

Effect of allergic rhinitis on nasal obstruction outcomes after functional open septorhinoplasty

Mofiyinfolu Sokoya, Joseph R. Gonzalez, Andrew A. Winkler*

Department of Otolaryngology, University of Colorado School of Medicine, USA

ARTICLE INFO

Keywords:

Open septorhinoplasty
Allergic rhinitis
Rhinoplasty
Nasal obstruction

ABSTRACT

Objective: To evaluate whether a diagnosis of allergic rhinitis affects surgical outcomes of open septorhinoplasty (OSR) and to examine whether OSR provides the same level of improvement in quality of life to patients with and without allergic rhinitis.

Study design, setting, subjects and methods: We performed a retrospective evaluation of 646 patients who underwent open septorhinoplasty in a tertiary otolaryngology practice between 2008 and 2015. Preoperative and postoperative quality of life (QoL) measurement using the validated Nasal Obstruction Symptom Evaluation (NOSE) Scale was performed on 307 patients meeting inclusion criteria. These patients were then divided into two groups based on a diagnosis of allergic rhinitis (non-AR vs AR). Comparisons were then made based on quality of life improvements by the NOSE score.

Results: There were 213 patients in the non-AR group vs. 94 patients in the AR group. After OSR, patients in both groups experienced significant improvement in nasal airway obstruction. Pre-op NOSE score averages were similar for the non-AR and AR groups (69.9 vs 73.4 $p = 0.087$). Average improvement in NOSE score for the non-AR and AR groups at 30 days was 48.6 vs 45.9 ($p = 0.41$); and at 90 day of 48.1 vs 51.5 ($p = 0.402$).

Conclusion: Patients with and without allergic rhinitis experience similar OSR outcomes as measured by the NOSE score. Open septorhinoplasty addresses multiple components contributing to nasal airway obstruction, and may offset the effects of allergic rhinitis. When indicated, it should be offered to patients with allergic rhinitis after complete medical management.

1. Introduction

Allergic rhinitis is a highly prevalent disease in the United States, affecting 1 in 6 adults. It negatively affects quality of life, and leads to losses in job productivity of \$2 to \$4 billion annually [1]. Allergic rhinitis is a type 1 hypersensitivity reaction that occurs when allergens in the nasal mucosa induce an IgE mediated inflammatory response [2]. Symptoms include rhinorrhea, nasal obstruction, sneezing and itching. It is often diagnosed by clinical history and physical examination, but nasal allergen provocation and specific IgE tests are also important adjuncts in diagnosis [3]. Comorbid conditions include asthma, atopic dermatitis, sleep-disordered breathing, conjunctivitis, rhinosinusitis, and otitis media. Nasal allergy has also been shown to affect outcomes of nasal surgery [4,5].

Nasal obstruction can be caused by multiple factors including infection, allergies, and structural deformities. Structural culprits leading to nasal obstruction include septal deformities, turbinate hypertrophy, and nasal valve collapse. Nasal airway obstruction due to nasal valve

collapse affects over 30 million individuals [6]. Various treatment methods can be used to address nasal airway obstruction, depending on the etiology. These include decongestants, nasal steroids, nasal stents, and surgery.

Functional rhinoplasty is undertaken to improve structure and function of the nose. Indications for this procedure include congenital nasal deformities such as cleft lip or palate nasal deformity, and acquired nasal deformities such as trauma, septal deviation, and nasal valve collapse. Rhinoplasty is employed to improve nasal valve cross-sectional area and improve nasal breathing. Mucosal disorders such as allergic rhinitis has been described as a cause of persistent airway obstruction after rhinoplasty [7]. Functional rhinoplasty also improves nasal passage airflow evaluated by validated outcome measures such as the Nasal Obstruction Symptom Evaluation (NOSE) score, a health related quality of life (QoL) measure developed by Stewart et al. in 2004 [8].

Prior studies have suggested that patients with allergic rhinitis experience a less profound improvement in NOSE scores [4]. However,

* Corresponding author at: Department of Otolaryngology, University of Colorado School of Medicine, 12631 E. 17th Avenue MS-B205, Academic Office One, Room 3001, Aurora, CO 80045, USA.

E-mail address: andrew.winkler@ucdenver.edu (A.A. Winkler).

<https://doi.org/10.1016/j.amjoto.2018.03.014>

Received 22 February 2018

0196-0709/ © 2018 Elsevier Inc. All rights reserved.

Stewart et al. reported that septoplasty outcomes as measured by the NOSE score seems to be unaffected by a diagnosis of allergic rhinitis [9]. No study in the English literature has specifically evaluated the effects of allergic rhinitis on quality of life outcomes of septorhinoplasty. The aim of this study is to evaluate the effect of allergic rhinitis on outcomes of open septorhinoplasty as evaluated by a QoL measure such as the NOSE score.

2. Methods

Institutional Review Board approval was obtained from the Colorado Multiple Institutional Review Board (COMIRB), and a retrospective review of the electronic medical record (EPIC, Verona, WI and Siemens Enterprise Document Management System, Malvern, PA) was undertaken. We performed a retrospective evaluation of 646 patients who underwent open septorhinoplasty by a single surgeon (AAW) in a single tertiary referral center between 2008 and 2015. Inferior turbinate reduction was performed when there was either mucosal or bony inferior turbinate hypertrophy. Surgical maneuvers utilized included submucosal turbinate reduction with a microdebrider followed by bony outfracture. Those patients included in the AR group presented with clinical symptoms of nasal congestion, obstruction, rhinorrhea, post-nasal drip, eye redness and tearing in response to environmental triggers. Inclusion criteria for the current study included: 1. Age > 18 years old, 2. Presence of nasal airway obstruction, and 3. Completion of NOSE questionnaire. Exclusion criteria included: 1. Presence of nasal deformity due to trauma, 2. Presence of inflammatory diseases such as granulomatosis with polyangitis, chronic rhinosinusitis and nasal polyposis. Main outcome measure was improvement in NOSE scores at three months after open septorhinoplasty. These patients were then divided into two groups based on a diagnosis of allergic rhinitis (non-AR vs AR). Comparisons between the AR and non-AR groups were made based on the NOSE score. Comparisons of intraoperative interventions were also made between the two groups. Comparisons of perioperative medical management were also performed between the two groups. Statistical analyses were performed with a two-sample *t*-test accounting for appropriate variances. Criteria for significance were set at a *p*-value < 0.05.

3. Results

Three-hundred and seven patients met inclusion criteria. The mean preoperative NOSE score was 70.7 (95% CI 68.6–72.9 ± SD 19.4), while the mean 90-day postoperative NOSE score was 19.2 (95% CI

16.2–22.2 ± SD 19.9) (Fig. 1). The mean 30-day delta NOSE score was 46.7 (95% CI 43.7–49.7 ± SD 23.2), and 50.4 (95% CI 46.6–54.1 ± SD 25.1) at 90 days (Fig. 2). There were 213 patients in the non-AR group vs 94 patients in the AR group. Male: female ratio was 0.6 for the AR group, and 0.58 for the non-AR group. (*p* = 0.74) Average age was 43.1 in the AR group and 39.0 in the non-AR group. (0.024) (Table 1) Pre-op NOSE score averages were similar for the non-AR and AR groups (69.9 vs 73.4 *p* = 0.087). After OSR, patients in both groups experienced significant improvement in nasal airway obstruction. Average improvement (delta) in NOSE score for the non-AR and AR groups at 30 days was 48.6 (95% CI 43.0–54.2 ± SD 23.9) vs 45.9 (95% CI 42.4–49.4 ± SD 23.0) (*p* = 0.41); and at 90 days of 48.1 (95% CI 40.9–55.3 ± SD 27.2) vs 51.5 (95% CI 47.0–55.9 ± 24.0) (*p* = 0.402). Intraoperative interventions such as spreader grafts, batten grafts, columellar struts, flaring sutures, osteotomies, and inferior turbinate reduction were performed at similar rates between the two groups. Preoperative nasal steroids were used in 50% of patients with allergic rhinitis and 19.7% of patients without allergic rhinitis. There was a statistically significant reduction in intranasal steroid use in both groups, to 30.9% and 11.3% respectively (*p* < 0.05). This data is presented in Table 3. Revision and complication rates were similar among the two groups. (Table 2) 82 patients (28 AR vs 54 Non-AR) had pre-op NOSE scores > 75, at 90 day follow up there was still no significant difference in delta NOSE score between the groups (60.5 vs 65.5, AR vs Non-AR, *p* = 0.385).

4. Discussion

Open septorhinoplasty has greatly evolved from the writings of Sushruta in seventh century India to a commonly performed procedure by otolaryngologists and facial plastic surgeons today. Goodman and Anderson popularized the open approach to rhinoplasty in the late seventies and early eighties [10,11]. Since then, OSR has been shown to provide good functional outcomes as measured by the NOSE score [12].

The improvements in NOSE score reported in the current study are similar to prior single and multi-center cohorts evaluating QoL after rhinoplasty. The delta NOSE of 50.4 is similar to 48.4, 44.6, 42.7 reported by Rhee, Most and Lindsay respectively [13–15]. We demonstrate that a diagnosis of allergic rhinitis does not have a significant effect on quality of life after open septorhinoplasty, as measured by the NOSE score. Our data suggests that septorhinoplasty improves disease-related quality of life, as well as the need for intranasal steroids.

Karatzanis et al. reported that patients with AR experience worse outcomes after septoplasty, and are less likely to be satisfied [4].

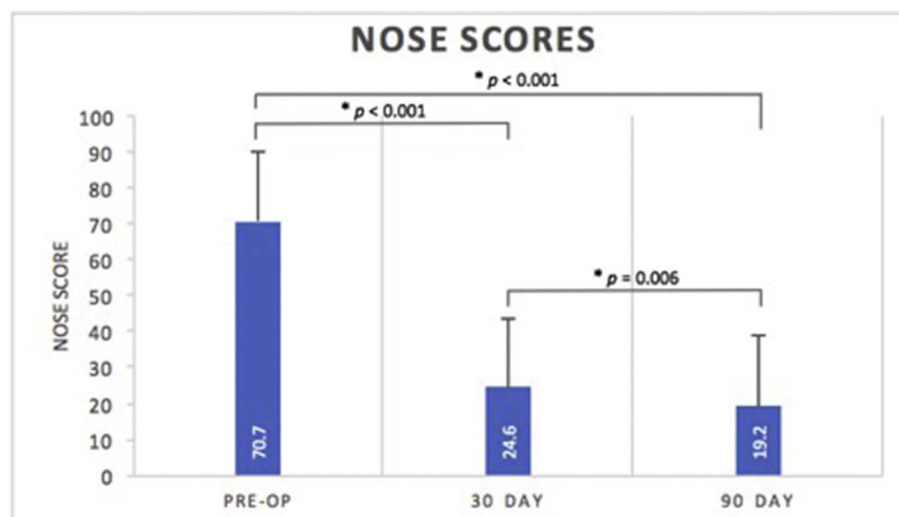


Fig. 1. Bar graph showing preoperative NOSE scores as well as 30 and 90 day postoperative NOSE scores.

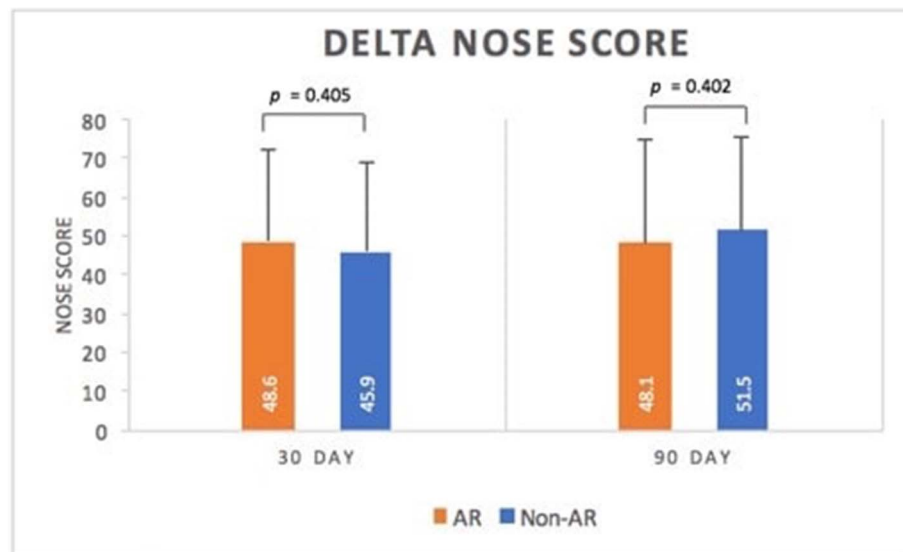


Fig. 2. Bar graph showing delta NOSE scores at 30 and 90 days in the allergic rhinitis and control groups.

Table 1
Patient demographics.

	AR	Non-AR	p-value
Male	56	123	–
Female	38	90	–
M:F	0.60	0.58	$p = 0.744$
Age (yrs)	43.1	39.0	$p = 0.024$

Table 2
Subgroup analysis.

	AR (%)	Non-AR (%)	Total (%)	p-value
Spreader graft	72.3	69.0	70.0	$p = 0.562$
Batten graft	29.8	23.0	25.1	$p = 0.208$
Columellar strut	93.6	92.9	93.2	$p = 0.824$
Flaring suture	6.4	4.7	5.2	$p = 0.539$
Osteotomies	18.1	28.1	25.1	$p = 0.065$
Revision	23.4	18.8	20.2	$p = 0.357$
Cosmetic	14.9	15.9	15.6	$p = 0.824$
Complications	8.5	7.5	7.8	$p = 0.764$
ITR ^a	92.6	89.7	90.6	$p = 0.424$

^a Inferior Turbinate Reduction.

Table 3
Patient medical management.

	AR (%)	Non-AR (%)	p-value
Preop nasal steroids	50 [*]	19.7 [¥]	< 0.01
Postop nasal steroids	30.9 [*]	11.3 [¥]	< 0.01
Oral antihistamines	39.4	5.2	< 0.01
Nasal antihistamines	12.8	0.9	< 0.01
Nasal anticholinergics	6.4	1.4	0.01

^{*} Pre vs Post Op Nasal Steroids in AR ($p = 0.009$).

[¥] Pre vs Post Op Nasal Steroid Use in Non-AR ($p = 0.011$).

Stewart et al. reported that surgical treatment of allergic rhinitis with inferior turbinate reduction as an adjunct to septoplasty does not produce an expected decrease in NOSE scores [9]. Septoplasty is a versatile surgery that addresses nasal airway obstruction by removing and/or straightening deviated areas. This procedure is sometimes combined with inferior turbinate reduction, with or without out-fracture, to correct inferior turbinate hypertrophy. Septoplasty with or without inferior

turbinate reduction corrects these two targets, and is beneficial for patients with appropriate surgical indications. Patients with allergic rhinitis, however, have a baseline level of mucosal hypertrophy that contributes to airway narrowing. While nasal airway cross sectional area is improved by septoplasty, it may not be sufficient to overcome the effect of allergic rhinitis, leading to relatively poorer outcomes.

Septorhinoplasty however, has the potential to address additional areas of obstruction, including the columella, caudal septum and nasal valves. The ability to utilize various grafts to surgically correct these deformities allows the surgeon to provide structural support to areas contributing to nasal airway obstruction. The correction of multiple surgical targets during septorhinoplasty provides for greater increases in nasal breathing improvement relative to septoplasty. This explains our finding that patients with allergic rhinitis experience a similar degree of improvement in NOSE scores compared to patients without allergic rhinitis. In addition, patients in both groups experienced a significant reduction in need for intranasal steroids postoperatively. This is likely as a result of a generally improved nasal passageway.

The effect of allergic rhinitis on nasal obstruction should not be understated. It has been described as a cause of secondary nasal obstruction following rhinoplasty surgery [16]. Patients with uncontrolled allergic rhinitis will likely continue to have a level of baseline nasal obstruction after nasal surgery, and it is important to treat these patients with appropriate medical therapy. Allergy testing and immunotherapy may also be entertained in patients who seek to discover and eliminate specific causes of allergic rhinitis. While the data from this study should not be used to abandon conservative management, they do support safely performing septorhinoplasty when appropriately indicated in patients with allergic rhinitis. The surgeon should seek to balance form and function, and should have an extensive discussion with the patient about subtle changes to nasal appearance.

There are a few weaknesses of this study. The study was performed on patients seen by a single surgeon at a single institution, and it could be made more robust, and externally valid by including more patients from more institutions. However, the uniformity of the approach, procedure, and institutional setting improves internal validity and prevents any variability in surgical results. Our outcome measure was NOSE score at 3 months. It is possible that 3 months is not an adequate length of time to sufficiently evaluate the surgical outcomes of OSR. Finally, the diagnosis of allergic rhinitis was made clinically, in concert with majority of practicing otolaryngologists, rather than skin or serologic testing. Future prospective studies using skin or serological testing with serological testing identifying levels of specific IgE are needed to more

strictly define the treatment groups.

5. Conclusions

Patients that carry the diagnosis of allergic rhinitis experience similar OSR outcomes as those without allergic rhinitis as measured by the NOSE score. There is also a reduction in intranasal steroid use postoperatively. The rhinoplasty surgeon should be aware of a patient's diagnosis of allergic rhinitis and provide preoperative counseling accordingly. Open septorhinoplasty has the ability to address more factors contributing to nasal airway obstruction than does septoplasty alone. When indicated, open septorhinoplasty may be safely offered to patients with allergic rhinitis in addition to medical management.

Disclosure

MS has no disclosures, JG has no disclosures, AAW has no disclosures.

References

- [1] Seidman MD, Gurgel RK, Lin SY, et al. Clinical practice guideline: Allergic rhinitis. *Otolaryngol Head Neck Surg* 2015;152(1 Suppl):S1–43.
- [2] Mims JW. Epidemiology of allergic rhinitis. *Int Forum Allergy Rhinol* 2014;4(Suppl. 2):S18–20.
- [3] Gómez F, Rondón C, Salas M, Campo P. Local allergic rhinitis: mechanisms, diagnosis and relevance for occupational rhinitis. *Curr Opin Allergy Clin Immunol* 2015;15(2):111–6.
- [4] Karatzanis AD, Fragiadakis G, Moshandrea J, Zenk J, Iro H, Velegrakis GA. Septoplasty outcome in patients with and without allergic rhinitis. *Rhinology* 2009;47(4):444–9.
- [5] Kim YH, Kim BJ, Bang KH, Hwang Y, Jang TY. Septoplasty improves life quality related to allergy in patients with septal deviation and allergic rhinitis. *Otolaryngol Head Neck Surg* 2011;145(6):910–4.
- [6] Aksoy F, Veyseller B, Yildirim YS, Acar H, Demirhan H, Ozturan O. Role of nasal muscles in nasal valve collapse. *Otolaryngol Head Neck Surg* 2010;142(3):365–9.
- [7] Beekhuis GJ. Nasal obstruction after rhinoplasty: etiology, and techniques for correction. *Laryngoscope* 1976;86(4):540–8.
- [8] Stewart MG, Witsell DL, Smith TL, Weaver EM, Yueh B, Hannley MT. Development and validation of the Nasal Obstruction Symptom Evaluation (NOSE) scale. *Otolaryngol Head Neck Surg* 2004;130(2):157–63.
- [9] Stewart MG, Smith TL, Weaver EM, et al. Outcomes after nasal septoplasty: results from the Nasal Obstruction Septoplasty Effectiveness (NOSE) study. *Otolaryngol Head Neck Surg* 2004;130(3):283–90.
- [10] Goodman WS. External approach to rhinoplasty. *Can J Otolaryngol* 1973;2(3):207–10.
- [11] Anderson JR, Johnson CM, Adamson P. Open rhinoplasty: an assessment. *Otolaryngol Head Neck Surg* 1982;90(2):272–4.
- [12] Floyd EM, Ho S, Patel P, Rosenfeld RM, Gordin E. Systematic review and meta-analysis of studies evaluating functional rhinoplasty outcomes with the NOSE score. *Otolaryngol Head Neck Surg* 2017;194599817691272.
- [13] Rhee JS, Poetker DM, Smith TL, Bustillo A, Burzynski M, Davis RE. Nasal valve surgery improves disease-specific quality of life. *Laryngoscope* 2005;115(3):437–40.
- [14] Lindsay RW. Disease-specific quality of life outcomes in functional rhinoplasty. *Laryngoscope* 2012;122(7):1480–8.
- [15] Most SP. Analysis of outcomes after functional rhinoplasty using a disease-specific quality-of-life instrument. *Arch Facial Plast Surg* 2006;8(5):306–9.
- [16] Winkler A, Sokoya M. Causes and prevention of secondary obstruction. *Facial Plast Surg* 2016;32(1):76–9.