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OSA and Primary Snoring: Palatal Surgery and Office-Based Procedures

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OSA and Primary Snoring: Palatal Surgery and Office-Based Procedures

Adam Vasconcellos, MD
Department of Otolaryngology, Head & Neck Surgery
Thomas Jefferson University Hospital
April 26, 2017
Disclosures

• None
• Case population N = 102 drivers receiving emergency care after accidents
• Control pop n = 152 from primary care centers, matched age/sex
• Mean age 44, men 77%
• AHI 10+ = OR 6.3 of traffic accident
The Science of Sleep

• 1836: Charles Dickens “The Pickwick Papers”

• Late 1800s: Doctors began to lump sleep apnea syndromes together using the term “Pickwickian Syndrome”

• 1960s: multiple reports to suggest that obesity is not essential for sleep related breathing problems
The Science of Sleep

- 1970 – first sleep clinic established at Stanford
- Observed correlation of prolonged pauses (apneas) in sleep with blood pressure rises
- Guilleminault documented reversal of cardiac arrythmias, HTN with tracheostomy
- Defined OSAS and later, AHI
The Science of Sleep

• 1978: Remmers et al: obstruction in apnea commonly at level of soft palate / oropharynx, not the larynx

• 1980: Colin Sullivan applied positive pressure air via nasal passages to a patient with severe OSAS
The Promise of Sleep

- General well-being
- Insulin metabolism
- Cardiovascular health
- Cognitive functioning
The Plan

What I’ll cover:
• OSA and Primary Snoring
• Anatomical Sites of Obstruction
• DISE Interpretation
• Minimally Invasive Techniques for Primary Snoring
• Palatal Surgery for OSA
The Plan

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• Palatal Surgery for OSA

Not for today
• Upper Airway Stimulation
• Extra-Palatal Sites of Intervention
• Kids
• CPAP
The Stats on OSA

• Dx Criteria (ICSD-2):
  • ≥ 5 / hour resp events
    • Apnea, Hypopnea, or RERA
  • Respiratory effort
  • Symptoms

• ≥ 15 / hour resp events
• Respiratory effort
• No symptoms

• Estimated 5-10% of US population
• Higher prevalence:
  • Male gender
  • BMI >30
  • Age 40+
  • Neck circumference >17in male, >14.5in female
• Comorbid Conditions:
  • HTN, smoking, ETOH, anatomic characteristics (i.e. retrognathia, tonsillar hypertrophy), family history
Typical Patient Presentation

- Daytime fatigue
- Waking up at night
- Ultimatum from a bed partner
  - Reports of apnea
  - Snoring
- Can’t deal with this:
Typical Patient Presentation

• Daytime fatigue
• Waking up at night
• Ultimatum from a bed partner
  • Reports of apnea
  • Snoring
• Can’t deal with this:

• CPAP Compliance: 4 hours/night
  5 nights/week
  • Est 50-70% noncompliance
  • Nasal congestion
  • Facial discomfort
  • Air leaks
  • Abdominal bloating
  • Claustrophobia
  • Social

• Many are never referred to us...
Patient Workup

- In-office exam of anatomical sites of obstruction
- Polysomnography (if not already performed)
  - CPAP Trial
- Drug Induced Sleep Endoscopy (DISE)
Anatomical Sites of Obstruction

- Nasal
- Velum
- Oropharynx
- Tonsils
- Tongue Base
- Epiglottis
Anatomical Sites of Obstruction

• Nasal
• Velum
• Oropharynx
• Tonsils
• Tongue Base
• Epiglottis
Anatomical Sites of Obstruction: Velum

Woodson 2015
Anatomical Sites of Obstruction: Oropharynx

Friedman classification: tongue in neutral position
Anatomical Sites of Obstruction: Tonsils

• Classification of Tonsil Size
Modified Friedman staging system

<table>
<thead>
<tr>
<th>Stage</th>
<th>Palate Position</th>
<th>Tonsil Size</th>
<th>BMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1</td>
<td>3, 4</td>
<td>&lt;40</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>3, 4</td>
<td>&lt;40</td>
</tr>
<tr>
<td>II</td>
<td>1, 2</td>
<td>1, 2</td>
<td>&lt;40</td>
</tr>
<tr>
<td></td>
<td>3, 4</td>
<td>3, 4</td>
<td>&lt;40</td>
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<tr>
<td>III</td>
<td>3</td>
<td>0, 1, 2</td>
<td>&lt;40</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>0, 1, 2</td>
<td>&lt;40</td>
</tr>
<tr>
<td>IV</td>
<td>1, 2, 3, 4</td>
<td>0, 1, 2, 3, 4</td>
<td>&gt;40</td>
</tr>
</tbody>
</table>

All patients with significant craniofacial or other anatomic deformities.

BMI = Body Mass Index.

Friedman 2004
Drug Induced Sleep Endoscopy (DISE)

- Assist surgeon to develop **anatomically focused** plan of care
- Anatomical location, severity, pattern of collapse
- Mimics sleep state with real time pulse oximetry
- Not perfect, but it’s the best we have
Drug Induced Sleep Endoscopy (DISE)

- Assist surgeon to develop **anatomically focused** plan of care
- Anatomical location, severity, pattern of collapse
- Mimics sleep state with real time pulse oximetry
- Not perfect, but it’s the best we have

- Identification of airway sites in need of surgery
- Outpatient selection for snoring treatments
- Adjunct during nasal surgery

Kohn 2015
Sedation Goals with DISE (Propofol)

- Patient asleep with steady breathing
- Nonarousable to verbal stimuli
- Arousable to sternal rub
- Snoring and apneas with mild desaturations (pulse O2 > 85%)
Patterns of Collapse

- VOTE scoring: no collapse – complete collapse (0-2)
- Indicate predominate type of collapse
- Subsites: velopharynx, oropharynx, tongue base, epiglottis

Kohn 2015
AP Collapse of Velopharynx
Concentric Collapse of Velopharynx
Lateral Collapse of Oropharynx
<table>
<thead>
<tr>
<th>DISE Finding</th>
<th>OSA Severity</th>
<th>Possible CPAP Alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palatal Flutter or Vibration</td>
<td>UARS, mild, moderate, severe</td>
<td>Palatal stiffening</td>
</tr>
<tr>
<td>Uvula prolapse</td>
<td>UARS, mild, moderate, severe</td>
<td>Partial uvulectomy</td>
</tr>
<tr>
<td>AP partial or total palatal collapse</td>
<td>Moderate-severe</td>
<td>Standard UUPP Inspire</td>
</tr>
<tr>
<td>Circumferential partial/total palatal collapse</td>
<td>Moderate-severe</td>
<td>Expansion pharyngoplasty</td>
</tr>
<tr>
<td>Tonsil Collapse</td>
<td>UARS, mild, moderate-severe</td>
<td>Tonsillectomy Expansion pharyngoplasty Oral appliance</td>
</tr>
</tbody>
</table>
• N = 87 patients with postoperative polysomnogram results
• Preoperative DISE (n=50): 8% multilevel surgery; 86% success* rate
• No preop DISE (n=37): 59.5% multilevel surgery; 51.4% success rate
• Success = 50% reduction from preop AHI; postop AHI < 20

• ESP: concentric collapse velum
• MMA: maxillary constriction
• Inspire: AP velum collapse
• TORS BOT: lingual tons hypertrophy or epiglottic collapse
Office-Based Procedures to Address Snoring
• N = 1643, habitual snorers referred for polysomnography
  • 65% male, mean age 48, mean BMI 30.9
• Snoring intensity (db) increased progressively as AHI increased \( r = -0.66, p < 0.01 \)
Primary Snoring

- Absence of apneas / hypopneas
- Palatal: 80-85%
- Vibration of soft tissues
- Theme of intervention: stiffen the palate
Muscular Anatomy of the Soft Palate

Troell 2000
Pillar Soft Palate Implant

- Primary snoring, mild OSA
- Braided polymer implants
- 18mm x 1.5mm
- Positioned near hard/soft palate junction
- One central, two paramedian

Walker 2006
Radiofrequency Tissue Ablation and Coblation

• **Primary snoring**
  - RF energy delivered to palate with 22-gauge needle electrode
  - Needle inserted into *muscle* of soft palate, entry point near junction of hard palate
• **Coblation**
  - One central, two paramedian

Troell 2000
Injection Snoreplasty

- **Primary snoring**
- Soft palate sclerotherapy
- 3% sodium tetradecyl sulfate, now ethanol used as well
- Single midline *submucosal* plane 27g needle, middle soft palate
- Expected mucosal sloughing, scarring to develop over 4-6 weeks
- Reinjection: paramedian

Brietzke 2002
Office-Based Procedures

• Local anesthesia
• Less pain
• Reported efficacy of approximately 80%
• Good candidates: obliquely oriented palate; long transverse distance between posterior pillars
• Standalone, or adjuncts

• Cost – Primary Snoring
  • $300 Injection Snoreplasty
  • $1500-$2200 for Pillar implant
• RF: mucosal ulceration
• Injections: mult treatments possible
• Pillar: risk extrusion (3-30%)
• Minimal if any effect on AHI
• Minimal if any aid with CPAP tolerance
Anterior Palatoplasty (Modified Cautery-Assisted Palatal Stiffening)

- AP collapse, Snoring or Mild OSA
- Local anesthesia in the office, or under GA
- Mucosa only, expose underlying muscle
- Widen airway, direct scar formation

Pang 2007
• N = 77; BMI < 33, Friedman II, AHI 1-30, tonsil grade 1-2
  • 38 snorers, 39 OSA
  • +/- tonsillectomy
  • <25% BOT collapse via Muller maneuver
• Mean f/u: 33.5 mo
• AHI mean 25 -> 9.9
• Snore Visual Analog Scale 8.4→ 2.5

Pang 2009
Palatal Surgery for OSA
Uvulopalatopharyngoplasty (UPPP)

• Obliquely oriented palate with primary AP collapse

• Rims of anterior and posterior pillar mucosa trimmed, approximated

• Redundant posterior pharyngeal wall mucosa resected

Fujita 1981
Uvulopalatopharyngoplasty (UPPP)
Uvulopalatopharyngoplasty (UPPP)
Uvulopalatal Flap

• Obliquely oriented palate with primary AP collapse
• Diamond-shaped incision through mucosal layer only.
• Mucosa/glandular tissue removed
• Tip of uvula approximated to hard/soft palate junction

Powell 1996
Prospective study, n = 83 pts evaluated 6mo and 48+ mo postoperatively

6 mo: 69.9% success

48+ months: 51.8% success

BMI > 30, AHI > 45 independently associated with failure

*Success: >50% AHI reduction, final AHI <20
Meta-analysis of 24 studies of patients having underwent UPPP or mUPPP

Observed complications;
- VPI (24 studies, n = 191)
- Dysphagia (7 studies, n = 83)
- Taste dist (4 studies, n = 10)
- Voice changes (7 studies, n = 46)
- Foreign body (9 studies, n = 427)
- Dry pharynx (7 studies, n = 150)
Expansion Sphincter Pharyngoplasty

- Concentric, Lateral collapse
- Palatopharyngeus muscle transected at inferior end
- Fascia attachment preserved to underlying horizontal constrictors
- Tunnel palatopharyngeus m. antero-supero-laterally
- Incision anterior surface of soft palate (last upper molar)
**Expansion sphincter pharyngoplasty for the treatment of OSA: a systemic review and meta-analysis**

Kenny P. Pang¹ · Edward B. Pang² · Ma Thin Mar Win³ · Kathleen A. Pang² · B. Tucker Woodson³

<table>
<thead>
<tr>
<th>Study</th>
<th>N</th>
<th>Age</th>
<th>BMI</th>
<th>Intervention</th>
<th>Pre-op AHI</th>
<th>Post-op AHI</th>
<th>Success rate</th>
<th>f/u</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pang 2007</td>
<td>45</td>
<td>42.1</td>
<td>28.7</td>
<td>EP vs UPPP</td>
<td>44.2 ± 10.2</td>
<td>12 ± 6.6</td>
<td>82.6</td>
<td>6</td>
</tr>
<tr>
<td>Sorrenti 2012</td>
<td>85</td>
<td>42.7</td>
<td>–</td>
<td>EP</td>
<td>33.3</td>
<td>11.7</td>
<td>89.2</td>
<td>36</td>
</tr>
<tr>
<td>Vicini 2014</td>
<td>24</td>
<td>54.2</td>
<td>27.2</td>
<td>TORS/EP vs TORS/UPPP</td>
<td>38.5 ± 14.3</td>
<td>9.9 ± 8.6</td>
<td>–</td>
<td>9</td>
</tr>
<tr>
<td>Ulualp 2014</td>
<td>50</td>
<td>8</td>
<td>32</td>
<td>EP vs TA</td>
<td>60.5 ± 38.5</td>
<td>2.4 ± 3.9</td>
<td>80</td>
<td>6</td>
</tr>
<tr>
<td>Carrasco 2015</td>
<td>53</td>
<td>43.9</td>
<td>27.5</td>
<td>EP vs UPPP</td>
<td>27.7 ± 7.5</td>
<td>6.5 ± 5.2</td>
<td>90</td>
<td>6.9</td>
</tr>
</tbody>
</table>

Success rates (in all articles) defined as 50% reduction of pre-operative AHI and an AHI <20, except Ulualp (2014), success rate defined as post-operative AHI <5
Transpalatal Advancement Pharyngoplasty

- posteriorly-based hard-soft palate junction
- Turns “vertically-oriented” palate into obliquely oriented palate
- Lateral flaps medial to greater palatine foramen, over hamulus
- Posterior osteotomy, with 1-2 mm rim of bone

Woodson 2007
Transpalatal Advancement Pharyngoplasty

• Sutures though palate drill holes into tensor aponeurosis laterally

• Strong rim of bone supports the sutures

Woodson 2007
• N = 28; AHI > 10, Tonsil size 3-4
• Mean age 33; BMI 32
• f/u 6mo
• AHI mean 40 -> 7
• ESS mean 11 -> 6
Z-Palatopharyngoplasty

- AP collapse
- Transect palatoglossus and palatopharyngeus muscles
- Uvula and palate split in midline

Friedman 2015
Lateral Pharyngoplasty

- Lateral pharyngeal collapse
- Divide superior constrictor
- Transverse subtotal resection of palatopharyngeus
- Closure in Z-plasty fashion

Pang 2006
Conclusions and Future Directions

• Healthy sleep is essential

• Many go untreated or undertreated by CPAP, and surgical options exist

• Everyone’s anatomy is different: Tailored approach to patient and anatomy
Special Thanks!

Dr. Boon
Special Thanks!

Dr. Boon

Colin
Special Thanks!

Dr. Boon

Colin

The Talented and Incredibly Good-Looking PGY-3 Class
References
