Sleep disordered breathing in children with Down syndrome

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Introduction

- Sleep disordered breathing (SDB) occurs when the upper airway is obstructed during sleep or when respirations are insufficient to maintain gas exchange.
- Children with Down syndrome have as part of their clinical syndrome, hypotonia[4,5], macroglossia[5], smaller upper airway[4-6], mid-face hypoplasia[4,5], micrognathia[5] and predisposition to obesity[6], all of which are risk factors for SDB.
- Children with Down syndrome are known to have a high prevalence of SDB (45-79%)[1], but the nature of the breathing disorder – upper airway obstruction or hypoventilation – has not been well characterized.
- The natural history of SDB has not been well-described.

Research Question

- To describe the age, type and severity of sleep-disordered breathing in girls with Down Syndrome referred to a tertiary care polysomnography (PSG) laboratory.

Methodology

Population

- Females 0-14 years with Down Syndrome who had PSG-diagnosed sleep disordered breathing at the Children's Hospital of Eastern Ontario from January 1, 2004 to March 30, 2011.

Design

- Ethics approval was obtained from the Children's Hospital of Eastern Ontario Research Ethics Board.
- Retrospective chart review of PSG data
- Demographic variables: age
- PSG variables: Apnea-hypopnea Index, arousal Index, lowest oxygen saturation.
- PSG studies were scored according to American Academy of Sleep Medicine standards in effect at the time of the study.
- Children were considered to have SDB if their total apnea-hypopnea index was greater than 1 event/hour and the physician interpretation concluded that SDB was present.

Statistical Analysis

- Demographic and PSG characteristics were summarized using descriptive statistics.
- The association between age and diagnosis of SDB was tested using a Mann Whitney test for significance

Results

Table 1. Demographics (N=29)

	Age at diagnosis (years)
Mean	**8.1359**
Median	**7.4771**
Std. Deviation	**3.68117**
Range	**11.57**
Minimum	**2.75**
Maximum	**14.32**
Type of Sleep Apnea	**Percent**
Obstructive	**26.1**
Central	**26.1**
Mixed	**47.8**

Table 2. Polysomnography Findings (N=29)

Median (Interquartile range)	Total Apnea-hypopnea index (N=23)	Lowest O_2 saturation (N=20)	Arousal index (N=22)
Whole group	**12.0 (2.1 – 21.8)**	**88 (79 – 89)**	**11.0 (6.8 – 15.1)**
Obstructive sleep apnea	**17.5 (5.5 – 32.6)**	**82 (74 – 89)**	**12.4 (4.6 – 33.9)**
Central sleep apnea	**2.0 (0.9 – 2.6)**	**89 (86 – 90)**	**8.1 (6.4 – 15.1)**
Mixed sleep apnea	**17.7 (3.6 – 23.8)**	**88 (75 – 90)**	**12.4 (8.8 – 15.4)**

Association between age of PSG and SDB (N=29)

- No statistically significant association was found between age of PSG and diagnosis of SDB (p=0.44).

Conclusion

- Although there was no significant association between age of PSG and diagnosis of SDB, the median age at diagnosis (7.4 years) is older than the usual age of OSA related to adenotonsillar hypertrophy, which peaks at 3-6 years[1].
- This study demonstrates a higher proportion of mixed apnea (47.8%) than recorded in previous literature[3].
- PSG findings show significant differences in oxygen saturations in these children compared to the normal range of oxygen saturations, which is greater than 92 to 95%[2].
- Arousal indices of these patients are quite high thus indicating that their sleep during PSG was fragmented.
- The apnea-hypopnea index (AHI) in each type of sleep apnea was greater than 1 event/hour and reached values that are indicative of severe SDB.
- The PSG results conclude that severity of diagnosed SDB is high, especially in those diagnosed with obstructive and mixed sleep apnea.

Future Directions

- These results require validation in a larger sample with the addition of gender as a demographic variable. This will lead to a better description of the age, type and severity in SDB patients.

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References

[1] Greenfeld, M., et al. Obstructive sleep apnea syndrome due to adenotonsillar hypertrophy in infants. Int J Pediatric Otorhinolaryngology. 2003 May; 67(10):1055-60.

[2] Mau, MK, et al. Normal oxygen saturation values in pediatric patients. Hawaii Med J 2005 Feb; 64(2):42, 44-5.

[3] Marcus, CL, et al. Obstructive sleep apnea in children with Down syndrome. Pediatrics 1991 Jul; 88(1): 132-9.

[4] Churchill, S., et al. Sleep measurement and monitoring in children with Down syndrome: a review of the literature, 1996-2010. Sleep Med Rev 2012 Oct; 16(5): 477-88.

[5] Infosino, A. Pediatric upper airway and congenital anomalies. Anesthesiology Clin N Am 2002; 20: 747-66.

[6] Redline, S., et al. Risk factors for sleep-disordered breathing in children. Am J of Respiratory and Clin Care Med 1999; 159(5): 1527-32.