Minimally Invasive Nasal Valve Repair

An Evaluation Using the NOSE Scale

Robert W. Dolan, MD

Objective: To determine the efficacy of a new surgical procedure to correct symptoms of nasal obstruction secondary to internal nasal valve narrowing.

Design: Consecutive case series.

Setting: Tertiary care multispecialty clinic.

Patients: Patients with symptoms of nasal obstruction for at least 1 year, a closed but otherwise anatomically normal nasal valve, and resolution of symptoms with lateralization of the upper lateral cartilage.

Intervention: Surgical correction of nasal valve stenosis by fibrocartilaginous resection and imbrication at the caudal upper lateral cartilage.

Main Outcome Measure: Validated Nasal Obstruction Symptom Evaluation (NOSE) scale score.

Results: Highly significant improvement was seen in nasal obstruction symptoms after the procedure. A significant correlation between the reported improvement and the preoperative NOSE scale scores was demonstrated ($P < .01$). There was poor correlation of symptomatic improvement with acoustic rhinometry measurements.

Conclusions: The described surgical repair is highly successful in relieving symptoms of nasal obstruction due to nasal valve stenosis in this selected group of patients. Patients with more severe symptoms of obstruction derive the greatest benefit.


MINIMALLY INVASIVE SURGICAL widening of the nasal valve (NV) targeting the composite tissues in the upper lateral nasal wall is a low-risk and reliable method of relieving nasal obstruction resulting from static NV stenosis. Mink originally defined the NV as the narrowest portion of the nasal cavity, characterized anatomically as the 2-dimensional slitlike opening between the caudal edge of the upper lateral cartilage (ULC) and the septum. Although deformities of the NV are known to be responsible for symptoms of nasal obstruction and stuffiness, surgical correction is often not attempted because conventional surgical techniques require significant surgical dissection or cartilage grafting and carry a high risk of relapse and external nasal deformity. Many patients with static NV stenosis do not desire a complex procedure, need cartilage augmentation, or want nose reshaping. For these patients a more targeted approach, as described in this report, is justified without the use of cartilage grafting, extensive dissection, or cosmetic change.

Based on a retrospective review of postoperative questionnaires and visual analog scales, my colleagues and I previously reported that this technique was highly successful in providing relief of nasal obstruction symptoms with negligible changes in the appearance of the nose. The present study involves a prospective consecutive series of patients whom I have treated and whose symptoms were evaluated with the validated Nasal Obstruction Symptom Evaluation (NOSE) questionnaire administered at baseline and at 3 months following the procedure.

METHODS

STUDY DESIGN

A consecutive series of patients underwent in-office surgical correction of NV stenosis at the Lahey Clinic between January 1, 2007, and November 30, 2008. Patients who reported nasal obstruction with the clinical finding of static NV stenosis and who met specific criteria were included. Patients must have experienced symptomatic relief after delicate endonasal manual lateralization of the caudal ULC. Only the NV procedure was performed. No other na-
sal procedures were done coincidentally or subsequently throughout the 3-month follow-up period. Pretreatment and posttreatment acoustic rhinometry (Hood Laboratories, Pembroke, Massachusetts) was performed on 5 patients.

Inclusion criteria for the study consisted of symptoms of nasal obstruction that had been present for at least 1 year, a closed but otherwise anatomically normal NV on passive respiration, and resolution of nasal obstruction with manual lateralization of the caudal aspect of the ULC. Patients were excluded if they met any of the following criteria: previous NV surgery, clinically significant NV area abnormalities including turbinate hypertrophy or septal deviation, other nasal pathologic manifestations such as excessive crusting or masses, active nasal infection, a history of head and neck irradiation, congenital or acquired vascular disease affecting the nose, nasal disfigurement, bleeding disorders, or pregnancy.

The validated NOSE questionnaire (Figure 1) was given to each patient during the 2 weeks before the procedure and at 3 months following the procedure. A single surgeon (R.W.D.) performed all of the NV procedures. Demographics, procedural side (right, left, or bilateral), complications, and previous nasal procedures were recorded.

TREATMENT

All patients included in this study underwent in-office surgical correction of NV collapse with the use of a standardized protocol described previously. Briefly, after prepping and draping the patient, local anesthetic (lidocaine hydrochloride, 1%, with 1:100,000 epinephrine) was injected over the prominence of the caudal ULC. Parallel incisions were made on either side of the caudal ULC (Figure 2A), and a strip of mucosa with the underlying attached fibrous tissue was removed to expose the caudal ULC (Figure 2B). Approximately 1 to 2 mm of the caudal ULC was resected (Figure 2C), and the mucosal incision was closed with 3 interrupted 4-0 chromic sutures (Figure 2D). No other procedures were performed coincident with the NV repair.

STATISTICAL ANALYSIS

The NOSE scale raw scores were converted to a scale of 0 to 100 by multiplying the summed scores by 5 as described by Stewart et al. The Wilcoxon signed rank test was used for non-parametric analysis of the baseline and 3-month follow-up scores. Linear regression analysis was performed to assess the change in NOSE scale scores from baseline.

This study was approved by Lahey Clinic’s institutional review board for the anonymous use of clinical data for research and publication.

RESULTS

A total of 29 patients (22 males) underwent repair of uncomplicated NV stenosis at the Lahey Clinic during the study period. Twenty-four patients completed the study and also completed preoperative and postoperative questionnaires. The remaining 5 patients were lost to follow-up.

The average age of the patients was 49 years. Twenty-three patients underwent bilateral procedures; 5 patients, right-sided procedures; and the remaining patient, a left-sided procedure. Of the patients who completed the preoperative and postoperative questionnaires, 20 underwent bilateral procedures; 3, right-sided procedures; and 1, a left-sided procedure. No complications were encountered.

Several patients had undergone previous nasal surgery, including septoplasty (4 patients), turbinoplasty (3), septrhinoplasty (2), and tip rhinoplasty (1). Nine patients had obstructive sleep apnea and were seeking relief of their nasal obstruction to facilitate mask use.

The individual pretreatment and posttreatment raw NOSE scale scores are summarized in Figure 3. Although each question measures a different symptom, the change seen for each symptom in response to treatment is similar. After summing the scores and converting them to a scale of 0 to 100, the pretreatment and posttreatment scores were analyzed (Table), demonstrating a highly significant improvement after treatment. Further analysis by linear regression comparing the change in scores with the baseline scores showed a highly significant correlation (Figure 4). This indicated that the baseline (pretreatment) NOSE scale score was proportional to the treatment effect.

Acoustic rhinometry showed that the posttreatment cross-sectional area values at the NV area were not significantly different from the pretreatment values (data not shown).

Minimally invasive NV surgery that targets the composite tissues in the lateral nasal wall is a safe and reliable method of relieving nasal obstruction from static NV stenosis. Outcome analysis was performed on a consecutive series of patients with the use of the validated NOSE scale questionnaire. The questionnaire was administered according to the guidelines outlined in the original study used for validation of the instrument, with assessments within 2 weeks before the procedure and 3 months after the procedure. Analysis showed a highly significant improvement in nasal obstruction symptoms. Regression analysis showed a significant correlation between the reported improvement and the preoperative NOSE scale scores, indicating that the baseline (pretreatment) NOSE scale score is predictive of the overall treatment effect. Acoustic rhinometry failed to detect a difference between the pretreatment and posttreatment cross-sectional NV area values.

That acoustic rhinometry did not detect a volume difference at the NV was disappointing. Although poor cor-
The validation of the NOSE scale was a significant advance in the study of procedures to correct symptoms of nasal obstruction. Initiated by the American Academy of Otolaryngology–Head and Neck Surgery Foundation, the scale was validated in a multi-institutional study of patients undergoing septoplasty. In contrast to global quality-of-life instruments, the NOSE scale is specific and sensitive to changes in nasal physiologic features.

Abnormalities within the NV area are primarily responsible for nasal obstruction. The NV area consists of several entities, including the inferior turbinate, piriform aperture, septum, and internal and external NVs. The causes of NV area obstruction are many and include scarring, masses, developmental or traumatic disfigurement, sepal or turbinate deformities, narrowing of the piriform aperture, and NV abnormalities. This report concerns static narrowing of the internal NV, which is the most common reason for congestion and nasal obstruction in patients without significant turbinate or septal deformities. Inferomedial displacement of the caudal ULC is the key anatomical finding in uncomplicated NV stenosis. Understanding the anatomical scroll at the NV is essential. The scroll is the interdigitation of the caudal ULC with the cephalic lower lateral cartilage (LLC). Normally, the caudal ULC sweeps medial to the cephalic LLC at the NV and, at its most distal extent, curves laterally to interlock with a medially curling LLC. Static NV stenosis may be present for many reasons, including excessive scrolling, inferomedial displacement of the caudal ULC, and medial displacement of the entire ULC (common after rhinoplasty). In his review, Kern described a variety of anatomical configurations at the scroll that result in NV stenosis, the most common of which is inferomedial displacement of the caudal ULC (occurring in 20% of cases). Although excessive resection of the ULC or LLC at the scroll could result in weakening and exaggerated collapse of the NV during inspiration, a conservative resection of the caudal ULC as described in this report can open the valve while minimizing weakness in the lateral nasal wall.

Clinical assessment of the patient with nasal obstruction should address the entire NV area, including the septum, inferior turbinates, and NV. If septal deviation or turbinate hypertrophy is thought to be at least partially contributory, then that abnormality should be corrected first. Septal deviation at the NV should be addressed as part of routine septoplasty. Correcting significant septal and turbinate deformities often relieves nasal obstruction symptoms, even in the presence of NV abnormalities. Targeted correction of the NV as described herein is best done for patients with persistent nasal obstruction and NV stenosis after septoplasty or turbinoplasty or for patients with NV stenosis—without septal or turbinate deformities—that responds to lateralization of the caudal ULC.

Clinical evaluation of the NV necessitates direct endonasal observation with or without an endoscope. The normal valve is open 15° to 20° and may collapse with brisk inspiration. Collapse with normal or slightly labored inspiration is abnormal, and these patients usually require stiffening of the lateral nasal wall and are not candidates for the procedure described in this report. Those with very narrow or closed NVs at rest who derive relief with manual opening of the valve are candidates for the technique.

The fundamental tenets of this surgical technique were first described in an obscure 1970 publication by Gray and later cited in 1978 by Kern in his review of NV sur-
The technique described herein is modified from Gray’s original description. Gray removed a triangular segment of the caudal ULC medially, whereas, in the modified technique, the entire 1 to 2 mm of the caudal ULC is resected with an emphasis on the apex of the valve. A bridge of mucosa and the underlying fibrous tissue overlying the caudal ULC are also resected to address excessive soft-tissue redundancy and valvular function during moderate inspiration.

Excision of a triangular segment of the caudal ULC, similar to what Gray described, has been performed for cosmetic narrowing along the upper lobule when associated with an LLC complete strip. The addition of the ULC resection enhances the effect of the traditional operation in which the LLC is completely stripped. Cosmetic changes in the nasal tip have not been seen after using the procedure described in this report because resecting only the caudal-most ULC and leaving intact the cephalic LLC minimizes the cosmetic effect. The cephalic LLC remains in its relative lateral and hooding position, shielding the underlying cartilage deficiency at the caudal ULC.

In conclusion, based on the comparison of pretreatment and posttreatment scores obtained with the validated NOSE scale instrument, this minimally invasive technique for repairing NV stenosis is highly successful in relieving symptoms of nasal obstruction. Patients with more severe symptoms derive the greatest benefit. The technique is office based and requires no downtime for the patient.

Submitted for Publication: June 3, 2009; final revision received August 3, 2009; accepted September 8, 2009.

Correspondence: Robert W. Dolan, MD, Department of Otolaryngology, Lahey Clinic, 41 Mall Rd, Burlington, MA 02492 (Robert.w.dolan@lahey.org).

Financial Disclosure: None reported.

Additional Contributions: Joanne Bilmazes, BS, assisted with data collection and organization.

Table. Average Pretreatment and Posttreatment NOSE Scale Scores

<table>
<thead>
<tr>
<th>Score</th>
<th>Pretreatment</th>
<th>Posttreatment</th>
<th>Median Difference</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw score, mean</td>
<td>13.33</td>
<td>6.33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Converted score, mean (SD)</td>
<td>66.67 (17.11)</td>
<td>31.67 (17.05)</td>
<td>−35.00</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

Abbreviations: ellipses, not applicable; NOSE, Nasal Obstruction Symptom Evaluation.

1. Mink P. Le nez comme voie respiratoire. Presse Otolaryngol (Belg). 1903;481-496.