Controversies in Upper Airway Evaluation in OSA

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OSA Surgery: Comparative Effectiveness

• 494 pages (5 pages on surgery)
• The strength of evidence is insufficient ..........
• “Compared to other treatments surgery is increasingly an afterthought in sleep medicine”
Redefining Success in Airway Surgery for Obstructive Sleep Apnea: A Meta Analysis and Synthesis of the Evidence

Adam G Elshaug, BSc(Hons), MPH\(^{a}\), John R Moss, MScSci, BEd, MBBS, FCHSE\(^{a}\), Anne Marie Southcott, MBBS(Hons), FRACP\(^{a}\), Janet E Hiller, MPH, PhD\(^{a}\)

**Phase I Surgery Success (%)**: Success Defined as 50% reduction in AHI and/or AHI ≤ 20

<table>
<thead>
<tr>
<th>Study</th>
<th>AHI &lt; 20 + 50%</th>
<th>AHI &lt; 10</th>
<th>AHI &lt; 5</th>
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<tbody>
<tr>
<td>Hendler, Costello et al. 2001</td>
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<td>Miller, Watson et al. 2002</td>
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<td>Villaseca, Morello et al. 2002</td>
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<td>Finkenstein, Stein et al. 2002</td>
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<td>Stuck, Maurer et al. 2003</td>
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<td>Ferguson, Heighway et al. 2003</td>
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<td>Sorrent, Piccin et al. 2004</td>
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<td>Lao, Shnayder et al. 2003</td>
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<td>Berger, Stein et al. 2003</td>
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<td>Riley, Powell et al. 2003</td>
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<td>Stuck, Starzak et al. 2004</td>
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<td>Dattilo and Drooger 2004</td>
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<td>Bowden, Kozlinski et al. 2005</td>
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Combined

**AHI < 20 + 50%**: 55%

**AHI < 10**: 31.5%

**AHI < 5**: 13%
Evolution of Sleep Surgery to Improve Outcomes

1. “Better patient selection”

2. Development of better multilevel surgeries
Physical Exam, Mueller’s Maneuver, Manometry, Cephamometry

- Mueller's is primarily a negative predictor
- MP-H associated with UPPP success but no threshold values
- No studies have shown ability to predict multilevel outcomes
Friedman Staging  Otol HNS 2003

- Helpful for Stage 1 .... not for Stage 3
Scandinavian UPPP Randomized Trial

Friedman Stage 1 and 2
BMI < 34

Thorax 2013
Airway Evaluation

\[
\text{Airway (t)} = \text{Structure (constant)} + \text{Physiology (t)}
\]

- Observed characteristics at any time (t)
  - Muscle tone
  - Airflow
  - Body position
Concept of Sleep Endoscopy

- "Waking behavior confounds upper airway examinations
- Goal(s)
  1. **Dynamically** reproducing upper airway behavior similar to natural sleep by pharmacologically artificially inducing the patient into a light sleep
  2. Assess **Static** structural characteristics
Problem: Sleep is complex

• Sleep = not just reversible sedation (unresponsive to the environment)
  – Complex amalgam of physiologic processes
Sedation Varies

– Sedation = pharmocologic cortical inhibition
– Other physiologic effects vary (example)
  • Ketamine (glutamate antagonist) sedation with muscle activation, maintains ventilatory control, increases in BP, hallucinations
  • Benzodiazepam (GABA agonist) sedation, muscle relaxation, ventilatory (CO2) depression, amnesia, antianxiety, antiseizure
EMG\textsubscript{UAW} Sleep Onset

Key Points:

- EMG in OSA is elevated compared to controls
- CPAP eliminates most of the differences
- EMG decreases with sleep onset is small

Fogel et al, Physiology 2005
Physiologic Cause of OSA is Sleep Related Ventilatory Control
VOTE Classification

- Velopharynx
- Oropharynx
- Tongue Base
- Epiglottis
Sedated ("Sleep") Endoscopy

<table>
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<th>TABLE I. VOTE Classification System.</th>
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<tr>
<td>Direction</td>
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<tr>
<td>Level</td>
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<tr>
<td>Velum</td>
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<tr>
<td>Oropharynx</td>
</tr>
<tr>
<td>Tongue base</td>
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<tr>
<td>Epiglottis</td>
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</table>

Degree of obstruction: 0, no obstruction (no vibration, <50%); 1, partial obstruction (vibration, 50% to 75%); 2, complete obstruction (collapse, >75%); x, not visualized.

A-P = anteroposterior.
Does drug-induced sleep endoscopy change the treatment concept of patients with snoring and obstructive sleep apnea?

Corinette Eichler • J. Ulrich Sommer • Boris A. Stuck • Karl Hörmann • Joachim T. Maurer

A Trial of Drug-Induced Sleep Endoscopy in the Surgical Management of Sleep-Disordered Breathing

M. Boyd Gillespie, MD, MS; Ryan L. Robb, MD; David R. White, MD; Christopher M. Dauvissat, MD, MS;

• “Theoretical” treatment recommendations may change ..... no data to show better results
Snoring noise locations:
- palate (43%)
- tongue base (7%)
- epiglottis (3%)
- multiple (42%)
Airway Structure in Sleep Apnea

- Abnormal lumen is the fundamental abnormality in OSA
- Airway is complex and NOT described by simple level of collapse or airway segments
Anatomic Landmarks as Reference points to measure the Lumen
Anterior Palatal Landmarks

• Anatomic elements define three palatal subtypes
  – Hard Palate (Open, narrow)
  – Anatomic Genu (Knee) (Open, compromised, narrow)
  – Velum (Open, compromised, narrow)
  – Lateral Wall (Open, normal, compromised, normal)
Phenotypes of Upper Pharynx

Oblique  Intermediate  Vertical
Hypopharynx (Modified Moore)

- Pattern of Narrowing
  - Type A (10%)
  - Type B (50%)
  - Type C (40%)

- Size of Narrowing
  - 1+ True Vocal Cords
  - 2+ Anterior Arytenoid
  - 3+ Posterior Arytenoid
  - 4+ Obstruction
Phenotypes of Lower Pharynx

Moore A  Moore B  Moore C
## Palatal Shape Subtypes

<table>
<thead>
<tr>
<th>Subtype</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Oblique</td>
<td>52%</td>
</tr>
<tr>
<td>Intermediate</td>
<td>23%</td>
</tr>
<tr>
<td>Vertical</td>
<td>25%</td>
</tr>
<tr>
<td>Lateral wall</td>
<td>36%</td>
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</tbody>
</table>
### Retroglossal Shape Subtypes

<table>
<thead>
<tr>
<th>Subtype</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Moore A (Lingual Tonsils)</td>
<td>9%</td>
</tr>
<tr>
<td>Moore B</td>
<td>31%</td>
</tr>
<tr>
<td>Moore C</td>
<td>50%</td>
</tr>
<tr>
<td>Epiglottis Alone</td>
<td>16%</td>
</tr>
<tr>
<td>Normal</td>
<td>11%</td>
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</table>
Awake Hypotonic vs Sedated Exam

- Velar Palate: 1.1 vs 1.1, p=ns
- Palatal Genu: 0.9 vs 1.0, p=ns
- Retropalatal LW: 0.5 vs 0.6, p=ns
- Tongue Base: 0.9 vs 1.5, p<0.01
- Epiglottis: 1.4 vs 2.1, p<0.01
- Hypopharyngeal LW: 0.6 vs 0.9, p=0.03
DISE and Surgical Failure

Nonresponders to Pharyngeal Surgery for Obstructive Sleep Apnea: Insights from Drug-Induced Sleep Endoscopy

Eric J. Kezirian, MD, MPH

<table>
<thead>
<tr>
<th>Palatal obstruction</th>
<th>All Previous Palate Surgery (n = 33)</th>
<th>Palate and Hypopharyngeal Surgery N=22</th>
<th>Palate Surgery and Genioglossus Advancement* (n = 7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>16 (48%)</td>
<td>6 (22%)</td>
<td>3 (43%)</td>
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<tr>
<td>Velum alone</td>
<td>1 (3%)</td>
<td>1 (5%)</td>
<td>0 (0%)</td>
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<tr>
<td>Velum + hypopharyngeal obstruction</td>
<td>16 (48%)</td>
<td>16 (72%)</td>
<td>4 (57%)</td>
</tr>
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</table>

• notable diversity of specific structures that contributed to airway obstruction during DISE
Summary

• Most evaluation methods fail to select for OSA surgical outcomes
  – Friedman Stage 1

• Sedated endoscopy
  – Uncertain usefulness for all patients
  – Lower pharyngeal obstruction
  – Post operative failures