

Prediction of outcome of radiofrequency ablation of the inferior turbinates

Asli Sahin-Yilmaz, MD¹, Çağatay Oysu, MD¹, Ibrahim Devecioglu, MD¹, Kadri Demir, MD¹ and Jacquelynne P. Corey, MD²

Background: Radiofrequency ablation (RFA) of the turbinates is used commonly for nasal obstruction; however, there is no consensus on patient selection for this surgery.

Methods: In a prospective clinical study, 53 adult subjects with bilateral turbinate hypertrophy were evaluated subjectively and objectively with anterior rhinomanometry at baseline and at 1, 3, and 6 months post-RFA of turbinates.

Results: RFA of the turbinates resulted in a significant decrease in predecongestant and postdecongestant visual analogue scale (VAS) scores and resistance measurements at postoperative months 1, 3, and 6 ($p < 0.001$ for all). Preoperative baseline subjective response to the decongestant showed a positive correlation with postoperative first month subjective and objective outcome ($p < 0.05$). Preoperative baseline objective response to the decongestant showed a highly significant correlation with postoperative 1-month, 3-month, and 6-month objective outcomes of surgery ($p < 0.05$ for all).

Conclusion: Objective measures do not correlate with long-term subjective satisfaction even when the nose is objectively patent in subjects who underwent inferior turbinate RFA. The patients' long-term subjective benefit from RFA surgery cannot be estimated after a rhinomanometry with topical decongestion is performed. Performing a rhinomanometry with topical decongestion may help only to estimate the patients' objective benefit from RFA surgery. © 2014 ARS-AAOA, LLC.

Key Words:

radiofrequency ablation; inferior turbinate hypertrophy; turbinate surgery; nasal obstruction; nonallergic rhinitis; visual analogue scale; rhinomanometry; nasal objective evaluation

How to Cite this Article:

Sahin-Yilmaz A, Oysu C, Devecioglu I, Demir K, Corey JP. Prediction of outcome of radiofrequency ablation of the inferior turbinates. *Int Forum Allergy Rhinol*. 2014;4:470-474.

Inferior turbinate hypertrophy is a common cause of nasal obstruction, often associated with allergic rhinitis, nonallergic rhinitis, and rhinosinusitis. Surgical treatment may play a role when medical treatment fails. The goal of the surgery is to reduce the volume of the turbinate to improve the nasal symptoms without disturbing the nasal functions.

Radiofrequency ablation (RFA) of the turbinates is 1 of the most common techniques currently used for the treatment of inferior turbinate hypertrophy.¹ Radiofrequency

causes a thermal lesion which results in submucosal fibrosis and consequently a decrease in the volume of the inferior turbinate. Significant healing of the turbinate samples on a molecular basis has been shown 8 weeks after surgery.²

Although RFA is used very commonly, there is no consensus on patient selection for this surgery. Effectiveness of the surgery has been suggested to depend on the hypertrophy of the erectile tissue of the inferior turbinate.³ The response of the erectile tissue to the decongestant may help the surgeon to estimate the postoperative outcome. In practice, patients are empirically selected on the basis of subjective complaint of nasal obstruction and surgeon's clinical examination.⁴ Few authors have suggested that more robust criteria of selecting patients may have a positive influence on the surgical outcome. Yilmaz et al.⁵ reported that the success of RFA treatment did not depend on the pretreatment visual analogue scale (VAS) score but on the amount of response to topical decongestant. Farmer et al.⁶ reported that patients with a low preoperative nasal airflow demonstrated the largest improvement following Coblation surgery of the turbinates.

¹Department of Otolaryngology, Umraniye Education and Research Hospital, Istanbul, Turkey; ²Department of Surgery, Section of Otolaryngology, University of Chicago, Chicago, IL

Correspondence to: Asli Sahin-Yilmaz, MD, Umraniye Education and Research Hospital, Kazim Karabekir mahallesi, Umraniye, Istanbul, Turkey; e-mail: aslisahin@hotmail.com

Potential conflict of interest: None provided.

Received: 2 October 2013; Revised: 22 October 2013; Accepted: 19 December 2013

DOI: 10.1002/alr.21303

View this article online at wileyonlinelibrary.com.

Our objectives in this study include presenting our 6 months of follow-up data after RFA of the inferior turbinates, and analyzing whether postoperative improvement by this surgery can be predicted with both subjective (VAS score) and objective measurements (rhinomanometry) preoperatively.

Patients and methods

Patients

This was a prospective, nonrandomized, unblinded clinical study with 53 participants: 23 men and 30 women (mean age 35.7 years; range, 18–65 years). The patients were given verbal and written information about the study and written informed consent was obtained. This study was approved by Umraniye Education and Research Hospital's Ethical Committee.

Inclusion criteria included bilateral nasal obstruction due to turbinate hypertrophy refractory to 3 months of medical therapy (nasal steroids). Patients with previous nasal surgery, septal deformity, sinusitis with or without nasal polyposis, and a history of systemic diseases were excluded. All patients underwent physical examination by the same surgeon.

Assessment of symptoms

Subjective measurements

Subjective symptom of nasal obstruction was measured by a standard 10-cm VAS. The measurement was repeated 10 minutes after application of a topical nasal decongestant (0.1% xylometazoline hydrochloride nasal spray) to both

spray) to both nostrils. The higher nasal resistance was recorded.

Surgical procedure

RFA (Curis®, Sutter Medizintechnik, Freiburg, Germany) was performed on all subjects by the same surgeon (third author) as an outpatient procedure. One strip of cotton soaked with topical lidocaine 4% was applied to both nasal cavities for 10 minutes. Both turbinates were injected with 3 to 4 mL of lidocaine without a vasoconstrictor agent. The inferior turbinate probe was used to create 2 to 3 lesions (10 W, RaVoR mode, Autostop, total energy ≤100 J). The patients were sent home and advised to use a saline solution for 2 to 3 weeks. Nasal tampons were never required.

Statistical analysis

Statistical analysis was made with NCSS (Number Cruncher Statistical System 2007) and PASS (Power Analysis and Sample Size 2008) statistical software, both from NCSS, LLC, Kaysville, UT. Wilcoxon signed rank test was used for comparison of preoperative vs postoperative values. Friedman test was used for follow-ups. Spearman's correlation analysis was used for analysis of correlations. Values of $p < 0.05$ were considered statistically significant.

Formulations for changes in VAS and resistance

The percentage change in VAS and nasal resistance measurements after application of the decongestant was defined as congestion factor VAS (CF VAS) and congestion factor resistance (CF R), respectively, and were calculated using the formula:

$$\text{CF (VAS or R)} = \frac{\text{postdecongestant (VAS or R)} - \text{baseline predecongestant (VAS or R)}}{\text{baseline predecongestant (VAS or R)}} * 100. \quad (1)$$

nostrils. Subjective symptoms were evaluated at baseline and at 1, 3, and 6 months postoperatively.

The percentage change in VAS and nasal resistance measurements after RFA of the turbinates was defined as success ratio VAS (SR VAS) and success ratio resistance (SR R), respectively, and calculated using the formula:

$$\text{SR (VAS or R)} = \frac{\text{postoperative predecongestant (VAS or R)} - \text{baseline predecongestant (VAS or R)}}{\text{baseline predecongestant (VAS or R)}} * 100. \quad (2)$$

Objective measurements

The nasal resistance was measured on each side with active anterior rhinomanometry (Rhinostream; Interacoustics, Assens, Denmark) at baseline and at 1, 3, and 6 months postoperatively. For each nasal cavity, the mean of 3 measurements was calculated. Both measurements were repeated 10 minutes after application of a topical nasal decongestant (0.1% xylometazoline hydrochloride nasal

Results

Subjective symptoms

As shown in Table 1, there was a significant decrease in both predecongestant and postdecongestant VAS scores following radiofrequency surgery at postoperative months 1, 3, and 6 ($p < 0.001$). There was no statistically significant change in these values between the 3-month and 6-month follow-ups.

TABLE 1. Preoperative and postoperative predecongestant and postdecongestant VAS and anterior R values

	VAS		<i>p</i>	Anterior R (<i>r</i>)		<i>p</i>
	Predecongestant	Postdecongestant		Predecongestant	Postdecongestant	
Preoperative	7.26 ± 0.90	4.09 ± 0.88	0.001	0.77 ± 0.29	0.40 ± 0.10	0.001
Postoperative						
1 month	4.21 ± 1.27	3.13 ± 0.89	0.001	0.55 ± 0.24	0.36 ± 0.11	0.001
3 months	3.08 ± 0.85	2.66 ± 0.73	0.001	0.42 ± 0.11	0.32 ± 0.09	0.001
6 months	3.36 ± 1.19	2.64 ± 0.83	0.001	0.45 ± 0.16	0.32 ± 0.09	0.001
<i>p</i>						
Preoperative vs 1 month	0.001	0.001		0.001	0.001	
Preoperative vs 3 months	0.001	0.001		0.001	0.001	
Preoperative vs 6 months	0.001	0.001		0.001	0.001	
1 month vs 3 months	0.001	0.001		0.001	0.001	
3 months vs 6 months	ns	ns		ns	ns	

R = resistance; ns = nonsignificant; Preop = preoperative; VAS = visual analogue scale;

The mean ± standard deviation (SD) improvement of nasal subjective symptoms 6 months after surgery was 53.14% ± 16.13%.

Objective symptoms

As shown in Table 1, there was a significant decrease in both predecongestant and postdecongestant resistance measurements following RFA surgery at postoperative months 1, 3, and 6 ($p < 0.001$). There was no statistically significant change in these values between the 3-month and 6-month follow-ups.

The mean ± SD improvement of nasal airflow determined by decreased nasal resistance after surgery was 38.91% ± 17.75%.

Correlations between preoperative and postoperative subjective (VAS) scores and objective (resistance) measurements

Table 2 shows the correlations between preoperative predecongestant and postdecongestant values and postoperative subjective and objective outcome.

Correlations between postoperative success ratios and preoperative (baseline) congestion factors

Table 3 shows the correlations between the postoperative subjective (VAS) and objective (resistance) success ratios at postoperative months 1, 3, and 6 and the congestion factor for subjective and objective measurements. There was no significant correlation between CF R at baseline and the SR in VAS at 6 months (Fig. 1). CF R baseline was positively

TABLE 2. Correlations between postoperative outcome and the preoperative decongestant test*

	Predecongestant baseline VAS	Postdecongestant baseline VAS	Predecongestant baseline R	Postdecongestant baseline R
VAS postoperative 1 month	ns	0.006 (0.37)	ns	0.037 (0.28)
VAS postoperative 3 months	0.001 (0.44)	0.049 (0.27)	ns	ns
VAS postoperative 6 months	ns	ns	ns	ns
R postoperative 1 month	ns	ns	0.000 (0.87)	0.002 (0.41)
R postoperative 3 months	0.003 (0.40)	ns	0.000 (0.78)	0.000 (0.46)
R postoperative 6 months	ns	ns	0.000 (0.65)	0.000 (0.52)

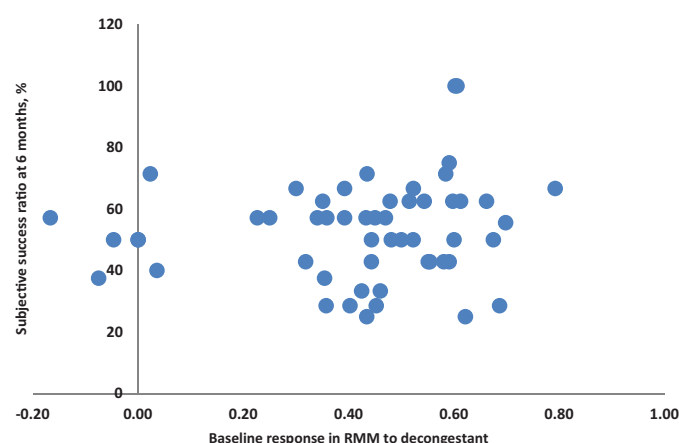
*Values are *p* (correlation coefficient).

R = resistance; ns = not significant; VAS = visual analogue scale;

TABLE 3. Correlations between postoperative outcome and the congestion factor for VAS and rhinomanometry*

	CF VAS baseline	CF R baseline
CF R baseline	0.019 (0.32)	—
SR VAS 1 month	0.013 (0.34)	0.419 (0.11)
SR VAS 3 months	0.097 (0.23)	0.052 (0.26)
SR VAS 6 months	0.086 (0.23)	0.348 (0.13)
SR R 1 month	0.001 (0.44)	0.002 (0.41)
SR R 3 months	0.076 (0.24)	0.000 (0.61)
SR R 6 months	0.151 (0.20)	0.000 (0.53)

*Values are p (correlation coefficient). Bold values are significant at $p < 0.05$. CF = congestion factor; R = resistance; SR = success ratio; VAS = visual analogue scale.

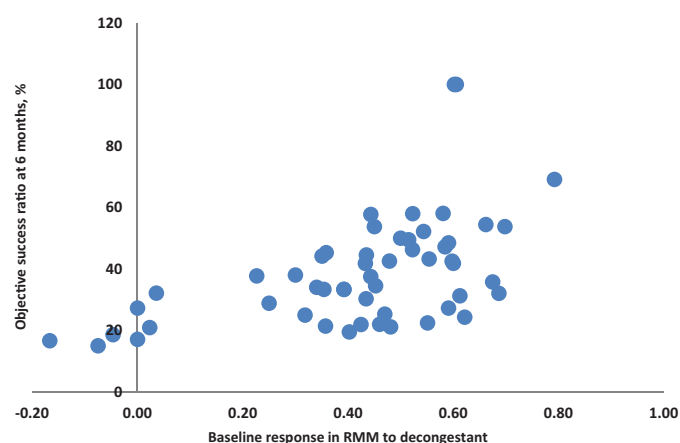
**FIGURE 1.** No correlation was observed between the 6-month improvement in VAS and the baseline response to decongestant measured by rhinomanometry ($p = 0.348$, $r = 0.13$).

correlated with all postoperative SRs in resistance (Table 2; Fig. 2 for month 6).

Discussion

There is no consensus in the literature regarding the patient selection for surgery of the inferior turbinates. According to Leong and Eccles,⁴ most surgical interventions are offered on the basis of patients' subjective complaint of nasal obstruction and clinical examination. Inappropriate selection of surgery or surgical modality as a therapeutic option is suggested to be a major cause of patient dissatisfaction.⁷ Therefore, it is crucial to select patients who will have the most benefit from turbinate surgery.

In this study we aimed to identify whether a decongestant test may help estimate which patients will have a better outcome after RFA of the turbinates. A similar study by Yilmaz et al.⁵ has suggested that the effect of decongestant on preoperative VAS scores could help predict the patients' subjective outcome until 6 months postoperatively. Our results in terms of subjective parameters

**FIGURE 2.** There is a significant correlation between the 6-month improvement in nasal resistance and the baseline response to decongestant measured by rhinomanometry ($p = 0.000$, $r = 0.53$).

were relatively similar to the study by Yilmaz et al.⁵; we were able to predict the early (1-month) postoperative success with our decongestant test, but failed to find a significant correlation for the following months (ie, 3-month and 6-month).

In our study, in addition to using subjective scoring, we evaluated our patients preoperatively with anterior rhinomanometry before and after decongestant application. Although there was a perfect correlation between the preoperative and postoperative resistance measurements, this objective test was not able to predict the subjective outcome of this surgery. On the other hand, our preoperative objective test was able to significantly predict the postoperative objective improvement in nasal functions.

To our knowledge, no other study has used an objective test to predict the outcome of RFA of the turbinates. For the Coblation technique, Farmer et al.⁶ suggested that the benefit was greatest in patients with a lower preoperative nasal conductance in posterior rhinomanometry; however, the definition of benefit in their study was dependent on the objective measurements, not the VAS score of the patient. Similarly, for the Diode laser turbinoplasty technique, Volk et al.⁸ found that presurgical effect of topical decongestion was correlated with postoperative improvement for the objective measurements in patients, not the subjective satisfaction.

It is well known that objective nasal tests are sometimes inconsistent with the patients' subjective assessment of nasal obstruction. Unknown confounding factors such as allergies or upper respiratory tract infections may be the reasons why we failed to predict the long-term subjective outcomes of this surgical technique with our preoperative measurements. For those patients with known confounders such as allergic rhinitis, further medical therapies could be instituted to prevent recurrent inferior turbinate hypertrophy in the postoperative period. Also, one must keep in

mind that nasal surgery has a large placebo effect that influences subjective scores.⁹

Summary

Similar to other reports, all of the patients in this study had a significant reduction in subjective symptom scores and nasal airway resistance measurements following RFA of the inferior turbinates.^{10–12}

A preoperative test that evaluates the *subjective* response to the decongestant could predict only the short-term postoperative improvement in subjective symptoms of the subjects.

A preoperative test that evaluates the *objective* response to the decongestant with rhinomanometry could predict only the short-term subjective improvement in VAS.

A preoperative test that evaluates the objective response to the decongestant with rhinomanometry could predict both the short-term and long-term objective improvement in the nasal airway.

Conclusion

Our study has shown that rhinomanometry has a high predictive value only for the objective outcome of RFA; ie, although the subjects had a patent airway at 3 to 6 months postprocedure, the subjective satisfaction had disappeared. We have shown that objective measures do not correlate with long-term subjective satisfaction even when the nose is objectively patent in subjects who underwent RFA of the inferior turbinates. Performing a rhinomanometry with topical decongestion before the procedure cannot estimate the patient's long-term subjective benefit from RFA surgery. 

References

1. Bhandarkar ND, Smith TL. Outcomes of surgery for inferior turbinate hypertrophy. *Curr Opin Otolaryngol Head Neck Surg.* 2010;18:49–53.
2. Gouveris H, Nousia C, Giatromanolaki A, et al. Immunohistological study of wound healing after submucosal radiofrequency tissue ablation of inferior nasal turbinate in a sheep model. *Am J Rhinol Allergy.* 2011;25:131–136.
3. Wheeler SM, Corey JP. Evaluation of upper airway obstruction—an ENT perspective. *Pulm Pharmacol Ther.* 2008;21:433–441.
4. Leong SC, Eccles R. Inferior turbinate surgery and nasal airflow: evidence-based management. *Curr Opin Otolaryngol Head Neck Surg.* 2010;18:54–59.
5. Yilmaz M, Kemaloglu YK, Baysal E, et al. Radiofrequency for inferior turbinate hypertrophy: could its long-term effect be predicted with a preoperative topical vasoconstrictor drop test? *Am J Rhinol.* 2006;20:32–35.
6. Farmer SE, Quine SM, Eccles R. Efficacy of inferior turbinate coblation for treatment of nasal obstruction. *J Laryngol Otol.* 2009;123:309–314.
7. Willatt D. The evidence for reducing inferior turbinates. *Rhinology.* 2009;47:227–236.
8. Volk GF, Pantel M, Guntinas-Lichius O, et al. Prognostic value of anterior rhinomanometry in diode laser turbinoplasty. *Arch Otolaryngol Head Neck Surg.* 2010;136:1015–1019.
9. Nease CJ, Kreimpl GA. Radiofrequency treatment of turbinate hypertrophy: a randomized, blinded, placebo-controlled clinical trial. *Otolaryngol Head Neck Surg.* 2004;130:291–299.
10. Garzaro M, Pezzoli M, Landolfo V, Defilippi S, Giordano C, Pecorari G. Radiofrequency inferior turbinate reduction: long-term olfactory and functional outcomes. *Otolaryngol Head Neck Surg.* 2012;146:146–150.
11. Sapçi T, Sahin B, Karavus A, et al. Comparison of the effects of radiofrequency tissue ablation, CO2 laser ablation, and partial turbinectomy applications on nasal mucociliary functions. *Laryngoscope.* 2003;113:514–519.
12. Bäck LJ, Hytönen ML, Malmberg HO, et al. Submucosal bipolar radiofrequency thermal ablation of inferior turbinates: a long-term follow-up with subjective and objective assessment. *Laryngoscope.* 2002;112:1806–1812.