Surgery of the Hypopharynx – So Many Choices

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Overview

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

Disclosures

Medical Advisory Board
- Medical Advisory Board
- Medical Advisory Board
- Research Funding
- Consultant
- Consultant
- Intellectual Property Rights
- Consultant, IP Rights

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- Consultant

Adapted from Table 7

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

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

Palate Surgery Outcomes:

Palate vs. Tongue Obstruction

Adapted from Table 7

Sher et al. SLEEP 1996;19:156-177

Palate Obstruction
Tongue Obstruction

0 20 40 60 80 100
0 20 40 60 80 100

75 33 7 25 13
23 33 7 25 13

AI RDI LSAT
Expansion Sphincter Pharyngoplasty

Lateral Pharyngoplasty

Site of Obstruction and Surgical Options

Past/Current

Palate/Tonsils

Hyopopharynx/

Retrolingual

Maxillofacial

Current/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

= Weight (kg) / [Height (m)]^2

= Weight (lb) * 700 / [Height (in)]^2

Obesity major OSA risk factor

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

What Is the Link between Obesity and OSA?

Why Is Obesity Associated with Worse Outcomes after Most Procedures?

Tongue Fat and Its Relationship to OSA
(Kim Schwab SLEEP 2014)
Case-control of BMI ≥28.7: OSA (90), non (31)
Subgroup analysis: 18 matched pairs (BMI, age, sex, race)
Tongue and masseter muscle volume and fat (Dixon)

Difference for tongue total volume and tongue fat but not for masseter
Difference between matched pairs was 12 mL for tongue volume and 8 mL for tongue fat

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
GA and MG Results

Most have overweight BMI but not obese (highest mean BMI 32)
Wide range mean baseline AHI
Success rates 39-87% in different series
Factors associated with outcomes
AHI (not universal)
BMI 29 or 30

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

Tongue Radiofrequency Randomized Trial

Woodson et al., Oto—HNS 2003
Level 1: randomized, placebo-controlled trial

8-Week Outcomes: Active RF vs. Sham

Adapted from Table 6 Outcomes Oto—HNS 2003;128:848-61

2-Year Outcomes: Final vs. Baseline

Adapted from Figure 1 Outcomes Oto—HNS 2005;132:630-35

Tongue Radiofrequency Improves UPPP/T outcomes

<table>
<thead>
<tr>
<th>FS</th>
<th>UPPP/T Only</th>
<th>UPPP/T + RF Tongue</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>80%</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>38% 55%</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>8% 33%</td>
<td></td>
</tr>
</tbody>
</table>

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**

Repose/AIRvance (Medtronic)

AirLift (Siesta Medical)

Technique

- Bone screw in mandible
- Pre-attached suture passed through tongue base and secured to stabilize tongue base

**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)

**TS: Handler 2013 EBM Review**

TS alone: 36% success

UPPP + TS: success 62%

Success: UPPP/TS = UPPP/GA = UPPP/GA/HS

**Li Eur Arch Oto 2013: Glossoptosis**

Cohort study: UPPP vs. UPPP/TS (pt preferences)

Modified Mallampati 1/2

OSA on PSG with NP trumpet (AHI >15)

No lingual T hyp; CT with retrolingual airway >12 mm

**Midline Glossectomy**

Morbid procedure with CO2 laser, cautery

Robinson technique: Coblation (not FDA indication)

TORS
Robotic-Assisted Surgery

da Vinci System
Intuitive Surgical

Urology, GYN, CT, and General Surgery
Minimally invasive, improved access, decreased morbidity

OSA: lingual T
FDA-approved with little data (Vicini)

Vicini Head Neck 2012
AHI 36 to 16; ESS 12.6 to 7.7
Resection: 13.5 ± 8.2 ml (< 7 ml poor)

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 (Vicini: better outcomes in BMI < 30)
   Amount of tissue resected (Vicini)
   ? Lingual tonsil vs. muscle only
Tongue Resection: Murphey Oto-HNS 2015

- Multilevel surgery
- Mean AHI 48 to 19*
- LSAT 77% to 84%
- ESS 11.4 to 5.7

Success 60%

Isolated glossectomy (n=24)
- AHI 42 to 25*

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)
- Superior border of thyroid cartilage

Hyoid Suspension Case Series

- Most have overweight mean BMI but not obese
- 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)

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 suprathyroid vs. central above vallecula
- Others resect lateral portions

<table>
<thead>
<tr>
<th>Selection by displacement of epiglottis from tongue base</th>
<th>Success (AHI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mickelson 1997 (midline gloss)</td>
<td>25% (3/12)</td>
</tr>
<tr>
<td>Catalfumo 1998</td>
<td>8*</td>
</tr>
<tr>
<td>Golz 2000</td>
<td>14*</td>
</tr>
<tr>
<td></td>
<td>78% (21/27)</td>
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</tbody>
</table>
Palate + Hypopharyngeal Surgery

<table>
<thead>
<tr>
<th>Procedure</th>
<th>成功率 (AHI)</th>
<th>范围</th>
<th>预测因素</th>
</tr>
</thead>
<tbody>
<tr>
<td>咽扁桃体前移术</td>
<td>62%</td>
<td>96/91</td>
<td>BMI</td>
</tr>
<tr>
<td>锯切下颌骨术</td>
<td>48%</td>
<td>16/33</td>
<td>BMI, AHI</td>
</tr>
<tr>
<td>舌根部射频消融术</td>
<td>35%*</td>
<td>95/269</td>
<td>20-75%</td>
</tr>
<tr>
<td>舌稳定术</td>
<td>35%*</td>
<td>27/77</td>
<td>20-82%</td>
</tr>
<tr>
<td>正中舌切除术</td>
<td>50%</td>
<td>37/74</td>
<td>25-83%</td>
</tr>
<tr>
<td>咽后上提术</td>
<td>50%</td>
<td>51/101</td>
<td>17-78%</td>
</tr>
<tr>
<td>牙齿+咽后方固定术</td>
<td>59%</td>
<td>180/328</td>
<td>24-78%</td>
</tr>
<tr>
<td>GA + HS</td>
<td>55%</td>
<td>180/328</td>
<td>24-78%</td>
</tr>
</tbody>
</table>

Kezirian EJ, Goldberg AN. Archives Oto-HNS 2006 Adapted from Table 7

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

- 上气道后庭手术
  - 上气道后庭手术
  - 其他气道手术（ESP 和 LP）
  - 口腔 LW
  - 吞咽
    - 咽后上提术
    - 舌稳定术
    - 舌切除术 (BMI >30/32)
    - 上气道刺激术 (BMI<32; 多数)
  - 上气道后庭
  - MMA
  - 术前咨询: BMI, AHI, 下颌骨(SNB), ?年龄

Conclusions

- 低成功率被视为手术技巧/技能的失败
- 选择合适的手术程序可能同样重要

Conclusions

- 选择气道后庭手术基于:
  - 手术程序技术（作用机制）
  - 患者解剖（评估）
  - 相关因素（选择）
  - 外科手术培训和经验
  - 患者偏好

Conclusions

- 管道手术（机制）
- 患者（评估）
- 因素（选择）
- 外科医生与结果
- 患者训练与经验
- 患者喜好

Conclusions

- 历史上的低成功率被视为手术技巧/技能的失败
- 选择合适的手术程序可能同样重要