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

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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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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
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- 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
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Anatomical Sites of Obstruction: Velum

Woodson 2015
Anatomical Sites of Obstruction: Oropharynx

Friedman classification: tongue in neutral position

Friedman 2004
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>
</tr>
<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
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- Identification of airway sites in need of surgery
- Outpatient selection for snoring treatments
- Adjunct during nasal surgery
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 UUPPP 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</td>
</tr>
<tr>
<td>Lateral oropharyngeal wall collapse</td>
<td></td>
<td>Expansion pharyngoplasty</td>
</tr>
<tr>
<td></td>
<td></td>
<td>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
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
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
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)

Pang 2007
Expansion sphincter pharyngoplasty for the treatment of OSA: a systemic review and meta-analysis

Kenny P. Pang¹ · Edward B. Pung² · 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
