The Laryngoscope

The Effect of Nasal Surgery on Nasal Continuous Positive Airway Pressure Compliance

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Objectives/Hypothesis: Nasal continuous positive airway pressure (CPAP) is the standard therapy for sleep apnea; however, compliance rates are historically poor. Among the most commonly cited reasons for nonadherence is nasal obstruction. Our study sought to examine if nasal surgery actually increases CPAP compliance.

Study Design: Prospective case series.

Methods: Nasal CPAP-intolerant obstructive sleep apnea (OSA) patients, with documented nasal obstruction, underwent septoplasty plus inferior turbinoplasty. Preoperative and postoperative data were collected on CPAP usage per night and subjective nasal obstruction with the Nasal Obstruction Symptom Evaluation (NOSE) Scale questionnaire.

Results: Eighteen patients met inclusion criteria and underwent septoplasty. CPAP usage increased significantly from 0.5 hours per night preoperatively to 5 hours per night postoperatively ($P < .05$). Subjective nasal obstruction on the NOSE Scale decreased from 16.1 preoperatively to 5.4 following surgical intervention ($P < .05$). CPAP pressure decreased from 11.9 preoperatively to 9.2 after surgery, with a trend toward signifiance ($P = .062$).

Conclusions: This study demonstrates improved CPAP compliance rates following septoplasty in OSA patients with nasal obstruction. Correction of nasal obstruction should be offered in nasal CPAP-intolerant individuals to improve CPAP compliance.

Key Words: Obstructive sleep apnea, continuous positive airway pressure, nasal surgery, septoplasty.

Level of Evidence: 3b

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INTRODUCTION

Obstructive sleep apnea (OSA) is a common condition known to affect 3% to 9% of middle-aged adults.[1] Since first described in 1981 by Sullivan et al., continuous positive airway pressure (CPAP) has become the accepted standard therapy for OSA due to its low risk and efficacious nature, with nasal CPAP being considered the physiologically optimal mechanism of pressurized air delivery.[2] However, real-world nasal CPAP effectiveness rates are relatively low due to problematic nonadherence, with compliance reported as 40% to 80% over the long term depending on the usage metric employed.[3–6] Reasons typically quoted for poor compliance often include nasal obstruction and nasal congestion. Untreated OSA has been associated with adverse sequelae including daytime somnolence, increased motor vehicle collision rates, and increased cardiovascular morbidity and mortality[7–12]; therefore, this problematic rate of nasal CPAP nonadherence is of particular concern.

There is a rapidly growing body of literature studying surgical intervention as treatment of OSA. Nasal surgery, in particular, has been assessed in multiple studies. Although nasal surgery as a solitary intervention is not supported as an OSA treatment modality, nasal surgery has been shown to be effective at decreasing CPAP pressure settings.[13–15] Interestingly, although it is commonly assumed that nasal surgery will also increase CPAP compliance, and many surgeons operate with that intent, to date there have not been any published studies specifically addressing this issue. Nonetheless, nasal surgery, and septoplasty in particular, continues to be widely deployed for this purpose. In the OSA population, some patients with more severe disease status represent potentially significant perioperative risk, and thus it behooves the surgical community to ensure that the proposed corrective nasal surgery is justified with best practice parameters. The objective of our study was, therefore, to assess if evidence exists for nasal CPAP compliance rates changing after surgery for nasal obstruction in a noncompliant CPAP patient population.

MATERIALS AND METHODS

Ethics approval was obtained though the Western University ethics review board. The study design was a case series. Inclusion criteria were patients diagnosed with OSA by overnight level 1 polysomnography, prescribed treatment with nasal CPAP, and subsequently unable to tolerate nasal CPAP (defined as <1 hour of use per night) after 2 months of consistent attempted use, with the nasal obstruction being given as the

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sole reason for intolerance and with an anatomical reason (deviated septum) being found on examination. Degree of septal deviation was not routinely recorded; rather, if a patient was found to have a septal deviation of any sort that was obstructive enough to cause symptoms, this was deemed sufficient for study inclusion purposes. Recognizing that there are many reasons for CPAP noncompliance, the research team thoroughly explored the various issues with the patients before determining that nasal obstruction was the sole stated reason for nonuse of the device. If other concerns were raised (e.g., claustrophobia, cost, comfort), these were addressed with the respective patients, but these people were not included in the study. Exclusion criteria were age <18 years, pregnancy, any prior nasal or upper airway surgery, nasal allergies, chronic rhinosinusitis, smokers, or other medical conditions that would preclude patients from surgery. Patients who were thought to have nasal valve collapse as a reason for nasal obstruction were offered corrective septorhinoplasty but not included in the study population, as we were looking to study the most straightforward cases only in this project.

Patients were evaluated with the Nasal Obstruction Symptom Evaluation (NOSE) Scale questionnaire,[16] demographic data, and CPAP usage data (hours of usage per night), and pressure obtained from the CPAP device itself. Those interested in surgical intervention were consented for and underwent a standard septoplasty with inferior turbinate reduction (i.e., turbinoplasty [bipolar submucosal cautery with out-fracture] is performed routinely with septoplasty at our institution). Following surgery, patients were assessed initially at 3 weeks postoperatively and then instructed to follow-up with their pulmonologist and CPAP vendor to restart nasal CPAP therapy. Six-month postoperative CPAP usage and NOSE Scale data were then collected. Statistical analysis of the CPAP and NOSE Scale data was completed using a Wilcoxon signed rank test with statistical significance set at $P < .05$.

RESULTS

Over a 6-month study, 20 patients were recruited as the study population, but two were lost to follow-up, leaving 18 patients who met all study criteria, who agreed to take part, and who were followed to conclusion. The mean age was 52 years (15 males, three females), with an average preoperative apnea-hypopnea index of 33.2. Preoperative evaluation revealed an average CPAP usage of 0.5 hours per night. Preoperative NOSE Scale data averaged 16.1 among the patients (where the maximum possible score = 20). Postoperatively, the mean nightly CPAP usage was 3.9 hours per night (significant difference compared to preoperative data at $P < .05$), whereas the mean postoperative NOSE Scale score was 5.4 (significant difference compared to preoperative data at $P < .05$). CPAP pressure data obtained from the devices themselves showed a mean preoperative pressure of 11.9 cm H_2O, which decreased to a mean of 9.2 cm H_2O after surgery; this showed a trend toward significance ($P = .062$). Following surgery, two patients no longer met the criteria for OSA as identified on postoperative polysomnogram. When the data were reanalyzed without these two patients, the mean postoperative nightly CPAP usage increased to 5.0 hours per night ($P < 0.05$), and the mean postoperative CPAP pressure decreased to 8.2 ($P < .05$). Table I displays the full results for the study population.

DISCUSSION

Sullivan et al. first described nasal CPAP in 1981, and since then this has become the recommended first-line therapy for most patients with OSA.[2] Once patients commence nasal CPAP however, long-term adherence rates are historically poor. Prior studies have demonstrated that many patients never fill the prescription for CPAP, and of those who do start, up to 50% cease treatment within the first week.[5] The reasons cited for noncompliance are many and include nasal obstruction, discomfort, and claustrophobia.[6,17] This reality highlights the fact that many patients are unable to tolerate CPAP and are not deriving the benefit of the potentially life-saving therapy.

A recent Triological Society best practice review article stated that nasal surgery alone should not be advocated as sole therapy for OSA, because when used as the sole modality, the cure rate is very low.[18] However, following nasal surgery, some patients experience improvement in nasal airflow and are able to decrease the pressure settings of the machine. Friedman et al. and Series et al. both reported decreased CPAP pressures settings for nasal-CPAP following nasal surgery.[13,14] Further study by Friedman, has also demonstrated improved CPAP tolerance with multilevel surgery.[15] All of the aforementioned studies, however, were conducted in the setting of patients who were tolerating preoperative CPAP. Our study differs in that no patients were able to tolerate nasal CPAP preoperatively. In our highly selected population, nasal surgery has been shown to increase CPAP adherence. Our study is the first to actually demonstrate this as a truism. Although this is a commonly assumed outcome from nasal surgery, the modern era of evidence-based care requires more

TABLE I.
Study Population Data and Results Before and After Septoplasty.

	Preoperative	Postoperative
Patient data, mean		
Age, yr	52	52
BMI	31.8	31.6
AHI	33.2	29.4*
NOSE Scale data, mode/5		
Congestion/stuffiness	3	2
Obstruction/blockage	4	0
Trouble breathing	5	2
Trouble sleeping	4	1
Trouble with exertion	3	0
NOSE Scale data, overall mean	16.1†	5.4†
CPAP data, mean		
Pressure, cm H2O	11.9	9.2
Hours of use/night	0.5†	3.9†

*AHI was not routinely checked in all postoperative patients, as nasal surgery was not intended to affect it. This figure represents the mean of 11 patients for whom data were available.

†Significant difference.

AHI = apnea-hypopnea index; BMI = body mass index; CPAP = continuous positive airway pressure; NOSE = Nasal Obstruction Symptom Evaluation.

stringent demonstration of intervention effectiveness than simple anecdotal data.

It is interesting that the CPAP pressure changes were not significantly different postoperatively as compared to preoperative, although there was a trend toward significance. This can partially be explained by the relatively small sample size of the study. However, in general, it seemed that in this population, patient compliance with nasal CPAP did not vary solely on decreased pressure changes but rather more on the issue of perceived increase in nasal airflow, suggesting that patient perception of their nasal patency may not closely correlate with the necessary CPAP opening pressure, and that conversely, CPAP pressure does not only depend on nasal patency.

One limitation of this study is the lack of rhinomanometry as a quasiobjective marker for nasal obstruction. The scientific literature in general suggests an absence of strong data correlating patient subjective perception of nasal obstruction to rhinomanometry outcomes,[19] and therefore we elected not to include this as an outcome measure, Instead, the NOSE Scale, a validated and reliable tool measuring patients' self-assessment of obstructive nasal symptoms, was considered as being more relevant. Another limitation of this study is the small sample size. Reasons for CPAP noncompliance are manifold, and it was surprisingly difficult to find a larger patient population who were dedicated to continuing nasal CPAP use but unable to do so strictly due to the isolated reason of nasal obstruction from a deviated septum. Our results, small sample status notwithstanding, are nonetheless encouraging.

CONCLUSION

This study demonstrates improved CPAP compliance rates following septoplasty in OSA patients with documented nasal obstruction. Although nasal surgery as sole modality should not be intended to be curative of OSA, correction of nasal obstruction should be offered in CPAP-intolerant individuals to potentially improve CPAP compliance rates, even in patients at higher perioperative risk because of their OSA. Given the marked improvement in CPAP adherence seen in our selected patient population following nasal surgery, we feel this adds to the current sleep surgical literature and validates an existing practice that was previously only theoretically based.

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