Combining Spreader Grafts with Suture Suspension for Management of Narrow Internal Nasal Valve Angles

Original Investigation

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Abstract

Objective: The present study aimed to evaluate the long-term results of combining spreader grafts with lateral suspension techniques for management of narrow internal nasal valves.

Methods: This prospective study included 79 patients who underwent surgical interference for dysfunctional nasal valve. The surgical intervention was a combination of two commonly used techniques for management of internal nasal valve dysfunction: spreader graft insertion and lateral suspension of the upper lateral cartilages. The patients were assessed using the nasal obstruction symptom evaluation (NOSE) tool, computed tomography (CT) scans, and endoscopic examinations.

Results: All patients reported initial improvement and satisfaction in nasal breathing. Seventy-two patients (91%) reported sustained relief of nasal breathing for at least 3 years postoperatively. The mean NOSE scores decreased from 69.8 to 20.65 postoperatively. The internal nasal valve angle, as measured endoscopically, increased from 7.23° to 13.05° on the right side and from 6.75° to 11.98° on the left side; the increase was statistically significant. The angle, as measured on axial CT scans, increased from 8.11° to 14.15° on the right side and from 6.98° to 12.13° on the left side' this increase, too, was statistically significant.

Conclusion: Combining spreader grafts with lateral suspension sutures provide good, stable, and sustained repair of dysfunctional narrowed internal nasal valves.

Keywords: Narrow nasal valve, nasal spreader graft, lateral cartilage suspension

Introduction

Proper breathing is one of the most important constituents and features of health and well-being. Several factors contribute to nasal airflow sufficiency. The internal nasal valve is a major factor affecting the amount and nature of nasal breathing; its dysfunction is commonly overlooked by physicians. A narrow internal nasal valve angle is a surgical challenge for otolaryngologists and plastic surgeons. Several procedures have been described to manage narrow internal nasal valve angles with variable results. These procedures include spreader grafts, batten grafts, and lateral suspension of the upper lateral cartilages (1-5).

Being a functional problem and owing to the multistructural nature of the nasal frame, a precise objective measurement of nasal airflow is still a clinical challenge. Most studies used subjective assessment of nasal breathing to determine the success or failure of surgical procedures (6-8). Objective tools such as CT scan and nasal endoscopy have also been described for assessment of the internal nasal valve (9, 10).

The present study aimed to evaluate the long-term results of combining spreader graft with lateral suspension techniques for the management of narrow nasal valve regions. Subjective and objective tools were used in the evaluation process.

Methods

This prospective study included 79 patients who underwent surgical correction of the narrow internal nasal valve region. Patients with significant hypertrophy of inferior turbinates were excluded from the study. All patients were operated upon and followed-up in a tertiary care university hospital from March 2009 to August 2014. Informed consent was obtained from all patients, and the study was approved by the Ethics Committee of the Alexandria University School of Medicine (11/18 - 10.02.2017).

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Diagnosis was made via standard ear, nose, and throat examination, anterior rhinoscopy, and endoscopic nasal examinations. Narrowing of the nasal valve was confirmed using the Cottle's test and internal tenting test.

Subjective assessment was performed using the nasal obstruction symptom evaluation (NOSE) score (11). Baseline NOSE scores were obtained at a preoperative visit, and follow-up NOSE scores were obtained.

A 0° 4-mm rigid endoscope (Storz Endoscopic Systems, Germany) was used for endoscopic examination of the patient in the sitting position. The internal nasal valve was identified at the first point of junction between the upper lateral cartilage and the nasal septum. Usually, not more than 1 cm of the endoscope is introduced into the nose. A series of photographs were captured, and the most appropriate one was selected for measurements (Figure 1).

All patients underwent standard CT evaluation with a slice thickness of 0.6 mm in bone algorithm. The internal nasal valve angle was measured on axial cuts using the OsiriX viewer (Pixmeo SARL, Switzerland) (Figure 2).

Surgical technique

The surgical intervention was a combination of two commonly used techniques for management of internal nasal valve dysfunction: spreader graft insertion and lateral suspension of the upper lateral cartilages.

An open rhinoplasty approach was used to expose the nasal vault in all patients (Figure 3). Bilateral mucoperichondrial septal flaps were elevated. Bilateral subperichondrial tunnels were then created under the upper lateral cartilages, and the upper lateral cartilages were carefully disarticulated from the septum.

A well-sized septal cartilage graft was harvested to be used as spreader graft. In patients with previous septal surgery where septal cartilage harvest was not attainable, a conchal cartilage harvest was performed (12). Any necessary rhinoplastic procedures were subsequently performed.

Spreader graft insertion

A spreader graft (2 cm×4 mm) was inserted on either sides of the nasal septal dorsum and secured in place with 5-0 Polydioxanone (PDS) sutures. The medial edge of the upper lateral cartilages was then sutured to the spreader grafts and to each other in the midline, using the same type of sutures, creating a slightly wider nasal septal angle (Figure 4).

Flaring sutures were then performed using the lateral suspension technique (5). The upper lateral cartilages were bilaterally sutured at a distance equal to half the width of the cartilage over the nasal bridge using a 5-0 PDS suture (Figure 5).

Endoscopic examination of the nasal cavity was then performed to ensure adequate widening of the internal nasal valve angle. Mattress suturing of the nasal septal mucosa eliminating sub-perichondrial dead space, was performed using 5-0 polyglactin sutures; the columellar incision was finally closed using 5-0 polypropylene sutures.

The patients were followed-up weekly for a month, then monthly for 3 months, and every 6 months for up to 3 years. All measurements were repeated during the last follow uo visit.

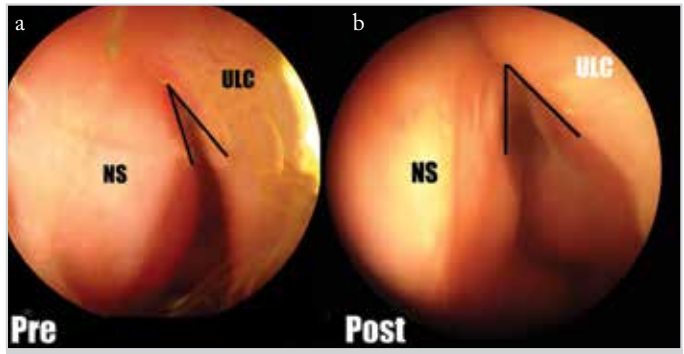

Figure 1. a, b. (a) Preoperative (Pre) and (b) postoperative (Post) endoscopic measurements of the internal nasal valve angle.
NS: nasal septum; ULC: upper lateral cartilage

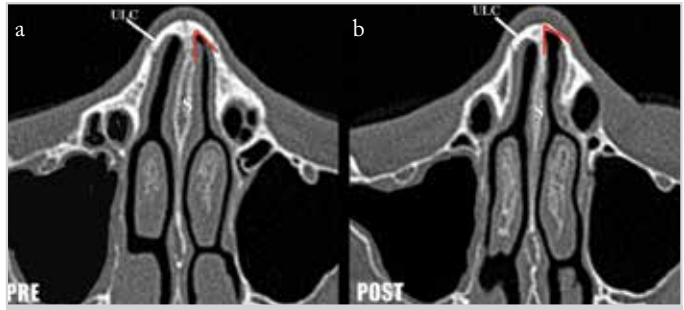

Figure 2. a, b. (a) Preoperative (Pre) and (b) postoperative (Post) radiologic measurements of the internal nasal valve angle
NS: nasal septum; ULC: upper lateral cartilage

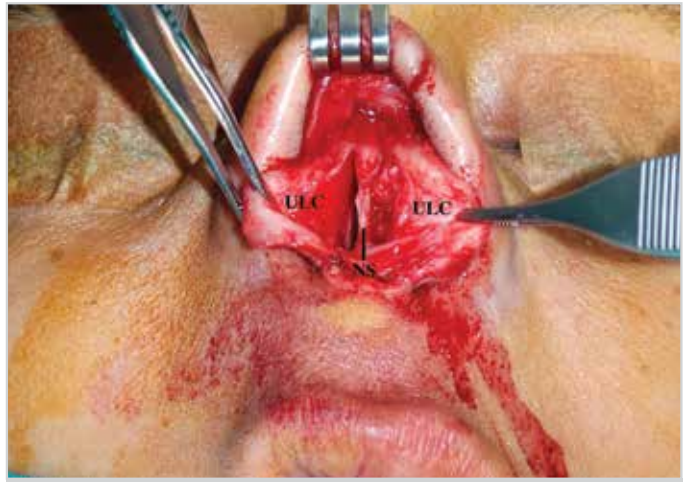

Figure 3. The nasal dorsum is exposed, and the nasal septum (NS) is separated from both the upper lateral cartilages (ULCs) through open rhinoplasty approach.

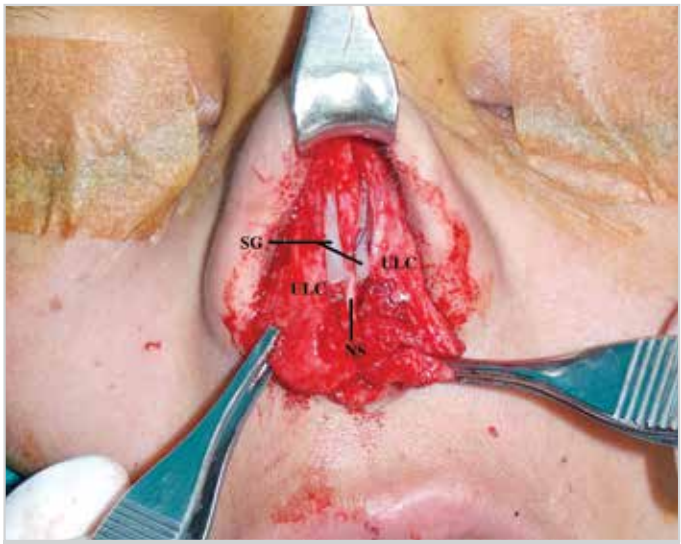

Figure 4. The spreader grafts (SG) are inserted and secured in place between the nasal septum (NS) and the upper lateral cartilages (ULCs).

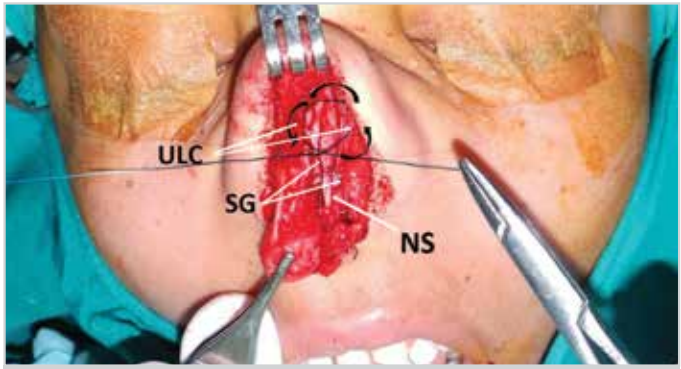

Figure 5. Lateral suspension sutures are placed at a distance equal to half the width of the upper lateral cartilage (ULC). The curved arrows indicate the direction of suturing. The sutures are secured in the midline over the nasal bridge.
NS: nasal septum; SG: spreader grafts

Figure 6. a, b. A male patient (a) with a crocked nose and nasal hump complaining of marked nasal obstruction, particularly on the right side. The same patient (b) 12 months after surgical intervention using a combined bilateral spreader graft insertion with lateral suspension flaring sutures to support both the upper lateral cartilages. Nasal breathing was improved after surgery.

Statistical analysis

Statistical analyses were performed using the XLSTAT (Addinsoft, NY, USA). The Student's t-test was used to compare the preoperative and postoperative means. $p<0.05$ was considered statistically significant.

Results

The study included 79 patients with diagnosed narrowing of the internal nasal valve. The patients comprised 56 males (age, 18-54 years; mean age, 31±3 years) and 23 females (age, 18-42 years; mean age, 28±4 years).

Previous nasal surgery included nine septorhinoplasty procedures (11.5%), three septoplasty operations (3.8%), and five turbinate surgeries (6.4%).

All patients underwent internal nasal valve repair using a combination of spreader graft insertion and lateral suspension technique. Sixty-two patients underwent additional rhinoplastic procedures. Seventeen patients required harvesting of the auricular cartilage.

The average duration for the surgical procedure was 90 min (±19 min). The operative duration was longer in patients who had previous rhinoplastic procedures (105 min±23 min).

All patients reported initial improvement and satisfaction in nasal breathing. Seventy-two patients (91%) reported sustained relief of nasal breathing for at least 3 years postoperatively. Figure 6-8 show three patients at the end of their follow-up period. All seven patients who reported inadequate improvement of nasal obstruction had at least one previous nasal surgical procedure; five (6.4%) had septorhinoplasty procedures, and two (2.3%) had septoplasty procedures.

The results of the NOSE scale and the endoscopic and CT scan measurements of the internal valve angle are shown in Table 1. The preoperative NOSE scale ranged from 58 to 89 with a mean of 69.8±8.7. The mean postoperative NOSE scale measurement, during the last follow up visit, was 20.65 (±4.8) and was significantly better than the preoperative score ($p=0.012$).

The internal nasal valve angle, as measured endoscopically, increased from 7.23° to 13.05°, on average, after surgery on the right side and from 6.75° to 11.98° on the left side, and this increase was statistically significant ($p=0.023$ and 0.019 respectively). The angle, as measured on axial CT scans, on average increased from 8.11° to 14.15° after surgery on the right side and from 6.98° to 12.13° on the left side, and this increase, too, was statistically significant ($p=0.020$, 0.015 respectively).

No significant complications were reported in the series. Prolonged postoperative edema was recorded in five patients (6.4%). No wound infection, keloid formation, septal hematoma/perforation, or complications related to the auricle were recorded in any of the patients.

Figure 7. a, b. A female patient (a) with a deviated nasal axis and droopy tip complaining of nasal obstruction, particularly on the left side. The same patient (b) 16 months after surgical intervention using a combined bilateral spreader graft insertion with lateral suspension flaring sutures. Nasal breathing was improved after surgery.

Figure 8. a, b. A female patient (a) with a nasal deformity complaining of marked nasal obstruction on both sides. The same patient (b) 32 months after surgical intervention using a combined bilateral spreader graft insertion with lateral suspension flaring sutures.

Table 1. Results of the NOSE scale and the endoscopic and computed tomography scan measurements of the internal valve angle

	Preoperative	Postoperative	p
NOSE* scale	58-89	17-24	0.012
Range (mean±SD)	(69.8±8.7)	(20.65±4.8)	
Endoscopic measurement (right)	5.93°-8.46°	11.34°-14.83°	0.032
Range (mean±SD)	(7.23°±1.05°)	(13.05°±0.91°)	
Endoscopic measurement (left)	4.99°-8.01°	10.16°-12.98°	0.019
Range (mean±SD)	(6.75°±1.34°)	(11.89°±1.16°)	
CT scan measurement (right)	6.83°-9.02°	12.79°-14.13°	0.020
Range (mean±SD)	(8.11°±1.14°)	(14.15°±1.17°)	
CT scan measurement (left)	5.01°-8.59°	10.46°-13.08°	0.015
Range (mean±SD)	(6.98°±1.03°)	(12.13°±1.24°)	

*NOSE: nasal obstruction symptom evaluation score; CT: computed tomography; SD: standard deviation

Discussion

Nasal valve dysfunction is a commonly neglected cause of chronic nasal obstruction that continues to be overlooked by several rhinologists (7,12). Kasperbauer and Kern (13) stated that knowledge regarding the structure and function of the nasal valve region is required by those who conduct nasal surgeries. The internal nasal valve is frequently overlooked by surgeons and not uncommonly compromised by nasal surgery, particularly rhinoplasty. Several techniques have been described to restore a functional patent internal nasal valve, and many times more than one technique is needed to repair dysfunctional nasal valves.

In the present study, we reevaluated a combination of the spreader graft technique, which widens the narrow nasal valve angle, with a suture suspension technique, which allows for more stable support of the upper lateral cartilages. Meyer et al. (14) described another suture technique to support the upper lateral cartilages.

Spreader grafts are best placed through an external approach. The advantage of this approach is that it allows precise secure placement of the graft in the internal nasal valve area (15). In addition, we used needles to secure the spreader grafts in position before applying the sutures, utilizing the idea proposed by Park et al. (16). Combining the suture technique and cartilage graft is useful in externally creating a symmetrical nose while internally obtaining a bisymmetrical cross-sectional nasal valve area .

The internal tenting test was positive in patients indicating a weak upper lateral cartilage. Postoperatively, all patients initially reported improved nasal breathing, including patients who were negative for the internal tenting test. These patients also showed sustained improvement in nasal breathing for the whole study period. This shows that even patients with no clinical evidence of a weak upper lateral cartilage would benefit from the lateral suspension technique.

Seven patients with at least one previous nasal surgical procedure showed less sustainability of their initial nasal breathing improvement (five with previous rhinoplasty operation and two with previous septoplasty operations). Failure of improvement in nasal breathing may be attributed to excessive fibrosis following previous surgical interventions.

Previous studies have shown that either spreader grafts or lateral suspension technique alone may sometimes fail to improve nasal breathing in patients with dysfunctional nasal valves (17). Because most patients with nasal valve dysfunction actually have a combination of both narrow nasal valve angles together with weak upper lateral cartilages, tackling one side of the problem would not practically solve the breathing problem on a long-term basis. Even patients with clinically normal strength of the upper lateral cartilage may benefit from the upper lateral cartilage supporting sutures.

The main limitations of this study are the probable difficulties in selecting patients who are most suitable for the described procedure, as well as the difficulties in properly placing the sutures. Moreover, in subsequent studies, we will elaborate more on the standardization of the endoscopic and radiological measurements of the internal nasal valve angle; however, this study shows that combining the spreader grafts technique with lateral suspension of the upper lateral cartilages would ensure better and longer lasting results for the management of dysfunctional nasal valve region than any of the two techniques alone.

Conclusion

Adding suspension sutures of the upper lateral cartilages to the spreader grafts technique provides more efficient and stable repair of the internal nasal valve even in patients with normal strength of the upper lateral cartilages. The described technique is simple and does not interfere with any other rhinoplastic procedures.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Alexandria University Alexandria School of Medicine (11/18 - 10.02.2017).

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

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