Updates in Surgical and Anesthetic Management of Obstructive Sleep Apnea

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Learning Objectives

• Case presentation

• Background

• Surgical & Anesthetic Management
  – Role of Drug-Induced Sleep Endoscopy (DISE)
  – Upper Airway Stimulator (Inspire ® device)
  – Transoral Robotic Surgery (TORS)
  – Postoperative considerations

• Team communication
One day in the alternatives to CPAP clinic…

• 67 yo ASA 3 male - severe OSA
  – Intolerant of CPAP
  – Daytime sleepiness, snoring
  – BMI 31

• Interested in surgery
Patient MD

- Apnea-Hypoapnea Index (AHI) → 32.6
- $O_2$ minimum → 78%
- Tolerates CPAP ~ 2 hours per night
Exam

- Septal deviation
- Tonsils absent
- Friedman TP 3
- Mallampati 4
- Class I occlusion
- Medialized palatopharyngeal muscles, uvula 1 cm
- Flexible nasal endoscopy: Minimal lingual tonsillar tissue
Defining OSA & Anesthetic Considerations
### Forms of Sleep Apnea

<table>
<thead>
<tr>
<th>Form</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obstructive</td>
<td>Continued thoracoabdominal effort in the setting of partial or complete airflow cessation</td>
</tr>
<tr>
<td>Central</td>
<td>The lack of thoracoabdominal effort in the setting of partial or complete airflow cessation</td>
</tr>
<tr>
<td>Mixed</td>
<td>A respiratory event with both obstructive and central features, with mixed events generally beginning as central events and ending with thoracoabdominal effort without airflow</td>
</tr>
</tbody>
</table>

Obstructive Sleep Apnea (OSA)

- Common sleep-related breathing disorder
- Prevalence ranges from 3% to 7%
- Several factors that increase vulnerability
### Respiratory Events During Sleep

<table>
<thead>
<tr>
<th>Event</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apnea</td>
<td>Cessation of airflow for at least 10 seconds</td>
</tr>
<tr>
<td>Hypopnea</td>
<td>A reduction in airflow ($\geq 30%$) at least 10 seconds with $\geq 4%$ oxyhemoglobin desaturation</td>
</tr>
<tr>
<td><strong>OR</strong></td>
<td>A reduction in airflow ($\geq 50%$) at least 10 seconds with $\geq 3%$ oxyhemoglobin desaturation <strong>OR</strong> an electroencephalogram (EEG) arousal</td>
</tr>
<tr>
<td>Respiratory effort–related arousal (RERA)</td>
<td>Sequence of breaths for at least 10 seconds with increasing respiratory effort or flattening of the nasal pressure waveform, leading to an arousal from sleep when the sequence of breaths does not meet the criteria for an apnea or a hypopnea</td>
</tr>
</tbody>
</table>

- **Apnea-Hypopnea Index (AHI)** = Apneas + Hypopneas per hour of sleep
- **Respiratory Disturbance Index (RDI)** = A+H+RERA per hour of sleep

Sleep-related Breathing Disorders

- Primary snoring
- Upper Airway Resistance Syndrome (UARS)
- Obstructive Sleep Apnea (OSA) Syndrome
- Obesity - Hypoventilation Syndrome

# OSA Severity

<table>
<thead>
<tr>
<th>Severity</th>
<th>AHI per Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>None/Minimal</td>
<td>&lt; 5</td>
</tr>
<tr>
<td>Mild</td>
<td>5 - 15</td>
</tr>
<tr>
<td>Moderate</td>
<td>16 - 30</td>
</tr>
<tr>
<td>Severe</td>
<td>&gt; 30</td>
</tr>
</tbody>
</table>
• Data from the Wisconsin Sleep Cohort Study

• Severe sleep-disordered breathing (AHI≥15):

• 10% among 30-49 year-old men
• 17% among 50-70 year-old men
• 3% among 30-49 year-old women
• 9% among 50-70 year-old women

Peppard et al. 2013.
STOP-BANG Screening Questions

< 3 questions positive
  – Low risk of OSA

≥ 3 positive
  – High risk of OSA

≥ 5 positive
  – High risk of moderate to severe OSA

Table 6. STOP–Bang Questionnaire Used to Screen Patients to Determine the Risk of Obstructive Sleep Apnea (OSA)

<table>
<thead>
<tr>
<th>Question</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>Snoring. Do you snore loudly (louder than talking or loud enough to be heard through closed doors)?</td>
</tr>
<tr>
<td>T</td>
<td>Tiredness. Do you often feel tired, fatigued, or sleepy during daytime?</td>
</tr>
<tr>
<td>O</td>
<td>Observed apnea. Has anyone observed you stop breathing during your sleep?</td>
</tr>
<tr>
<td>P</td>
<td>Pressure. Do you have or are you being treated for high blood pressure?</td>
</tr>
<tr>
<td>B</td>
<td>BMI &gt; 35 kg/m²</td>
</tr>
<tr>
<td>A</td>
<td>Age &gt; 50 years</td>
</tr>
<tr>
<td>N</td>
<td>Neck circumference &gt; 40 cm</td>
</tr>
<tr>
<td>G</td>
<td>Male gender</td>
</tr>
</tbody>
</table>

Joshi et al. 2012.
Polysomnography & Diagnosis

- Overnight sleep lab PSG = gold standard
- Home sleep studies widely used
Medical Comorbidities

- Cardiovascular disease
- GERD
- Alcoholism and tobacco use
- Stroke
- HTN (does not improve during sleep)
- Arrhythmias (atrial fibrillation)
- Pulmonary HTN
- Diabetes
- Memory loss - Kumar R et al. 2008.

- 1022 enrolled patients
- 68 percent with OSA → mean AHI 35
- OSA & stroke or death
  - Hazard ratio = 2.24
- After adjustment for confounders: OSA with stroke or death
  - Hazard ratio = 1.97
Society of Anesthesia and Sleep Medicine Guideline on Intraoperative Management of Adult Patients With Obstructive Sleep Apnea

Stavros G. Memtsoudis, MD, PhD,*† Crispiana Cozowicz, MD,∗† Mahesh Nagappa, MD,‡ Jean Wong, MD, FRCPC,§ Girish P. Joshi, MBBS, MD, FFARCSI,∥ David T. Wong, MD, FRCPC,§ Anthony G. Doufas, MD, PhD,¶ Meltem Yilmaz, MD,# Mark H. Stein, MD,** Megan L. Krajewski, MD,†† Mandeep Singh, MBBS, MD, MSc, FRCPC,‡‡§§¶¶## Lukas Pichler, MD,*† Satya Krishna Ramachandran, MD,*** and Frances Chung, MBBS, FRCPC§
Summary Recommendations

• Risk of difficult airway management
• Anesthetics & analgesics drugs → Perioperative risk
• NMBAs increase risk
• Propofol sedation → Hypoxia
• Benzodiazepines → Airway obstruction
• Desflurane and sevoflurane → Increase safety
• Ketamine and alpha-2-agonists → ? Increase safety
• Regional anesthesia may decrease risk
## Perioperative Complications with OSA

From Joshi et al. (2012). In *Anesthesia and Analgesia*.

### Table 1. Concerns with Obstructive Sleep Apnea Patients Undergoing Ambulatory Surgery

<table>
<thead>
<tr>
<th>Time</th>
<th>Concerns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intraoperative</td>
<td>Difficult/failed mask ventilation and/or tracheal intubation.</td>
</tr>
<tr>
<td></td>
<td>Difficulty maintaining adequate oxygen saturation.</td>
</tr>
<tr>
<td>Immediate</td>
<td>Delayed extubation.</td>
</tr>
<tr>
<td>postoperative</td>
<td>Obstruction and/or desaturation after extubation.</td>
</tr>
<tr>
<td></td>
<td>Postobstructive pulmonary edema.</td>
</tr>
<tr>
<td></td>
<td>Need for tracheal reintubation.</td>
</tr>
<tr>
<td></td>
<td>Exacerbation of cardiac comorbidities: hypertension, arrhythmias, myocardial ischemia and infarction, pulmonary hypertension, heart failure.</td>
</tr>
<tr>
<td></td>
<td>Cerebrovascular disorders (e.g., stroke).</td>
</tr>
<tr>
<td></td>
<td>Prolonged postanesthesia care unit stay.</td>
</tr>
<tr>
<td></td>
<td>Delayed discharge home.</td>
</tr>
<tr>
<td></td>
<td>Unanticipated hospital admission.</td>
</tr>
<tr>
<td>Postdischarge</td>
<td>Readmission after discharge.</td>
</tr>
<tr>
<td></td>
<td>Hypoxic brain death and death.</td>
</tr>
</tbody>
</table>
Memtsoudis et al. 2011.

- 2,610,441 orthopedic surgeries → 2.5 % OSA
- 3,441,262 general surgeries → 1.4 % OSA

With OSA more pulmonary complications:
- Aspiration pneumonia
- ARDS
- Intubation/mechanical ventilation
- PE after orthopedic procedures
OSA & Airway Assessment

• Difficult intubation: 8 times higher

• Preoperative otolaryngology evaluation
  – Direct visual examination
  – Flexible endoscopic nasopharyngoscopy
    • Muller maneuver
  – CT/MRI
ASA Recommended Guidelines for Perioperative OSA Management

Practice Guidelines for the Perioperative Management of Patients with Obstructive Sleep Apnea

An Updated Report by the American Society of Anesthesiologists Task Force on Perioperative Management of Patients with Obstructive Sleep Apnea

2014. Anesthesiology
Recommendations & Criteria

• Preoperative evaluation
• Determination of inpatient vs outpatient
• Preoperative preparation
• Intraoperative management
• Discharge to unmonitored settings
Surgical Evaluation and Treatment of OSA
## Surgical Treatments

<table>
<thead>
<tr>
<th>Anatomical Location</th>
<th>Surgical Procedure</th>
<th>Anesthetic Technique</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nasal</td>
<td>Septoplasty, functional rhinoplasty, turbinate reduction, nasal polypectomy</td>
<td>Local +/- sedation or general anesthesia with supraglottic airway or endotracheal tube</td>
</tr>
<tr>
<td>Oral/oropharyngeal/nasopharyngeal</td>
<td>UPPP, UPF, Tonsillectomy/adenoidectomy</td>
<td>GA with ETT</td>
</tr>
<tr>
<td>Hypopharyngeal</td>
<td>GA, tongue reduction surgery</td>
<td>GA with ETT</td>
</tr>
<tr>
<td>Laryngeal</td>
<td>Epiglottoplasty, hyoid suspension</td>
<td>GA with ETT</td>
</tr>
<tr>
<td>Global Airway</td>
<td>MMA, Maxillomandibular expansion</td>
<td>GA with nasal ETT</td>
</tr>
<tr>
<td>Trachea</td>
<td>Tracheostomy</td>
<td>Local +/- sedation or general anesthesia with supraglottic airway or endotracheal tube</td>
</tr>
</tbody>
</table>

Abdelmalak and Doyle. 2013.
Assessment and Diagnosis

• History
• Polysomnogram data
• Epworth Sleepiness Scale
• BMI and neck circumference

• Physical exam
  – Mallampati classification
  – Friedman tongue position

• Awake nasal flexible laryngoscopy
Epworth Sleepiness Scale

- Scores 0-9 → ”normal” range
- 10-24 → excessive daytime sleepiness

Relative Indications for Surgery

• Moderate or severe OSA (AHI > 15)
• Minimum $O_2 < 90\%$
• UARS or mild OSA
  - Excessive daytime sleepiness
  - Poor QOL
• Cardiac arrhythmias
• CPAP intolerance or patient preference
• Medically optimized

- AHI $\geq 15$
- Epworth sleepiness scale (ESS) $\geq 12$
- $<50\%$ use at 1 & 3 months after initiation

Rosen et al. 2012.
Surgical Options?
Surgical selection

• Most have multilevel obstruction → consider multilevel surgery
  – Nasal airway
  – Palate or pharyngeal surgery
  – Hypopharyngeal expansion
Measuring Outcomes

• Variable success → few achieve cure

• Surgical success:
  – AHI < 20
  and
  – AHI reduced by ≥ 50%

• Surgical cure: AHI < 5 per hour
Patient MD

• Several options discussed
  – Multilevel surgery
  
  or...

  – Drug induced sleep endoscopy (DISE) → evaluate for Upper Airway Stimulation
Sleep Endoscopy

• Drug-Induced Sleep Endoscopy (DISE)
  – Approximates natural sleep state
  – Endoscopic evaluation of upper airway

• Identify and stratify level of obstruction

• Risks of anesthesia & airway compromise

Charakorn N. 2016.
<table>
<thead>
<tr>
<th>Indications</th>
<th>Contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSA</td>
<td>Allergy to sedative agents</td>
</tr>
<tr>
<td>Failed CPAP</td>
<td>Pregnancy</td>
</tr>
<tr>
<td>Considering alternatives to CPAP</td>
<td>Significant medical comorbidities</td>
</tr>
<tr>
<td></td>
<td>Relative: Obesity or markedly severe OSA</td>
</tr>
</tbody>
</table>
Procedural Steps & Considerations

- Prior PSG & awake nasal endoscopy
- **Outpatient** procedure in procedure suit or OR
  - Standard anesthetic equipment
  - Anesthesia staffing required
- Equipment:
  - Local anesthetic +/- nasal decongestant
  - Flexible endoscope
  - BIS Monitor
  - Surgical and anesthesia team
DISE – Michigan Medicine Protocol

• Pre-operative management
  – No anxiolytic
  – Supine awake endoscopy performed

• Intraoperative Management
  – Backup emergency airway plan
  – BIS monitor
  – Propofol started at 150 mcg/kg/min and titrated with constant infusion to attain BIS level 50 – 65
  – Supplemental oxygen safe
A Comparison of Dexmedetomidine Versus Propofol During Drug-Induced Sleep Endoscopy in Sleep Apnea Patients

Byung-Woo Yoon, MD; Jeong-Min Hong, MD; Sung-Lyong Hong, MD, PhD; Soo-Kweon Koo, MD, PhD; Hwan-Jung Roh, MD, PhD; Kyu-Sup Cho, MD, PhD

2016

Variable Findings for Drug-Induced Sleep Endoscopy in Obstructive Sleep Apnea with Propofol versus Dexmedetomidine

Robson Capasso, MD¹, Talita Rosa, MD¹, David Yung-An Tsou, MD¹,², Vladimir Nekhendzy, MD³, David Drover, MD³, Jeremy Collins, MD³, Soroush Zaghi, MD¹, and Macario Camacho, MD⁴,⁵

2016

Dexmedetomidine versus propofol during drug-induced sleep endoscopy and sedation: a systematic review

Edward T. Chang¹ · Victor Certal²,³ · Sungjin A. Song¹ · Soroush Zaghi⁴ · Marina Carrasco-Llatas⁵ · Carlos Torre⁶ · Robson Capasso⁴ · Macario Camacho⁴,⁷
European position paper on drug-induced sleep endoscopy: 2017 Update

Keypoints

- Technical and clinical standardization of drug-induced sleep endoscopy
- Endoscopic evaluation under drug-induced sedation of patients affected by Obstructive Sleep Apnoea Syndrome
- Site, grade and patterns of upper airways collapse during sedation and its relation with natural sleep.
- Main sedative agents applied during drug-induced sleep endoscopy and its advantages and disadvantages.
- Scoring classification system for drug-induced sleep endoscopy and its standardization.
TABLE 1  Sedative agents main characteristics

<table>
<thead>
<tr>
<th>Sedative agents</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
</table>
| Propofol        | ● Quick safe manageable  
                  ● Less muscle relaxation  
                  ● Easier control of titration | ● Technique dependent (MCI or TCI) |
| Midazolam       | ● Longer and more stable examination window  
                  ● Midazolam antidote available | ● More difficult to handle in case of overdosing  
                  ● Longer hospital stay |
| Combined (P + M)| ● Quicker and more stable mimicking of natural sleep  
                  ● Midazolam antidote available | ● Technique dependent (MCI or TCI)  
                  ● Increases sneezing |
Why BIS Level 50 – 65

- Bispectral index monitoring (BIS) correlates with sleep stages
  - Light sleep EEG patterns at BIS 75-90
  - Slow wave sleep at 20-70

- BIS 50-65 induces snoring & sleep-like state
  - 30 patients undergoing DISE
  - Compared with controls - natural sleep PSG

Sleigh JW et al. 1999.
Babar-Craig H et al. 2012.
DISE Scoring and Classification – DeVito et al. 2014.

- No consensus on structures/levels classification

- Severity
  - VOTE System with 3 degrees (none, partial, complete)
  - Quantitative system (0-25%, 25-50%, 50-75%, 75-100%)

- Configuration
  - Severity
  - Site
  - Pattern obstruction: anteroposterior, lateral, concentric
Some systems have only 3 degrees of severity (none, partial and complete obstruction), whereas other systems use a semiquantitative system with 0%-25%, 25%-50%, 50%-75% and 75%-100% of obstruction.

The simplicity of the VOTE [Velum (palate), Oropharyngeal lateral walls, Tongue and Epiglottis] classification system\(^{65}\) is a deliberate compromise to (over) comprehensiveness. Of all possible
Sleep Endoscopy - Assessment

- VOTE classification
  - Scoring 0-2, A-P vs lateral vs concentric
    - None, without vibration (<50% airway narrowing)
    - Partial (50-75%)
    - Complete (>75%)

Velum  Oropharynx  Tongue  Epiglottis

FIGURE 1  Complete anteroposterior collapse in the velum region

FIGURE 2  A-B, Circumferential collapse in the velum region

FIGURE 3  A-B, Lateral wall collapse in the velum and lateral pharyngeal walls

FIGURE 4  A-B, Epiglottic trapdoor phenomenon
**FIGURE 5**  A-B, Tongue base collapse due to lingual tonsil hypertrophy

**FIGURE 6**  A-B, Tongue base collapse due to muscle relaxation
Drug-Induced Sleep Endoscopy and Surgical Outcomes: A Multicenter Cohort Study

Katherine K. Green, MD, MS; David T. Kent, MD; Mark A. D’Agostino, MD; Paul T. Hoff, MS, MD; Ho-Sheng Lin, MD; Ryan J. Soose, MD; M. Boyd Gillespie, MD, MSc; Kathleen L. Yaremchuk, MD; Marina Carrasco-Llatas, Md PhD; B. Tucker Woodson, MD; Ofer Jacobowitz, MD, PhD; Erica R. Thaler, MD; José E. Barrera, MD; Robson Capasso, MD; Stanley Yung Liu, MD, DDS; Jennifer Hsia, MD; Daljit Mann, MD; Taha S. Meraj, MD; Jonathan A. Waxman, MD, PhD; Eric J. Kezirian, MD, MPH
• 275 patients at 14 centers
• Moderate interrater reliability
• Lower surgical response
  - Oropharyngeal lateral wall obstruction
  - Complete tongue-relate obstruction
• Tonsil size and BMI → inversely related
• Velum and epiglottic obstruction → not predictive
Patient MD – Sleep Endoscopy

- VOTE scoring system (0-2):
  - Velum: 2 A-P
  - Oropharynx: 1 lateral
  - Tongue base/ lingual tonsils: 1 A-P
  - Epiglottis: 0
- Septoplasty and turbinate reduction performed
- NOT a candidate for lingual tonsillectomy
Upper Airway Stimulation Criteria

- Non-concentric collapse at velum
- Partial obstruction at tongue base
- BMI < 32
- AHI between 20 - 65
Upper Airway Stimulation
The Distal Hypoglossal Nerve

Hypoglossal Nerve (CN XII)

Styloglossus Muscle

Hyoglossus Muscle

Genioglossus Muscle

Geniohyoid Muscle

Gentle stimulation
Hypoglossal Nerve Stimulation Effect

No Stimulation

Gentle Stimulation

Base of Tongue

Palate

Base of Tongue

Palate
Inspire® Upper Airway Stimulation.

Timing

Stimulation delivered during inspiration

Inspire Upper Airway Stimulation.

Accessed On January 16, 2019:
https://www.inspiresleep.com/what-is-inspire-therapy/how-inspire-therapy-works/
Stimulation Therapy for Apnea Reduction (STAR) Trial – 2014 *NEJM*

- Multicenter, prospective, cohort (N=126)
- Primary: AHI & O\textsubscript{2} desaturation index
- Secondary:
  - Epworth Sleepiness Scale
  - Functional Outcomes of Sleep Questionnaire (FOSQ)
  - % of sleep time with SpO\textsubscript{2} <90%

Strollo PJ Jr et al. 2014.
Upper Airway Stimulation for OSA

- AHI 20 - 50
- Difficulty with CPAP
- BMI < 32
- Exclusions
  - Significant comorbidities
  - Other sleep disorders
  - Unfavorable anatomy

Table 1. Characteristics of the Study Population at Baseline.*

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Participants (N=126)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age — yr</td>
<td>54.5±10.2</td>
</tr>
<tr>
<td>Male sex — no. (%)</td>
<td>105 (83)</td>
</tr>
<tr>
<td>White race — no. (%)†</td>
<td>122 (97)</td>
</tr>
<tr>
<td>Body-mass index‡</td>
<td>28.4±2.6</td>
</tr>
<tr>
<td>Neck size — cm</td>
<td>41.2±3.2</td>
</tr>
<tr>
<td>Blood pressure — mm Hg</td>
<td>128.7±16.1</td>
</tr>
<tr>
<td>Systolic</td>
<td>128.7±16.1</td>
</tr>
<tr>
<td>Diastolic</td>
<td>81.5±9.7</td>
</tr>
<tr>
<td>Hypertension — no. (%)</td>
<td>48 (38)</td>
</tr>
<tr>
<td>Diabetes — no. (%)</td>
<td>11 (9)</td>
</tr>
<tr>
<td>Asthma — no. (%)</td>
<td>6 (5)</td>
</tr>
<tr>
<td>Congestive heart failure — no. (%)</td>
<td>2 (2)</td>
</tr>
<tr>
<td>Uvulopalatopharyngoplasty — no. (%)</td>
<td>22 (17)</td>
</tr>
</tbody>
</table>

Strollo PJ Jr et al. 2014.
Results

• PSG at 12 months
  – Median AHI decreased 68% (29.3 → 9.0)
  – Median ODI decreased 70% (25.4 → 7.4)

• 66% had at least 50% reduction in AHI

Secondary outcome measures

– Improved responses on sleep surveys
– Median sleep time at $\text{SpO}_2 < 90\%$ decreased from 5.4% → 0.9%

Results

• Therapy withdrawal for 7 days (randomized)
  – AHI increased from 7.6 $\rightarrow$ 25.8

• Complications
  – 2 required reoperation to reposition device
  – 18% with temporary tongue weakness

Upper Airway Stimulation for Obstructive Sleep Apnea: 5-Year Outcomes

B. Tucker Woodson, MD¹, Kingman P. Strohl, MD², Ryan J. Soose, MD³, M. Boyd Gillespie, MD⁴, Joachim T. Maurer, MD⁵, Nico de Vries, MD⁶,⁷, Tapan A. Padhya, MD⁸, M. Safwan Badr, MD⁹, Ho-sheng Lin, MD¹⁰, Olivier M. Vanderveken, MD, PhD⁷, Sam Mickelson, MD¹¹, and Patrick J. Strollo Jr, MD¹²
STAR TRIAL 60 MONTH

• 97/126 completed protocol
• 71 consented to a voluntary PSG
• Improvement in Epworth Sleepiness Scale & QOL
  - AHI < 20 events/hour and > 50% reduction → 75%
• Events related to lead/device adjustments → 6%
Hypoglossal Nerve Stimulator, Anesthetic Considerations

• Thorough pre-operative evaluation

• General anesthesia + ETT
  – No long-acting paralytic

• Airway management discussion with surgical and anesthesia teams
Transoral Robotic Surgery (TORS) for benign disease of the upper airway
TORS Consideration

Alternative: multilevel surgery
- Lateral pharyngoplasty
- Lingual tonsillectomy, robotic transoral approach
Friedman grading for lingual tonsillar hypertrophy

Grade I

Grade II

Grade III

Grade IV

TORS - History

- 2006: O’Malley et al. introduced TORS for base of tongue neoplasms

- 2011: Vicini et al. TORS for treatment of OSA

- 2015: Hoff et al. reviewed 293 TORSs for benign indications
  - 77 complications (59 patients) within 3 months
  - 12 bleeding events
  - 14 dehydration
  - 15 dysphagia
  - 2 reintubation
2011

• Successful - 76.6%
  • 50% reduction of pre-operative AHI
  • Overall AHI <20 events per hour
• Bleeding - 4.2%
• Transient dysphagia - 7.2%
2017

• Significant improvement in the following:
  - AHI
  - Epworth Sleepiness Scale
  - Lowest $O_2$ saturation
  - Snoring visual analog scale

• Surgical success rate - 68.4%
• Cure rate (postoperative AHI < 5) - 23.8%
BMI predicts success

- 121 patients with AHI > 15
  - AHI 42.7 → 22.2
  - 84% improved AHI
  - 51% had success (AHI < 20 and 50% reduction)
  - 14% had cure (AHI < 5)

  - BMI < 30 – 69.4% success (p=0.004)

  - BMI > 30 – 41.7% success

Hoff PT et al. 2014.
Friedman stage & surgical success

<table>
<thead>
<tr>
<th>Friedman stage</th>
<th>Friedman palate position</th>
<th>Tonsil size</th>
<th>BMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1, 2</td>
<td>3, 4</td>
<td>&lt;40</td>
</tr>
<tr>
<td>II</td>
<td>1, 2</td>
<td>0, 1, 2</td>
<td>&lt;40</td>
</tr>
<tr>
<td></td>
<td>3, 4</td>
<td>3, 4</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>3, 4</td>
<td>0, 1, 2</td>
<td>&lt;40</td>
</tr>
<tr>
<td>IV</td>
<td>any</td>
<td>any</td>
<td>&gt;40</td>
</tr>
</tbody>
</table>

- any patient with craniofacial abnormalities

118 patients TORS LT +/- other procedures

Stratified by Friedman stage (palate position + tonsil size)

Friedman stage predicts success

- Stage I – 75%
- Stage II – 70%
- Stage III – 66%
- Stage IV - 10%

- 70% vs 51% success for BMI < 30 or > 30 (p=0.04)
• Nasal intubation
  – High risk of difficult airway
• General Anesthesia
  – ≤ 30% FiO\textsubscript{2}
  – TIVA with paralysis
  – Multimodal analgesia
• Eye shield
• Rotate bed
• Lower incisor guard
• Davis-Meyer mouth gag
  – McIver if edentulous
• Instruments
  – 30 degree scope
  – Maryland dissector
  – Monopolar (15J)
Airway Management

- Intraoperative dexamethasone
- Extubation in the OR
  - Consider airway exchange catheter
- Monitor overnight
  - CPAP if able
- Prolonged intubation / tracheostomy - Rare
So Which Surgery?!?

Comparing Upper Airway Stimulation to Transoral Robotic Base of Tongue Resection for Treatment of Obstructive Sleep Apnea

Colin Huntley, MD, Michael C. Topf, MD, Vanessa Christopher, Karl Doghramji, MD, Joseph Curry, MD and Maurits Boon, MD

2018
Upper Airway Stimulation vs TORS

- Upper Airway Stimulation

- 50 men and 26 women
- Surgical success – 87%
- Postoperative AHI < 15 - 89%
- Postoperative AHI < 5 – 59 %
- No readmissions
Upper Airway Stimulation vs TORS

- **TORS**

- 20 men and 4 women
- Surgical success – 54%
- Postoperative AHI < 15 – 50%
- Postoperative AHI < 5 – 21%
- Mean stay - 1.33 days
- 4 readmitted
Summary

- OSA is frequently encountered

- Numerous criteria for diagnosis and severity

- DISE aids in diagnosis & surgical planning

- New modalities demonstrating significant potential
  - Upper Airway Stimulation → Hypoglossal nerve stimulator
  - Transoral Robotic Surgery
THE TEAM!!
THANK YOU

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References

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