

Laryngopharyngeal Reflux is Associated with Nasal Septal Deviation

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Abstract

Objective: Laryngopharyngeal reflux (LPR) is defined as a retrograde flow of gastric contents into the larynx and hypopharynx. However, a possible pathophysiological contribution from nasal resistance has been proposed, according to which increased nasal resistance associated with septal deviation may cause increased respiratory effort, resulting in a more negative intrathoracic pressure, which may, in turn, overcome the upper esophageal sphincter and lead to the retrograde passage of gastric contents. The aim of this study was to investigate whether septal deviation of adequate severity necessitating septoplasty is associated with an increased use of proton pump inhibitors (PPIs) in comparison with the general population.

Material and Methods: This retrospective single-center cohort study investigated the usage of PPIs in patients undergoing septoplasty. Hospital databases were searched to identify patients aged 18-85 years who underwent septoplasty from January 2012 to December 2016. Electronic medical records were reviewed to collect details pertaining to demographic variables, usage of PPIs, smoking and drinking status, and other comorbidities. A control group of subjects who underwent an unrelated procedure (arthroscopy) was also sampled.

Results: The data of 200 patients (29% females, mean age 40.8±14.8 years) who underwent septoplasties were compared with those of 200 control subjects (39.5% females, mean age 45.3±15.0 years) who underwent arthroscopies. The incidence of PPI usage in patients undergoing septoplasty was found to be significantly greater than that in the control group (Pearson's chi-square 4.7, Odds Ratio [OR] 1.97, p=0.03).

Conclusion: Patients who undergo septoplasty have a significantly increased rate of PPI usage, which suggests that nasal obstruction is associated with LPR and gastroesophageal reflux disease. Further studies are required to explore this association and develop potential therapeutic strategies.

Keywords: Laryngopharyngeal reflux, nasal obstruction, reflux, septal deviation, septoplasty

INTRODUCTION

Laryngopharyngeal reflux (LPR) is a combination of rhinolaryngological and gastrointestinal conditions that affects the upper airway. LPR is distinct from gastroesophageal reflux disease (GERD) as the gastric contents are deposited extraesophageally into the pharynx and larynx rather than into the esophagus alone. Therefore, the otolaryngologist often finds LPR with non-specific upper airway symptoms, which may include frequent throat clearing, cough, globus sensation, dysphonia, and sore throat (1). Chronic untreated LPR may cause laryngeal mucosal injury and may contribute to refractory chronic rhinosinusitis (2).

The prevalence of LPR has been reported to range from 28.4% to 49.2% (3) in the general population, and its impact on health systems has been increasing with an increase in the number of otolaryngologist office visits by approximately 500% between 1990 and 2001 (3). Studies have also reported that approximately 10% of all otolaryngologist visits are due to complaints linked to LPR (4, 5), with half of all laryngeal complaints ultimately being diagnosed as LPR (6). Considering the common symptoms, it has been found that LPR has a significant impact on the quality of life as well as on mental health (7). In addition, LPR may remain undiagnosed for an extended period of time and be treated empirically without a correct diagnosis (8).

Traditionally, LPR severity has been established using scales such as the reflux symptom index (RSI) and the reflux finding score, both of which have been validated (9) and have a nonlinear relationship between each other (10).

Treatment of LPR has traditionally included lifestyle modifications, anti-acid therapy comprising proton pump inhibitors (PPIs) (11), and various surgical options (12). However, there is limited published evidence to comprehensively support the efficacy of surgical approaches for LPR (12, 13).

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Recent evidence has suggested that LPR has a negative impact on nasal resistance and nasal congestion and that treatment of LPR is associated with improved subjective and objective nasal findings (14).

Anecdotally, we have observed that several patients with LPR often have significant septal deviation, which suggests a possible association that could be causative in some cases of LPR. Therefore, we hypothesized a possible pathophysiological mechanism underlying this potential association, i.e., increased nasal resistance associated with septal deviation causes increased inspiratory effort, thereby resulting in a more negative intrathoracic pressure, which may, in turn, overcome the upper esophageal sphincter and lead to the retrograde passage of gastric contents. In fact, it has been reported that RSI values were improved after multilevel surgery for obstructive sleep apnea (5) that affected the nasal airway pressures, thus supporting our hypothesis.

Therefore, the aim of the present study was to objectively demonstrate an association between patients with nasal obstruction requiring septoplasty and an increased prevalence of PPI usage preoperatively.

MATERIAL AND METHODS

Cohort Characteristics

A sample of consecutive patients who underwent a septoplasty with or without inferior turbinoplasty at a tertiary referral hospital in Sydney, Australia, between January 2012 and December 2016 was identified through a retrospective review of electronic medical records. Patients who were aged <18 or >85 years were excluded. Patients were also excluded if they had undergone a revision procedure, the indication for their surgery was cosmetic, or they underwent any other additional procedure as a part of the operation (e.g., functional endoscopic sinus surgery, dacryocystorhinostomy, tumor or skull base surgery, multilevel surgery for sleep-disordered breathing, or others). The first 200 patients who fulfilled the inclusion criteria were included in this study.

A comparative cohort was also identified from hospital databases of the same tertiary referral hospital. Consecutive patients who underwent knee arthroplasty between January 2012 and December 2016 were considered

as the control group. Patients in this group who were aged <18 or >85 years were also excluded, and the first 200 patients fulfilling these criteria were included.

Patients' Demographic Data

The demographic data of the patients were also retrieved from the electronic medical records, which included age, gender, height, weight, smoking status, PPI usage, Mallampati scores, and the American Society of Anesthesiologists (ASA) physical status classification score for each patient. Body mass index (BMI) was calculated for each patient using height and weight.

Smoking was considered when patients were actively smoking or had ceased within the past 12 months before surgery. PPI use was defined as the current usage of drugs irreversibly blocking the hydrogen/potassium adenosine triphosphatase enzyme system. Patients should have used at least a once-daily dose, with the specific indication of therapy being gastroesophageal reflux disease or LPR. Patients who used PPIs for other indications such as gastrinomas and eosinophilic esophagitis were not considered to be using a PPI. Patients using histamine antagonists such as ranitidine were also not included.

The Mallampati score was defined based on the initial description given by Mallampati et al. (15) in 2015, consisting of four classes ranging from complete visualization of the soft palate to complete obstruction of the soft palate from view. The ASA physical status score was defined as a 6-point ordinal score as described in the latest version of the ASA and approved by the ASA House of Delegates on October 15, 2014 (16).

Ethical board review was received by the Western Sydney Local Health District Human Research Ethics Committee (WSLHD HREC) before data collection and initiation of this study (Approval Number: SSA/14/WMEAD/221, HREC LNR/14/WMEAD/192).

Statistical Analysis

Statistical analysis was performed using IBM Statistical Package for the Social Sciences software version 24.0 (IBM SPSS Corp.; Armonk, NY, USA). Descriptive data were presented as percentages and numbers for categorical variables and as mean values with standard deviations for normalized continuous variables. A Student's paired t-test was used to compare parametric data between septoplasty and control groups. A chi-squared test was used to analyze univariate categorical data, and Kendall's tau-B was used to compare ordinal values. Binomial logistic regression was used for multivariable analysis. The statistical significance was defined at $p < 0.05$.

RESULTS

Patients' Demographic Characteristics

A total of 200 subjects were recruited in both the septoplasty group (29% females, $n=58$; mean age 40.8 ± 14.7 years) and the control group (39% females; $n=78$; mean age 45.3 ± 15.0 years). BMI values showed no significant difference between the two groups ($26.9 \text{ kg/m}^2 \pm 5.2$ vs $29.3 \text{ kg/m}^2 \pm 6.3$, respectively).

The majority of patients in the septoplasty group had a Mallampati score of 1 (46.4%), followed by scores of 2 (40.4%), 3 (10.9%), and 4 (1.6%). Most of the patients in the control group also had a Mallampati score of 1 (45.8%), followed by scores of 2 (43.3%), 3 (10%), and 4 (0%).

In the septoplasty group, most of the patients had an ASA score of 1 (40.2%), followed by scores of 2 (39.7%) and 3 (19.6%). Similarly, there were 52.9% of patients in the control group with an ASA score of 1, followed by

Table 1. Demographics of each patient cohort

	Septoplasty Group	Control Group
Number of Patients (n)	200	200
Age (years \pm SD)	40.8 \pm 14.7	45.3 \pm 15.0
Sex (%)	29%, n=58	39%, n=78
BMI (mean \pm SD)	26.9 \pm 5.2	29.3 \pm 6.3
Mallampati Score		
1	46.4%	45.8%
2	40.4%	43.3%
3	10.9%	10.0%
4	1.6%	0%
ASA Score		
1	40.2%	52.9%
2	39.7%	37.6%
3	19.6%	9.4%
4	0%	0%

37.6% and 9.4% of patients with ASA scores of 2 and 3, respectively. No patients in either group had an ASA score ≥ 4 . Table 1 shows the complete demographic details of the study patients.

Comparison of PPI Usage

PPI usage was found to be higher in the septoplasty group (15.5%, n=31) than in the control group (8.5%, n=17), which showed a statistically significant difference in the univariable analysis (Pearson's chi-squared=4.64, OR 1.97, p=0.03.)

The multivariable analysis performed using multiple logistic regression also revealed a statistically significant association between PPI usage and patients with nasal obstruction requiring septoplasty after adjusting for age, BMI, and sex (B statistic 1.11, p=0.002).

DISCUSSION

A statistically significant association was found between septoplasty and PPI usage in this study compared with a similar age- and gender-matched cohort. This results suggests that our original hypothesis that nasal obstruction may be associated with LPR is plausible.

Recent evidence shows that nasal obstruction and LPR may have a stronger association than previously believed. Dagi et al. (14) conducted a case-control study of 100 adults and reported that patients with LPR who used oral antireflux medication had a reduced total nasal resistance on rhinomanometry and an improved Nasal Obstruction Symptom Evaluation score. Other authors have also suggested that GORD or LPR is a type of nonallergic rhinitis syndrome that causes chronic postnasal drip and, in severe cases, nasal congestion (17).

However, we suspected that this association also runs the other way, i.e., the negative intrathoracic pressure caused by the increased respiratory effort due to nasal airway obstruction, from septal deviation or otherwise, may lead to gastric contents overcoming the upper esophageal sphincter and result in symptoms of LPR.

Obviously, there are several limitations in this study. First, this study demonstrated the association but did not confirm the causation; however, this study does provide preliminary evidence suggesting that the biologically plausible mechanism must be investigated further. Second, PPI usage was the determinant to identify whether patients were suffering from symptoms of reflux. However, several patients will likely be diagnosed with the traditional GORD, and we did not confirm whether the patients were experiencing the symptoms of LPR.

Nevertheless, we believe that these preliminary results warrant further investigation to clarify the proposed association. Thus, we recommend a higher powered, prospective study to examining more objective measures of reflux such as upper gastrointestinal and laryngeal endoscopy or pH monitoring in the esophagus, larynx, and pharynx both before and after surgery. Moreover, a further study examining whether patients require ongoing PPI usage following nasal airway surgery may be of translational impact.

CONCLUSION

There is an association between patients with septal deviation requiring septoplasty and PPI usage. This finding supports the hypothesis that LPR may be associated with negative upper airway pressure linked to nasal obstruction.

Ethics Committee Approval: Ethics committee approval was received for this study from Western Sydney Local Health District Human Research Ethics Committee (WSLHD HREC) (Approval Number: SSA/14/WMEAD/221, HREC LNR/14/WMEAD/192).

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