi), gr_bayazian@yahoo.com (G. Bayazian), mojtabasohrabpour@yahoo.com (M. Sohrabpour), hemmatjoot@yahoo.com (T. Hemmatjoo).

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(50%), confusional arousals (28.5%), snoring (21.4%), and leg discomfort at night associated with restless legs syndrome (RLS) (11.9%) [7]. It has been reported that even primary snoring is associated with an increase in the odds of mental-behavioral deficiency in children; on the other hand, children with sleep disorders, especially those with adenotonsillar hypertrophy, are susceptible to psychiatric disorders and ADHD [4,8]. Since adenotonsillar hypertrophy is the most important reason for the obstruction of the upper airways and obstructive apnea in children [9,10], it is important to further evaluate obstruction of upper airways in children with ADHD. In this context, previous studies have shown that there might be a relationship between adenotonsillar hypertrophy and the obstruction of airways and symptoms of ADHD.

It has been reported that adenotonsillar hypertrophy has significant psychological effects on 6–9-year-old children by obstructing the airways. In this context, children with adenotonsillar hypertrophy, who have airway obstruction, suffer from more emotional instability compared to healthy children. However, no differences have been reported in depression and anxiety scores between these two groups [4]. In addition, it has been reported that sleep disorders, psychiatric disorders and ADHD are common problems in children with adenotonsillar hypertrophy [11]. Therefore, it appears AT might help decrease the severity of ADHD symptoms by solving the problem of airway obstruction [12].

A study in the USA showed the effects of AT on weight gain and a decrease in hyperactivity [13]. Two other studies in Brazil and Taiwan showed a decrease in the severity of ADHD after AT [14,15]. However, it was claimed in a retrospective cohort study in Canada that AT improves sleep, respiration and quality of life but it does not result in changes in behavior [16].

Recent studies on the effect of AT on psychiatric problems and ADHD symptoms have shown that six months after AT the severity of ADHD and sleep disorders decreases, with a significant decrease in all the symptoms of ADHD. However, no changes have been reported in oppositional defiant disorder and behavioral problems [11]. In addition, it has been reported that AT decreases the symptoms and signs of inattention, hyperactivity and impulsivity [17].

Considering the need for a scientific evaluation of the relationship between AT and the severity of the symptoms of ADHD and the paucity of studies on the subject, with little consistency between their results, it is necessary to carry out further studies in an attempt to achieve more scientific evidence in this respect. Therefore, the present study was undertaken to determine the effect of adenotonsillectomy on the severity of symptoms and signs and behavior of children with ADHD, adenotonsillar hypertrophy and sleep disordered breathing.

2. Methods

In this longitudinal study, 65 children referring to Pediatric Hospital, Tabriz University of Medical Sciences, Tabriz, Iran, were evaluated during a 9-month period in 2013. The subjects were candidates for AT and had sleep disordered breathing (SDB) along with ADHD.

2.1. Inclusion and exclusion criteria

Inclusion criteria consisted of informed written consent of the parents to participate in the study, adenotonsillar hypertrophy along with SDB, being a candidate for AT, an initial diagnosis of ADHD in children, and no history of medical and psychological treatment modalities for ADHD.

Exclusion criteria consisted of simultaneous use of surgery for the treatment of SDB, any attempt to treat ADHD during the study period in the form of medications and use of psychological techniques, affliction with psychiatric conditions other than ADHD and severe somatic diseases (such as severe cardiac, respiratory, neurologic and neuromuscular conditions), use of medications affecting sleep, respiration or behavior, use of psychiatric medications and no alleviation of SDB after surgery.

2.2. Procedures steps

All the 3–12-year-old children who were candidates for AT were examined and precise history was taken in relation to the presence of SDB for screening purposes. In the presence of severe continuous nocturnal snoring, open mouth breathing, restlessness during sleep and hypertrophied palatal tonsils (Grades III and IV) at examination, initial evaluations were carried out in relation to the presence of ADHD symptoms using CPRS-R criteria and if high CPRS-R scores were achieved, a pediatric psychiatrist carried out an interview for a definitive diagnosis in relation to affliction with ADHD based on DSM-IV-TR criteria. The subjects were included in the study after a definitive diagnosis of ADHD and after obtaining informed written consent from the parents.

After general anesthesia, the hypertrophy of the adenoid and the obstruction of the posterior choanae of the children were confirmed by direct examination by using a flexible fiberoptic nasal endoscope. As it will be discussed later, in children presenting with upper airway obstruction and suspected adenoid hypertrophy, flexible nasal endoscopy is the best initial choice for evaluation of the adenoid size [18]. After confirmation of adenoid hypertrophy, AT was carried out. After the surgical procedure, all the subjects were examined at 3- and 6-month postoperative intervals in relation to the severity of ADHD symptoms using the CPRS-R criteria through interview with parents. The subjects were excluded from the study if evaluation of the results of AT 1-, 3- and 6-month postoperative intervals showed that the symptoms and signs of respiratory obstruction and SDB had not been resolved. Therefore, 12 children were excluded from the study because the symptoms of respiratory obstruction and SDB had not been resolved.

2.3. Research tools

2.3.1. K-SADS-PL semi-structured diagnostic interview

This diagnostic semi-structured interview designed according to DSM-III-R and DSM-IV was filled through an interview with parents and children by a psychiatrist. K-SADS-PL is capable of diagnosing mood, anxiety, behavioral, and other psychiatric disorders.

K-SADS scoring was as follows: score of zero, absence of adequate data; a score of 1, presence of symptoms and signs; a score of 2, presence of sub-threshold symptoms and signs; a score of 3, presence of threshold criteria.

The reliability of the Persian version of K-SADS diagnostic interview was reported to be 0.81, using test/retest method, with 0.69 inter-rater reliability [19]. We used this tool for the diagnosis of ADHD and other psychiatric co-morbidities in children.

2.3.2. Conner's Parent Rating Scale-Revised (CPRS-R) Questionnaire

Conner's Parent Rating Scale-Revised Questionnaire (CPRS-R) is a widely used and validated measure of child behavior for children 3 to 17 years of age. Twenty-seven questions were used to evaluate behavior at three time intervals: (1) before adenotonsillectomy"; (2) three months after surgery; and (3) six months after surgery. The 27 questions were reported by parents/guardians using a 4-point scale (0 = not true at all; 1 = partially true; 2 = pretty much true; and 3 = absolutely true). The questionnaire has four indexes: (1) Index A (oppositional behavior); (2) Index B (cognitive