Upper Airway Surgery for the Treatment of Obstructive Sleep Apnea: Surgical Outcomes and the Effect on CPAP Therapy

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BACKGROUND
Obstructive sleep apnea (OSA) is a sleep disorder affecting more than 5% of the adult population. The syndrome is characterized by upper airway collapse leading to hypoventilation. Patients present with several cardinal symptoms including snoring, daytime somnolence, and reports of arousal and asphyxia. Neurological and anatomical factors contribute to the etiology of OSA. Untreated OSA has been associated with poor outcomes including decreased quality of life, cardiovascular morbidity and mortality, as well as, increased accidents related to sleepiness.

Tracheostomy was the first described treatment for OSA. In 1981, Sullivan et al. introduced continuous positive airway pressure (CPAP), which quickly gained worldwide acceptance and has remained the mainstay of treatment since that time. Unfortunately, in those who accept treatment with CPAP, compliance is often poor leading to suboptimal treatment or treatment failure.

As early as the initial use of CPAP, the literature describes surgical therapies for OSA. These techniques have been modified to address specific anatomic abnormalities causing obstruction. Traditionally, uvulopalatopharyngoplasty (UPPP) has been the primary surgical procedure used to address OSA. UPPP is used to enlarge the pharyngeal inlet by removing excess palatal and pharyngeal tissue. Newer techniques including the lateral pharyngoplasty (Cabinet) and expansion sphincter pharyngoplasty (Woodson) have been developed to address lateral collapse, not typically remedied by conventional UPPP. Nasal septoplasty and inferior turbinate reduction have been used to help improve CPAP compliance in individuals with historically poor compliance secondary to nasal obstruction. Current therapy may also include treating obstruction at the tongue base.

Multiple studies have shown improvement in post-operative apnea/hypopnea indices (AHI), as well as, improved quality of life measurements with those who have undergone upper airway reconstructive therapy for OSA.

Recent studies also seem to indicate upper airway surgery for the treatment of OSA can have a positive effect on CPAP effectiveness and compliance. There is limited objective data with regard to CPAP usage; however, we are now able to objectively evaluate this endpoint using CPAP smart card equipped machines.

RESULTS
A total of 44 patients underwent upper airway surgery for the treatment of OSAHS at our institution. Twenty-six (59%) were male and eighteen (41%) were female. The mean age of our population was 46 years (range: 17-75 years) and the median body mass index (BMI) was 31 (range: 21 - 47.5). All patients underwent traditional uvulopalatopharyngoplasty (UPPP), lateral pharyngoplasty or expansion sphincter pharyngoplasty. Additionally, patients underwent turbinate reduction (n = 31), septoplasty (n = 21) and base of tongue reduction (n = 19). Thirty (68%) patients underwent surgery during one setting while fourteen (32%) required staged procedures. Table 1 compares pre and post-operative BMI, polysomnography data, and Epworth sleepiness scales (ESS). The change in median body mass index for our patients was statistically significant, however the narrow range of the BMI data impact this finding and the differences are not clinically significant. Post-operative AHI, rapid-eye movement apnea/hypopnea index (REM AHI), minimum oxygen saturation (minimum SaO2), amount of time below SaO2 of 88% (time below 88%) and ESS all improved post-operatively, the differences were statistically significant. Figure 1 shows the changes in the distribution of the data for pre- and post-operative AHI values. The post-operative values are significantly lower and more narrowly distributed, representing improvement among the majority of patients. Twenty (45%) patients required CPAP therapy following upper airway surgery. CPAP compliance increased and optimal pressure settings decreased following surgical intervention. However, the data lacked adequate completeness for legitimate statistical comparisons.

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<tr>
<th>Table 1. Pre- and Post-op Changes in OSA Related Measures</th>
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<td>Variables</td>
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<td>BMI</td>
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<tr>
<td>AHI</td>
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<tr>
<td>REM AHI</td>
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<td>Minimum SaO2 (%)</td>
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<td>Time Below 88% (min)</td>
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<td>ESS</td>
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CONCLUSION
Pallate augmentation and multilevel upper airway surgery are effective treatment options for moderate-severe OSAHS. In patients who continue to require post-operative therapy, these surgical interventions may reduce CPAP settings and improve CPAP compliance. All patients undergoing CPAP therapy should be required to use electronically monitored devices in order to objectively measure compliance.

LIMITATIONS AND FUTURE RESEARCH
Data completeness is an inherent problem with retrospective studies like this one. Specifically, CPAP compliance data were incomplete among these patients. Many of the patients did not have pre-operative smart card CPAP devices. Standardization of care and data collection can minimize the effects of this problem.

We are currently developing a prospective clinical trial that will follow OSA patients from their initial polysomnogram. Our goal is to more completely understand and explain the effects of upper airway surgery, specifically on patients who are non-compliant with CPAP therapy. This will include the implementation of smart card technology to monitor CPAP usage objectively.

BIBLIOGRAPHY