International Journal of Pediatric Otorhinolaryngology 78 (2014) 1026–1029

Contents lists available at ScienceDirect

International Journal of Pediatric Otorhinolaryngology

journal homepage: www.elsevier.com/locate/ijporl

Obstructive sleep apnea in younger school children with Down syndrome

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ARTICLE INFO

Article history:
Received 12 November 2013
Received in revised form 27 March 2014
Accepted 29 March 2014
Available online 8 April 2014

Keywords:
OSA
Pediatric
Down syndrome

ABSTRACT

Objective: We aimed to assess the prevalence of obstructive sleep apnea (OSA) in 8 year old school children with Down syndrome (DS). While the prevalence in otherwise healthy children is below 5%, the prevalence estimates in children with DS are uncertain (30–80%). OSA directly affects cognitive development and school performance.
Study design: Population based cross sectional study in a limited geographical area.
Methods: Polysomnography (PSG) with video and audio recordings was performed in 8-year-old children with DS in a pediatric sleep unit according to the guidelines of American Academy of Sleep Medicine. Twenty-nine of all 32 children with DS within a restricted area comprising >50% of the Norwegian population and 54% of the children with DS born in Norway in 2002 were enrolled.
Results: This study reports an apnea hypopnea index AHI > 1.5 in 28 of 29 children and an obstructive apnea index (OAI) > 1 in 24 of 29 children. 19 children (66%) had an AHI > 5 and 17 children (59%) had an OAI > 5 which indicated moderate to severe OSA. No correlation was found between OSA and obesity or gender.
Conclusion: The high prevalence of disease found in these previously undiagnosed 8-year-old children underlines the importance of performing OSA diagnostics in children with DS throughout childhood. These findings suggest that the prevalence of OSA remains high up to early school years. In contrast to earlier publications, this current study has the advantage of being population based, the study is performed on children of a narrow age band to estimate prevalence of disease and the diagnostic gold standard of PSG is applied.

1. Introduction

Obstructive sleep apnea (OSA) is characterized by complete or partly obstruction of the upper airways, which causes a fragmentation of sleep and gas exchange abnormalities. OSA in children is associated with concentration deficit, reduced ability to learn and has been reported to correlate with lower cognitive function, developmental delay and school failure [1]. Treatment of OSA has shown a positive effect on sleep quality, neurocognitive behavior symptoms and quality of life in children [2–4].

Recently revised clinical practical guidelines emphasize that children with craniofacial syndromes are at high risk for OSA [5–7]. In addition to the altered craniofacial anatomy, muscle hypotonia and adenotonsillar hypertrophy may contribute to a higher prevalence of OSA in children with DS [7–9]. The prevalence of OSA in children with DS exceeds that of otherwise healthy children

Abbreviations: AHI, apnea hypopnea index; BMI, body mass index; CAI, central apnea index; OAI, obstructive apnea index; ODI, oxygen desaturation index; OSA, obstructive sleep apnea; PSG, polysomnography.

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http://dx.doi.org/10.1016/j.ijporl.2014.03.030
0165-5876/

6 to15 times according to former studies [6,8,10–16]. However, the rate of OSA in school children has not been reported.

The objective of this study was to assess the medical follow up and prevalence of OSA in a population-based sample of younger school children with DS. We also wanted to study the association between OSA and gender, body mass index and performed airway surgery during childhood. Overnight polysomnography (PSG) with video and audio recordings was applied as diagnostic tool.

2. Methods

2.1. Population

A population based cross sectional study was conducted in Norwegian children with DS born in 2002. The children were recruited in 2010 and health examinations were carried out from November 2010 to November 2011. The Regional Committee for Medical Research Ethics (2010/1950), and the Norwegian Data Inspectorate gave approval to the study. The children were identified through the Departments of Medical Genetics at the Universities of Oslo, Bergen and Tromsø, who have complete national data in genetic registries. Eligibility criteria included a diagnosis of DS based on karyotypic information and physical examination. Further criteria were home address within the Health Authority Region South-East, which includes 57% (32 of 56 children) of all children born with DS in 2002. A total of 29 out of 32 children underwent PSG, a response rate of 90%. To avoid communication difficulties, only children with at least one parent with Norwegian as mother tongue were included. All pediatric rehabilitation center were consulted for possible left outs. To minimize scorer variability, the same experienced sleep specialist analyzed all sleep recordings. Anamnestic data on somatic disease and medical follow up was collected through a parental questionnaire responded by 53 out of 57 parents of children with DS born in Norway in 2002. None of the children were on steroid treatment. Furthermore, none of the children had an acute bacterial infection or were on antibiotic treatment 2 weeks prior to the sleep test.

2.2. Outcome

Clinical ear, nose and throat examination was conducted in all children. Height and weight was registered and body mass index (BMI) calculated. Children were categorized into normal weight and overweight (BMI; female BMI < 18.69, male BMI < 18.76) [17]. All patients underwent in patient attended overnight PSG (Embla, Resmed, Norway) with simultaneous video and audio recording. The PSG recordings included a six-channel electroencephalogram (C3/M2, C4/M1, O2/M1, O4/M2, F3/M2, F4/M1), right and left electrooculogram, and submental electromyography. Ribcage and abdominal wall movements were measured using respiratory inductance plethysmography. Flow was measured with nasal pressure transducer and the arterial oxygen saturation was monitored via pulse oximetry. Electrocardiography, body position and electromyography from both legs were also included. Video and audio recordings give supportive information of symptoms of upper airway obstruction other than apneas and hypopneas, like neck extension, gasp for air, mouth breathing and snoring. Sleep was scored according to the guidelines from American Academy of Sleep Medicine [18].

An obstructive apnea was defined as at least two breaths with more than 90% reduction in flow in the presence of ribcage and abdominal movement. A central apnea was defined as at least two breaths with more than 90% reduction without respiratory effort (with subsequent oxygen desaturation of at least 3% or an arousal, or if the event lasts for more than 20 s). Hypopneas were defined as 50% decrease in flow for at least two breaths with subsequent oxygen desaturation of at least 3% or an arousal. The hypopneas were not classified further. Apnea hypopnea index (AHI) was defined as the number of apneas and hypopneas per hour of sleep,

Table 1
PSG characteristics in 29 children with Down syndrome.

Gender	AHI	ODI	CAI	OAI	BMI	Tons	Ad	Mean SaO_2	Minimum SaO_2
Male	11.5	26.1	0.4	0.8	22.6			95	82
Female	1.1	3.7	0.0	1.1	25.4			95	80
Female	12.8	18.8	5.9	6.9	18.3			96	87
Male	9.7	16.4	.9	8.8	20.5			94	83
Female	30.5	53.9	6.6	23.9	16.8			96	87
Female	4.0	3.3	2.7	1.3	16.5	x		97	92
Female	16.1	12.4	7.2	8.9	19.5			96	85
Female	15.6	21.8	.6	15	18.4	x	x	96	88
Female	1.9	2.4	.9	1.0	16.5		x	95	90
Female	8.6	10.8	2.0	6.6	16.9		x	96	88
Male	7.8	11.8	.7	7.1	22.6			96	84
Male	3.4	3.5	.1	3.3	17.7			97	91
Male	17.7	9.9	10.9	6.8	19.2		x	96	91
Male	6.3	5.2	1.6	4.7	17.0			97	92
Female	24.2	24.8	4.2	20.0	19.1			95	85
Male	1.6	3.3	1.2	.4	15.4			98	92
Female	6.0	18.5	3.2	2.8	15.8			94	91
Male	2.9	5.3	2.0	.9	19.0			97	92
Male	1.7	3.0	1.4	.3	17.5		x	96	91
Female	1.7	4.0	.5	1.2	14.9	x		96	93
Female	11.2	13.8	.3	10.9	16.3	x		95	85
Male	9.8	17.1	4.8	5.0	17.8		x	95	88
Female	16.0	17.1	.8	15.2	20.4			97	83
Female	37.0	38.2	.5	36.5	16.1			94	85
Male	13.0	13.4	.8	12.2	17.6			96	84
Female	2.3	6.3	1.0	1.3	17.5			95	89
Male	3.1	3.5	1.1	2.0	*			97	93
Male	10.5	15.9	1.2	9.3	16.2			93	84
Male	9.1	16.0	3.3	5.8	*		x	94	87

AHI = apnea hypopnea index, ODI = oxygen desaturation index, CAI = central apnea index, OAI = obstructive apnea index, BMI = body mass index, Tons = tonsillectomy, Ad = adenoidectomy, SaO_2 = oxygen saturation, * = missing.