Long-term outcomes in medial flap inferior turbinoplasty are superior to submucosal electrocautery and submucosal powered turbinate reduction

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Background: **Techniques for inferior turbinate reduction vary from complete turbinectomy to limited cauterization. Surgical methods differ on the degree of tissue reduction and reliance on surgical tissue removal vs tissue ablation. The outcome and morbidity from 3 different turbinate techniques are compared.**

Methods: **A randomized double-blinded study was performed. Patient nasal cavities were randomized to different interventions on each side within the same patient. One group had a combination of submucosal powered turbinate reduction (designated "submucosal") and submucosal electrocautery (designated "electrocautery"); and the second group had a combination of submucosal powered turbinate reduction (designated "submucosal") and medial flap turbinoplasty (designated "turbinoplasty"). Patient-scored nasal obstruction and rhinorrhoea (1 to 5) along with blindly assessed nasal airway patency ratings (1 to 4) was done at 12 and 60 months postoperatively. Pain requiring additional analgesia, crusting, bleeding (needing review), and revision were documented.**

Results: **A total of 100 patients were recruited (age 32.79 ± 13.58 years; 39% female). This represented 200 nasal airway surgeries with 100 submucosal procedures, 50 electrocautery and 50 medial flap turbinoplasties. No patients complained of worsening of their obstruction. At 60 months patients in the turbinoplasty group had greater outcomes, with 90.2% having occasional or no decongestant use (Kendall's tau B $p < 0.001$) compared to electrocautery (15.8%) and submucosal (37.8%). Fewer turbinoplasty patients had a revision procedure (12%, $\chi^2 = 20.08$, $p < 0.001$) compared to electrocautery (54%) and submucosal (40%). Crusting was more common in the electrocautery group (58% vs submucosal 2% and turbinoplasty 0%; $\chi^2 = 92.04$; $p < 0.001$).**

Conclusion: **The medial flap turbinoplasty provided consistent, robust results. Long-term relief of obstructive symptoms without additional risk of complication was observed in the turbinoplasty group.** © 2015 ARS-AAOA, LLC.

Key Words:
inferior turbinate; turbinoplasty; medial flap; reduction; rhinitis

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Inferior turbinate hypertrophy, as a cause of nasal obstruction, is commonly secondary to inflammatory rhinitis (allergy [type1], occupational [type 4]), drug reactions, hormonal abnormalities, and idiopathic vasomotor changes.[1] Since the first surgical treatment of the hypertrophied inferior turbinate in 1895, many techniques have been described and considerable debate continues as to the most effective method.[2,3] Debate exists on the long-term effectiveness of procedures such as electrocautery and laser reduction.[4,5] These techniques rely on tissue ablation to create volume reduction. Predicting the response to thermal injury results in an unpredictability to outcome. In

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Additional Supporting Information may be found in the online version of this article.

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comparison, techniques involving turbinate resection, either partial or total, have more predictable volume reduction. The ideal surgical reduction should be mucosal preserving and preserve physiological function. Such physiological preservation avoids distorted airflow and abnormal perceptions of breathing. A physiologically preserving approach may help avoid the phenomenon associated with "empty nose syndrome," although the role of turbinate resection is still debatable in these patients. The ideal turbinate reduction procedure removes the obstructive portions of the turbinate while preserving the medial physiologic mucosa, thus maintaining the sensory functions and humidification of inspired air. Techniques for turbinate reduction should reliably reduce nasal obstruction while maintaining normal mucosal function and limiting the propensity for complications such as bleeding and crusting.[6] A randomized, controlled, double-blinded study comparing long-term outcomes of 3 turbinate procedures: submucosal turbinate reduction, electrocauterization, and medial flap turbinoplasty was performed.

Patients and methods

Population

Patients with symptomatic perennial nasal obstruction were recruited. The nasal obstruction was persistent despite medical therapy that included a minimum 4-week trial of intranasal corticosteroid. Patients with both allergic and nonallergic rhinopathies were recruited. Imaging of paranasal sinuses with computed tomography (CT) had to demonstrate no evidence of inflammatory sinus disease. Strict exclusion criteria included a previous history of turbinate surgery, traumatic septal deformity, nasal polyposis, other nasal mucosal diseases, radiological or endoscopic evidence of sinusitis, and nasal valve abnormalities. The study was approved by the local human research ethics committee (SENTFDSC2002/4). Patients provided informed consent for the study.

Intervention and allocations

Consecutive consenting patients were allocated to receive differing combinations of 3 different techniques of nasal turbinate reduction performed on each nasal cavity. The first half of the study population received either submucosal powered turbinate reduction (submucosal) or submucosal monopolar electrocautery (electrocautery). The second half of the study received submucosal powered turbinate reduction (submucosal) or medial flap turbinoplasty (turbinoplasty). For each patient, the method of turbinate reduction was determined randomly, by alternate allocation between sides.

Technique

All procedures were performed under general anesthetic with a laryngeal mask. Preparation of the nasal turbinate included injection with 1% xylocaine and 1:80,000 adrenaline. Cottonoid paddies with 300 mg cocaine and phenylephrine were used for 10 minutes topically. The submucosal powered turbinate reduction (submucosal) was performed with powered 2.9 mm intramucosal turbinate blade (Medtronic, Minneapolis, MN). A small incision was made in the head of the turbinate and the blade introduced to raise a subperiosteal flap. The powered debulking then occurred in a submucosal technique along the entire length of the turbinate without bone removal but with lateral outfracture of the bone. The submucosal monopolar electrocautery (electrocautery) was performed with a monopolar diathermy needle (Covidian-Medtronic, Minneapolis, MN). An attempt was made to create 3 passes with the diathermy needle within each turbinate and to avoid visible blanching of the mucosal surface, followed by lateral outfracture of the bone. The medial flap turbinoplasty (turbinoplasty) was performed as described by the authors[7] (Supporting Video). The procedure commences with the creation of a window to the inferior meatus, at the anterior inferior turbinate in the axilla between the inferior turbinate medially and the pyriform aperture laterally. The posterior soft tissue tail is removed with the microdebrider, and a medial flap is created by removal of the inferior border. The remaining mucosal flap is elevated in a subperiosteal plane using a Cottle dissector. The turbinate bone and lateral mucosa are then removed along the vertex of the inferior meatus. The arterial supply, the medial and lateral branches of the inferior turbinate artery, is then identified and cautery is applied using a bayonet bipolar forceps. Attention is then directed at sculpting the anterior head, undermining the soft tissue with microdebrider or ensuring bone removal is flush to the pyriform. The medial flap is then rotated laterally onto itself and Surgicel dressing is placed to support the flap. Concomitant septoplasty was performed if asymmetry was present. All surgical procedures were performed by the senior author (R.S.).

Outcomes

Nasal obstruction was measured using a subjective symptom score. Patients scored on a 5-point ordinal scale (worse than preoperative, no change from preoperative, improved but requiring regular decongestants, improved but occasional need for decongestants, improved and no need for decongestants).

Assessment of each nasal airway was made by anterior rhinoscopy and endoscopy and was carried out by a second blinded clinician. A 4-point ordinal scale of severe obstruction, moderate obstruction, mild obstruction, or no obstruction was given. This was based on the ability to visualize the nasopharynx without decongestion, the posterior aspect of the turbinate, middle portion of the turbinate, or only the anterior head. Outcomes were assessed postoperatively at 12 months and 60 months.

In cases of subjective failure requiring a revision procedure, patients were converted to a bilateral medial flap turbinoplasty as this is considered the authors' gold

TABLE 1. Complications of turbinate reduction

Short-term (<1 month)	Long-term
Bleeding (requiring review)	Atrophic rhinitis
Pain/discomfort (additional analgesia)	Adhesions
Crusting (requiring additional debridement)	Anosmia
Malodor	Epiphora
Increased hospital stay (>1 day)	Failure (requiring revision procedure)

standard of a robust and reliable reduction and recontouring of the inferior turbinate.

Patients were also reviewed at 1 and 4 months for complications. Potential complications of turbinate reduction, listed in Table 1 were recorded, if present, in all cases. Short-term complications were considered in the first month postoperatively. Pain was considered significant if analgesia was required, crusting was defined as need for additional debridement, and bleeding was defined as significant bleeding if any medical intervention such as unplanned admission, cauterization, or packing was required.

Statistical analysis

Statistical analysis were performed using SPSS v 21 (IBM, Armonk, NY). Descriptive data presented as percentages and means ± standard deviation (SD). Kendall's tau-B was used for ordinal values. Chi-squared analysis was used for relationships of nominal variables. Student *t* test (2-tailed) used for comparisons of parametric data. There was no intention to treat analysis, as soon as a revision procedure was performed, patients dropped out of the analysis. Results were deemed significant with a p value of < 0.05.

Results

A total of 100 patients were recruited (age 32.79 ± 13.58 years; 39% female). This represented 200 nasal airway surgeries with 100 submucosal procedures, 50 electrocautery, and 50 medial flap turbinoplasties. The baseline characteristics are represented in Table 2 and there was no significant differences between treatment arms. There were 7 patients lost to follow-up (4 with electrocautery/submucosal and 3 with turbinoplasty/submucosal procedures).

Patient outcomes at 60 months

At 60 months, 36.5% of patients had undergone a revision procedure. Of those with their original procedure performed, the total group reported nasal obstruction as: worse than preoperatively (0%), no change (14.2%), improved with regular decongestant use (32.7%), improved with occasional decongestants (36.3%), or improved with no decongestants (16.8%). The 60-month outcomes based on technique is shown in Table 3 and there was a statistically significant proportion of patients in the turbinoplasty group have greater outcomes with 90.2% have occasional or no decongestant use (Kendall's tau B $p < 0.001$). All dissatisfied patients were offered revision surgery, which occurred within 24 months of the initial procedure. Revision surgery was performed in 36.5% of all patients. Electrocautery (54.2%) and submucosal (40%) had higher rates of revision than turbinoplasty (12%; $p < 0.001$).

TABLE 2. Patient allocation

	Electrocautery (n = 50)	Submucosal (n = 100)	Turbinoplasty (n = 50)	*p*
Age (years)	32.14 ± 14.63	32.79 ± 13.62	33.44 ± 12.63	0.893
Gender (% female)	42%	39%	36%	0.828

TABLE 3. Sixty-month status by patient reported outcome[a]

	Original procedure			
Nasal obstruction	Electrocautery	Submucosal	Turbinoplasty	*p*
Worse than preoperatively	0.0	0.0	0.0	<0.001
No change	57.9	9.4	0.0	
Improved (regular decongestants)	26.3	52.8	9.8	
Improved (occasional decongestants)	15.8	32.1	51.2	
Improved (no decongestants	0.0	5.7	39.0	

[a]Values are percentages.

TABLE 4. Sixty-month outcomes by blind assessor[a]

	Original procedure			
Nasal patency	Electrocautery	Submucosal	Turbinoplasty	*p*
Severe obstruction	31.6	5.7	0.0	<0.001
Moderate obstruction	36.8	9.4	2.4	
Mild obstruction	21.1	60.4	34.1	
No obstruction	10.5	24.5	63.4	

[a]Values are percentages.

TABLE 5. Twelve-month status by patient reported outcome and blinded assessor[a]

	Original procedure			
	Electrocautery	Submucosal	Turbinoplasty	*p*
Nasal obstruction (12 months)				<0.001
Worse than preoperatively	0	0	0	
No change	8	4	0	
Improved (regular decongestants)	56	51	18	
Improved (occasional decongestants)	34	39	46	
Improved (no decongestants	2	6	36	
Nasal patency (12 months)				<0.001
Severe obstruction	22	1	0	
Moderate obstruction	34	15	12	
Mild obstruction	24	52	34	
No obstruction	20	32	54	

[a]Values are percentages.

Nasal patency

At 60 months, a significant proportion of patients had a greater nasal patency assessment by a blind assessor (Table 4) with 97.5% of turbinoplasty patients with mild or no obstruction (Kendall's tau b $p < 0.001$). The remaining 12 months nasal patency and symptom scores are shown in Table 5. Additionally, an association was found between the proportion of patients requiring a revision procedure and the groups that the blind assessor felt were poor (Table 6).

Complications

Only pain, crusting, and bleeding were reported as short-term complications. Pain requiring additional analgesia was reported by 27 patients (electrocautery 22%, submucosal 9%, and turbinoplasty 14%; $\chi^2 = 4.84$, $p = 0.089$). Crusting, requiring debridement, was recorded for 31 patients (electrocautery 58%, submucosal 2%, and turbinoplasty 0%; $\chi^2 = 92.04$, $p < 0.001$). Postoperative bleeding requiring nasal packing or further surgical intervention occurred in 9 patients (electrocautery 0%, submucosal 7%, and turbinoplasty 4%; $\chi^2 = 3.84$, $p = 0.147$). No additional short-term complications were recorded. No long-term complications or adverse effects (apart from revision) were reported by patients or recorded by the clinician during their 60-month follow-up.

TABLE 6. Association of patients requiring a revision procedure and 12-month blind assessor scores[a]

	No revision	Revision (conversion to turbinoplasty)	*p*
Severe obstruction	0.0	16.4	Kendall's tau-b $p < 0.001$
Moderate obstruction	7.9	38.4	
Mild obstruction	40.2	41.1	
No obstruction	52	4.1	

[a]Values are percentages.

Discussion

The ideal turbinate reduction procedure removes the obstructive nonfunctional portions of the turbinate while preserving the medial physiological mucosal portion that is responsible for warming and humidification of inspired air. Techniques for turbinate reduction should reliably reduce nasal obstruction while maintaining normal mucosal function and limiting the propensity for complications such as bleeding and crusting.[8,9]

In our study, reduction of inferior turbinate and relief of nasal obstruction was best achieved with the endoscopic medial flap turbinoplasty technique. There was a sustained benefit at 60 months after the surgical procedure with good examiner and patient scores. This technique was associated with low rates of nasal crusting and troublesome primary hemorrhage. In comparison, relief of nasal obstruction by electrocautery, although initially good, was not maintained long-term. Initial results with submucosal and electrocautery were good; however, at 12 months postoperatively there was an increased need for decongestant therapy to sustain subjective patient improvement. Additionally, 40% to 54% of procedures required conversion to medial flap turbinoplasty by 60 months. Our results show that resection of turbinate bone, preservation of nasal mucosa, and a controlled volume reduction contributes to a more robust long-term outcome.

Historical procedures including turbinectomy in particular have been reported to be associated with numerous complications, particularly bleeding.[10] Such complications were not found to be significantly associated with the described techniques, particularly those mucosal preserving techniques, submucosal and turbinoplasty, similar to additional reports in the literature.[11]

One of the major limitations to this study was the exact recording of any additional maintenance therapy used by patients. Included patients were not restricted to avoidance of medical management during the follow-up period and only data regarding the use of decongestive therapies was recorded. Dropout rates were similar between groups and included patients maintained a 93% 5-year follow-up, which is one of the longest reported in the literature.

Conclusion

The medial flap inferior turbinoplasty is a technically straightforward procedure that provides long-term relief of obstructive symptoms without significant risk of complication. The removal of both the lateral mucosa and the bone, as well as a controlled reduction of the medial mucosa, is less likely to lead to re-expansion of the turbinate with the passage of time compared to submucosal debrider or electrocautery techniques.

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