Sleep Apnea Update

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Prevalence

- The prevalence of significant sleep apnea is about 5%
- Incidence is about 2% per year for AHI > 15


The Cleveland Family Study


- Factors associated with sleep disordered breathing
  - Age
  - Gender
  - BMI
  - Waist-Hip Ratio
  - Serum Cholesterol

Gender Hormonal Effects

The risk for OSA is 3 times greater in post-menopause women

The effects of gender and BMI are affected by aging

After the age of 50, gender is no longer felt to be an important variable

After the age of 60, BMI is no longer felt to be an important variable

History in OSA

- Snoring, choking, gasping
- Sleepiness
- Witnessed apneas
- Family history
- Erectile dysfunction
- Mood
- Memory attention problems

The Epworth Sleepiness Scale

*How likely are you to doze off or fall asleep in the following situations (0-3 scale):*

- Sitting and reading
- Watching TV
- Sitting, inactive, in a public place
- As a passenger in a car for an hour
- Lying down in the afternoon
- Sitting and talking to someone
- Sitting quietly after a lunch without alcohol
- In a car, while stopped for a few minutes in traffic

Physical Findings in OSA

- Obesity is one of the best predictors of OSA
  - 40% of those with BMI > 40
  - 50% of those with BMI > 50
- Neck circumference is a surrogate for central obesity
  - > 17 inches for men; > 16 inches for women
- Hypertension
  - Loss of morning dip in BP
- Narrowed airway
Testing

- In lab polysomnography
- Home sleep apnea testing
  - Best validated for those considered at high risk for moderate to severe obstructive sleep apnea
  - Not all home sleep tests are created equal

Apnea Hypopnea Index

<table>
<thead>
<tr>
<th>Apnea Hypopnea Index</th>
<th>Total Apneas + Total Hypopneas</th>
<th>Total Sleep Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>AHI ≥ 5 events/hr</td>
<td>mild</td>
<td></td>
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<tr>
<td>AHI ≥ 15 events/hr</td>
<td>moderate</td>
<td></td>
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<tr>
<td>AHI ≥ 30 events/hr</td>
<td>severe</td>
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Sequelae in OSA

The effects of sleep-disordered breathing include:

- Daytime sleepiness
- Neuro-cognitive impairment (memory loss)
- Impaired quality of life
- Metabolic effects
- Cardiovascular effects
Loss of Vigilance

<table>
<thead>
<tr>
<th>Car Accidents in SDB (n=913)</th>
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<tbody>
<tr>
<td>Accidents</td>
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<tr>
<td>Population</td>
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OSA and Metabolic Dysfunction

- OSA is associated with glucose intolerance and insulin resistance, independent of potential confounders.
- OSA is an independent risk factor for the metabolic syndrome.
  - Hypoxemia may be the predisposing factor to the metabolic alterations associated with OSA.
- CPAP improves insulin sensitivity in some patients with OSA.

Cardiovascular Outcomes associated with OSA

- Systemic hypertension
- Pulmonary hypertension (only with sustained hypoxemia)
- Nocturnal arrhythmias
- Coronary artery disease
- Congestive heart failure
- TIA/stroke
- Death

Wisconsin Sleep Cohort Study


Peppard et al. NEJM 2000
Recurrence of Atrial Fibrillation after Cardioversion is higher in patients with untreated OSA.

Kanagala et al. Circ. 2003. *p < 0.009 compared to controls
**p < 0.013 compared to treated OSA

Stroke and Death

![Image of Kaplan-Meier survival curve]

Yaggi, HK NEJM. 2005.

Treatment for OSA

- Weight loss
- Therapy for nasal congestion (allergic rhinitis)
- Lateral decubitus sleeping position
- Avoidance of alcohol
- Smoking cessation
- Avoidance of muscle relaxants
- Avoidance of sleep deprivation
Medical Therapies for OSA: Conclusions

There are NO medical therapies that are indicated as primary treatment for OSAS.

Collapsed Airway in Obstructive Sleep Apnea

- Definition of compliance
  - > 4 hours/night on 70% of nights

- Compliance probably about 50 - 60%
  - Patients overestimate nightly use

- Compliance patterns are determined early

- Few clear predictors of compliance:
  - Daytime sleepiness
  - More severe disease

Airway with CPAP

Compliance With CPAP
**CPAP: Complications**

- Rhinorrhea
- Nasal congestion or dryness
- Epistaxis
- Skin abrasions/rashes
- Chest discomfort
- Claustrophobia
- Air swallowing
- Inconvenient
- “Not sexy”

**Mandibular Repositioning Appliances**

**Oral Appliances**

- Compared to CPAP:
  - Are not as effective for reducing AHI
  - Equal reductions in subjective sleepiness
  - Preferred to CPAP in head-to-head trials
  - Outperform surgery only in head-to-head trials
  - Optimal appliance not clear
  - No clear predictors of efficacy
  - Post-fit PSG needed to prove efficacy

**Current Guidelines**

- CPAP is better at reducing AHI
- First line alternative for those with mild to moderate OSA
- Second line option for those with severe OSA
Practical Considerations for Prescribing Oral Appliances

- Mild to moderate OSA (AHI 5-30)
- Preference for OAs over CPAP
- Retrognathia/Micrognathia
- Positional OSA
- CPAP intolerance with more severe disease
- Cost Variable: $750 to $3000

Surgical Options for Obstructive Sleep Apnea

Eugene Chio, MD
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Director, Division of Sleep Surgery
Department of Otolaryngology – Head & Neck Surgery
The Ohio State University Wexner Medical Center

OSAHS

- Estimated to affect 12-20 (2-4%) million Americans
- >2:1 Male:Female ratio
  - 1:1 after menopause
- Progressive disorder that can worsen over time

Cardiovascular risks in OSA

Pack, AI. Am J Respir Crit Care Med. 2006
### Treatment options

- Behavioral Modifications
  - Sleep positional therapy
  - Weight loss
  - Avoidance of sedatives/alcohol before bedtime
- May improve or eliminate OSA
- Not likely to cure someone with moderate to severe OSA

### Treatment Options

- **PAP**
  - Cpap or BiPap
  - Gold standard of therapy
  - Compliance is a problem
    - 30-80% compliance rates
  - Oral appliances
    - Allows for mandible to be positioned in a neutral or forward position
    - Prevents prolapse of tongue and hypopharynx
    - Not good option for pts w/ TMJ issues or edentulous pts

- **Surgery to improve PAP use**
  - Septo/turb/polyps
  - Adenotonsillectomy
- **Non-upper airway surgery**
  - Tracheostomy
  - Bariatric surgery (BMI>40 or >35 with medical comorbidities)
- **Upper airway surgery**
  - Nasal, palatal, hypopharyngeal

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**CPAP**

![Image of CPAP mask](https://via.placeholder.com/150)

Author: Zborski (CC BY-SA 3.0)
Surgery for OSAHS

- Nasal surgery
  - Turbinate reduction/turbinectomy
  - Septoplasty
  - Nasal valve repair
- Pharyngeal surgery
  - Adenotonsillectomy
  - UPPP, ESP, ZPPP
  - Palatal stiffening (Pillar implants, RF somnoplasty)
- Tongue base/Hypopharyngeal surgery
  - Suspension techniques
    - Genioglossus advancement, hyoid / tongue base suspensions
  - Tongue base reductions
    - RFBOT, partial glossectomy, TORS
  - Hypoglossal nerve stimulator

Septoplasty

Before Surgery

After Surgery

Grade 1 inferior turbinate, with a mild septal deviation.

Grade 2 inferior turbinate, mild septal deviation.

Grade 4 inferior turbinate enlargement, straight septum.

Grade 3 inferior turbinate, small septal spur.

Images Courtesy of Sleep Apnea Surgery Center - Kasey Li, MD
<table>
<thead>
<tr>
<th>Recovery from nasal surgery</th>
<th>Nasal surgery</th>
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<tbody>
<tr>
<td>• Nasal soreness for 1-2 weeks</td>
<td>• Nasal surgery has not, by itself, been shown to decrease sleep apnea any significant amount</td>
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<tr>
<td>• Oozing or drainage for the first week</td>
<td>• Usually done in conjunction with other upper airway procedures to either maximize airway or to increase comfort of CPAP use</td>
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<tr>
<td>• Nasal congestion for 1-2 weeks</td>
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<tr>
<td>• No nose blowing for 2-3 weeks</td>
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<table>
<thead>
<tr>
<th>Palatal Surgical Options</th>
<th>UPPP</th>
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<tr>
<td>• Uvulopalatopharyngoplasty (UPPP, UP3)</td>
<td>• Good results in reduction of snoring</td>
</tr>
<tr>
<td>• Expansion sphincter pharyngoplasty (ESP)</td>
<td>• Unpredictable results for curing apnea</td>
</tr>
<tr>
<td></td>
<td>• 20-25% successful in unselected OSA pts</td>
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<tr>
<td></td>
<td>• 50-60% successful in selected pts</td>
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Pt selection for UPPP

- Theoretically pts with collapse at the level of the velopharynx should respond well to UPPP
- Identification of site of collapse has been difficult
- Even pts with collapse at velopharynx have had poor response to UPPP

Physical exam findings

- Size of tonsils
- Length of uvula
- Friedman tongue position (modified Mallampati)

Tonsil and uvular size

![Tonsil and uvular size images](Dental Press J. Orthod. vol.16 no.1 Maringá Jan./Feb. 2011 (CC BY-NC-SA 4.0))

Friedman tongue position

![Friedman tongue position images](Dental Press J. Orthod. vol.16 no.1 Maringá Jan./Feb. 2011 (CC BY-NC-SA 4.0))
**UPPP surgical technique**

Author: DrCamachoent (CC BY-SA 3.0)

View of the throat 8 years following uvulopalatopharyngoplasty.

Author: Dmd3eorg (CC BY-SA 3.0)

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**Expansion Sphincter Pharyngoplasty**

Expansion sphincter pharyngoplasty: A new technique for the treatment of obstructive sleep apnea

Kenny P. Pang, FRCS(Ed), and B. Tucker Woodson, MD, Republic of Singapore; and Milwaukee, WI

- Aimed at addressing lateral pharyngeal wall collapse seen on Mueller maneuver

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**ESP technique**

Author: Lusb (CC BY 3.0)

**ESP technique**

Author: Lusb (CC BY 3.0)
Recovery from palatal surgery

- Sore throat x 2-3 weeks
- Soft/liquid diet
- Off of work/school for approx 1 week
- Slight risk of bleeding (3-5%), most commonly 5-7 days after surgery

Tongue base procedures

- Reposition tissue
  - Hyoid myotomy and suspension
  - Tongue base suspension
- Reducing tissue
  - Radiofrequency (RF)
  - Lingual tonsillectomy
  - Midline partial glossectomy

Hyoid and tongue base suspension

Image courtesy of www.sleep-apnea-guide.com

Tongue suspension procedure

Image and video used with permission from Siesta Medical, Inc
Hypoglossal nerve stimulation

- The hypoglossal nerve (CN XII) is responsible for tongue movement (protrusion, retraction, rolling, side to side)
- During sleep, muscle tone decreases and the tongue can prolapse into the throat and block off the lower airway
- Theoretically, stimulation of the tongue to protrude should open up the airway

Inspire® upper airway stimulation

Images courtesy of Inspire Medical Systems, Inc.

Results

- Nonrandomized study, 126 pts
- AHI at 12 mo decreased 68%, from 29.3 to 9.0
- ODI decrease of 70% from 25.4 to 7.4

Current inclusion criteria for Inspire

- AHI between 20-65/hr
- BMI under 32kg/m²
- Absence of complete concentric collapse at the level of soft palate on drug induced sleep apnea (DISE)
Inspire. at Ohio State

- Currently approved at OSU for a limited run
- Plan on being the first center in central Ohio to perform the implant
- Less than 40 surgeons currently trained nationwide to perform this procedure
- First dynamic (not static) therapy for tongue base repositioning