Obstructive Sleep Apnea
In Children

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Objectives

- Definition
- Epidemiology
- Pathophysiology
- Symptoms & Signs
- Diagnosis
- AAP Clinical Practice guidelines (Pediatrics)
- Complications.
- Treatment.
Definition of OSA

- Childhood obstructive sleep apnea (OSA) syndrome is characterized by **episodic upper airway obstruction** that occurs during sleep. The airway obstruction may be **complete or partial**.
- Three major components of obstructive sleep apnea have been identified:
  - Episodic hypoxia.
  - Intermittent hypercapnia.
  - Sleep fragmentation.
Sleep Disordered Breathing
SDB

Primary Snoring UARS OSA
Epidemiology

12%-----------------------------3%

Primary Snoring UARS OSA

Increased in the high risk group
Sleep Disordered Breathing (SDB)

- Most common indication for AT
- > 530,000 performed annually.

H&P
- H&P failed to reliably predicted the presence or severity.
- 55% of children who suspected to have OSA were confirmed by sleep study. Brietske 2004: Otolarng, head, neck, surgery.

PSG
- AAP 2002 Peds: Sleep study is gold standard.
- Executive summary of respiratory indications for sleep study. Sleep 2011.
- Only 10% of patients have pre op sleep study prior to Tonsillectomy.
OSA Epidemiology

- Snoring in children:
  - 7% - 10% Habitual snorers
  - 20% Intermittent snorers
- OSA – 1% to 3% of preschool children
- Peaks ages two to five years & second peak in adolescence.
- Gender distribution: M:F ratio approximately equal in children (younger age).
- Prevalence is higher among African Americans
Conditions associated with High Prevalence of OSA

Down’s: 57-100%

Achondroplasia 48%

Pierre Robin sequence: 76%

Prader-Willi Syn: 93%

Neuromuscular disorders: 53% DMD

Obesity
Obesity & OSA

**Obesity: BMI > 95%**

- SDB is 25-40%.
- Obese Children
  - High severe OSA
  - More complications post op.
- Residual OSA
Obesity & OSA

- Costa & Mitchell:
- Meta analysis of four studies:
  - AT reduced the severity of OSA
  - Rarely curative
  - 60-88% have persistent SDB post tonsillectomy.
- Recommend pre op (planning pre op care) and post op for long term management.

Pathophysiology of OSA

Structural factors
- Adenotonsillar hypertrophy
- Craniofacial abnormality
- Obesity

Neuromotor tone
- Cerebral palsy
- Genetic diseases
- N-M Diseases

Other factors
- Genetic
- Hormonal
- C-Reactive Protein

Oxidative & Inflammatory pathways may play a role in OSA-Induced end-organ injury

11
12

Cross-Section of Oropharynx

- Nasal obstruction
- Tonsillar hypertrophy
- Micro- or retrognathia
- Large tongue
Symptoms of **Pediatric** Obstructive Sleep Apnea Syndrome (OSAS)

- Frequent snoring (≥ 3 nights/week);
- Labored breathing during sleep;
- Gasps/snoring noises/observed episodes of apnea;
- Sleeping in a seated position or with neck extended;
- Cyanosis;
- Headache upon awakening;
- Daytime sleepiness;
- Attention-deficit/hyperactivity disorder (ADHD);
- Learning problems;
- Sleep enuresis (especially after 6 months of continence).

**Evidence:**
history alone poor sensitivity and specificity for diagnosing OSAS;
Pediatric questionnaires at best screening, not diagnostic, tools.

Physical Exam

- Nasal airway.
- Oral Airway
  - Tonsils
  - Bite
  - Palate
  - Tongue
  - Pharynx
- Neck size

![Physical Findings Increase Risk for Pediatric OSAS](image)
The degree of tonsillar hypertrophy may not correlate with the presence of OSAS
Diagnosing Pediatric OSAS: Identify Comorbid and Confounding Conditions

- **OSA-related comorbidities:**
  - Systemic hypertension;
  - Daytime sleepiness, irritability, attention deficits, hyperactivity, academic difficulties, frontal lobe executive dysfunction;
  - Failure to thrive, growth retardation, underweight;
  - Born premature;

- **Conditions frequently coexisting with OSAS:**
  - Asthma, recurrent otitis media, pressure equalization tubes, GERD, metabolic syndrome, insulin resistance, fatty liver disease.

OSA IN CHILDREN

CASES REVIEW

NORMAL BREATHING

OBSTRUCTIVE SLEEP APNEA
Review of Case 1 History

- 15 y/o Asian with loud snoring, witnessed apnea, and daytime sleepiness (ESS = 17)
- Nocturnal: nightly snoring for 2 yrs
- Daytime: falls asleep in class 2-3 times/wk; worsening grades, moody, hard to wake in AM
- Sleep-wake schedule: falls asleep 11 PM, wakes 6:00 AM for school; naps 2-3x/wk; weekends: asleep by 12 MN, wakes 9 AM
- ROS: seasonal allergies, no current medications
- PE: BMI 33 kg/m2, narrow palate, 4+ tonsils
Review of Case 1 PSG Summary

Time

Sleep Stage

Arousals

SaO₂

Apnea and Hypopneas

Position

Respiratory Event Graph

Body Position
Case 1: Key Discussion Points

- Severity of symptoms
  - Hypersomnia less common
  - Getting enough sleep
- Severity of OSA: OAHI₃ = 96/hr
  - ≥ 30 is severe
- OSA risk factors: obesity, race
- Management: adenotonsillectomy 1st line of therapy
Follow-up Case 1

- Improved after adenotonsillectomy
  - Wgt ↓ 2 kg, but residual symptoms
- Split night PSG ordered
  - Diagnostic portion: OAHI$_{3A}$ = 35/hr (still severe)
  - Treatment: relief of OSA @ 5 cwp
  - Compliance: many challenges
Review of Case 2

• 21 month old African-American male
• Nocturnal: snoring, restlessness, witnessed apnea
• Daytime: mouth breather
• ROS: former 33 week preterm, impaired growth, eczema, lansoprazole for reflux symptoms
• PE: nasal congestion, refused to open mouth
• PSG: “technically challenging study” toddler had problems tolerating airflow sensors: cannula (nasal pressure + EtCO₂) and nasal-oral thermistor
  – Audible snoring
  – Inductance plethysmography belts and sum signal working
Patterns of Childhood SDB
( Look beyond the AHI)

• Desaturation beard in REM.
• Thoracoabdominal asynchrony.
• Audiovisual observations:
  — Retractions
  — Snoring & Who is snoring
• Flow limitation
• Respiratory related arousals
• Tachypnea
• Elevated ETCO2
DIAGNOSIS

OSA
Screening

• Questionnaires: at best is screening not diagnostic.
• Snoring audiotapes
• P/E:
  – low sensitivity and specificity
  – Poor predictors of OSA severity or risk of post op complications

• Nocturnal Videotapes
• Oximetry
• Nap-PSG
  – High false-negative rate, indicative if positive
Respiratory Indications for PSG in children

PRACTICE PARAMETERS (SLEEP, MARCH 2011)
2012 AAP Clinical Practice Guideline for the Diagnosis and Management of Pediatric OSA

Clinical Practice Guideline

Diagnosis and Management of Childhood Obstructive Sleep Apnea Syndrome

abstract

OBJECTIVES: This revised clinical practice guideline, intended for use by primary care clinicians, provides recommendations for the diagnosis and management of the obstructive sleep apnea syndrome (OSAS), that is, OSAS associated with adenotonsilar hypertrophy and/or obesity in an otherwise healthy child who is being treated in the primary care setting.

METHODS: Of 3166 articles from 1958–2010, 356 provided relevant data. Most articles were level I–IV. The resulting evidence report was used to formulate recommendations.

RESULTS AND CONCLUSIONS: The following recommendations are made: (1) All children/adolescents should be screened for snoring. (2) Polysomnography should be performed in children/adolescents with snoring and symptoms/signs of OSAS, if polysomnography is not available, then alternative diagnostic tests or referral to a specialist for more extensive evaluation may be considered. (3) Adenotonsillectomy is recommended as the first-line treatment of patients with adenotonsilar hypertrophy. (4) High-risk patients should be monitored as patients postoperatively. (5) Halters should be reevaluated postoperatively to determine whether further treatment is required. Objective testing should be performed in patients who are high risk or have persistent symptoms/signs of OSAS after therapy. (6) Continuous positive airway pressure is recommended.


Technical Report Behind It

Diagnosis and Management of Childhood Obstructive Sleep Apnea Syndrome

abstract

OBJECTIVE: This technical report describes the procedures involved in developing recommendations on the management of childhood obstructive sleep apnea syndrome (OSAS).

METHODS: The literature from 1965 through 2011 was evaluated.

RESULTS AND CONCLUSIONS: A total of 1188 titles were reviewed, of which 30 provided relevant data. Most articles were level I–IV. The prevalence of OSAS ranged from 0.3% to 7%, with obesity being the most common risk factor. OSAS was associated with comorbidities, such as hypertension, and a normal sleep apnea syndrome. Most diagnostic testing found low sensitivity and specificity. Treatment of OSAS resulted in improvements in behavior and attention, although improvements in objective abilities were not seen. Primary treatment is adenotonsillectomy. Data were insufficient to recommend specific surgical techniques; however, children undergoing partial tonsillectomy should be monitored for possible recurrence of OSAS. Although OSAS improved postoperatively the proportion of patients who had OSAS regressed from 13% to 28% in the risk population to 7% when obese children were included and obstructive sleep apnea criteria were used. Nevertheless, OSAS may improve after 6 months in obese children, thus supporting surgery as a reasonable initial treatment. A significant number of obese patients required intubation or continuous positive airway pressure (CPAP) postoperatively, which has not been the case for intubation before CPAP.

AAP 2012 Practice Guidelines for Dx and Tx Pediatric OSAS: Evidence Grading & Limitations

**Level I:** well-designed RCTs or diagnostic studies in relevant population (7%)

**Level II:** RCTs or dx studies with minor limitations; overwhelming consistent evidence from observational studies (17%);

**Level III:** Observational studies (case-control and cohort design (31%);

**Level IV:** Case reports, expert opinion (46%).

- 350 articles published with last 10 years were used to clinical practice guidelines;
- A large increase in number of published studies recently but still:
  - Most were level III or IV (retrospective case-control or case series);
  - Many studies hampered by lack of a control group or blinding not present or not reported;
  - Few randomized, blinded, controlled studies;

**Future research needed:** randomized clinical trials with blinding for diagnosing and treating pediatric OSAS.

2012 AAP Clinical Practice Guideline Recommends Level 1 PSG

- PSG should be performed in all with snoring and symptoms/signs of OSAS
  
  [Recommendation, Evidence Quality A];

  - One night of PSG usually sufficient to confirm OSA, but not reliable for sleep architecture.

- Why?

  - Stratify OSAS severity which helps determine risk for complications and sequelae;
  
  - Identify those:
    
    - At greater risk for postoperative complications;
    
    - Likely to need a postoperative PSG.

Pediatric Polysomnography

Documents arousals, parasomnias, abnormal sleeping position, and attends to any technical problem.
When is Pediatric PSG Best Tolerated?

- Caretaker is present
- Prior orientation to PSG—utilize a video/pictorial manual
- Experienced & comfortable PSG technologist with children
- The sleep specialist provides directions in advance of the test, e.g. montage to be used, when to supplement with oxygen, split night study in older children, etc.

*Practice Parameters for The Respiratory Indications for PSG*
*Sleep 2011; 34 (3): 379-388*
If PSG Not Available, Alternative Tests?

• If PSG “not available”, recommend clinicians:
  
  1) Order alternative objective diagnostic test(s) [Option, Evidence Quality C]
     a) Nocturnal video recording;
     b) Nocturnal oximetry;
     c) Daytime nap PSG, or
     d) Ambulatory PSG;

  2) Or refer child to a sleep specialist or otolaryngologist. [Recommendation, Evidence Quality D].

Rationale: some objective tests are better than depending upon clinical evaluation.
Ambulatory PSG in older children or adolescents with high probability for OSA and no comorbidities is technically feasible...

Figure 1—Spearman Rho correlation comparing the obstructive apnea hypopnea index of the ApneaLink autoscore with polysomnography

High correlation
PSG OAHI and
ApneaLink Plus
OAHI = 0.886

Figure 2—Receiver operator characteristics (ROC) curves of OAHI ApneaLink manual and auto score vs. polysomnography at OAHI > 1.5 (A), OAHI > 5 (B), and OAHI > 10 (C)

ROC showed high congruence for OAHI PSG and Device

- Receiver operator characteristics (ROC) curves show high congruence for OAHI PSG and device;
- Autoscore of device was very good;
- Specificity improves with increasing OAHI cutoffs.

Clinical practice guideline: Polysomnography for sleep disordered breathing prior to tonsillectomy in children

Roland PS et al

American Academy of Otolaryngology—Head and Neck Surgery Foundation
FACTS

• 10% of patients are having PSG prior to surgery.
  – Access to a sleep lab.
  – Typical wait time is 6 weeks.
  – Cost
  – Reliable test.
Background

- 90% adenotonsillectomies in the US are performed without prior Polysomnogram (PSG)
- American Academy of Pediatrics suggests PSG for diagnosis, and for determining severity prior to surgery.
Objectives

• This guideline provides otolaryngologists with evidence-based recommendations for using polysomnography in children, aged 2 to 18 years, with SDB who are candidates for tonsillectomy.

Panel included anesthesiology, pulmonology, otolaryngology-head and neck surgery, pediatrics, and sleep medicine.
Clinician should refer children with SDB for PSG if:

- Obesity
- Down syndrome
- Craniofacial abnormalities
- Neuromuscular disorders
- Sickle cell disease
- Mucopolysaccharidoses
The Role of PSG

- Avoid unnecessary surgery in children with Non obstructive events.
- Confirm the presence of OSA.
- Document the severity.
- Assist in preoperative planning.
- Providing a baseline PSG for comparison after surgery

- Roland PS et al
Admission post-Op AT

1- Younger than age 3
2- Severe obstructive sleep apnea (apnea-hypopnea index of 10 or more obstructive events/hour, oxygen saturation nadir less than 80%, or both)
3- High Risk Group
Polysomnography

• **DEFINITIONS:**
  Obstructive apnea:
  Hypoapnea:
  Hypoventilation
  RERA
Respiratory Rules For Children Apnea

Event > Two breaths
+ Thermal Sensor amplitude drop > 90% > 90% of event
+ Respiratory effort present throughout the event
+ The Event duration is measure the same way as in adults
Hypopnea Rules

<table>
<thead>
<tr>
<th>Event &gt; Two breaths</th>
<th>The nasal pressure signal drops &gt; 50%</th>
<th>The drop last &gt; 90% of the event</th>
<th>The Event is associated with an arousal, awakening or at least 3% SpO2 desaturation</th>
</tr>
</thead>
</table>

![Graph showing hypopnea event criteria with nasal pressure and SpO2 desaturation](image-url)
Obstructive Hypoventilation

- Paradoxical Rib-Cage Motion
- Hypercapnia
UARS
# Severity of OSA

<table>
<thead>
<tr>
<th>Severity</th>
<th>AHI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>1</td>
</tr>
<tr>
<td>Mild</td>
<td>1.5-5</td>
</tr>
<tr>
<td>Moderate</td>
<td>6-9</td>
</tr>
<tr>
<td>Severe</td>
<td>10 or &gt; or SpO2 &lt; 80%</td>
</tr>
<tr>
<td>Obstructive Hypoventilation</td>
<td></td>
</tr>
<tr>
<td>ETCO2</td>
<td>&gt; 53</td>
</tr>
<tr>
<td>or</td>
<td>&gt; 9% of TST</td>
</tr>
</tbody>
</table>
Pediatric OSA

CONSEQUENCES
Consequences of Pediatric OSA

- Effects on growth
- Neurocognitive morbidity
- Cardiovascular consequences
- Enuresis
FTT

• Is related to energy expenditure during sleep due to Increase WOB not to reduce caloric intake.

• Improve with T & A.
Neurocognitive Morbidity

- Hyperactivity, inattention, aggression
- Impaired school performance
- Daytime sleepiness
- Depression

ADD/ADHD = sleep disruption & intermittent hypoxia
Complications:

CVS

- **Cor-pulmonale** - used to be a common presentation, but is rare currently
  - *When it does develop-can be reversed by Tx*
  *Tal, Pediatr Pulmonol, 1988:*

- Ventriculography in children who had abnormal questionnaire for OSAS:
  - 37% had Rt. ventricular EF ↓
  - 67% had abnormal wall motion
  - All of the 11 pt who had a repeat evaluation after T&A showed **improvement**.

- **Hypertension.**
Complications:  

**Enuresis**

*Weider, Otolaryngol Head Neck Surg, 1991:*

- 115 enuretic children undergoing T&A
  - 66% and 77% reduction in enuretic nights 1m and 6 m Post-T&A
  - In the group with secondary enuresis, 100% were dry 6 m Post-T&A
TREATMENT

PEDIATRIC OBSTRUCTIVE APNEA HYPOAPNEA INDEX (POHHI)
Treatment Guidelines

• POAHI < 5 but asymptomatic:
  – Nasal steroids
  – Position modification

• Adenotonsillectomy:
  – Symptomatic patient with POAHI < 5/hour.
  – POAHI > 5/ hour

• POAHI> 5, No tonsils:
  – CPAP:
    • Mask fit, education, support, desensitization
  – Rapid Maxillary Expansion
  – Weight management
  – Exercise program
  – Nasal steroids
  – Treat Comorbidities:
    • GERD, asthma, AR
  – Optimize sleep/wake habit
Why Would I Consider T & A for Symptomatic Child with PAOHI ≤ 5?

- Recent prospective study compared IQ scores on 104 white middle class children (mean age 9):¹
  - 31 OSA (mean PAOHI 10/h, Nadir SpO2 91%, desat index 2/h), 13 primary snorers and 60 controls;
  - Mean total, verbal, and performance IQs significantly lower in OSA (98, 96, 101) and primary snorers (95, 91, and 100.5) compared with controls (116, 118, and 110).

- Another study found habitually snoring had IQ 10 points lower compared with non-snoring controls.²

Treatment of Pediatric OSA

- **Surgical**
  - Adenotonsillectomy
  - Uvulopalatopharyngoplasty
  - Craniofacial surgery
  - Tracheostomy
  - Bariatric surgery: Limited experience.

- **Medical**
  - Continuous positive airway pressure
  - Weight loss if obese
  - Intranasal steroids *(modest effect)*
AAP 2012 Clinical Practice Guidelines for **Treating** Pediatric OSAS: **Adenotonsillectomy First Line Tx**

- Adenotonsillectomy (AT) is **first** line treatment for symptomatic child with adenotonsillar hypertrophy (ATH) and does not have contraindications for surgery [Evidence Grade B, Recommendation];

- High risk patients should be hospitalized following surgery.

  - **T & A** remains first line choice in obese children:
    - Argue that trying AT in obese child preferable to lifelong CPAP treatment (especially with poor compliance).

**State-of-Art AT in 2013:**

1) Coblation;
2) Remove only 90% of tonsils when done for sleep apnea alone;
3) Oral clonidine or oral midazolam preoperative;
4) Reduce opiates by half;
5) Identify and hospitalize overnight high risk;
6) Inferior turbinoplasty if needed.
T & A

- **Tauman et al. J Peds 2006. 149; 803-8.**:
  - 110 patients with OSA, S/P T&A.
  - 25% achieve AHI < 1/hour.
  - 46% had AHI < 5/hour
  - 29% had AHI > 5/hour.
- **Obesity and AHI are major determinant for outcome.**
- **Others such as facial anomalies.**
Surgical outcome for T & A

- Improves the QOL (Sleep disturbances, physical & emotional symptoms, hyperactivity and daytime functions). Arch Oto Head Neck surg 2005, 131.


- Improved school performance. Peds 1998

- T&A reduced healthcare utilization. Peds 2004.113
AAP 2012 Clinical Practice Guidelines for Treating Pediatric OSAS Beyond T & A

- **Postoperative PSG** indicated for high risk for residual, and those who had moderate to severe OSA on their preoperative PSG [Evidence grade B, Recommendation];

- **CPAP** evaluation and treatment for those with significant residual symptoms following AT, or if AT not performed.

- **Rapid maxillary expansion** may be effective in specially selected patients.

- **Weight loss** for obese or overweight [Evidence Grade C, Recommendation];

- **Intranasal corticosteroids** for children:
  - Residual mild OSA post-AT or
  - Mild OSAS in who AT is contraindicated or not done [Evidence grade B, Option].
Rapid Maxillary Expansion

- 32 children with enlarged tonsils grade 2-3. and clinically narrow maxilla were treated with either T & A or RME.
- Outcome was similar in term of AHI, nadir SaO2.
- Two cases in RME failed treatment
Rapid Maxillary Expansion

High Arched Palate
Children on CPAP

- **FDA:**
  - Not approved < 7 yrs of age or < 40 lbs.
  - Masks are very limited.
  - Maternal education will improve compliance.
Special Considerations for CPAP in Children

• Need wide variety of mask sizes and styles to fit children
• Compliance may be enhanced by behavioral techniques
  – Empowerment
  – Positive reinforcement
  – Desensitization
  – Role modeling
CPAP Outcome

• Improve quality of life (parents & child).
• Hyperactivity- Improved.
• Behavioral Improved.
• Sleepiness- Improved.
• Improved nasal symptoms.

Marcus, Peds : 2006
Effects of Positive Airway Pressure Therapy on Neurobehavioral Outcomes in Children with Obstructive Sleep Apnea

Marcus CL, et al.
Marcus, CL, et al

Design

• Neurobehavioral assessments were performed at baseline and after 3 months of positive airway pressure therapy in a heterogeneous group of 52 children and adolescents.
• Group included developmentally delayed Children.
Results

• Adherence varied widely (mean use 170±145 [SD] minutes/night).

• Positive airway pressure therapy was associated with significant improvements in attention deficits (p<0.001), sleepiness on the Epworth scale (p<0.001), behavior (p<0.001), and caregiver- (p=0.005) and child- (p<0.001) reported quality of life.
# PAP Efficacy – Medical Outcomes

<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>N and Age</th>
<th>Outcomes</th>
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<tbody>
<tr>
<td>Palombini et al 2004</td>
<td>Prospective</td>
<td>14</td>
<td>Auto-CPAP well tolerated and effective</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8m to 12y</td>
<td></td>
</tr>
<tr>
<td>Marcus et al 2006</td>
<td>Prospective, multi-center, randomized</td>
<td>29</td>
<td>↓ AHI, ↑ SaO2</td>
</tr>
<tr>
<td></td>
<td>double-blind</td>
<td>2y to 16y</td>
<td>↑ Subjective</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CPAP = BiPAP</td>
</tr>
<tr>
<td>Marcus et al 2012</td>
<td>Prospective, randomized double-blind</td>
<td>56</td>
<td>↓ AHI, ↑ SaO2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2y to 16y</td>
<td>CPAP = Bi-Flex</td>
</tr>
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</table>
## Compliance in Pediatric CPAP

<table>
<thead>
<tr>
<th>Study</th>
<th>Mask training or pt ed</th>
<th>Free equip</th>
<th>Humid</th>
<th>Ramp</th>
<th>Calls</th>
<th>Visits</th>
<th>Adherence</th>
<th>Hrs/night</th>
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</thead>
<tbody>
<tr>
<td>Marcus 2006</td>
<td>✓ 2 week</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>48 hr 1 wk</td>
<td>Bi-month</td>
<td>66%</td>
<td>5.3</td>
</tr>
<tr>
<td>O’Donnell 2006</td>
<td>✓ 1 on 1 ed.</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>1-2 wks</td>
<td>6m to 1yr</td>
<td>52 – 82%</td>
<td>4.7</td>
</tr>
<tr>
<td>Uong 2007</td>
<td>✓ 30 min ed</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>Initial</td>
<td>2-4wk 6m</td>
<td>73 – 85%</td>
<td>7.0</td>
</tr>
<tr>
<td>Nixon 2011</td>
<td>✓ 2 hour ed</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>Weekly</td>
<td>?</td>
<td>33%</td>
<td>4.7</td>
</tr>
<tr>
<td>Difeo 2012</td>
<td>✓ 2 week</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>48 hr 1 wk</td>
<td>Bi-month</td>
<td>78%</td>
<td>3.3</td>
</tr>
</tbody>
</table>
Barriers to compliance

Compliance Rates in Children Using Noninvasive Continuous Positive Airway Pressure
Anne R. O'Donnell, FRACP, PhD¹; Candice L. Bjornson, MD, MSc¹; Shelly G. Bohn, BSc, RPSGT¹; Valerie G. Kirk, MD¹

- Compliance decreased:
  - With increasing age
  - If used full face mask

- 10/13 children who took >90 days to use CPAP had impaired cognition
  - Down syndrome, developmental delay
Areas for Future Research for Role of T & A in Children/Adolescents with OSAS

- Risks of persistent OSAS and long-term recurrence of OSAS after partial vs. total tonsillectomy;
- How well does resolution of OSAS correlate with resolution of its complications and sequelae?
- Risks of T & A in a patient with acute URI?
- What PSG parameters predict postoperative respiratory compromise;
- Would obese older children/adolescents be better served by not trying AT first?
Summary

- Definition & Epidemiology.
- Pathophysiology.
- Signs & symptoms.
- Complications.
- Diagnosis.
- Treatment.
- Recent literatures
Question #1

• High risk condition that is high risk for OSA is:
  – A. Down’s syndrome
  – B. Sickle cell anemia
  – C. Achondroplasia
  – D. All of the above.
Question #1

• High risk condition that is high risk for OSA is:
  – A. Down’s syndrome
  – B. Sickle cell anemia
  – C. Achondroplasia
  – D. All of the above.
Question #2

• Severe OSA in children is defined by:
  – A. AHI > 30 /hour.
  – B. AHI > 10 /hour and SpO2 < 80%
  – C. AHI > 5 /hour and ETCO2 > 50 torr.
  – D. Snoring with very large tonsils.
Question #2

• Severe OSA in children is defined by:
  – A. AHI > 30 /hour.
  – B. AHI > 10 /hour and SpO2 < 80%
  – C. AHI > 5 /hour and ETCO2 > 50 torr.
  – D. Snoring with very large tonsils.
Question #3

• Sleep study is recommended for:
  – A. Down’s syndrome
  – B. A child with snoring and BMI > 95% for age.
  – C. An infant with Pierre Robin Syndrome
  – D. All of the above.
Question #3

• Sleep study is recommended for:
  – A. Down’s syndrome
  – B. A child with snoring and BMI > 95% for age.
  – C. An infant with Pierre Robin Syndrome
  – D. All of the above.
thank you

gzureikat@gmail.com