Sleep Apnea: Diagnosis & Treatment

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Sleep Apnea

Sleep Apnea is
- Common
- Dangerous
- Easily recognized
- Treatable

Types of Sleep Disordered Breathing
- Apnea
  - Cessation of airflow ≥ 10 seconds
- Hypopnea
  - Decreased airflow ≥ 10 seconds associated with either:
    - Arousal
    - Oxyhemoglobin desaturation

Apnea Patterns

<table>
<thead>
<tr>
<th>Airflow</th>
<th>Obstructive</th>
<th>Mixed</th>
<th>Central</th>
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<tbody>
<tr>
<td>Respiratory effort</td>
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Central Sleep Apnea
- Central Alveolar Hypoventilation
- High-Altitude Periodic Breathing
- Cheyne-Stokes Ventilation
  - Congestive Heart Failure (CHF)
  - 40% of those with LVEF < 40%
  - Causes sleep fragmentation and hypoxemia
  - Treatment: CHF tx, oxygen, theophylline, acetazolamide, Positive Airway Pressure, Adaptive Servoventilation

Obstructive Sleep Apnea is
- A disorder of sleep and breathing due to repetitive collapse of the upper airway
- Causes
  - Awake symptoms
  - Impaired performance
  - Cardiovascular complications

Prevalence of Obstructive Sleep Apnea
- Chart showing prevalence of Obstructive Sleep Apnea among 30-60 year olds
- Male, Female, U.S. Pop
- AHI > 5 SAS Asthma
- Percent of Population

Obesity Trends* Among U.S. Adults
- (*BMI ≥ 30, or about 30 lbs. overweight for 5'4" person)
- 1990
- 1999
- 2009
- Source: Behavioral Risk Factor Surveillance System, CDC

Pathophysiology of Apnea
- Diagram showing the pathophysiology of sleep apnea
- Awake: Small airway + neuromuscular compensation
- Loss of neuromuscular compensation
- Decreased pharyngeal muscle activity
- Airway collapses
- Apnea
- Hypoxia & Hypercapnia
- Increased ventilatory effort
- Hyperventilate: correct hypoxia & hypercapnia
- Airway opens
- Pharyngeal muscle activity restored
- Arousal from sleep
Clinical Consequences

Sleep Apnea

Sleep fragmentation, Hypoxia/Hypercapnia
Excessive daytime sleepiness
Cardiovascular Complications
Mortality

Consequences
Excessive Daytime Sleepiness
- Increased motor vehicle crashes
- Increased work-related accidents
- Poor job performance
- Decreased quality of life

Cardiovascular
- Systemic hypertension
- Cardiac arrhythmias
- Myocardial ischemia
- Cerebrovascular disease
- Pulmonary Hypertension/cor pulmonale

Consequences: Mortality
18 Year Follow-up: All Cause Mortality
No CPAP Treatment

N = 1396
Adjusted for age, BMI, Htn, CV disease
Young et al. Sleep 2008;31:1071

Consequences: Hypertension

Prospective Study of Association Between OSA and Hypertension

Sleep Apnea Risk Factors
- Obesity
- Increasing age
- Male gender
- Anatomic abnormalities of upper airway
- Family history
- Alcohol or sedative use
- Smoking
- Associated conditions
Risk Factor: Obesity

Adapted from Davies RJ et al. Eur Respir J 1990;3

Risk Factor: Age & Gender

Adapted from Young T et al. N Engl J Med 1993;328

Risk Factor: Menopause

Odds Ratios:
- AHI ≥ 5/hr
  - Peri: 1.2 (0.7, 2.2)
  - Post: 2.6 (1.4, 4.8)
- AHI ≥ 15/hr
  - Peri: 1.1 (0.5, 2.2)
  - Post: 3.5 (1.4, 8.8)

Adapted from Young T, et al, Am J Respir Crit Care Med 2003; 167:1183

Evaluation for OSA

- Routine Health Maintenance Exam (PCP)
- PI Compliance of Symptoms (CPAP/PPS)
- High Risk Screenings (CPAP)
- Sleep Evaluation (PSG)
- Evaluate for Other Sleep Disorders


Routine Health Maintenance Evaluations

- Screening questions about OSA
  - Is the patient obese?
  - Is the patient retrognathic?
  - Does the patient complain of daytime sleepiness?
  - Does the patient snore?
  - Does the patient have hypertension?
  - A positive response to any of these questions should trigger a comprehensive sleep evaluation


Diagnosis: History

- Snoring (loud, chronic)
- Nocturnal gasping and choking
  - Ask bed partner (witnessed apneas)
- Automobile or work related accidents
- Personality changes or cognitive problems
- Risk factors
- Excessive daytime sleepiness

Sleep Apnea: Is Your Patient at Risk? NIH Publication, No 95-3803
**Diagnosis: Assessing Daytime Sleepiness**

- Often unrecognized by patient
- Ask family members
- Must ask specific questions
  - Fatigue vs. sleepiness
  - Auto crashes or near misses
  - Sleep in inappropriate settings
    - Work
    - Social situations

**Diagnosis: Physical Examination**

- Upper body obesity / thick neck
  - ≥ 17” males
  - ≥ 16” females
- Hypertension
- Obvious airway abnormality

**Physical Examination**

**Case History: MVA victim**

- History
  - “Passed out” while driving
  - Doesn’t remember what happened in car but was sleepy on drive prior to accident
  - Falls asleep frequently at work & movies
  - Wife won’t sleep in same room due to snoring
- Exam
  - BP 160/95, 5'10”, 270 lbs, BMI = 38.7,
  - 18” neck circumference
  - Crowded oropharynx
- What should be done next?

**MVA Victim: Next step?**

- Electrophysiologic study
- Sleep deprived EEG
- Overnight sleep study
- 24 hour Holter monitor
- Brain MRI

**Answer: Overnight Sleep Study**

- Most likely etiology
- Document presence and severity
  - Signs and symptoms poorly predict disease severity
  - Appropriate therapy dependent on severity
- Other causes of daytime sleepiness
Testing Options

- In-laboratory full night polysomnography
- Split night studies
- Home diagnostic systems
  - Oximetry to full polysomnography

In-Lab Polysomnogram

Limited Channel Test

Limited Channel Tests

- Advantages
  - Don’t require stay in sleep laboratory
  - Accurate for moderate to severe OSA
  - May cost less
- Disadvantages
  - Reliability unknown in patients with other medical comorbidities
  - Can’t detect other sleep disorders
  - Higher failure rate
  - Don’t know who takes test with most devices

Therapeutic Approach

- Behavioral
- Medical
- Surgical

Behavioral Interventions

- Encourage patients to:
  - Lose weight
  - Avoid alcohol and sedatives
  - Avoid sleep deprivation
  - Avoid supine sleep position
  - Stop smoking
Weight Loss and Sleep Apnea

Mean Change in AHI, Events/hr

-20 to -10 to -5% to +5 to +10% to +20

Change in Body Weight

Adapted from Peppard PE et al. JAMA 2000;284.

Medical Interventions
- Positive airway pressure
- Continuous (CPAP)
- Bilevel PAP
- Automatic titration PAP (AutoPAP)
- Oral appliances
- Expiratory resistance valves
- Other (limited role)
  - Medications
  - Oxygen

Positive Airway Pressure

Benefits of CPAP: Mortality
Observational Trial of Long-term Cardiovascular Outcomes from OSA

CPAP Benefits: Blood Pressure
Effect of Therapeutic vs. Subtherapeutic CPAP on BP

Benefits of CPAP: Performance

Obstacles hit in 30 min.

Before CPAP (n=6)  After CPAP (n=6)  No Apnea (n=12)

CPAP Compliance
- Patient report: 75%
- Objectively measured use
  - ≥ 4 hrs for ≥ 5 nights/week: 46%
- Maintenance programs improve compliance
  - Intensive compliance programs: 65-80%

CPAP Compliance
- Emphasis shifting from diagnosis to management
- CMS: By 3 months patient must
  - Show objective evidence of compliance
    - > 4 hrs/night for 70% of nights
  - Show subjective improvement
    - Eval by MD between 31-90 days from start
  - 3rd party payers have adopted same standard
  - Compliance monitoring and management needs to be part of any OSA treatment program

Oral Appliances
- Indications
  - Snoring and apnea (not severe)
- Efficacy
  - Variable
- Side effects
  - TMJ discomfort, dental misalignment, and salivation

Oral Appliance: Mechanics

Expiratory Resistance Valves
- Mild-moderate OSA
- Variable efficacy

Surgical Alternatives
- Bypass upper airway
- Tracheostomy
- Reconstruct upper airway
Surgical Alternatives
- Reconstruct upper airway
- Nasal operation
- Tonsillectomy
- Uvulopalatopharyngoplasty (UPPP)
- Laser-assisted uvulopalatopharyngoplasty (LAUP)
- Radiofrequency tissue volume reduction
- Palatal implants
- Genioglossal advancement
- Maxillomandibular advancement

Staged Surgical Procedures

Case: Persistent Sleepiness
- 47 yo male diagnosed with moderate OSA and treated with CPAP
- After 3 months on CPAP c/o continued daytime sleepiness
  - Reports sleeping 8 hrs/night
  - No change in weight
  - Still sleepy while driving
- What should you do next?

Answer: Check CPAP Compliance
- Reasons for lack of improvement
  - Noncompliance
  - Poor sleep habits
  - Alcohol and sedative use
  - Depression
  - Weight gain
  - Nonapneic sleep disorder
- Persistent or recurrent symptoms
  - Consider referral to sleep specialist

Case: Persistent Sleepiness
- Send for surgical evaluation
- Send for oral appliance
- Send for bariatric surgery
- Check CPAP compliance
- Start on modafinil (Provigil)
PAP Compliance Monitoring

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References