Selecting Hypopharyngeal Surgery in OSA

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Overview
Why hypopharyngeal surgery?
Evaluation techniques for procedure selection
Hypopharyngeal procedures and outcomes

Why Hypopharyngeal Surgery?
Effective surgery directed at site(s) of obstruction
Nose
Palate
Hypopharynx

Fujita Classification
Type I  Palate
Type II  Combined
Type III  Hypopharynx

Disclosures
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Berendo Scientific
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Intellectual Property Rights
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OSA surgery review (Sher et al. Sleep 1996)
UPPP “successful” in 41% of all OSA patients
52% Fujita Type I
5% Fujita Types II and III
Conclusion: failure to identify site(s) of obstruction is principal factor in poor results for surgery

Friedman Stage (Friedman OtoHNS 2002)
Success of UPPP/T:  
- Stage I: 81%
- Stage II: 38%
- Stage III: 8%
Unfortunately, few patients Stage I

Expansion Sphincter Pharyngoplasty

Lateral Pharyngoplasty
Site of Obstruction and Surgical Options

Current
- Palate/Tonsils
- Hypopharynx/
- Retrolingual
- Maxillofacial

Future?
- Velum/Palate
- Oro LW
- Tongue
- Epiglottis
- Maxillofacial

Body Mass Index

Crude measure of obesity
- Underweight: <18.5
- Normal: 18.5 - <25
- Overweight: 25 - <30
- Obese Class I: 30 - <35
- Obese Class II: 35 - <40
- Obese Class III: 40+

Not really an eval technique
Easy, low cost, and associated with outcomes
May affect structures involved and nature of involvement
Obesity major OSA risk factor

BMI formula:
= Weight (kg) / [Height (m)]^2
≈ Weight (lb)*700/[Height (in)]^2

What Is the Link between Obesity and OSA?
Why Is Obesity Associated with Worse Outcomes after Most Procedures?

Fat Is Deposited in Tongue in Obese Subjects
(Nashi et al, Laryngoscope 117:1467, 2007)

Correlation of Percent Tongue Fat with BMI
(Nashi et al, Laryngoscope 117:1467, 2007)
Factors and Outcomes

Examining case series studies, although some small
Most randomized trials are pilot studies (sample size)

Factors: BMI, preop AHI, cephalogram measures
Outcomes: AHI and “success”
“Success” = 50% reduction in AHI/AI to absolute level
no greater than 20/15/5
Major oversimplification
  Goal generally to improve OSA/AHI
  Other outcomes (sleepiness, QOL)
However, AHI reported widely and enables comparison

Hypopharyngeal Procedures

Genioglossus advancement
Mortised genioplasty
Tongue radiofrequency
Tongue stabilization
Midline glossectomy
Hyoid suspension
Partial epiglottectomy
Maxillomandibular advancement

Genioglossus Advancement
Rectangular osteotomy below incisor roots between canines
--GBAT: circular osteotomy
Capture genial tubercle and genioglossus muscle attachments
Advance bone fragment and muscle attachment to place genioglossus on tension
Risks: dental numbness, injury

Mortised Genioplasty
Hendler et al., Sleep Breathing 2001
Capture of genioglossus, geniohyoid, mylohyoid, and digastric muscles
Risks similar to GA, although some differences
BMI Pre AHI Post AHI Success (AHI) Factors

Riley 1994 39% (9/23)
Johnson 1994 59 14* 78% (7/9) PAS and MP-H (not real statistical analysis)
Lee 1999 53 19* 69% (24/35)
Miller 2004 (GBAT) 30.5 53 16* 67% (7/11) AHI < 40; BMI and AHI
Lee 1999 53 19* 69% (24/35)
Miller 2004 (GBAT) 30.5 53 16* 67% (7/11) AHI < 40; BMI and AHI
Liu 2005 28.0 62 30* 52% (23/44) Al < 20; low BMI (<30) in sample
Emara 2011 27.5 (all < 30) 41 15* 87% (20/23) All age < 60 years
Kim 2012 25.8 60 29* 48% (16/33) BMI <30
Hendler 2001 (mortised genioplasty) 32.6 60 29* 48% (16/33) AHI, BMI <30
dos Santos 2007 (genioplasty) 25.4 (all below 30) 12 4* 70% (7/10) BMI (all < 30 in sample)

Tongue Radiofrequency

Many areas of the body
Heart, prostate, oncology
Turbinates, palate, tonsils, tongue
Energy delivered to create injury, then fibrosis
Multiple technologies
Monopolar (Gyrus/TCRF) vs. Bipolar (ArthroCare and Celon)
Less invasive
Can be done in clinic—titratable, snoring

8-Week Outcomes: Active RF vs. Sham

Outcome Oto-HNS 2003;128:848-61
Adapted from Table 6
Tongue Radiofrequency Improves UPPP/T outcomes

<table>
<thead>
<tr>
<th></th>
<th>FS</th>
<th>UPPP/T Only</th>
<th>UPPP/T + RF Tongue</th>
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<tbody>
<tr>
<td>I</td>
<td>80%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>38%</td>
<td>55%</td>
<td></td>
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<tr>
<td>III</td>
<td>8%</td>
<td>33%</td>
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Palate surgery alone provides improvement
Addition of tongue RF improves outcomes for patient subgroups that would not be expected to have ideal outcomes after palate surgery

Friedman Oto—HNS 2003
Friedman Oto—HNS 2004

Tongue Radiofrequency Case Series

Most have overweight BMI but not obese (highest mean BMI 32)
Wide range mean baseline AHI
Success rates 20-80% in different series
Factors associated with outcomes
AHI (not universal)
BMI 29 or 30
Friedman Stage (II better than III)
**Tongue Stabilization Case Series**

Most have overweight BMI (highest mean 31)
Wide range mean AHI
Success rates 20-80% in different series
Factors associated with outcomes (limited eval)

AHI
BMI 29, graph
? Suture tightening

Source: Vicente Laryngoscope 2006 (n=54)

**Midline Glossectomy**

Morbid procedure with CO2 laser, cautery
Robinson technique: Coblation (not FDA indication)

**Tongue Resection: Midline Glossectomy, SMILE, Hyoepiglottoplasty, and Lingual Tonsillectomy**

Most series have mean BMI in obese range (29-36)
Mean baseline AHI wide range but higher than RF/TS
Success rates 25-100% in different series
Factors associated with outcomes

AHI
BMI (31 in responders vs. 38 in nonresponders)

**Hyoid Suspension**

Rationale: Pharyngeal soft tissues attach to mobile hyoid bone
Advance hyoid, limit mobility
Mandible inferior border with fascia lata or sutures (Repose/Airvance)
--suture breakage?
Superior border of thyroid cartilage

http://sleep-doctor.com/blog
<table>
<thead>
<tr>
<th>Technique</th>
<th>BMI</th>
<th>Pre AHI</th>
<th>Post AHI</th>
<th>Success (AHI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vilaseca 2002</td>
<td>27.8</td>
<td>48.3</td>
<td>29.0*</td>
<td>56% (5/9)</td>
</tr>
<tr>
<td>Neruntarat 2003</td>
<td>29.3</td>
<td>44.5</td>
<td>15.2*</td>
<td>78% (25/32)</td>
</tr>
<tr>
<td>den Herder 2005</td>
<td>26.3</td>
<td>33</td>
<td>18*</td>
<td>71% (10/14)</td>
</tr>
<tr>
<td>Bowden 2005</td>
<td>34.1</td>
<td>36.5</td>
<td>37.6</td>
<td>17% (5/29)</td>
</tr>
<tr>
<td>Benazzo 2008</td>
<td>28.2</td>
<td>37</td>
<td>19*</td>
<td>62% (67/109)</td>
</tr>
<tr>
<td>Baisch 2006</td>
<td>28.2</td>
<td>38</td>
<td>19*</td>
<td>60% (40/67)</td>
</tr>
<tr>
<td>Gillespie 2011</td>
<td>32</td>
<td>41</td>
<td>19*</td>
<td>70% (16/23)</td>
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Hyoid Suspension: Is BMI a factor?

- Baisch series: No? However, few BMI > 33
- Bowden mean BMI 34, success 17%
- Success in other series with mean BMI < 30 is notably higher

Hyoid Suspension in Combination with Other HP Procedures: Case Series

- Wider range of mean BMI
- Mean baseline AHI wide range but higher than RF/TS
- Success rates 20-80% in different series, for different techniques
- Factors associated with outcomes
  - AHI
  - BMI 30, 32
  - SNB angle on lateral cephalogram (normal 80±2 degrees; >78 degrees)
  - Age (one study; not examined much as a factor)
Partial Epiglottectomy
Resection of portion of epiglottis
Below: central suprahoid vs. central above vallecula
Others resect lateral portions

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<thead>
<tr>
<th></th>
<th>BMI</th>
<th>Pre AHI</th>
<th>Post AHI</th>
<th>Success (AHI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mickelson 1997 (midline gloss)</td>
<td>36.0</td>
<td>73</td>
<td>47*</td>
<td>25% (3/12)</td>
</tr>
<tr>
<td>Catalfumo 1998</td>
<td>42</td>
<td>8*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Golz 2000</td>
<td>23.4</td>
<td>45</td>
<td>14*</td>
<td>78% (21/27)</td>
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Selection by displacement of epiglottis from tongue base
Selection same as Catalfumo

Factors Associated with Outcomes
BMI: cutpoint of 30 or 32 kg/m²
AHI: more important than for palate surgery outcomes
Mandible/SNB: not as thoroughly studied (lack of cephalogram data?) but appears to be important
Structures: VOTE
Age?: very little data, but I believe important

What Do I Do?: Structure-Based Approach
Velum/Palate  UPPP ± tonsillectomy
              Other palate procedures (ESP and LP)
Oro LW        ? Hyoid suspension, ESP, LP, MAD/MMA
Tongue        Genioglossus advancement
              Tongue RF
              Tongue stabilization
              Tongue resection (BMI >30/32)
Epiglottis    Hyoid suspension vs. Partial epiglott
Maxillofacial MMAM MMA
Counseling patients key: BMI, AHI, mandible (SNB), ?age
Conclusions

Selecting a hypopharyngeal surgery based on:

- Procedure technique (mechanism of action)
- Patient anatomy (evaluation)
- Factors associated with outcomes
- Surgeon training and experience
- Patient preferences

Conclusions

Poor outcomes have always been considered a failure of surgical technique/skill

Selection of appropriate procedure(s) may be just as important