Use of Sleep Endoscopy to Assess Positional Obstructive Sleep Apnea: A Prospective Study

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ABSTRACT

Educational Objective: At the conclusion of this presentation, the participants should be able to discuss the effects of body position on the upper airway of patients with obstructive sleep apnea (OSA).

Objectives: To assess the effect of body position on the oropharyngeal and hypopharyngeal anatomy of patients with obstructive sleep apnea (OSA) by comparing sleep endoscopy in supine and lateral positions.

Study Design: Prospective study.

Methods: Ten patients were enrolled with and without positional OSA (non-supine 50% reduction in oropharyngeal index). Sleep endoscopy was performed and compared in both supine and lateral positions to determine if sleep position affected the level and degree of upper airway obstruction.

Results. Sleep position significantly altered the pattern of upper airway obstruction in positional OSA (p < 0.05). Compared to supine sleep endoscopy in the supine position, a significant reduction in tongue base and epiglottic obstruction in positional OSA patients (p < 0.05). In contrast, no significant change was seen in patients without positional OSA. A mixed-effects model was used to examine the interaction between position and OSA, with the results showing a significant effect of position on OSA.

Conclusions. Sleep endoscopy performed in the supine versus lateral sleeping position changes the dynamics of upper airway collapse, especially in position-dependent OSA patients. Identifying this may help tailor a less invasive surgical therapy. A review of the polysomnography hypnoaerograms may also help decide if positional OSA is present, suggesting that positional sleep endoscopy may be helpful. As far as the authors are aware, this is the first study which attempts to address one of the most critical questions in sleep endoscopy, the fact that it is only usually performed in the supine position.

INTRODUCTION

Obstructive sleep apnea (OSA) is a common condition that falls within the spectrum of sleep-disordered breathing. Although the prevalence of OSA is well-established, the prevalence is expected to rise. The disorder causes collapse of the upper airway during sleep, resulting in complete or partial cessation of airflow.

Some patients experience more airflow obstruction while supine compared to non-supine positions. If the difference between the apnea-hypopnea index in supine and non-supine positions is 50% or greater, the condition is referred to as positional OSA. Positional patients are thought to make up a substantial component of the OSA population. Several studies have shown that 56% of patients with OSA qualify as positional. Even more patients (30%) improve when sleeping in non-supine positions, but not to the extent to be diagnosed with positional OSA.

Continuous positive airway pressure (CPAP) is the most common therapy for OSA. Despite the efficacy of CPAP, more than half of OSA patients find it intolerable. An alternative approach to managing OSA is surgical modification of the upper airway. The success of these surgeries can be enhanced with techniques that identify the site of obstruction, thereby preventing unnecessary surgery on non-obstructive areas. In 1991, Croft and Pringle described drug-induced sleep endoscopy (DISE), a methodology that artificially induces sleep apnea with a pharmacologic agent while visualizing the upper airway using a flexible endoscope. DISE can guide the surgical management of OSA. DISE findings can be classified based on level, configuration, degree, and sustainability of collapse.

To our knowledge, no study has been able to visually observe the phenomenon of positional OSA. This study will determine whether positional OSA can be elicited by drug-induced sleep endoscopy and how the diagnostic ability compares to polysomnography (PSG).

METHODS AND MATERIALS

Patient Selection

• All patients (18+ years) with OSA between September 2011 and February 2012 at an academic tertiary care center.
• Exclusion criteria: Prior PSG or propofol allergy.
• Polysomnography (PSG) was performed prior to DISE.
• Positional OSA was defined as a difference of 50% or more in apnea-hypopnea index (AHI) between supine and non-supine positions.
• An equal number of patients were selected with positional and non-positional OSA, as defined by the PSG.

Positional Drug-Induced Sleep Endoscopy and Classification of Morphological Features

• DISE was performed in the OR with patients initially positioned laterally. Unconscious sedation was induced with propofol. Adequate sedation was defined as absence of response to verbal stimulation in a normal voice.
• A flexible video endoscope was introduced and upper airway observed for obstruction in lateral and supine positions. A recording device stored video from DISE.
• DISE was analyzed using a categorization based upon previous studies as described in Table I.

Statistical Analysis

• Changes to the pattern of upper airway obstruction were analyzed using McNemar’s test. The Fisher’s exact test was used.

RESULTS

Table I: Upper Airway Obstruction Classification System.

<table>
<thead>
<tr>
<th>Level</th>
<th>Palate</th>
<th>Partial Complete Intermittent Sustained</th>
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<tbody>
<tr>
<td>Lateral wall</td>
<td></td>
<td>I</td>
</tr>
<tr>
<td>Tongue base</td>
<td>t</td>
<td>1</td>
</tr>
<tr>
<td>Epiglottis</td>
<td>e</td>
<td>1</td>
</tr>
</tbody>
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• All patients with positional OSA demonstrated tongue base or epiglottic obstruction.
• Overall, lateral positioning significantly altered the pattern of upper airway obstruction in positional OSA patients (P < .05).
• All positional OSA patients showed some improvement in obstruction by lateral DISE.
• Tongue base or epiglottic obstruction was the primary site of improvement in most of these patients. No patient demonstrated complete resolution of multi-level collapse with lateral positioning.

Figure 1. Nasopharyngoscopic view of the tongue base of a positional OSA patient in the supine (a) and the lateral (b) position during drug-induced sleep endoscopy.

Figure 2. Nasopharyngoscopic view of the tongue base of a non-positional OSA patient in the supine (a) and the lateral (b) position during drug-induced sleep endoscopy.

DISCUSSION

DISE has traditionally been performed in the supine position. This is one of the main criticisms of this technique as patients often sleep in other positions. To our knowledge, this is the first study to evaluate the effect of position on DISE findings.

Sleep position can have dramatic effects on OSA severity. Over half of OSA patients qualify as having positional OSA. Our results suggest that DISE findings improve in the lateral supine position for most patients with positional OSA. In contrast, the pattern of obstruction in non-positional OSA patients did not change in the lateral position.

A number of therapies have been evaluated by researchers to address positional OSA. These therapies are designed to prevent the individual from assuming their worst sleep position, usually being the supine position. Most research suggests that positional therapy has better patient compliance than CPAP, but is less effective at reducing the AHI. Given this limitation, positional therapy is rarely considered a first-line intervention for OSA. Select populations of positional OSA patients may benefit just as much from positional therapy as CPAP, more than half of OSA patients find it intolerable. An alternative approach to managing OSA is surgical modification of the upper airway. The success of these surgeries can be enhanced with techniques that identify the site of obstruction, thereby preventing unnecessary surgery on non-obstructive areas. In 1991, Croft and Pringle described drug-induced sleep endoscopy (DISE), a methodology that artificially induces sleep apnea with a pharmacologic agent while visualizing the upper airway using a flexible endoscope. DISE can guide the surgical management of OSA. DISE findings can be classified based on level, configuration, degree, and sustainability of collapse.

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• Based upon these findings, lateral positioning would change the surgical management of oropharyngeal and hypopharyngeal collapse.

Non-Positional OSA

• Lateral positioning did not significantly change the findings of patients with non-positional OSA (P > .05).

Figure 2. Nasopharyngoscopic view of the tongue base of a non-positional OSA patient in the supine (a) and the lateral (b) position during drug-induced sleep endoscopy.

CONCLUSIONS

This study demonstrates that DISE can be performed in both supine and lateral positions. Lateral positioning significantly improved the upper airway morphology for patients with positional OSA, especially at the tongue base and epiglottic level. Clinicians should consider using DISE in different positions to best tailor the surgical management of positional OSA patients.

REFERENCES

5. Ravesloot et al. pointed out that positional OSA patients frequently had tongue base or epiglottic obstruction on DISE. This is in agreement with our findings and other studies that had corroborated the association between positional OSA and tongue base obstruction. Given the potential for tongue base obstruction, some believed that positional OSA patients would respond better to tongue base surgery. However, a follow-up study found that positional OSA patients do not respond better than non-positional patients to tongue base or multilevel surgery. The study also found that improvement in AHF following tongue base and multilevel surgery was not position dependent. It still remains unclear whether positional therapy can help improve the response to tongue base surgery.

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