ABSTRACT

Interventional Drug-Induced Sleep Endoscopy: A Novel Technique to Guide Surgical Planning for Obstructive Sleep Apnea

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INTRODUCTION

• Obstructive sleep apnea (OSA) is characterized by episodes of upper airway collapse during sleep resulting in apnea and hypopnea.
  • Apnea/hypopnea defined by cessation/reduction of airflow/ oxygen desat.
  • Complaints include snoring and daytime sleeping
  • Associated with serious health problems such as cardiovascular disease
• Continuous positive airway pressure (CPAP)
  • Gold standard OSA treatment, although compliance rate < 50%
• Surgical techniques
  • Alternative intervention, limited by unsatisfactory cure rates
  • Need to develop means to identify appropriate surgical candidates
• Drug-induced sleep endoscopy (DISE)
  • Devised in 1991, targeted approach to surgery
  • Visualization of obstruction during sedative-induced sleep
  • Critical question fidelity of sedative-induced sleep compared to natural sleep, although studies demonstrate validity and reliability
• Nasopharyngeal tubes (NPT)
  • Soft, flexible tubes, used as adjunct in airway management
  • Placed through nasal cavity/nasopharynx into oropharynx until tip just beyond soft palate
  • Slit open palate, separate soft palate from posterior wall of oropharynx
• NPT placement as a treatment for OSA
  • palate is primary level of collapse in most OSA patients
  • Some efficacy, but limited by poor patient tolerance
• NPT placement as a diagnostic tool for OSA
  • Discern which patients who would respond to isolated oropharyngeal surgery from those patients who require a multilevel approach
  • Identifying patients who will improve with a less extensive surgical approach
• NPT placement, palatal collapse may improve with a less extensive surgical approach
• Stenting palate open (NPT placement or palatal sleep surgery)
  • May also decrease downstream pharyngeal collapse by reducing negative pharyngeal pressure
• No study has evaluated the effect of a NPT on upper airway obstruction during sleep endoscopy.
• Our study could help to provide evidence as to whether improving palatal collapse can improve upper airway collapse at other sites.
• These findings could enhance the ability of DISE to select the appropriate surgical intervention.

METHODS AND MATERIALS

Patient Selection

• 41 patients (age > 18 years) with OSA between July 2014 and November 2014 at an academic tertiary care center
• Exclusion criteria: Prior OSA surgery or propofol allergy.
• Polysomnography (PSG) was conducted prior to DISE.

Interventional Drug-Induced Sleep Endoscopy and Classification of Morphological Features

• DISE was performed in the OR.
• Unconscious patients induced with IV propofol.
• Flexible video endoscope introduced and upper airway observed.
• Compare obstruction with and without a Robartzi nasopharyngeal airway in place (Figure 1).

DISE analyzed using categorization in Table 1.

TABLE I. Upper Airway Obstruction Classification System.

<table>
<thead>
<tr>
<th>Level</th>
<th>Degree</th>
<th>Partial</th>
<th>Complete</th>
<th>Intermittent</th>
<th>Sustained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palate</td>
<td>P</td>
<td>P</td>
<td>***</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>Lateral wall</td>
<td>L</td>
<td>L</td>
<td>***</td>
<td>***</td>
<td></td>
</tr>
<tr>
<td>Tongue base</td>
<td>t</td>
<td>T</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Epiglottis</td>
<td>e</td>
<td>E</td>
<td>1</td>
<td>2</td>
<td></td>
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Statistical Analysis

• Changes to pattern of upper airway obstruction were analyzed using McNemar’s test or Fisher’s exact test.
• P value < .05 was considered statistically significant.

RESULTS

Study Demographics

<table>
<thead>
<tr>
<th>Patient Characteristics</th>
<th>Mean ± SD</th>
<th>Range</th>
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<tbody>
<tr>
<td>Age (yr)</td>
<td>43.8 ± 12.1</td>
<td>19-69</td>
</tr>
<tr>
<td>Gender (M/F)</td>
<td>33/8</td>
<td>-</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>30.5 ± 7.6</td>
<td>18-44</td>
</tr>
<tr>
<td>AHI (events/hr)</td>
<td>27.6 ± 20.2</td>
<td>6-88</td>
</tr>
<tr>
<td>Tonsil size (grade 0-4)</td>
<td>2.9 ± 1.7</td>
<td>0-4</td>
</tr>
</tbody>
</table>

Overall Pattern of Upper Airway Collapse

• Most common site of collapse was the palate (95.1%).
• About 1/2 of patients demonstrated lateral wall collapse (34.1%).
• Most patients (82.9%) demonstrated multilevel obstruction.
• Single level obstruction found in some patients (17.1%).

Multilevel Upper Airway Obstruction and Interventional Drug-Induced Sleep Endoscopy

• In patients with multilevel collapse, a significant portion of patients demonstrated at least a partial improvement (74%) and some patients a complete resolution (35%) of downstream upper airway collapse with NPT placement (P < 0.05).
• Nearly all of these patients had complete palatal obstruction.
• At least partial reduction in collapse was observed at the lateral walls (86%), epiglottis (55%), and tongue base (50%).
• Completely resolved collapse with NPT placement was rare at tongue base level (13.0%), whereas was common at lateral wall level (57.1%).

CONCLUSIONS

To our knowledge, this is the first study to evaluate the efficacy of soft palatal stenting on downstream pharyngeal obstruction during drug-induced sleep endoscopy (DISE). Our results demonstrate that reducing palatal collapse can reduce obstruction in downstream sites of the upper airway. The novel technique of placing a nasopharyngeal tube during DISE may help sleep surgeons to select the affects of palatal sleep surgery and identify patients who would respond to this procedure alone, separating them from those that would require multilevel surgery. Taken together, Interventional DISE may help better direct a minimally invasive approach to surgery for OSA.

REFERENCES