Children Who Snore – Do they have Sleep Apnea?

Iman Sami, M.D.
Division of Pulmonary and Sleep Medicine, Children’s National
No disclosures relevant to this talk
Objectives

- Describe the spectrum of sleep disordered breathing (SDB) in healthy children
- Describe Nocturnal Polysomnography (PSG)
- Describe phenotypes and diagnosis of obstructive sleep apnea (OSA)
- Discuss sequelae and treatment options of OSA
Sleep History

• Bed-time problems
• How long a child takes to fall asleep
• Quantity
• Quality
• Sounds
Sleep Disordered Breathing

• Spectrum of repetitive episodes of complete or partial obstruction of the airway during sleep.
• “Hark, how hard he fetches breath.”
  — William Shakespeare, *King Henry IV, Part 1*
Primary Snoring (PS)

- No significant obstructive events, arousals, or gas exchange abnormalities
- Often noticed while family is on vacation and sharing a room with child
- 10-12% of children
Upper Airway Resistance Syndrome (UARS)

• Increasingly negative intra-thoracic pressures during inspiration that lead to arousals and sleep fragmentation
• Events may not meet scoring criteria for obstructive apnea or hypopnea
• Gas exchange unaffected
Obstructive sleep apnea (OSA)

• Prolonged partial or complete upper airway obstruction
• Disrupts normal ventilation and gas exchange
• Disrupts normal sleep
• 1-4% of children
Pathophysiology of OSA

When snoring is reported:

- “Heroic” snorts
- Asynchronous movements of chest & abdomen
- Witnessed apnea
- Disturbed sleep
- Sweating
- Enuresis
Other red flags

- Behavioral problems
- Academic concerns
- Excessive daytime sleepiness
- Mouth-breathing
- Recurrent adeno-tonsillitis
Despite taking a good history

• Cannot distinguish with certainty between primary snoring and obstructive sleep apnea
• Clinical suspicion is high --- Referral for a PSG
Polysomnography – gold standard to diagnose OSA

Who needs a sleep study?
Revised AAP Clinical Practice Guidelines (2012) - Diagnosis of OSA

- All children/adolescents should be screened for snoring
- PSG should be performed if OSA is suspected
- If not available, then specialist evaluation with an alternative test recommended

Marcus et al, PEDIATRICS Vol. 130, No. 3, Sept 2012
AASM Practice Parameters

• Recommend PSG – suspected OSA in children (S)
• Nap - not recommended (O)
• Insufficient data for unattended in-home portable PSG testing
• PSG indicated in children considered for Tonsillectomy and Adenoidectomy (T & A) (G) to establish the severity of OSA, (postoperative risk) and need for a repeat PSG after surgery

Aurora RN, et al Sleep. 34:379-388 2011
Otolaryngology guidelines (2011)

- PSG - most reliable and objective test to assess presence and severity of OSA,
- PSG is not necessary to perform routinely to diagnose SDB
Children's National Medical Center
PEDIATRIC SLEEP DISORDERS LABORATORY
SLEEP STUDY REQUEST FORM

Phone: (202) 476-2022 Fax: (202) 476-2981

PATIENT INFORMATION: (may attach demographic sheet)
Name
Last
First
MI
DOB
Age
Y
M
Sec.
M
F
Insurance Carrier and ID #
Parent's name
Address
Contact Information: Phone (Home) (Work) (Mobile) e-mail
Referring Physician
Specialty
Referring Ph #
Fax #
Primary Care Physician
Ph #
Date
Ordering Physician Signature

REASON FOR SLEEP STUDY REFERRAL

NOTE: PLEASE ATTACH A COPY OF THE PATIENT'S MOST RECENT CLINICAL ENCOUNTER DOCUMENTING DETAILS OF THE SLEEP HISTORY, PHYSICAL EXAM AND REASON FOR REFERRAL

PRESENTING COMPLAINTS: (Check all that apply)
Snoring
Choking/gagging
Apnea
Obstructive sleep apnea
Obstructive apnea
Obstructive hypoventilation
Obstructive hypoventilation with diaphragmatic paralysis
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Obstructive hypoventilation with diaphragmatic paralysis
Obstructive hyp...
### REASON FOR SLEEP STUDY REFERRAL

**NOTE:** Please attach a copy of the patient’s most recent clinical encounter documenting details of the sleep history, physical exam and reason for referral.

#### PRESENTING COMPLAINTS: (Check all that apply)

<table>
<thead>
<tr>
<th>Complaint</th>
<th>Other Complaints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loud snoring</td>
<td>Cyanosis/hypoxia</td>
</tr>
<tr>
<td>Choking/gagging/arousals</td>
<td>ALTE</td>
</tr>
<tr>
<td>Observed apneas in sleep</td>
<td>Agnosia of prematurity</td>
</tr>
<tr>
<td>Restless sleep</td>
<td>On CPAP/BiPAP</td>
</tr>
<tr>
<td>Nocturnal diaphoresis</td>
<td>On O2</td>
</tr>
<tr>
<td>Enuresis</td>
<td>On ventilator</td>
</tr>
<tr>
<td>Fever</td>
<td>On O2</td>
</tr>
<tr>
<td>Sleepwalking</td>
<td>Night wakeings</td>
</tr>
<tr>
<td>Difficulty falling asleep</td>
<td>Insufficient sleep</td>
</tr>
<tr>
<td>Sleep terrors</td>
<td>Insomnia</td>
</tr>
<tr>
<td>Mood/behavior problems</td>
<td>Attention problems/ADHD</td>
</tr>
<tr>
<td>Insomnia</td>
<td>Academic concerns</td>
</tr>
<tr>
<td>Sleep hygiene</td>
<td>Other</td>
</tr>
<tr>
<td>Nocturnal seizures</td>
<td>Other</td>
</tr>
</tbody>
</table>

#### RISK FACTORS/MEDICAL CONDITIONS: (Check all that apply):

<table>
<thead>
<tr>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adenotonsillar hypertrophy</td>
</tr>
<tr>
<td>S/P T&amp;A Date</td>
</tr>
<tr>
<td>Obesity BMI</td>
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<tr>
<td>Allergies</td>
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<tr>
<td>Asthma</td>
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<tr>
<td>Family history OSA</td>
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<tr>
<td>Gastroesophageal reflux</td>
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<tr>
<td>Craniofacial anomalies</td>
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<tr>
<td>Down syndrome</td>
</tr>
<tr>
<td>Neuromuscular disease/CP</td>
</tr>
<tr>
<td>Prematurity/RPD</td>
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<tr>
<td>Seizures (type):</td>
</tr>
<tr>
<td>Other</td>
</tr>
<tr>
<td>Sickle cell disease</td>
</tr>
</tbody>
</table>

**Previous sleep studies?**

- Yes
- CNMC lab?
- Other lab? (if so, please attach previous sleep study results)

**CURRENT MEDICATIONS:**

**POLYSOMNOGRAM REQUESTED:**

- Elective
- Urgent
- Pre-op
- Surgery date __________

- PSG 95810
- PSG + CPAP/BiPAP titration (initial) 95811
- PSG + MSLT 95810 + 95805
- PSG + CPAP/BiPAP titration (repeat) 95811
  - Current settings: __________
- PSG + Seizure montage 95810
- PSG + Other (Ventilator, O2, Tracheostomy) 95810
  - Requires referral by a pediatric pulmonologist
Pediatric Sleep Lab

- Requests are screened and prioritized
- Pediatric Sleep Lab - caters to infants, children and teenagers with “space” for parent
- Location - inpatient
- Staff – child-friendly, ratio of tech to patient is high
- Capnography
- Severe studies – priority in scoring and interpretation
Polysomnography Recordings

From I Sami & J Owens, Polysomnography for the Pediatric Pulmonologist, Diagnostic Tests in Pediatric Pulmonology, 1st Ed. 2014
“Wired up”
BASELINE POLYSOMNOGRAPHY REPORT

• Signals recorded:
• Methodology:
• Patient Information
• Reason for referral:
• Study Summary
• History:
• Medications Reported:
• Sleep Staging and Architecture: EEG
• Respiratory findings: RDI (includes all apneas, hypopneas and RERAs). The AHI (includes all respiratory events except RERA’s)
• Oxygenation and ETCO2:
• Limb Movement findings:
• EKG findings:
• Impression/Recommendations:
• Final Diagnosis:
Hypnogram

- Hypoventilation
  - Maximum end-tidal carbon dioxide $> 54$ mmHg
  - End-tidal carbon dioxide $> 50$ mmHg for more than 25% of TST
- Sleep Fragmentation
  - Increased EEG arousals $> 10$/hr
  - Increased awakenings
Obstructive Apnea

Obstructive Hypopnea

Central Apnea
PSG diagnostic criteria for OSA

- Mild OSA - AHI > 1.5 or AI > 1 /hour
- Moderate OSA - AHI is >5,
- Severe OSA – AHI > 10.
- Hypoxemia
  - Oxygen desaturation nadir < 91%
  - Change in oxygen nadir from baseline > 3%
Hypoventilation:
- Maximum end-tidal carbon dioxide > 54 mmHg
- End-tidal carbon dioxide > 50 mmHg for more than 25% of TST

Sleep Fragmentation:
- Increased EEG arousals - >10/hr
- Increased awakenings
Case I

- 4 year old
- History: Snores, poor appetite, has wheezed with URIs,
- Mouth-breathes during sleep with head extended
- Pre-school told his parent he should be evaluated for “ADHD”.
Case I

• Physical Exam:
• Weight < 3%, length 10-25%
• Adenoidal facies with allergic shiners
• Cervical lymph nodes: ++
• Rest of exam unremarkable except:
Type I OSA

- Most common cause is Adeno-tonsillar Hypertrophy
- Strong association between OSA, and asthma
Case II

- 12 year old – snores very loudly so siblings do not want to share a room
- Has asthma with worsening control in last 3-4 years despite ICS and leukotriene modifier
- Academic performance: poor, sometimes falls asleep in class, always in the car
- Teased by other kids
Case II

- BMI – 34, large neck circumference
- Edematous nasal turbinates,
- Narrow palate, tonsils: 2+
- End-expiratory wheezing on lung examination
Type II OSA

• Major risk factor: Obesity
• Morning headaches
• Co-morbidities:
  – Allergic rhinitis
  – Asthma
  – Hyperglycemia
  – Hypertriglycerideridemia
Other Investigations

- Serum HCO3 and hematocrit
- Imaging
- EKG
- Echocardiogram
- Pulmonary Function Tests
Why do we care about OSA?
Cognitive and Behavioral Consequences of OSA

• Strong association between SDB and:
  – Behavior - hyperactivity, inattention, & aggression
  – Cognition – IQ, memory, academic performance and executive functioning

Cognitive and Behavioral Consequences of OSA

• Mechanisms: Sleep fragmentation and intermittent hypoxemia impact prefrontal cortex
• Window of vulnerability in developing children
• Treatment interventions may only partially reverse deficits

Metabolic & Cardiovascular Consequences of OSA

From D Gozal Metabolic Consequences of SDB, Principles & Practice of Pediatric Sleep Medicine, 2nd Ed. 2014
You have the report – what next?

- It’s not just the AHI -
- Impact on the child’s wellbeing
- Mild cases: trial of anti-inflammatory therapy - montelukast and nasal steroids
- Orthodontal procedures
- Moderate and severe cases – surgical treatment and/or positive airway pressure

Revised AAP Clinical Practice Guidelines (2012) - Management of OSA

• Adeno-tonsillectomy - first-line treatment of patients with adeno-tonsillar hypertrophy
• High-risk patients - monitored postoperatively
• Postoperative evaluation
• Intranasal corticosteroids - mild OSA
• Weight loss - in patients who are overweight or obese.

Marcus et al, PEDIATRICS Vol. 130, No. 3, Sept 2012
Persistence of OSA post T & A

• Up to 27%
• Risk factors:
  – Obesity
  – Asthma
  – High AHI
  – GERD
  – Down’s syndrome
  – CP

Revised AAP Clinical Practice Guidelines (2012) - Management of OSA

• Continuous positive airway pressure - if adeno-tonsillectomy not performed or OSA persists postoperatively.

Marcus et al, PEDIATRICS Vol. 130, No. 3, Sept 2012
Treatment Options

- Mask-fitting
- CPAP after a protocol of desensitization
- Titration study
- Bilevel PAP if pressures high or hypoventilation
Acknowledgements

• Pulmonary and sleep colleagues in the Division of Pulmonary and Sleep Medicine, CNHS
Thank you – Questions?

You have to do something about your snoring: I don't want to go through a winter like that again.