



Original Article

Sleep disordered breathing in children with cerebral palsy

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ARTICLE INFO

Article history:

Received 11 November 2015

Received in revised form

27 January 2016

Accepted 28 January 2016

Available online 6 June 2016

Keywords:

Cerebral palsy

Sleep

Sleep disordered breathing

The Pediatric Sleep Questionnaire

Rehabilitation

ABSTRACT

Objectives: The purpose of this study was to investigate the frequency of Sleep Disordered Breathing (SDB) in children with Cerebral Palsy (CP), and determine whether a relationship between SDB and age, gender, weight status, type of CP, motor function level, and spasticity can be established.

Methods: The study included 94 children with CP and 94 healthy children with normal development, between the ages two and 18. SDB was assessed using the Sleep-Related Breathing Disorder (SRBD) scale of the Pediatric Sleep Questionnaire (PSQ).

Results: No statistically significant difference was found with respect to age and gender between the study and the control groups. It was found that 9.6% of the patients with CP had snoring, 12.8% had sleepiness, 37.2% had attention deficiency-hyperactivity, and 18.1% had SRBD. SRBD was statistically significantly higher in patients with CP compared with the control group. No significant relationship was detected between SRBD and age, gender, weight status, type of CP, motor function level, spasticity, and epilepsy.

Conclusions: Our result confirm that SDB is more common in children with CP than typically developing children. Thus, SDB problems should be identified in routine clinical practice in patients with CP, by using the SRBD scale of the PSQ.

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1. Introduction

In typically developing children the frequency of sleep disorders may reach 50% [1]. Sleep disordered breathing (SDB) is a group of respiratory disorders that are observed, or become more severe, during sleep. This group includes central apnea, hypoventilation, and obstructive sleep apnea. SDB is an issue that disrupts normal ventilation and sleep architecture, leads to important cardiovascular and neurocognitive problems and to retardation in development, affecting the quality of life in individuals with neuromuscular diseases, and may, albeit rarely, cause death [2,3]. The frequency of SDB, one of the most frequently observed sleep disorders in childhood, varies between four percent and 11%. It has been reported that while the prevalence of habitual snoring is between five percent and 12%, apneic events during sleep is between 0.2% and four percent, and obstructive sleep apnea is between one percent and four percent [4].

Cerebral palsy (CP), the prevalence of which is about two in 1000 live births [5], is a movement and posture disorder caused by a non-progressive damage in the developing brain. Motor disorders are generally accompanied by sensory, perception, communication, behavior and cognitive disorders, and epilepsy [6]. In children with CP there are very few studies investigating the frequency of SDB and the factors related to it. In the study by Newman et al., SDB was detected in 14.5% of the children with CP [7].

In children with CP, a wide variety of structural and functional factors such as maxillary hypoplasia, enlarged inferior turbinates, adenotonsillar hypertrophy, hypotonia of palate, and constrictor muscles, glossoptosis, retrognathia, laryngomalacia, gastro-oesophageal reflux leading to upper airway inflammation and laryngeal dystonia can result in airway obstruction [8]. In addition, children with CP also have a predisposition to sleep disorder and SDB for reasons such as abnormal neuromuscular control of their upper airway [9], asynchronism of the abdominal and thoracic diaphragm movements [10], upper respiratory tract obstruction, serious visual disorders, brainstem dysfunction, anticonvulsant use, lung aspiration, joint contracture and scoliosis, and postural disorders due to spasticity [11].

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In all children with CP, SDB can lead to significant medical problems that influence their quality of life, and therefore must be very carefully assessed. Polysomnography, which is the gold standard method used in the diagnosis of the obstructive sleep apnea, is an expensive evaluation method that is not available or accessible at every center. The Pediatric Sleep Questionnaire (PSQ), one of the scales prepared for screening, may be used to investigate the presence of obstructive sleep apnea [3].

The purpose of this study was to investigate the frequency of SDB in children with CP, using the sleep-related breathing disorder (SRBD) scale of the PSQ [12], and to determine whether a relationship between SDB and age, gender, weight status, type of CP, motor function level, and spasticity can be established.

2. Methods

The study included 94 children with CP who were hospitalized for rehabilitation and 94 typically developing children between two and 18 years of age. Children whose anticonvulsant, sedative, or stimulant medications had been changed within the previous month, which might affect sleep, and who had additional diseases such as traumatic brain injury, stroke, or a psychiatric disease were excluded from the study.

The ages, genders, height, and weight of both the healthy children and the children with CP, and the accompanying problems, the presence of epilepsy, spasticity, and motor function levels of the children with CP, were recorded. The children in the study group were divided into five groups according to the type of CP: spastic diplegic, hemiplegic, triplegic, tetraplegic, and dyskinetic.

The body mass index (BMI) was calculated as weight (kg)/height² (m²). The children with CP and the children in the control group were divided into four weight status categories using their ages and BMI values according the percentile table, which reflects the values of the Turkish children [13]: thin (less than the 5th percentile), normal (5th percentile to less than the 85th percentile), overweight (85th to less than the 95th percentile), and obese (equal to or greater than the 95th percentile).

The spasticity level was assessed using the Modified Ashworth Scale in both the lower and upper extremities [14]. The level of motor function was assessed using the Gross Motor Function Classification System (GMFCS) [15].

SDB was assessed using the SRBD scale of the PSQ [12], of which validity and reliability studies have been made in Turkish [16,17]. The SRBD scale consists of 22 items. The answers are “Yes” = 1, “No” = 0, or “I don’t know”. The average of the answers other than “I don’t know,” shows the average score, which varies from zero to

one. An average score of more than 0.33 indicates the presence of SDB. The scales of the SRBD scale include a four-item sleepiness, a four-item snoring, and a six-item attention deficiency/hyperactivity subscale [18]. The study protocol was approved by the ethics committee of the institutions and informed consent was obtained from parents.

3. Statistical analysis

Statistical analyses were performed by using SPSS version 11.5 software. The descriptive statistics were specified in terms of the number of cases and percentages. The chi-square test was used to evaluate whether there was a difference in the demographical data and the SRBD frequencies of the study and control groups. In the experimental group, the chi-square and Fisher's exact tests were used to compare the clinical and demographical characteristics, and their relationship with SRBD was investigated. The Mann–Whitney *U*-test was used to determine whether a statistically significant difference was present for continuous or orderable variables that were not normally distributed. After the relationship was investigated, the results were evaluated using univariate analysis, and a multivariate logistic regression analysis was conducted.

4. Results

The characteristics of the study and the control groups are given in Table 1. No statistically significant difference was found with respect to age and gender between the study and the control groups (*p*-values: 0.662 and 0.465, respectively). However, a significant difference was detected between the two groups with respect to BMI and weight status category. The average BMI was 15.9 in CP patients and 18.7 in the control group (*p* = 0.000) (Table 1). The clinical characteristics of the study group are given in Table 2.

While there was no statistically significant difference between the study and the control groups with respect to the frequency of snoring, sleepiness, and attention deficiency-hyperactivity (*p*-values: 0.419, 0.487, and 0.084, respectively), a statistically significant difference was detected between the two groups with respect to SRBD (*p* = 0.029). The frequency of SRBD was 18.1% in the study group and 7.4% in the control group (Table 3).

The children in the study group were divided into two subgroups with their ages ranging between two to seven years and 8–17 years, and no significant difference was observed with respect to the frequency of SRBD between the two groups (*p* = 0.864). While in the study group, the frequency of SRBD was higher in

Table 1
Characteristics of the study and control groups.

Characteristics	Study group (N = 94)	Control group (N = 94)	<i>p</i>
	N (%)	N (%)	
Age			<i>p</i> * = 0.662
2–7 years	48 (51.1%)	45 (47.9%)	
8–18 years	46 (48.9%)	49 (52.1%)	
Gender			<i>p</i> * = 0.465
Female	42 (44.7%)	47 (50%)	
Male	52 (55.3%)	47 (50%)	
Weight status category			<i>p</i> * = 0.000
Thin (less than the 5th percentile)	32 (34%)	5 (5.3%)	
Normal (5th percentile to less than the 85th percentile)	46 (48.9%)	58 (61.7%)	
Overweight (85th to less than the 95th percentile)	9 (9.6%)	16 (17%)	
Obese (equal to or greater than the 95th percentile)	7 (7.4%)	15 (16%)	
BMI (kg/m ²)	Mean ± SD, median (min–max)	18.7 ± 3.9, 17.7 (11.5–36)	<i>p</i> ** = 0.000
	15.9 ± 3.8, 15.3 (7.9–28)		

Abbreviation: BMI, body mass index.

* Chi-square test;

** Mann–Whitney *U*-test.

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