Obesity and Sleep

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Disclosures

- No disclosures
Objectives

- Explain the importance of sleep
- Describe obstructive sleep apnea (OSA)
- Identify treatments of OSA and why obese children may not respond to the common treatments
- Describe symptoms of narcolepsy
By 2 years of age, the average child has spent 9,500 hrs sleeping (13 months)

Sleep is the primary activity of the brain during early development

Between 2-5 yrs children spend equal amounts of time asleep and awake

40% of time during childhood and adolescence is spent asleep
Functions of Sleep

- Basic function of sleep remains a mystery
- What we understand about sleep has evolved from studies that examine the impact of induced sleep loss
- What we DO know...
  - Adequate sleep is imperative for sustaining life and optimal functioning
  - Recent studies indicate adequate sleep is necessary for optimal learning
Functions of Sleep

- Cognition
  - Remember what we learn
  - Organize thoughts/rationalize/avoid consequences
  - React quickly
  - Work accurately & efficiently
  - Think abstractly
  - Creativity
What is “Sufficient” Sleep?

“The amount of sleep that a child needs to feel well rested.”
Normal Sleep Patterns

- Total sleep (nighttime & naps)
  - Newborns (0-2 months) (average 13-14 ½ hrs)
  - Infants (2-12 months) (average 12-13 hrs)
  - Toddlers (12 months – 3 yrs) (average 11-13 hrs)
  - Preschoolers (3-5 yrs) (average 9-10 hrs)
  - School-aged children (6-12 yrs) (average 9-10 hrs)
  - Adolescents (12-18 yrs) (average 7-7 ½ hrs)
    - *Recommended 9-9.25 hrs per night
Insufficient Sleep

- Mood disturbance
- Fatigue
- Daytime behavior problems (over activity, impulsive)
- Cognitive impairment
- Risk taking behaviors
- Academic problems
- Need for stimulant medications
Causes of Insufficient Sleep

* Academic & extracurricular activities (delay bedtimes)
* Social activities
* Early school start times
* The Electronic Sandman (TV, iPad, cell phones, laptops) provide stimulation and enough light exposure to suppress the normal evening surge of melatonin resulting in delayed onset of sleep
* Sleep Disorders
Occurrence of repetitive episodes of complete or partial upper airway obstruction during sleep, usually occurring in association with loud snoring and daytime sleepiness.

Apnea: (Adult) complete cessation of airflow for at least 10 seconds w & w/o oxygen desaturation.

Apnea: (children) complete cessation of airflow differs - based on baseline respiratory rate.
Obstructive sleep apnea (OSA) affects ~3% of the pediatric population.

Population studies show a 2-4 fold increase in snoring in obese children (Chest, 2004).

Obese children aged 2 to 18 years have a 4-5 fold increased risk of sleep disordered breathing compared to their normal weight peers.
Risk Factors for OSA

- Upper airway obstruction
  - Enlarged tonsils & adenoids (most common cause)
  - Allergies
  - Craniofacial abnormalities
  - GERD
  - Nasal septal deviation
  - Obesity
  - Cleft palate
  - Chronic nasal obstruction & mouth breathing
Risk Factors for OSA

- Upper Airway Reduced Muscle Tone (floppy airway)
  - Neuromuscular disease
  - Hypothyroidism
High risk patients for OSA

- Achondroplasia
- Down syndrome
- Prader-Willi syndrome
- Sickle cell disease
10% of children with OSA were obese
50%-60% of obese children undergoing sleep studies had OSA
55% of morbidly obese children undergoing bariatric surgery had evidence of OSA
Population–based study of 399 children ages 2-18 yrs found that obesity was the most significant risk factor for OSA. (Arens and Muzumdar, 2010)
The severity of OSA parallels the severity of obesity
Most children with OSA are of normal weight
Studies show significant correlation between weight and sleep disordered breathing (including snoring, OSA and central apnea)
Adipose tissue in the throat, neck, chest wall and abdomen create increased upper airway resistance, worsen gas exchange, increase work of breathing
Highest risk in supine position and REM
Overweight & obese children are at high risk for metabolic and cardiovascular complications of OSA (insulin resistance and systemic hypertension)

- **Hormone imbalance**
- **When sleep deprived, our body makes more ghrelin and less leptin**

**Leptin**
- Adipose tissue derived hormone that is responsible for the sense of satiety
- It makes us feel full so we stop eating
- Also a potent respiratory stimulant – decreased activity leads to reduced responses to hypercapnia and reduced ventilatory drive

**Ghrelin** - Hormone that stimulates hunger
Pathophysiology of OSA in Obese Children

- Anatomic factors
  - Adenotonsillar hypertrophy
  - 50% of obese kids still have residual OSA
  - Large tongue, fat pads in soft palate and pharyngeal walls
- Functional factors
  - Increased airway collapsibility
- Chest wall mechanics
  - Increased weight on chest wall and reduced lung compliance
  - Reduced residual capacity from abdominal visceral fat
- Ventilatory drive
  - Unclear, but in adults, ventilatory instability and decreased ventilatory response to hypoxia and hypercarbia (Arens and Muzumdar)
Symptoms of OSA

- **Nocturnal Symptoms**
  - Frequent loud snoring
  - Observed breathing pauses
  - Restless sleep
  - Night sweats
  - Chronic mouth breathing

- **Daytime Symptoms**
  - Morning headaches
  - Mouth breathing
  - Difficulty swallowing
  - Poor appetite
  - Hyponasal speech
  - Excessive sleepiness
  - Mood changes
  - ADHD like behaviors
  - Learning difficulty
Sleep-Disordered Breathing and Obstructive Sleep Apnea

http://on.aol.com/video/what-causes-your-child-to-snore--517514416
Diagnosing OSA

- Polysomnography “overnight sleep study” is The Gold Standard
- Performed in an accredited sleep lab
- Provides important baseline information for children with additional risk factors (OSA is not completely resolved with T&A) – obesity
Diagnosing OSA
Established in 2006
6 beds
7 nights/week
Located at CMS
Cost = $5,000 per study
Treatment for OSA

- **Surgery**
  - Tonsillectomy, adenoidectomy, turbinate reduction, cleft repair, flaps, tracheostomy

- **Lifestyle modification**
  - Weight reduction

- **Oral appliances**
  - Maxillary expanders

- **CPAP/BiPAP**

- **Supplemental oxygen**
Removal of both the tonsils & adenoids is more effective than either alone

T&A: 70-90% of uncomplicated cases results in complete resolution of symptoms

50% of obese children have residual OSA s/p T&A
Losing 10% of body weight can decrease symptoms of OSA by 30%
Dietary modifications
Increased physical activity
Decrease screen time
Bariatric surgery?
Treatment for OSA

- If T&A unsuccessful or with underlying conditions - **obesity**, craniofacial anomalies, neuromuscular disease
- Continuous positive airway pressure (CPAP)
  - Positive pressure is generated by a blower attached to a mask
- BiPAP delivers inspiratory and expiratory air pressure
Treatment for OSA (CPAP)
OSA & Athletes – High School FB players

- In August 2013, the American Academy of Sleep Medicine released a statement advising that offensive and defensive lineman are at increased risk of OSA because of heavier weights and thicker necks.
- Adolescent males may be classified as overweight or obese.
  - Despite being physically fit.
- Recent study shows 1 in 5 lineman were morbidly obese.
  - Only 8% of lineman were of a healthy weight.
OSA & Athletes – High School FB players

2013

- High school linemen
  - Average height: 6’2”
  - Average weight: 270 lbs
  - BMI = 34.7kg/m²

2001

- High school linemen
  - Average height: 6’
  - Average weight: 190 lbs
  - BMI = 25.8kg/m²
In 2009, Mayo clinic did a study on 169 retired NFL players
60% of lineman had OSA
Average age: 54 years
Average BMI: 34kg/m²

In 2012, another study of NFL players suggested that the overall increased body size may increase the risk of OSA

Wide receiver Percy Harvin, not overweight, has OSA and uses CPAP
OSA & Athletes
Narcolepsy

- Chronic lifelong central nervous system disorder (dysfunction of hypocretin/orexin neuropeptide system in the hypothalamus)
  - Typically presents in adolescence and early adulthood
  - Profound daytime sleepiness
  - Significant functional impairment
Common Symptoms of Narcolepsy

- Excessive daytime sleepiness (sleep attack)
- Sleep paralysis
- Sleep onset and offset hallucinations
- Disrupted night time sleep
- Cataplexy – sudden, brief loss of muscle tone
- Inattentiveness
- Irritable
- Weight gain
Several studies suggest kids with narcolepsy are more likely to be overweight or obese...increasing risk of OSA further compromising daytime function

- More likely to have abnormal eating behaviors like bingeing
- Hypothalamic dysfunction and lack of hypocretin (orexin) may effect hunger and satiety
- Decreased physical activity due to sleepiness
Narcolepsy & The Famous
References

Thank You!

Questions?