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The correlation between tonsil size and academic performance is not a direct one, but the results of various factors

Multifattorialità della correlazione tra ipertrofia tonsillare e performance scolastica

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SUMMARY

Chronic upper airway obstruction most often occurs when both tonsils and adenoid are enlarged but may occur when either is enlarged. Obstructive sleep syndrome in young children has been reported to be associated with an adverse effect on learning and academic performance. The aim of this study was to evaluate the effect of relative size of the tonsil on academic performance in 4th grade school children. In 320 children, physical examination to determine the size of tonsils was performed by the otorhinolaryngologist. A questionnaire was developed to assess sleep patterns and problems, and socio-demographic data for the student participants. Furthermore, their school performance was assessed using their grade in mathematics, science, reading, spelling, and handwriting. No association between tonsil size and academic performance was found. Snoring frequency, body mass index and body weight showed a positive relation with tonsil size. There was no association between tonsil size and sleepiness during the day, sleeping habits, hyperactivity, enuresis, history of tonsillectomy in children and parental cigarette smoking and education. In conclusion, this study did not show any significant relationship between tonsil size and academic performance in 4th grade students. Further studies are recommended with a larger sample size, cognitive exams for evaluation of attention, and follow-up of the students until high school, when the discrepancy of the students' academic performance is more obvious.

KEY WORDS: Tonsil • Hypertrophy • Academic performance • Sleep

RIASSUNTO

L'ostruzione cronica delle vie aeree superiori è spesso associata all'ipertrofia adenotonsillare, ma può verificarsi anche in assenza di essa. La sindrome da apnea ostruttiva del sonno nel bambino è associata ad un effetto negativo sulla performance scolastica. Lo scopo di questo studio è stato quello di valutare gli effetti delle dimensioni delle tonsille sulla performance scolastica di bambini al quarto anno della scuola primaria. Su 320 bambini è stato eseguito un esame obiettivo otorinolaringoiatrico per determinare le dimensioni delle tonsille. Inoltre, è stato messo a punto un questionario per valutare i dati socio-demografici e le caratteristiche del sonno dei soggetti inclusi nello studio. Infine, la performance scolastica è stata misurata sulla base dei voti ottenuti dai partecipanti nelle seguenti materie: matematica, scienze, lettura, spelling, scrittura. Non è stata riscontrata un'associazione statisticamente significativa tra le dimensioni delle tonsille e la performance scolastica, mentre è stata osservata una relazione positiva tra la frequenza del russamento, il body mass index ed il peso e le dimensioni delle tonsille. Non è stata riscontrata una relazione diretta tra le dimensioni delle tonsille e la sonnolenza diurna, il sonno abituale, l'iperattività, l'enuresi, l'anamnesi di tonsillectomia, l'esposizione a fumo passivo e il livello scolastico. In conclusione, questo studio non ha evidenziato nessuna relazione statisticamente significativa tra le dimensioni delle tonsille e la performance scolastica al quarto anno della scuola primaria. Sarebbe utile effettuare ulteriori studi su campioni più numerosi, valutando la capacità di attenzione, e con un follow-up prolungato fino alle scuole superiori, dove è più probabile che si evidenzino discrepanze nella performance scolastica degli studenti.

PAROLE CHIAVE: *Tonsille • Ipertrofia • Performance scolastica • Sleep apnea*

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Introduction

Frequent snoring is a common condition in pre-pubertal children, affecting approximately 4.9-12% of all children of this age [1-4]. Sleep disorders in children ranges from primary snoring (i.e., snoring without repeated arousal and gas exchange abnormalities) through upper airway resistance syndrome (i.e., snoring with laboured breathing and repeated arousal but without gas exchange abnormalities) to obstructive sleep apnoea syndrome (OSAS) (snoring with intermittent hypoxia, hypercapnia, and repeated arousal) [5].

Schooling problems have been repeatedly reported in case-series of children with OSAS, and, in fact, may underlie more extensive behavioural disturbances, such as restlessness, aggressive behaviour, excessive daytime sleepiness, and poor neurocognitive test performances [6].

Since adenotonsilar hypertrophy is the most common cause of OSAS in children [7], it can be a predictor of OSAS and its related conditions. In this study, the relationship was evaluated between tonsil size as a predictor of OSAS and the academic performance in primary school children.

Material and Methods

A cross-sectional study was carried out on a sample of 4th grade primary school children of both sexes in Shahrekord, Iran. A total of 320 children were randomly selected using the official directory of public and private schools of the town.

A questionnaire was developed to assess sleep patterns and sleep problems for the participants. The questionnaire included questions on sleep duration and latency, and sleep-related problems, such as snoring, witnessed sleep apnoea, and daytime sleepiness. Collected sociodemographic data included age, sex, height, weight, family education, smoking status, and school performance.

The study protocol was approved by the Ethics Committee at Shahrekord University of Medical Sciences and informed consent was obtained from parents of children before enrollment in the study.

After a full explanation of the purpose of the study by investigators, questionnaires were filled out during the interview with the parents. Snoring was investigated with the following question: Does your child snore? Responses were rated on a four-point rating-scale ranging from "never" and "occasionally" to "frequently" and "always". Parental education was investigated separately for each parent. The highest graduation (four-point scale: no graduation/primary school, secondary school, high school, college/university) was scored. The children were examined as far as concerns tonsil size by an otorhinolaryngologist. Tonsil size was classified as follows: grade 0: no obstruction in airway; grade 1: < 25% obstruction in airway; grade 2: 25-50% obstruction in airway; grade 3: 50-75% obstruction in airway; grade 4: > 75% obstruction in airway. Furthermore, their school performance was assessed using their grade in mathematics, science, reading, spelling, and handwriting. With regard to their sleepiness in the classroom, their teacher was requested to give information in this respect.

All analyses were performed with statistical software (Statistical Package for the Social Science, release 11.0 for Windows; SPSS; Chicago, IL, USA). Descriptive statistics were used to summarize subject characteristics and questionnaire results. Comparisons between distributions were made using Kruskal-Wallis, Spearman's χ^2 test and χ^2test for trend where appropriate. A p value < 0.05 was considered statistically significant.

Results

The mean age of participants was 10.45 ± 0.49 years; mean BMI was 16.75 ± 2.66 kg/m^2; mean sleep duration was 8.9 ± 0.95 hours/day. Of the children interviewed, 66.6% had never snored, 30.9% occasionally snored, while 1.9% and 6% children were reported to snore frequently or always, respectively. There was no significant association of snoring with sex or age. Analysis of school grades revealed no significant association of academic performance with snoring frequency ($p > 0.05$). Moreover, no significant association was found between the students' grades and their sociodemographic data or that of their family ($p < 0.05$). Daytime sleepiness was reported in 15 (4.7%) and 33 (10.3%) of the students as always and occationally, respectively. Tonsil size was grade 0, 1, 2, 3, and 4, in 1.9%, 53.4%, 29.7%, 8.8%, and 1.6% of the children respectively. The mean ± standard deviation (SD) for mathematics, science, reading, spelling, and handwriting was 17.98 ± 2.48, 18.68 ± 2.1, 19.5 ± 1.13, 19.29 ± 1.42, and 19.23 ± 1.42, respectively.

No significant association was found, in this study, between the size of tonsils and sleep duration, enuresis, day sleepiness, and the grade of mathematics, science, reading, spelling, and handwriting; however, there was a significant association between body mass index (BMI) and tonsil size ($r = 0.176$, $p = 0.002$). Furthermore, significantly more snoring during sleep and more sleepiness in the classroom ($p < 0.05$) occurred in those children with larger tonsils.

Discussion

In this study, a sample of 320 fourth-grade children was examined using a questionnaire that contained items regarding individual sociodemographic characteristics, school performance, and sleep patterns and sleep-related problems. Previous studies from a variety of countries found that the prevalence of habitual snoring ranged from 3.2 to 12.1% in children [1 9-13] and from 5 to 40% in adults [14-21], depending on the definition of habitual snoring, population characteristics such as age and sex, and study setting.

Moreover, we examined the size of tonsils in the pupils and its relationship with their academic performance and sleep-related problems. No significant association emerged between the tonsil size and the school performance. However, there was a significant relationship between tonsil size and habitual snoring. These data are in contrast with those of other studies which have shown that snoring is associated with poor academic performance in

children [22-26]. This difference might be due to the following aspects:

a. We examined tonsil size whereas other studies evaluated the habitual snoring or gas exchange for the comparison with the academic performance.
b. In this study, only 28 (8.8%) and 5 (1.6%) of the students had 3rd and 4th grade size of tonsils, which can induce OSAS. Therefore, this small sample size could account for not having found a significant association between tonsil size and school performance.
c. The children, in this study, came from a moderately fair to good socioeconomic group with good healthcare and a significant number had had their tonsils removed due to tonsil problems and were entered into the study in 0 grouping.
d. In this study, we had only 5 pupils with tonsil hypertrophy. On the other hand, as mentioned in the report by Gozal [22], the blood hypoxia is related to poor academic/scholastic performance, which is found in grade 4 of tonsil hypertrophy. Thus, the the small sample size might also account for this discrepancy.
e. The mean grades of all courses, in this survey, were high and SD was low, which might negatively affect our results. (Choosing the grade of children for evaluation was a major problem for such a study, because in lower grades, all the scores were high and, in upper grades, the tonsils would be shrunken).
f. Urschitz et al. [24] reported that therapeutic intervention in children with OSAS improves the attention deficit and hyperactivity, although the learning status and school performance had not improved after treatment. According to this report, in our opinion, if we were to evaluate the relationship between tonsil size and learning status of the pupils, instead of their scholastic grades we might find a significant association.
g. Finally, this descrepancy could be completely incidental.

The strong association between BMI and snoring, in our results, is interesting because it has not been taken into consideration in the previous studies; however, it has been shown in studies on adults [15 18 27 28]. Bloom et al. [28] suggested that this may be related to a reduction in pharyngeal airway diameter produced by deposits of adipose tissue in obese individuals. Pharyngeal resistance correlates with increasing weight/height ratio or obesity.

In the recent study by Eliasson et al. [29] no correlation was found between total sleep time and academic performance in middle school and high school students. Our results also showed that tonsil size does not affect the duration of sleep and daytime sleepiness, which indicates that the sleep pattern in children is affected mainly by family behaviour and it can be improved by family habits.

Our results showed that there is a significant association between tonsil size and frequency of snoring. Previous studies [30 31] have also shown that adenotonsilectomy improves snoring. Thus, tonsil examinations might be a good indicator for evaluation of snoring frequency in children.

Several limitations of the present study must be borne in mind. Our results may have been subject to biases related to surveys. Data on snoring were evaluated via parental questioning and not based on objective measures. Parental perception of night-time symptoms such as snoring depends on the presence of a family member in the bedroom of the child during the night and could be affected by personal, social, and cultural differences. Thus, snoring may tend to remain unrecognized by parents and, therefore, underestimated in surveys.

In conclusion, we did not find any significant relationship between tonsil size and academic performance in 4th grade students in Shahrekord. Our results indicate that the correlation between tonsil size and academic performance is not a direct one, but the results of various factors. We recommend further studies on larger study populations, with cognitive examinations for the evaluation of attention, and follow-up of the students until high school, when the discrepancy of the academic performance can be better defined.

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