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What is This?
Simultaneous Tonsillectomy and Nasal Surgery in Adult Obstructive Sleep Apnea: A Pilot Study

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Abstract

Objective. Although adenotonsillectomy is the accepted treatment for obstructive sleep apnea (OSA) in the pediatric population, tonsillectomy has not been widely adopted in adults, and its success in this group has not been well reported. Despite the lack of current evidence, there may be an important role for tonsillectomy in selected adult cases, and further study is required. This is a pilot study from a larger group of subjects currently enrolled and awaiting surgery and repeat polysomnography.

Study Design. Retrospective series with chart review.

Setting. Tertiary referral teaching hospitals.

Subjects and Methods. Thirteen consecutive eligible subjects with tonsilar hypertrophy and OSA were identified after treatment. These patients had undergone pre- and postoperative polysomnography for assessment of the severity of sleep-disordered breathing. Post hoc analysis of key parameters was performed by Wilcoxon signed rank and paired t tests. Tonsillectomy was performed on all subjects, using the diathermy dissection technique. Nasal surgery was performed simultaneously in 11 subjects for symptomatic nasal blockage unresponsive to medical treatment.

Results. There was a statistically significant improvement in the severity of OSA after surgery. The total Respiratory Disturbance Index (RDI) was significantly decreased from median values of 31.7 to 5.5 (P = .0002). The RDI in rapid eye movement and non–rapid eye movement sleep and the arousal index were also significantly decreased.

Conclusion. In selected adult subjects, tonsillectomy with intercurrent nasal surgery should be considered an effective treatment for OSA and may reduce the requirement for continuous positive airway pressure, oral appliances, or further therapeutic intervention.

Keywords

tonsillectomy, nasal obstruction, obstructive sleep apnea, snoring

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Although adenotonsillectomy is a well-established treatment of obstructive sleep apnea (OSA) in the pediatric population, the role of tonsillectomy in the adult OSA population has been more controversial.¹ Nocturnal continuous positive airway pressure (CPAP), delivered via a nasal or full face mask, is still the accepted treatment for adults with moderate to severe OSA. However, therapeutic adherence to this therapy can be problematic due to several factors. It is particularly an issue in subjects with preexisting nasal obstruction and in those requiring high pressures.² The cosmetic appearances are also a problem, especially in younger subjects. A small number of studies have explored the role of tonsillectomy in selected adult cases, after unsuccessful CPAP treatment.³–⁵ Success has been in the range of 40% to 100%, but subject numbers have been small. We present our experience with tonsillectomy and nasal surgery for OSA in selected adult subjects.

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Methods

This study was approved by the Human Ethics and Research Committee of the participating Institution (St Vincent’s Hospital, Sydney, Australia). All polysomnography was inpatient based and performed at the same laboratory (Sleep Investigation Unit, Sleep Health and Research Royal North Shore, Sydney, Australia).

Subjects, who met the inclusion criteria and who had completed pre- and postoperative diagnostic polysomnography, were selected from the databases of the participating physician and surgeon. The inclusion criteria were age older than 16 years, OSA diagnosed by polysomnography, clinical grading of tonsil size as Friedman grade 3 or 4, and a Müller maneuver associated with 75% to 100% collapse of the lateral pharyngeal walls (Table 1). These inclusion criteria identify patients in whom it is thought that lateral pharyngeal collapse is the major contributor to their OSA, rather than patients with disease primarily at the level of the velopharynx who would typically be offered uvulopalatopharyngoplasty (UPPP). Because this study focuses on one particular anatomic region, data for tongue size and palatal configuration were not collected. Patients with lesser degrees of lateral pharyngeal collapse were excluded from this pilot study but will be evaluated in separate work.

Informed consent was obtained for the surgery. All subjects underwent tonsillectomy, performed by the diathermy dissection technique. Some subjects underwent nasal surgery, and this was performed under the same general anesthesia. Some surgeons believe that simultaneous surgery involves lower morbidity than staged procedures, but the ultimate decision to avoid staged procedures was made by the enrolled patients. The indication for septoplasty was symptomatic nasal blockage in the presence of a nasal septal deviation. The indication for submucous resection of the inferior turbinates was persistent nasal blockage in the presence of chronic rhinitis, unresponsive to daily intranasal topical corticosteroid (mometasone 50 μg/spray or budesonide 64 μg/spray) use for 3 months.

Standard 21-channel diagnostic polysomnography was performed preoperatively and again at a minimum of 8 weeks following surgery. The studies were scored by the sleep technologists of the Sleep Studies Unit, according to standard Chicago criteria.

Pre- and postoperative polysomnogram data were entered into SPSS Version 19 (SPSS, Inc, an IBM Company, Chicago, Illinois) and assessed for the presence or absence of normal distribution using the Shapiro-Wilk test. Measures that were normally distributed both pre- and postoperatively were compared using a paired t test. If either measure was not normally distributed, comparison reverted to the Wilcoxon signed rank test. Statistical significance was defined as \( P < 0.05 \). Comparisons were made for measurements of total respiratory disturbance index (RDI), RDI in rapid eye movement (REM) and non–rapid eye movement (NREM) sleep, arousal index, percentage of total sleep time in REM and NREM, minimal oxygen saturation in REM and slow-wave (stage 3 and 4 NREM) sleep, and body mass index (BMI).

Subjects were reviewed at 1 and 3 weeks postoperatively, then at least every 6 months. The CPAP pressures were noted pre- and postoperatively.

Surgical success was defined as a reduction in RDI of at least 50%, along with a postoperative RDI of less than 20.

Results

Thirteen consecutive eligible subjects were selected from the databases of the participating physician and surgeon for the purposes of this analysis. The mean age was 36 years.
least 50%. Five subjects with moderate OSA had successful operative RDI of less than 20 and a reduction in RDI of more than 50% (range, 23-57 years), and there was no association between the subjects’ age (independent samples t test) or tonsil grade (Fisher exact test) and our definition of surgical success. All subjects were men, with our data differing from epidemiological studies of OSA in which male-to-female ratios have varied from 2.2:1 to 7.9:1 with increasing disease severity.5 The median BMI preoperatively was 29.3 kg/m² (range, 24.1-45.4).

Eleven subjects underwent simultaneous nasal surgery. Nine subjects had both septoplasty and submucous resection of the inferior turbinates. One patient had only a septoplasty, and another patient had only submucous resection of the inferior turbinates.

Overall, the preoperative median total RDI was 31.7 (range, 16.2-72.7). This fell to 5.5 postoperatively (range, 0-53.1), a significant difference (P = .001). Two patients had a less than 50% reduction in their RDI after surgery, with one of these patients still having an RDI of greater than 20 (Figure 1).

The changes in RDI during NREM and REM sleep were also significant: median RDI in NREM fell from 29.9 to 5.3 (P = .002), whereas median RDI in REM fell from 33.9 to 5.4 (P = .019). Nocturnal arousals were significantly less (preoperative median = 48, postoperative median = 18.1, P = .005).

Although there were trends toward improvement in the minimal nocturnal oxygen saturation in both REM (mean 3% improvement) and NREM (mean 3.3% improvement) sleep, neither was statistically significant. There was no significant difference in overall minimal nocturnal oxygen saturation before and after surgery (P = .181). There was no significant difference between median BMI before (29.3 kg/m²) and after surgery (29.6 kg/m², P = .637), which, if present, may have had a confounding influence on the results.

Preoperatively, 2 subjects had mild OSA (RDI 10-25), 6 had moderate OSA (RDI 25-35), and 5 had severe OSA (RDI >35). Both subjects with mild OSA had successful surgery (100%), with surgical success being defined as a postoperative RDI of less than 20 and a reduction in RDI of at least 50%. Five subjects with moderate OSA had successful surgery (83%), and the remaining patient had a substantial drop in his RDI (28.7 to 15.9). Four subjects with severe OSA had successful surgery (80%). The final subject had no improvement, with a pre- and postoperative RDI of 53.

None of the 3 subjects who were left with mild OSA postoperatively required CPAP as per the Practice Parameters of the Australasian and American Sleep Association Guidelines of 2009 because of their absence of symptoms and relevant comorbidities. There were no major complications from the surgery. Specifically, there were no cases of posttonsillectomy hemorrhage, epistaxis, or hospital readmissions. One subject did present to the emergency department 48 hours after discharge with acute dyspnea. All investigations were normal, and the diagnosis was aspiration-induced laryngospasm. He recovered completely.

Discussion

Nocturnal CPAP continues to be first-line treatment for adult subjects with moderate to severe OSA. This study suggests a role for tonsillectomy and nasal surgery in the treatment of selected OSA subjects—namely, those of a younger age with clear visual evidence of tonsillar enlargement. This is the first study of which we are aware that shows a rate of surgical success as high as 69%. Furthermore, 92% of subjects (all but 1) had a postoperative RDI of <20, and 85% of subjects reduced their RDI by at least 50%, fulfilling the description of surgical success (Figure 1).

Apart from the offer of significant reduction in OSA severity, tonsillectomy may provide a drop in the required CPAP pressure level. This may increase adherence to CPAP and is likely to be associated with greater comfort, less machine noise, and subsequent rhinitis.2,7 Nakata et al8 studied the effect of tonsillectomy on nasal resistance in 20 subjects with OSA. There was a significant improvement in nasal resistance after tonsillectomy, with the expectation that this would improve CPAP compliance due to lower CPAP pressures.

Only 1 subject in the current study failed to demonstrate any improvement after tonsillectomy. His BMI was 31.6, approximating the median BMI, so weight is unlikely to have been a factor. There were no other unusual morphometric or tonsillar pathologies to account for the lack of response in this subject. Possible reasons for failure include the preexisting architecture of his upper airway with a large neck circumference (46 cm) and strong family history of snoring and premature heart disease, suggesting a likely genetic predisposition. His ethnicity was French Mauritian. Importantly, there was no significant change in his BMI, which, if present, may have been a confounding factor.

Although it is possible that any nasal surgery performed made a contribution to the improvement of RDI, we believe that the improvement was most likely due to the tonsillectomy. Nasal surgery may reduce CPAP pressures, but there is no clear evidence that it reduces RDI.7 All subjects had requested the nasal surgery and tonsillectomy to be done under the same general anesthetic. There is no evidence of increased morbidity from this combined procedural approach.
Other studies have supported a role for tonsillectomy in the treatment of selected adult OSA subjects. Verse et al\(^5\) studied 9 adult subjects with OSA. All subjects had a maximal intertonsillar space of 5 mm at the narrowest point (mouth open, no phonation, and no tongue depressor) and underwent tonsillectomy, with pre- and postoperative polysomnography. Eight of 9 subjects (89%) achieved an apnea-hypopnea index (AHI) <20 and a greater than 50% reduction in AHI 3 to 6 months postoperatively. All 4 subjects with mild OSA achieved this goal, with the authors suggesting mild OSA may be more responsive to tonsillectomy. Sleep efficiency, sleep architecture, and body weight were not significantly different pre- and postoperatively. Oxygen desaturation measures were not statistically compared. This is a limited study; however, it does confirm the findings of the current study and suggests a predicted response in milder disease. It does not include more severe disease as per the current study, and so direct comparisons cannot be drawn.

Nakata et al\(^4\) studied 30 adult subjects with OSA. All subjects had grade 2 to 4 tonsil size, according to Friedman classification, and underwent tonsillectomy, with pre- and postoperative polysomnography. Only 40% of the subjects achieved an AHI <20 and an AHI improvement index of greater than 50% at 6 months postoperatively. The CPAP pressures were reduced in 4 subjects who did not achieve surgical success. Factors associated with successful outcome were BMI <25 and tonsil size grade 3. Overall, lowest oxygen saturation, oxygen desaturation times, and arousal index were significantly improved after tonsillectomy. Body mass index was not significantly different.

This study supports the current data indicating success in those with grade 3 or greater tonsillar enlargement, as well as reductions in CPAP driving pressures in those with residual disease. The current study could not reproduce the improvements in the nadir of oxygen saturation, which possibly reflects a type II error related to the study size and potentially 1 outlying patient with more extreme desaturation. Ten of the 13 patients still had a minimum oxygen saturation of less than 90% after surgery. Another possible reason is the presence of factors to do with chest wall mechanics driven by the BMI, in which there is a degree of pulmonary restriction. The current study does confirm a trend toward improved saturation control and may reach significance with additional recruitment, which is currently under way. Baseline pulmonary function testing may be important in the additional recruitment.

Nakata et al\(^4\) found 100% of subjects with BMI <25 were successfully treated by tonsillectomy, implying that thinner subjects may have better outcomes. However, Martinho et al\(^3\) studied 7 obese adult subjects with OSA and a mean BMI of 36.6. All had a 50% to 100% obstruction of the oropharyngeal orifice, as judged clinically. After tonsillectomy, 6 subjects (86%) had a reduction of AHI greater than 50%. There was a significant improvement in AHI, minimal oxygen saturation, and percentage of slow-wave sleep (stage 3-4 NREM). The current analysis does not support BMI as a predictor of postoperative outcome, which appears to date to be independent of outcome. Despite postoperative discomfort, there is also no suggestion that upper airway surgery may contribute to weight loss. The discrepancy between these data may possibly be related to ethnicity (Japanese, Portuguese vs other whites), also considering that the 1 subject in the current analysis was of French Mauritian origin.\(^9\)

In summary, the evidence suggests subjects with Friedman size 3 and 4 tonsils and mild to moderate OSA (RDI 10-35) may have a better response to tonsillectomy. Body mass index has no predictive effect on outcome, but racial/craniofacial effects may play a role. This latter observation remains largely speculative but worthy of further investigation. We believe that the finding of 75% to 100% lateral pharyngeal collapse upon Muller maneuver is an important preoperative assessment criterion and that the presence of concomitant mechanical nasal obstruction is best addressed at the time of tonsillectomy, conveying no additional surgical morbidity and being of some potential additional benefit. It is unlikely to be of any independent benefit offered alone.

**Conclusion**

Tonsillectomy and nasal surgery saw a reduction of RDI by at least 50% and a postoperative RDI less than 20 in 85% of our subjects, which is a higher rate of surgical success than other reports in recently published literature.\(^10\)\(^12\) All subjects, with 1 exception, were downstaged to mild residual OSA, allowing for the clinical cessation of nocturnal CPAP. The improvement in the RDI may lead to reduced long-term sequelae and may provide for increased adherence with CPAP for the subjects requiring intervention for residual disease. Improvements in the majority of objective parameters of sleep following surgery have been associated with considerable patient satisfaction and subjective daytime function, even in those with residual disease. Offering patients with OSA a complete “cure” (AHI <5) in terms of objective measures is prone to disappoint, but targeted surgical treatments based on fastidious clinical assessment remain a useful tool in their multimodality treatment.

**Author Contributions**

Nicholas W. Stow, design, surgery, manuscript; Phillip J. P. Sale, data analysis, manuscript; Donald Lee, data acquisition; David Joffe, data acquisition; Richard M. Gallagher, design, surgery.

**Disclosures**

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