

ONLINE FIRST

The Effects of Alar Batten Grafts on Nasal Airway Obstruction and Nasal Steroid Use in Patients With Nasal Valve Collapse and Nasal Allergic Symptoms

A Prospective Study

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Importance: Clinical management of nasal airway obstruction (NAO) in patients with and without nasal allergic symptoms and nasal valve collapse (NVC).

Objective: To examine the impact that autologous alar batten grafts have on patients with NAO owing to NVC and their affect on nasal steroid use and allergic symptoms.

Design: A prospective study.

Setting: Indiana University Medical Center, Indianapolis.

Participants: Patients with NAO due to NVC with or without symptoms of nasal allergic symptoms.

Interventions: All of the patients had placement of autologous batten grafts during the study period.

Study Selection: Prospective study of patients with dynamic NVC undergoing alar batten graft treatment.

Data Extraction: Nasal Obstruction Symptom Evaluation survey preoperatively and postoperatively, prospective outpatient questionnaire to determine use of nasal steroids and presence of nasal allergic symptoms preoperatively and postoperatively.

Results: A total of 126 patients underwent surgical intervention for the treatment of NAO due to NVC. All of

these patients were using nasal steroid sprays, and 78 patients (62%) also reported nasal allergic symptoms at their initial presentation. At 6-month and 1-year postoperative evaluations, 118 (94%) and 122 (97%), respectively, reported significant improvement of their NAO, regardless if they had presented with or without allergic nasal symptoms. Sixty-two of the 78 patients (79%) who initially presented with NAO owing to NVC and nasal allergic symptoms preoperatively reported significant improvement in their NAO and nasal allergic symptoms postoperatively. Eight of 126 (6%) restarted their use of nasal steroids postoperatively. All 8 of these patients reported nasal allergic symptoms preoperatively. No patients in the nonallergic group continued the use of nasal steroids postoperatively. There was no increase in nasal steroid use at the 12-month follow-up visit.

Conclusions and Relevance: Nasal airway obstruction due to NVC in patients can be surgically treated with autologous alar batten grafts. In addition, the use of alar batten grafts may improve NAO in patients with nasal allergic symptoms and reduces their use of nasal steroids. These results support the idea of potential surgical repair of the nasal valve to treat patients with NAO due to nasal allergic symptoms and NVC.

Level of Evidence: 4.

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NASAL AIRWAY OBSTRUCTION (NAO) due to nasal valve collapse (NVC) is a common health condition that affects more than 30 million individuals.^{1,2} Many patients with NVC may also experience symptoms associated with allergic rhinitis. Patients are frequently treated with nasal steroids and decongestants with mini-

mal to no success before receiving a referral to an otolaryngologist or facial plastic surgeon. The annual dollars spent on nasal steroids for allergic rhinitis is approximately \$2.8 billion.^{3,4}

Nasal airway obstruction can be caused by structural impasses and/or inflammation associated with allergy, infections, or inflammatory diseases.⁵ Nasal valve collapse is commonly cited as a structural

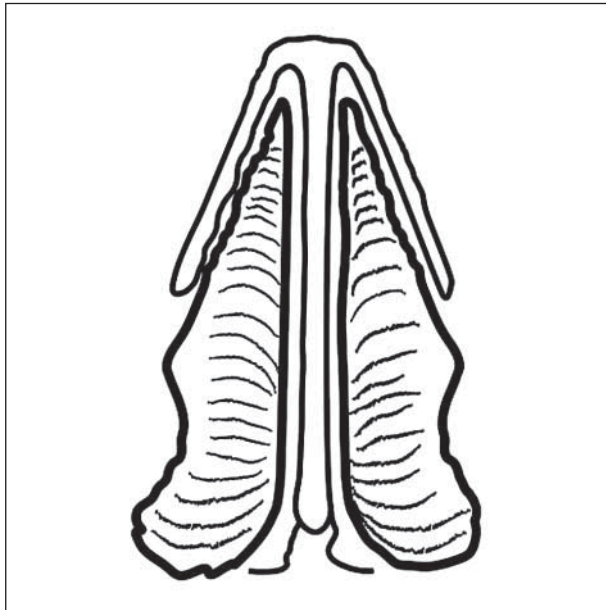


Figure 1. Illustration of the base of the nose showing a cross-sectional view of a patent nonobstructed nasal valve.

cause of NAO, and the nasal valve is an important anatomical site of nasal airway resistance (**Figure 1** and **Figure 2**). To achieve an optimal airway in patients with NVC, multiple anatomic abnormalities may need to be surgically treated because other structural irregularities can present concurrently with NVC, as identified in other studies.⁶⁻⁸

Various methods are currently used to treat NAO, including internal and external stenting appliances, decongestants, nasal steroids, and surgical interventions. Some patients may undergo surgical treatments, such as septoplasty and turbinate reduction, that either fail or the results of which are short-lived owing to persistent untreated NVC.^{9,10} Other patients are frequently treated unsuccessfully with medical management, including nasal steroids, which are the most commonly prescribed medical treatment in the population of patients with NAO.

The aim of the present study was to examine how surgical intervention with autologous alar batten grafts affected NAO in patients with NVC. In addition, the impact of surgery on the subsequent use of nasal steroid sprays was studied.

METHODS

The study included patients with NAO associated with NVC, all of whom were using nasal steroids for symptoms of allergic rhinitis or NAO, and were seen from August 2010 through May 2011 at Indiana University Medical Center, Indianapolis. If findings from the physical examination were consistent with visible, dynamic NVC on inspiration, patients underwent bilateral autologous septal cartilage batten graft placement along with other concomitant procedures as indicated, such as septoplasty and inferior turbinate reduction. The Nasal Obstruction Symptom Evaluation (NOSE) validated survey was used to measure patients' subjective preoperative and postoperative NAO using a Likert scale. The Likert scale was defined as follows: no problem (0), very mild problem (1), moderate prob-

lem (2), fairly bad problem (3), and severe problem (4). In addition, patients were queried about the presence of allergic rhinitis symptoms and their use of nasal steroids preoperatively and postoperatively. Patients were designated as having allergic rhinitis, concurrently with the NVC and NAO, if they were noted to have itchy nose, sneezing, and rhinorrhea on the Allergic Rhinitis Questionnaire.¹¹ Patients were examined at 1 month, 6 months, and 1-year postoperatively. The NOSE validated survey was completed during 6-month and 1-year clinical visits with patients.

Exclusion criteria included patients with obvious trauma to their nose causing NAO, as well as patients with inflammatory conditions, such as chronic rhinosinusitis and nasal polypsis.

This study was approved by the institutional review board of Indiana University School of Medicine (No. 1102-56).

Our technique of nonanatomic batten graft placement used by the senior author (T.Z.S.) is similar to techniques described by others.^{5,6,12-15} The planned subcutaneous pocket for batten graft placement was marked with a marking pen; the patient was then prepared with Betadine, and 1 mL of 1% lidocaine with 1:100 000 epinephrine was injected along planned marginal incisions into the subcutaneous pocket. Marginal incisions were made bilaterally with a No. 15 blade. A precise sub-superficial muscular aponeurotic system pocket was created just superficial to the lateral crus of the lower lateral cartilage and extended to the lateral pyriform bone. Batten grafts were sculpted from septal cartilage spanning a distance from the lateral crura to 3 to 4 mm overlying the pyriform bone to ensure adequate stability and to counteract valve collapse (**Figure 3**). Grafts were secured in place to the underlying lateral crura using 5-0 PDS horizontal mattress sutures (Ethicon Inc). The wound was irrigated with saline and blotted to remove any remaining fluid. Monopolar cautery with a Colorado tip was used for hemostasis as needed. The incisions were carefully approximated with a 5-0 fast absorbing gut in an interrupted fashion.

RESULTS

After inclusion and exclusion criteria were met, 126 patients of the senior author's were included in the study. The patients' ages ranged from 17 to 68. All 126 patients were using nasal steroids on initial presentation. Of these, 78 (62%) reported allergic symptoms, as supported by the Allergic Rhinitis Questionnaire, including itchy nose and eyes, rhinorrhea and sneezing, along with NAO during their first office visit (with T.Z.S.) prior to nasal valve surgery. Eleven (9%) had undergone prior nasal surgery for NAO.

Similar to patients in prior studies, our patients had other concurrent nasal procedures performed at the time of batten graft placement. Septoplasty (either revision or primary) was performed in all of the 126 patients, either for correction of septal deviation or obstructing spurs (35 patients [28%]) or harvesting of septal cartilage for batten grafts (91 patients [72%]). Conchal cartilage harvest was also performed if adequate septal cartilage was unavailable (4 patients [3%]). Inferior turbinate outfracture with submucosal resection along with septoplasty was performed in 19 patients (15%). Of these 19 patients, 11 (58%) had their septoplasty performed for NAO. Ninety-one patients (72%) were diagnosed as having dynamic NVC alone as the cause for their NAO and

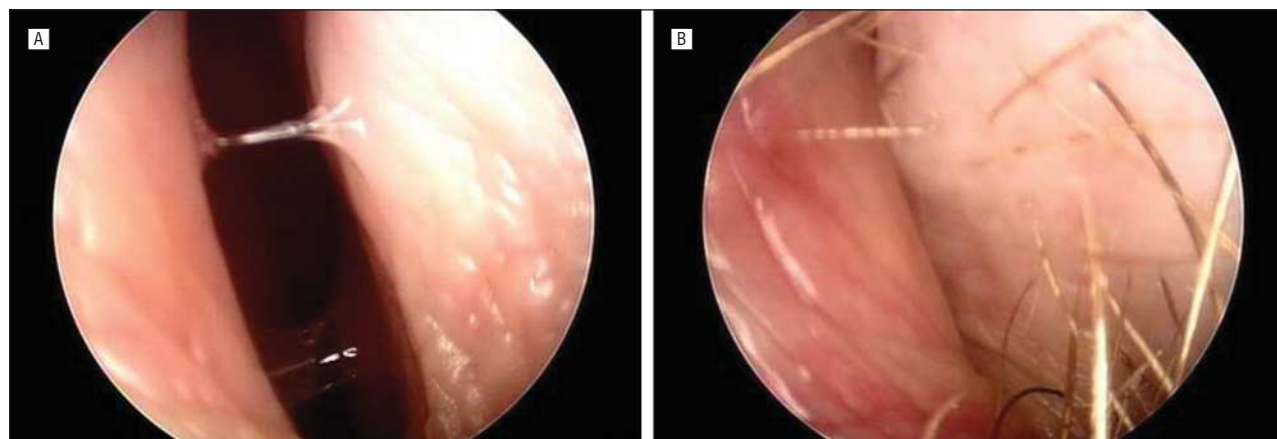


Figure 2. Endoscopic view of a patient with nasal valve collapse. A, The patient at rest. B, The same patient during inspiration with collapse of the valve by the lateral nasal wall.

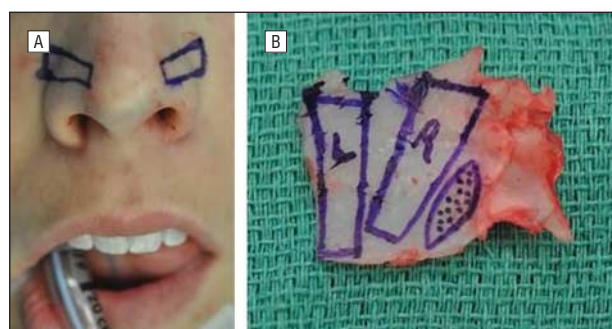


Figure 3. Batten graft. A, Markings on the external nasal surface mark the orientation of the graft placement. B, Harvested septum with left and right alar batten grafts marked out.

underwent septoplasty and/or conchal cartilage graft harvest for fashioning batten grafts. Four (3%) underwent conchal cartilage harvest for graft placement.

One hundred fourteen of 126 patients (94%) at their 6-month follow-up appointments and 122 of 126 (97%) at their 12-month evaluation reported statistically significant improvement in their nasal airway patency. Using a series of 2-tailed paired *t* tests for the NOSE validated survey data, we found that the posttest ratings were significantly improved from ratings of their preoperative state across all comparisons (nasal congestion or stuffiness, nasal blockage or obstruction, trouble breathing through the nose, trouble sleeping, unable to get enough air through the nose during exercise or exertion) ($P < .001$) (**Table**).

There was no difference in postoperative nasal airway patency between patients who initially presented with or without allergic nasal symptoms. At the 6-month and 1-year postoperative evaluation, 94% and 97% of patients, respectively, reported continued patency of their nasal airway, irrespective if they had preoperative nasal allergic symptoms. Sixteen of 78 patients (21%) who initially presented with allergic nasal symptoms reported persistent allergic symptoms at 1-year postoperatively. Two of the 16 patients (3%) in this subset reported persistent NAO with persistent allergic symptoms, while 14 of the 16 (18%) reported improved NAO with persistent allergic symptoms. Sixty-two of the 78 patients (79%)

Table. Mean Results of Nasal Obstruction Symptom Evaluation Survey^a

Symptom	Score	
	Preoperative	Postoperative
Nasal		
Congestion	3.61	0.81
Obstruction	3.64	0.55
Trouble breathing through nose	3.75	0.49
Trouble sleeping	2.50	0.55
Unable to get air through nose	3.29	0.59

^aScores: 0, not a problem; 1, very mild problem; 2, moderate problem; 3, fairly bad problem; 4, severe problem (postoperative results obtained at 12 months).

who initially presented with NAO due to NVC and nasal allergic symptoms preoperatively reported significant improvement in their NAO and nasal allergic symptoms postoperatively.

No patients reported residual NAO with improvement in allergic symptoms. Eight of 126 (6%) restarted their use of nasal steroids in an effort to better manage their allergic symptoms at 6 months after surgery. All 8 of these patients reported nasal allergic symptoms preoperatively. No patients in the preoperative nonallergic group continued the use of nasal steroids postoperatively. There was no increase in nasal steroid use at the 12-month follow-up visit.

COMMENT

Surgical treatment of NAO owing to NVC using alar batten grafts has been well described. The current literature, however, is void of any analysis or literature regarding the need for continued use of nasal steroids in patients with or without allergic rhinitis symptoms (or prior diagnosis of allergic rhinitis), after surgical treatment of NVC for NAO. In our patient population, diagnosis of NVC was made based on physical examination of the external and internal nose with visible dynamic

collapse noted on inspiration. Patients included in our study all had positive responses to the modified Cottle maneuver during clinical examination correlating with a high likelihood of NVC as the etiology of obstruction. In addition, most of our patients presented with little or no septal deviation (72% without), turbinate hypertrophy (85% without), or other causes of nasal obstruction, further supporting the reliability of the diagnosis of valve collapse. In previously published studies on NVC surgery, concurrent surgical treatment of other anatomic areas (ie, septum and inferior turbinates) with placement of batten grafts are frequently reported.^{6-8,11} Although septal and/or turbinate surgical procedures may be interpreted as confounding variables in determining the contribution of NVC, septal deviation, or turbinate hypertrophy components to patients' outcomes, the reality is that many patients do present with multiple nasal anatomic irregularities, and to avoid multiple separate anesthesia and surgical procedures, most patients prefer to have optimal treatment of their NAO in one setting.

Most patients (97%) in our study group had significant improvement in their airway postoperatively and no longer required nasal steroids (94%). Preoperatively, a large subset of patients (62%) reported having allergic symptoms compared with only 21% of this subset postoperatively, as supported in their Allergic Rhinitis Questionnaire. What is most remarkable is that patients' allergic symptoms during the allergy seasons, as well as their use of nasal steroids, decreased significantly at 6 months and 1-year postoperatively.

All of our patients were using nasal steroids at the time of initial evaluation. The reason for this in the patients with allergic nasal symptoms is clear; however, the use of nasal steroids in the patients who reported no allergic nasal symptoms preoperatively remains less evident. Potential reasons for nasal steroid use in this subset include misdiagnosis by their primary care physician or rather an attempt to medically manage NAO by their primary care physician. In addition, insurance companies increasingly require the documentation of failed prolonged use of nasal steroids before authorizing surgical intervention, thus necessitating nasal steroid use even in patients with obvious structural obstructions in need of definitive surgical treatment. It is not surprising, therefore, that all 48 of our patients (100%) who reported no allergic symptoms preoperatively discontinued the use of their nasal steroids postoperatively.

It is unclear why most of our patients had improvement with their allergic symptoms. A study by Ciprandi et al¹⁶ examined the relationship of allergic symptoms in patients with diminished nasal airway flow and found a higher concentration of inflammatory cytokines in these patients' nasal passages as well as greater symptoms. Thus, restoration of nasal airflow may contribute to improvement in allergic symptoms by decreasing inflammatory factors in the nasal airway. In addition, a recent study by Kim et al¹⁷ explored the effects of septoplasty on the quality of life in patients with allergic rhinitis. They noted improvement in allergic symptoms, medication use, and quality of life. Possible reasons included a more patent airway for routing topical nasal steroid medication and

or nasal saline irrigation, thus requiring less medication over time.

An additional explanation for improvement of symptoms in patients with allergic rhinitis after nasal valve surgery is that the increased nasal airflow resulting from surgical treatment may open the nasal passages enough to alleviate symptoms of NAO caused by inflammatory conditions. Surgical treatment, therefore, opens the nasal passageway to a specific threshold level such that inflammatory conditions are not as bothersome or obstructing. Without a longer follow-up period in our study, it is difficult to determine whether improvements in allergic symptoms will be maintained to a similar degree over the next several years.

In our study, improving NAO by correcting NVC also improved allergic symptoms and decreased the use of nasal steroids. This raises the question whether increasing nasal airflow, such as through functional rhinoplasty (ie, nasal valve repair), should be considered a treatment option for patients with NAO due to allergic symptoms that are intractable to medical treatment with nasal steroids or other medications. It is well established that the efficacy of intranasal steroid use is largely due to a local anti-inflammatory effect; however, most safety concerns and the potential risks of nasal steroid use are consequences of systemic absorption. Various nasal steroids and their corresponding percentages of systemic bioavailability are as follows:

Steroid	%
Flunisolide	49.0
Triamcinolone acetonide	46.0
Budesonide	34.0
Mometasone furoate	<0.1
Fluticasone propionate	<1.0

Overall, most adverse effects of nasal steroid therapy are mild and include headache, epistaxis, pharyngitis, sneezing, gastrointestinal tract disturbance, and nasal burning or irritation.^{18,19} The potential for more serious complications is worrisome and varies based on the systemic absorption profile²⁰; complications may include atrophy or perforation of the nasal septum, cataracts, glaucoma, and chorioretinopathy.²¹

The annual cost of nasal steroid medication per patient ranges from \$200 (generic) to \$1200.²² Therefore, in our study population, there may potentially be an annual cost savings of \$12 400 to \$74 400 spent on nasal steroid medication, assuming full-year usage of nasal steroids, which resulted from the reduction of 78 patients to 16 patients who continued to use nasal steroid medication after surgical treatment. These savings become even more striking if the entire patient population with NAO and NVC with allergic symptoms in the United States or worldwide is considered or the potential of prolonged medication use for multiple years or for a patient's lifetime is factored. The cost of surgical treatment for a patient with NAO from NVC, however, must also be factored in before true cost savings can be measured. In our patient population, out-of-pocket costs for the patient ranged from \$50 to around \$1500 per patient depending on the specific insurance carrier of the patient.

In conclusion, NAO due to NVC in patients with and without allergic symptoms can be successfully surgi-

cally treated with alar batten grafts. Surgical treatment alleviates NAO and can improve allergic nasal symptoms while reducing the need for or use of nasal steroids. The underlying association between nasal valve surgery and resolution of allergic complaints, and a reduced need for nasal steroid therapy may be the result of increased airflow's dampening affect on the inflammatory response, which requires further study.

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Conflict of Interest Disclosures: None reported.

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