Outline

- Background information
- History
- Physical exam
- Diagnostic modalities
- Surgical management
  - Types of procedures
  - Protocol for best outcome

Mr. Pickwick from “The Pickwick Papers” by Charles Dickens
Background Information

Sleep disordered breathing

- Primary snoring
- Upper airway resistance syndrome (UARS)
  - Frequent nighttime awakenings
  - Daytime sleepiness
- Obstructive sleep apnea syndrome (OSAS)
  - Nocturnal episodes of apnea and oxygen desaturation
  - Daytime sleepiness
- Obesity hypoventilation syndrome (Pickwickian)
  - Obese
  - Daytime hypercapnia
  - Sleep disordered breathing
Obstructive sleep apnea facts:
- Affects approximately 18 million Americans
- Up to 70% of cases associated with obesity
- Increased incidence with age
- Increased overall mortality
- 38,000 CV deaths per year related to OSA
- MVA risk up 7x
History

- Daytime sleepiness
- Bedtimes
- Awakening times
- Body position
- Restless sleep
- Alcohol and sedative use
- Caffeine intake
- Mouth breathing
- Morning headaches
- Menopause status

*Input of bed partner/family member is key
Physical Exam

- Body habitus
  - Obesity
  - Achondroplasia
  - Chest wall deformity
  - Marfan’s syndrome

- Nasal obstruction
  - Septum
  - Polyps/tumors
  - Turbinates
  - Adenoids
  - Nasal valve collapse

- Oropharyngeal obstruction
  - Jaw
  - Palate
  - Tongue
  - Tonsils
  - Posterior pharyngeal wall
Physical Exam

- Hypopharyngeal/laryngeal obstruction
  - Epiglottis
  - Lingual tonsil
  - Vocal cords
  - Tumors
  - Müller maneuver

- Neck
  - Size
  - Lymph nodes
  - Thyroid

- Cardiovascular
  - Arterial HTN
  - Peripheral edema
Diagnostic Modalities

- Questionnaires
- Cephalometric analysis
- Polysomnography
Sleep Apnea Questionnaires

- Epworth
- Stanford
- QOL

**EPWORTH SLEEPINESS SCALE**

Please answer the following questions based on this scale:

0. Would never fall asleep
1. Slight chance of dozing
2. Moderate chance of dozing
3. High chance of dozing

<table>
<thead>
<tr>
<th>Situation</th>
<th>Chance of Dozing</th>
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<tbody>
<tr>
<td>Reading</td>
<td></td>
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<tr>
<td>Watching TV</td>
<td></td>
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<tr>
<td>Sitting in a public place (e.g., theater or meeting place)</td>
<td></td>
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<tr>
<td>Driving a car, stopped at a traffic light</td>
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<tr>
<td>As a passenger in a car for an hour without a break</td>
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<tr>
<td>During quiet time after lunch without alcohol</td>
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<tr>
<td>Lying down to rest when circumstances permit</td>
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**Epworth Score < 8 = Normal**

Total Score: __________
Cephalometric Analysis

- Lateral radiographs of face/skull base
- Points plotted to evaluate position of mandible in reference to skull
- Linear and angular measurements
- 6 major relations
- PAS, P, H
Cephalometric Analysis

Normal

Shortened mandible
Elongated soft palate
Decreased airway space
Polysomnography

Measurements
- Pulse ox, EEG, EOG, ECG, EMG, oral/nasal airflow, respiratory effort, limb/body movements

Definitions
- Apnea – lack of ventilation for $\geq 10$ sec with signs of arousal
- Hypopnea – decrease in respiratory movement with a drop in $O_2$ sat or with signs of arousal
- AHI or RDI = (Apneas + Hypopneas)/hours of sleep

Important parameters
- RDI
- Lowest $O_2$ saturation
- Number of desaturations below 90%
- Length of time below 90%
Sleep Disordered Breathing

- Primary snoring
  - RDI < 5
  - No daytime sleepiness
- Upper airway resistance syndrome (UARS)
  - RDI < 5
  - Arousal Index > 5
- Obstructive sleep apnea syndrome (OSAS)
  - RDI > 5
  - O₂ desaturation < 90%
- Obesity hypoventilation syndrome (Pickwickian)
  - BMI >30 kg/m²
  - Daytime hypercapnia w/ PaCO₂ ≥ 45mmHg
  - Sleep disordered breathing
Surgical Indications

- RDI > 15
- RDI > 5 and < 15 with daytime sleepiness
- $O_2$ desaturation < 90%
- Cardiac arrhythmias
- Unsuccessful medical therapy (CPAP)
- Medically stable for surgery
Surgical Management

- Rhinological procedures
- Palatal reduction
- Tongue base suspension/reduction
- Genioglossus advancement
- Hyoid suspension
- Maxillomandibular advancement
- Tracheotomy
Rhinological Procedures

- Increased nasal resistance may increase negative pressure of airway during inspiration
- Septoplasty, turbinate reduction, FESS
- Corrects deviated septum, allergic rhinitis, nasal polyposis, chronic rhinosinusitis
- Considered adjuncts to other procedures/treatments
- Improvement of nasal CPAP compliance
- Clinical usefulness for sleep apnea is controversial
Palatal Reduction

Uvulopharyngopalatoplasty (UPPP)

- Corrects oropharynx obstruction
- Most common procedure
- Trim excess palatal length and uvula
- Often combined with tonsillectomy
- Success rate 40-50% (only 6% if macroglossia present)
- Complication rate of 1.5% nonfatal, 0.2% fatal

* Success = RDI reduction of ≥50% or absolute drop of ≥20
Tongue Base Suspension/Reduction

Suspension
- Sutures attach to screw at inner mandible
- Reduces tongue collapse
- Variable success 20-82%

Reduction
- Tissue reduction from heat generated by radiofrequency
- Multiple office based treatments
- Promising success rate 60-85%
Genioglossus Advancement

- Osteotomy of anterior mandible with advancement and rotation to prevent retraction
- Reduces tongue collapse
- Variable success rate of 23-77%
- Complications of muscle injury, nerve damage
Hyoid Suspension

- Hyoid dissected inferiorly and advanced over thyroid cartilage
- Usually performed in conjunction with GA or UPPP
- Variable success rate of 17-65%
- Requires incision on external neck
- May cause dysphagia
Maxillomandibular Advancement

- Lefort I osteotomy, bilateral ramus osteotomies, anterior inferior mandibular osteotomy
- 10-14 mm advancement ideal but occlusion must be maintained
- Enlarges posterior airway
- Success rate 75-100%
- Alters facial appearance
Tracheotomy

- Indicated for presence of severe, life-threatening OSA
- Only procedure that will consistently show 100% success rates for severe OSA
- Not completely curative for patients with cardiopulmonary decompensation
- Rarely done due to QOL, social stigma issues
Surgical Planning

Which procedure should be done?
Surgical Planning

Levels of obstruction

- Type I – Nasal cavity or nasopharynx
- Type II – Palate/oropharynx
- Type III – Base of tongue/hypopharynx

*Determined by PE and cephalometric analysis*
## Surgical Planning

### Level of severity

<table>
<thead>
<tr>
<th>Level of Severity</th>
<th>RDI</th>
<th>LSAT</th>
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</thead>
<tbody>
<tr>
<td>Mild:</td>
<td>&lt;20</td>
<td>&gt;85</td>
</tr>
<tr>
<td>Moderate:</td>
<td>20-40</td>
<td>&gt;80</td>
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<tr>
<td>Moderate/Severe:</td>
<td>40-60</td>
<td>&gt;70</td>
</tr>
<tr>
<td>Severe:</td>
<td>&lt;60</td>
<td>&lt;70</td>
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Surgical Planning

- Target level or levels of obstruction
- As severity of OSA increases, so should invasiveness/aggressiveness of the procedure
- Patient desires/preferences/goals
- Health status
- Minimize surgical intervention and avoid unnecessary surgery
Stanford Protocol

Prospective study based on protocol developed at Stanford sleep center

- N = 135 for mild/moderate OSA
- N = 42 for severe OSA
- Goal – minimize surgical interventions and avoid unnecessary surgery while achieving a cure
- Success = RDI reduction of ≥50% or absolute drop of ≥20

Groups

- Phase I – Oropharynx – UPPP
  - Oropharynx/hypopharynx - GA+HS+UPPP
  - Hypopharynx - GA+HS
  *HS not performed if intraoperatively patient considered to have achieved adequate enlargement of hypopharynx with GA alone, or if airway edema considered to be likely after GA completed

- Phase II – MMA

Success Rates

- Phase I – Mild/Moderate = 71-78%; Severe = 42%
- Phase II – Those that failed phase I = 100%
Stanford Protocol

To achieve goal of minimal surgical intervention while achieving cure:

- Presurgical evaluation – PE with flexible scope, cephalometric analysis, sleep study
  
  \[ \downarrow \]

- Phase I surgery based on site of obstruction and severity of disease
  
  \[ \downarrow \]

- 6 month postoperative sleep study
  
  \[ \downarrow \]

- Lack of success
  
  \[ \downarrow \]

- Phase II surgery - MMA
Conclusion

- Need for comparison of procedures alone or in combination
- Procedures should be tailored to specific sites of obstruction
- Definition of success should include oxygen desaturation time, number of episodes, lowest value
- Postoperative sleep study important
References