Obstructive Sleep Apnea in Children with Down Syndrome

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Background

- Children with Down syndrome (DS) have a higher risk of obstructive sleep apnea (OSA; 20-80%) with potential reduced surgical outcome success (18-66%) and reliance on parental report of symptoms.
- If left untreated, OSA can result in cardiovascular complications, impaired growth, learning difficulties, and increased morbidity.
- Beyond prevalence estimates, many prior OSA studies with this population are based on small sample sizes with varying results.

Objectives

- Identify prevalence characteristics, and comorbidities of OSA.
- Determine if the presence or absence of OSA is related to parental report of sleep related symptoms.
- Examine the success of procedures such as adenotonsillectomy (T&A) is curing OSA disease.
- Evaluate management and determine the success of medical treatment, non-invasive ventilation, or secondary sleep surgery.

Methods

- This is retrospective exploratory study of 1,105 children with DS followed by the Sie Center for Down Syndrome (SCDS) at Children's Hospital Colorado with a documented polysomnography (PSG).
- All participants (male=604, 54.7%; female=499, 45.2%, unknown=2, 0.2%) met the inclusion criteria of having at least one PSG, a diagnosis of DS, and one SCDS appointment since November 2011.
- Clinical details were collected including results from diagnostic PSG, surgical interventions, OSA symptoms, demographics, comorbidities, treatment plans, and outcomes.

Results

Prevalence, Characteristics, and Comorbidities

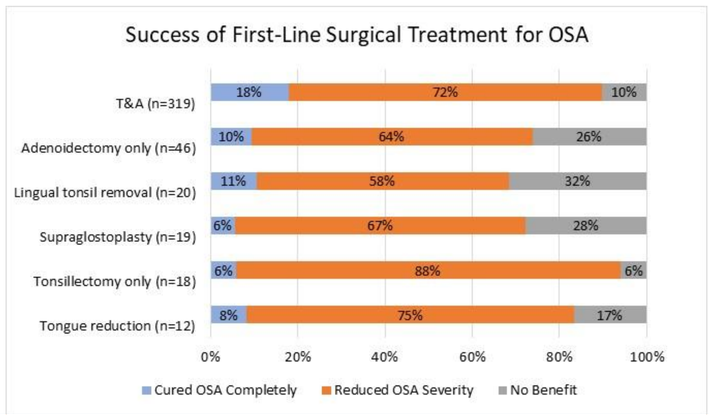
- 55.3% (1,105/1,997) of children with DS had a documented PSG at an average age of 5.44 years (SD=4.92) at first test.
  - Remaining 892 children included those under the AAP DS Guidelines recommended age of 4 or had parental non-follow up/refusal.
  - Children with PSG identified as White, non-Hispanic/Latino (n=611, 55,3%), Hispanic/Latino (n=371, 33.6%), Black or African American (n=47, 4.3%), more than one race (n=19, 1.7%), Asian (n=14, 1.3%), American Indian or Alaska Native (n=5, 0.5%), and other (n=38, 3.4%).
- Overall, 90.3% (n=934) were diagnosed with OSA (mild=36.2%; moderate=21.5%; severe=42.3%) on first PSG.
- Risk ratios for OSA in children with DS are outlined in Table 1.

Table 1 Comorbidities/factors as risk for OSA in Children with Down syndrome (DS)

Results	No. (%) of Patients with OSA: DS With Comorbidity	DS Without Comorbidity	Risk Ratio (95% Confidence Interval)	Significance Level
Neonatal complications				
Apnea	116 (74.4%)	889 (48.3%)	1.540 (1.388 to 1.708)	p < 0.001
Required oxygen	617 (56.0%)	388 (43.3%)	1.294 (1.181 to 1.418)	p < 0.001
Respiratory Distress Syndrome	198 (61.5%)	807 (48.2%)	1.276 (1.155 to 1.410)	p < 0.001
Musculoskeletal abnormalities	627 (57.0%)	378 (42.1%)	1.353 (1.233 to 1.483)	p < 0.001
Hips anomaly	30 (65.2%)	975 (50.0%)	1.305 (1.052 to 1.619)	p = 0.041
Comorbidities				
Frequent pneumonia	321 (74.0%)	684 (43.8%)	1.690 (1.561 to 1.829)	p < 0.001
Aspiration	211 (71.5%)	794 (46.7%)	1.533 (1.404 to 1.674)	p < 0.001
Pulmonary hypertension	277 (70.1%)	498 (55.6%)	1.485 (1.256 to 1.756)	p < 0.001
Lung disease	89 (72.4%)	916 (48.9%)	1.480 (1.315 to 1.667)	p < 0.001
Seizures	71 (71.0%)	934 (49.2%)	1.442 (1.262 to 1.442)	p < 0.001
Heart defects	878 (52.4%)	127 (39.4%)	1.329 (1.152 to 1.533)	p < 0.001
Behaviors				
Behavioral challenges	319 (74.4%)	686 (43.8%)	1.700 (1.571 to 1.839)	p < 0.001

Success of Procedures

- Of the 827 children with DS who received post sleep study intervention for their OSA, 94.1% (n=778) had a documented follow-up PSG.
- Overall, 47.0% (n=439/934) children with DS received surgical intervention as a first-line of treatment for OSA.

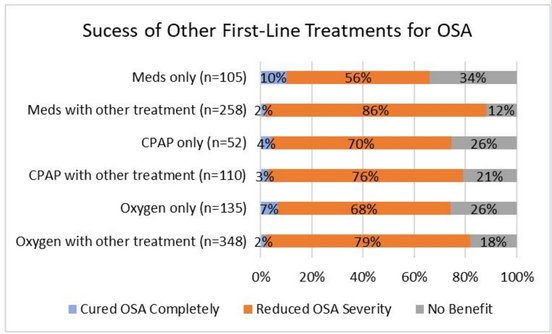


Success of Procedures (Cont.)

- 44 children with DS had drug-induced sleep endoscopy (DISE) prior to their first-line surgery. There was no significant difference in success of surgical outcome when a DISE was used (p=0.251).
- Cochran-Armitage test of trend confirmed a linear trend exists between OSA severity (mild=0.262, moderate=0.231, and severe=0.508) and surgical intervention used as a first-line treatment (p < 0.001), with severe OSA associated with surgery.
- There was not a correlation between severity of OSA and T&A surgical outcome success as a first-line treatment (Somers' *d*=0.053, p=0.446).

Medical Treatment and Non-invasive Ventilation

- CPAP, oxygen, and medications when prescribed with another treatment, also aided in reducing OSA severity.



Parental Report of Sleep Related Symptoms

- As assessed by reported sleep related symptoms in chart review, parental report for pauses in breath (p=0.022) was the only sleep related symptom significant at predicting OSA.
  - Snoring; restless sleep; snorting, coughing or choking; mouth breathing; nighttime sweating; bed-wetting; sleep terrors; difficulty paying attention; behavioral problems; poor weight gain; and hyperactive were not related to OSA diagnosis.

Conclusions

- Approximately half of children with DS have OSA (46.8%, n=934/1,997). This is most likely an underestimate since this reported prevalence includes the 892 children without a PSG.
- Specific comorbidities that correlate with increased OSA risk include neonatal complications, musculoskeletal abnormalities, and pulmonary/lung complications.
- Pauses in breathing were the only parental reported symptom that predicted OSA.
- Overall, 47.0% of children had a surgical intervention as their first-line of treatment, with T&A having the most success curing OSA completely.
- Severity of OSA more likely leads to surgical treatment as a first-line treatment; however, does not predict success of treatment.
- CPAP, oxygen, and medications can reduce OSA severity and are often most effective in combination with other treatments.

Implications

- Except for pauses in breath, most parental reported OSA symptoms are unreliable at predicting an OSA diagnosis in children with DS; therefore, it is important for these children to receive a routine PSG at age 4 as recommended by the AAP DS Guidelines unless there are signs that warrant earlier testing.
- Educational outreach is needed to inform practitioners and families on common comorbidities and symptoms in children with DS that are associated with increase risk of OSA. Related neonatal complications may especially be important at identifying risk early.
- When applicable, T&A is an optimal first-line treatment option; however, further research should examine the value of using DISE in this specific population.

Disclosures

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