PEDIATRIC OBSTRUCTIVE SLEEP APNEA

(OSA)

DEFINITION OSA

- **Inspiratory airflow is either partly (hypopnea) or completely (apnea) occluded during sleep. The combination of sleep-disordered breathing with daytime sleepiness is referred to as the *OSA syndrome***
- **Obstructive apnea occurs when there is complete cessation of airflow for ≥ 10 s.**

PATHOPHYSIOLOGY

4 major predisposing factors for upper airway obstruction:

- **Anatomic narrowing.**
- **Abnormal mechanical linkage between airway dilating muscles and airway walls.**
- **Muscle weakness.**
- **Abnormal neural regulation.**

PATHOPHYSIOLOGY

- **Sleep fragmentation**
- **Increased work of breathing**
- **Alveolar hypoventilation**
- **Intermittent hypoxemia**

COMPLICATIONS

- **Neurobehavioral disturbances, ADHD**
- **Diminished learning capabilities**
- **Failure to thrive**
- **Pulmonary hypertension.**
- **Cor pulmonale.**

CONDITION ASSOCIATED-CAUSES

- **Tonsillar and adenoid hypertrophy.**
- **Neuromuscular disorders.**
- **Myelomeningocele.**
- **Obesity.**
- **Pierre Robin sequence.**
- **Cerebral palsy.**
- **Down syndrome.**
- **Hypothyroidism.**

EPIDEMIOLOGY

- **United States: Affecting 2–3% of all children (snoring: 8-27%)**
- **2-8 years (adenotonsillar lymphatic tissue growth).**
- **Sex: prepubertal children: male = female, older adolescents: male > female**
- **Races: black children > white children, high frequency of OSA / adult Asia: craniofacial structures.**

HISTORY

- **Nonspecific**
- **Interview: speciality, sensity # 50-60%**
- **Family: snoring, allergies, exposure to tobacco smoke.**
- **History of loud snoring >=3 nights/week: increase suspicion of OSA.**
- **Breathing difficulties during sleep, unusual sleeping positions, morning headaches, daytime fatigue, irritability, poor growth, behavioral problems.**

PHYSICAL

- **Growth chart, height, weight, obesity.**
- **Nasal passenge**
- **Palate**
- **Tonsillar hypertrophy, uvula**
- **Malformation: cleft, chin, maxilla**
- **Compression**
- **Cardiac examination**
- **Conditions in cause**

POLYSOMNOGRAPHY

- Sleep state (≥2 EEG leads)
- Electrooculogram (right and left)
- Electromyelogram (EMG)
- Airflow at nose and mouth (thermistor, capnography, or mask and pneumotachygraph).
- Chest and abdominal wall motion
- Electrocardiogram (preferably with R-R interval derivation technology)

POLYSOMNOGRAPHY

- Pulse oximetry (including a pulse waveform channel)
- End-tidal carbon dioxide (sidestream or mainstream infrared sensor)
- Video camera monitor with sound montage.
- Transcutaneous oxygen and carbon dioxide tensions (in infants and children<8y)

Reference range parameters for sleep gas exchange and gas exchange in children are as follows:

- Sleep latency > 10 minutes
- Total sleep time (TST) > 5.5 hours
- Rapid eye movement (REM) sleep >15% of TST
- Percentage of stage 3-4 non-REM sleep > 25% of TST
- Respiratory arousal index (number per hour of TST) < 5
- Periodic leg movements (number per hour of TST) < 1
- Apnea index (number per hour of TST) < 1
- Hypopnea index (nasal/esophageal pressure catheter; number per hour of TST) < 3
- Nadir oxygen saturation > 92%
- Mean oxygen saturation >95%
- Desaturation index (>4% for 5 s; number / hour of TST) < 5
- Highest CO2 52 mm Hg
- CO2 > 45 mm Hg < 20% of TST

TREATMENT

Medical therapy: limited value

- Antihistamine or antimuscarinic: nasal congestion, benefit is uncertain.
- Leukotriene modifier: eliminate residual OSA following surgery, improve clinical outcomes without surgery.
- Budesonide for 6 weeks: sustained improvement in mild OSA

TREATMENT

Positive-pressure ventilation: safe, efficient, alternative to further surgery or tracheotomy in children and infants with unresolved OSA after tonsillectomy and adenoidectomy.

- CPAP
- BiPAP

TREATMENT

Surgery:

- Tonsillectomy and adenoidectomy
- Tracheotomy.
- Uvulopharyngopalatoplasty, epiglottoplasty.
- Bariatric surgery.

Pediatric obstructive sleep apnea (OSA): A potential late consequence of respiratory syncitial virus (RSV) bronchiolitis

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- Nerve growth factor (NGF), mRNA, tyrosine kinase receptor (trkA), neurokinin 1 (NK1) receptor mRNA, protein expression, substance P protein: in 34 children OSA adenotonsillar tissue hypertrophy> in 25 children with recurrent tonsillitis (RI). (*University of Louisville Human Research Committee-2007)*
- Strikingly similar to the changes in the lymphoid tissues from bronchoalveolar lavage specimens obtained from intubated children during RSV infection.

STUDY OBJECTIVES

- Hypothesis: children who suffered from severe RSV bronchiolitis during infancy maybe at higher risk for OSA later in childhood.

METHODS

- 21 randomly selected children (mean age ± SD: 5.2 ± 1.5 years) with a history of verified RSV-induced bronchiolitis during their first year of life.
- 63 control subjects (mean age ± SD: 5.1 ± 0.7 years) with no history of RSV bronchiolitis served as a control group.

METHODS

- RSV: ELISA or culture
- Sleep questionnaire: 14 points
- Exclusion: adenotosillectomy, obesity, …
- Polysomnography: 12h quiet, darkened room, 24°C. No drug induced sleep.

RESULTS

- Obstructive apnea/hypopnea index (2.3□±□1.9 vs. 0.6□±□0.8□/hr total sleep time (TST); *P*□<□0.05): significantly higher
- Respiratory arousal indices (1.3□±□1.0 vs. 0.1□±□0.2□/hr TST; *P*□<□0.05): significantly higher
- The lowest SpO2, ETCO2, and sleep indices: no significant differences

DISCUSSIONS-CONCLUSION

- OSA is more likely to occur among children with a history of significant RSV bronchiolitis during infancy.


THANK YOU
FOR YOUR ATTENTION !