Advanced Treatments for Obstructive Sleep Apnea

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What We’ll Cover

• What is OSA?
  – Causes
• Signs/symptoms of sleep apnea
• Health risks
• Latest approaches to treatment
What is Sleep Apnea?

• Pliable or disproportionately large structures in upper airway collapse when airway dilators lose tone (waking input).

• Partial collapse causes reduction ("hypopnea") in airflow.

• Complete collapse causes cessation ("apnea") of airflow.

• Hypoxia (↓O2) and hypercapnia (↑CO2) prompt brief arousals during which recovery breathing occurs.

• Sleep architecture is disrupted and physiologic stress is increased, leading to daytime neurocognitive impairment and elevated cardiovascular risk.
Show Me!
Normal Breathing

- Mouth closed
- Tongue in normal forward position
- Airway clear
- Breathing through the nose

Obstructed Breathing

- Mouth open
- Tongue collapsed in throat
- Airway blocked
- Breathing through the nose and mouth
**Signs/Symptoms**

- Snoring, witnessed apneas, gasps for breath
- Daytime sleepiness, unrefreshing sleep
  - Increased risk of motor vehicle accidents, work problems
- Morning headaches
- Memory/concentration; ADHD (children)
- Frequent nocturia (urination at night)
  - Not ALWAYS the prostate!
Friedman Scale

Fig 1. Friedman Palate Position 1 allows visualization of the entire uvula and tonsils

Fig 2. Friedman Palate Position 2 allows visualization of the uvula but not the tonsils

Fig 3. Friedman Palate Position 3 allows visualization of the soft palate but not the uvula

Fig 4. Friedman Palate Position 4 allows visualization of the hard palate only
High-Arched Hard Palate

- Crowds oral airway and forces tongue backwards
- Impedes Nasal Airflow, leads to open mouth breathing and retropositioning of the tongue
The Association of Tongue Scalloping With Obstructive Sleep Apnea and Related Sleep Pathology

Todd M. Weiss, MD, Strahil Atanasov, MD, and Karen H. Calhoun, MD, FACS, Springfield, Illinois; Galveston, Texas; and Columbia, Missouri

Otolaryngology–Head and Neck Surgery (2005) 133, 966-971
Retrognathia: backward positioning of the mandible
# Neck Circumference and Pretest Probability of OSA

<table>
<thead>
<tr>
<th>Neck Circumference</th>
<th>% with OSA</th>
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<tbody>
<tr>
<td><strong>Men</strong></td>
<td></td>
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<tr>
<td>17 inches</td>
<td>31%</td>
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<tr>
<td><strong>Women</strong></td>
<td></td>
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<tr>
<td>15 inches</td>
<td>14%</td>
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Young et al. NEJM 329:1429
Obstructive Sleep Apnea

- Moderate or severe OSA in ~6% of adults in the US population
- Prevalence increasing with obesity epidemic
- Daytime impairment symptoms are common complaints
- Significant link to medical disease
Medical Comorbidities

• Hypertension (esp: Refractory HTN)
• Heart disease (CAD/CHF/arrhythmia)
• Stroke
• Nocturnal GERD
• Glaucoma
• Obesity, Metabolic syndrome
• Type 2 DM
• Depression/anxiety
• Insomnia
• Fibromyalgia
• Dementia
• ADHD
The AHI is the most common metric to predict future risk from OSA

• Apnea-Hypopnea Index (AHI)
  - Number of Apneas & Hypopneas per hour of sleep
  - AHI ≥ 5 is considered abnormal if CV risk factors or daytime impairment symptoms are present. BP’s tend to be higher, associated with “non-dipping status”
  - AHI ≥ 15 — mortality risk may be increased
  - AHI ≥ 30 is strongly associated with increased mortality
The Wisconsin Sleep Cohort (2008)

• 1522 patients collected from a community-based sample underwent polysomnography

• 18-year follow up

• Compared mortality rates for no OSA (AHI<5), mild OSA (AHI 5-14), moderate OSA (AHI 15-29) and severe OSA (AHI≥30)
WSC: Risk of death tracks with the AHI

These three groups numerically began to separate, but statistically were still similar.

For AHI > 30, a significant mortality increase was seen.

Important: Increased mortality was noted in sleepy and nonsleepy patients!
Oxygen Desaturation and Apnea Associated Arrhythmias

• Degree and frequency of oxygen desaturation
  – Intermittent hypoxia is linked to production of inflammatory mediators, which lead to endothelial damage as well as sleepiness
  – May be additive to other risk factors, e.g., pre-existing coronary disease

• Apnea associated arrhythmias
1st Need to Diagnose

Home sleep apnea test (HSAT)
- Basic diagnostic test
- Allows scoring of respiratory events only (does not stage sleep)
- Good positive predictive value (high specificity)
- High false negative rate (upwards of 24%)

Polysomnogram (PSG)
- Gold standard
- Mixed/central sleep apnea
- Hypoventilation
- Parasomnias
- Only way to “rule out” sleep apnea
Treatment Options for OSA

• Positive airway pressure therapy
• Oral Appliance Therapy
• Surgery:
  – Nasal, oropharyngeal, maxillofacial
  – Hypoglossal Nerve Stimulation Therapy ("INSPIRE")
• Airway strengthening exercises
• Weight Loss
• Positional Therapy
CPAP-What It’s Not
How Positive Airway Pressure Therapy Works to Open the Airway

- Positive pressure is delivered via one of many interfaces (“masks”)
- Helps keep posterior airspace open during sleep
- Works in all sleeping positions
- Most effective noninvasive way to lower the AHI
Again, No!
Oral Appliance Therapy

• Repositioning the lower jaw
  – Stabilizing the lower jaw and tongue
  – Increasing the muscle tone of the tongue

• Advantages: convenient, portable

• Disadvantages:
  – Less effective than PAP to lower AHI
  – May induce dental/TMJ side effects
  – Expensive
  – Treatment may take months
  – Typically requires patient to avoid supine sleep to be optimally effective

• Predictors for success:
  – Non-obese
  – Milder OSA
  – Retrognathia
  – Patient able to tolerate non-supine sleep
  – Functional nasal airspace
Hypoglossal Nerve Stimulation
“INSPIRE” device

- Device implanted like a pacemaker
- Turned on during sleep
- Stimulates distal hypoglossal nerve, which allows airway dilation
An Inspired Candidate

• Must meet the following criteria:
  – Moderate to Severe OSA (AHI 15-65); with less than 25% centrals
  – Not significantly overweight (BMI < 33)
  – Unsuccessful with CPAP/BPAP
  – 22 years or older
  – Not pregnant or expecting to get pregnant during the process of receiving/titrating device
  – No current need for MRI
Other Surgical Treatment

• Nasal reconstruction (septal repair, turbinate reduction)
  – Mild OSA

• Oropharyngeal Soft Tissue Surgery:
  – Tonsillectomy & Adenoidectomy
    • May be first line therapy for pediatric OSA
  – Uvulo/palatal pharyngeoplasty (UPPP)
  – Base of tongue reduction/lingual tonsil resection

• Maxillofacial surgery
  – Genioglossus advancement-hyoid myotomy and suspension (GAHMS)
  – Bi-Maxillary advancement or Maxillary and Mandibular osteotomy (MMO)
Other Considerations

• Weight Loss
  – Usually improves the problem, but most often does not cure it
  – Can possibly decrease pressure requirement, which can improve tolerability
  – Bariatric surgery can improve OSA, but typically does not cure it.

• Positional Therapy--Get off your back!
  – Only effective in “supine predominant” OSA
“And now for something completely different”
Airway Strengthening

• Didgeridoo Practice Therapy\(^1\)
  – One RCT showed 50% reduction in AHI with 4 months of practice
  – Circular breathing\(^*\)

• “Singing for Snorers”
  – Reduced snoring frequency and improved Epworth Scores

• Myofunctional therapy

Special thank you to:

David McCarty, MD
Medical Director
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