Long-term Results of Radiofrequency Turbinoplasty for Allergic Rhinitis Refractory to Medical Therapy

Hsin-Ching Lin, MD; Pei-Wen Lin, MD; Michael Friedman, MD; Hsueh-Wen Chang, PhD; Yan-Ye Su, MD; Yu-Jen Chen, MD; Tanya M. Pulver, MD

Objective: To study the long-term outcomes of radiofrequency (RF) turbinate surgery for the treatment of allergic rhinitis refractory to medical therapy.

Design: A retrospective review of a prospective data set.

Setting: Tertiary referral center.

Patients: A total of 146 patients with allergic rhinitis refractory to medical therapy undergoing RF turbinoplasty were included.

Main Outcome Measures: A standard 0 to 10 visual analog scale (VAS) was used to assess the allergic symptoms including nasal obstruction, rhinorrhea, sneezing, itchy nose, and itchy eyes prior to RF turbinoplasty and at 6 months and 5 years postoperatively. The long-term clinical benefits and complications were reviewed. Statistical analysis was determined by repeated measures of analysis of variance.

Results: No adverse reactions such as bleeding, infection, adhesions, or olfactory change were encountered. Of the 146 patients, 119 were followed up at least 5 years postoperatively. Five years after treatment, 101 patients had complete data available for analysis. They reported improvement of nasal obstruction, with the mean (SD) VAS score decreasing from 6.65 (1.92) to 4.45 (2.54). The mean (SD) VAS score changed from 5.90 (2.79) to 3.79 (2.97) for rhinorrhea; from 5.15 (2.77) to 3.50 (2.77) for sneezing; from 3.67 (3.03) to 2.41 (2.30) for itchy nose; and from 2.94 (3.02) to 2.02 (2.42) for itchy eyes (all P < .001, paired t test with Bonferroni correction).

Conclusion: This long-term study has demonstrated that the RF turbinoplasty for allergic rhinitis appears to be an effective and safe tool for treating allergic rhinitis refractory to medical therapy.

Center, Kaohsiung, Taiwan. Since 2000, all of our patients treated with RF turbinate surgery have undergone routine assessment at our clinic before and after treatment. This assessment includes evaluation of common allergic symptoms such as nasal obstruction, rhinorrhea, sneezing, itchy nose, and itchy eyes. Patients were asked to complete a global patient assessment (GPA) questionnaire designed to monitor satisfaction after undergoing a procedure. Patients who did not return for follow-up were contacted by telephone. Only those patients who completed both preoperative and postoperative surveys and postoperative GPA forms at least 5 years after the procedure were enrolled.

**PATIENT SELECTION**

All of the patients with allergic rhinitis had typical clinical symptoms and signs, as well as a high titer of specific IgE antibodies for house dust and/or other antigens. They had been previously treated with conventional medical management without satisfactory improvement for at least 3 months before surgery. Patients with systemic disease, previous turbinate surgery, severe nasal septal deviation, nasal polypsis or chronic rhinosinusitis, upper respiratory tract infection within a week preoperatively, a history of radiotherapy, or oral steroid use were excluded. Before surgery, the patients were also assessed by an ophthalmologist to exclude any ophthalmological disorder that may induce the symptom of eye pruritus such as trichiasis, entropion, blepharitis, blepharoconjunctivitis, keratoconjunctivitis, or dry eye syndrome.

The medical records and telephone survey of all patients with allergic rhinitis who responded poorly to medical therapy and were treated with RF turbinate surgery were reviewed. Patients with missing preoperative or postoperative data were eliminated from the study. Those patients who lacked postoperative surveys were contacted at a minimum of 5 years following their surgery to complete their data. Treatment was regarded to have failed if the patient underwent additional surgery to address his or her allergic symptoms following RF turbinate surgery, failed to improve in at least 1 of the specified common allergic symptoms, worsened in any 1 of the common symptoms, or did not satisfy the surgical results.

**SURGICAL PROCEDURES**

All procedures were performed with the use of local anesthesia by one of us (H.-C.L.). The surgical procedure was performed according to our previously described techniques. Radiofrequency energy was delivered at a frequency of 465 Hz with an RF generator (model S2 Radiofrequency Control Unit; Somnus Medical Technologies Inc, Sunnyvale, California) and an SP 1100 turbinate handpiece (40-mm needle electrode, consisting of a 10-mm active portion, 30-mm insulated part, and 2 thermocouples).

**ASSESSMENTS AND STUDY END POINTS**

Patient surveys were conducted using a standard 0 to 10 visual analog scale (VAS), with 0 representing no symptoms and 10, the most severe symptoms. Symptoms assessed preoperatively and during follow-up visits included nasal obstruction, rhinorrhea, sneezing, itchy nose, and itchy eyes. All surgical candidates were given surveys prior to any surgical intervention.

At the 5-year postoperative follow-up, patients were also asked to complete a GPA questionnaire, which assessed patient satisfaction by asking (1) if given the choice, would the patient choose to undergo the same procedure (yes/not sure/no) and (2) how would the patient rank his or her overall experience on a scale of −5 to +5, with −5 being the worst outcome possible and +5 being the best outcome possible. Although the GPA questionnaire contained additional parameters, we chose to use only these 2 in the study prior to collecting or analyzing any data.

**STATISTICAL ANALYSIS**

Results were expressed as mean (SD). Comparisons of scores of the common symptoms of allergic rhinitis including nasal obstruction, rhinorrhea, sneezing, itchy nose, and itchy eyes generated with a 0 to 10 VAS with preoperative and 5-year postoperative anchor points were made using repeated analysis of variance. When significant differences were noted, individual means were compared using the paired t test with Bonferroni correction. Differences were considered to be statistically significant when the P value was less than .05.

**RESULTS**

As of April 2008, there were 146 patients with allergic rhinitis refractory to medical treatment who underwent RF turbinate surgery with more than 5 years of follow-up. Some patients experienced mild numbness over the teeth (27 of 146; 18.5%) during the operation. No immediate complications such as acute bleeding or infection were encountered, nor were any long-term adverse reactions, including recurrent epistaxis, synechiae, nasal dryness, bone necrosis, atrophic rhinitis, or olfactory change, encountered 5 years after surgery. Twenty-seven patients were lost to follow-up. We defined a favorable response as both improvement of at least 1 of the common allergic symptoms, without worsening of any of the remaining allergic symptoms and patient satisfaction with the surgical results. The 6-month and 5-year response rates were 77.3% (92 of 119) and 60.5% (72 of 119), respectively.

Of the 119 patients (58 women and 61 men; mean age, 30.2 years), 17 went on to receive other additional nasal surgery including laser turbinectomy, submucosal resection of the turbinate, and alternative Chinese corrosive therapy because of no obvious response to the RF surgery. One patient was diagnosed as having hepatocellular carcinoma 3 months postoperatively. These 18 patients were excluded from the study. Thus, 101 patients (49 female and 52 male; mean age, 29.1 years) had a minimum follow-up of 5 years and complete data for the final analysis. Patients reported improvement in nasal obstruction, rhinorrhea, sneezing, itchy nose, and itchy eyes (P < .001 for all). The surgical results of these 101 patients are given in the Table.

Patient satisfaction with RF turbinate surgery was measured using the 5-year follow-up GPA form questionnaire. Favorable results were based on positive responses to the following 2 parameters: (1) whether patients would undergo the same procedure again and (2) how patients ranked overall experience with their procedure based on a scale extending from −5 ("worst outcome I could have expected") to +5 ("best outcome I could have expected"). Of the allergic patients, 58 (37.4%) responded yes to having the same procedure performed again, while 38 (37.6%) responded no and 5 patients (5.0%) were not sure. The mean (SD) score for the sec-
The close association of nasal allergies with these media with effusion, frequently complicate allergic respiratory diseases, including asthma, sinusitis, and otitis. Upper and lower respiratory diseases, underscore the need for long-term improved treatment options for this disorder. Upper and lower respiratory diseases, including asthma, sinusitis, and otitis media with effusion, frequently complicate allergic rhinitis. The close association of nasal allergies with these conditions has been supported by extensive epidemiologic evidence.8 The present study focused solely on the long-term outcomes of RF turbinoplasty with regard to the common symptoms of allergic rhinitis. Whether the benefits of this procedure could extend to patients with the aforementioned associated conditions to help prevent recurrent episodes and improve the response to therapy is a subject for further inquiry.

Allergic ocular symptoms, common in patients with allergic rhinitis, are associated with reduced quality of life and related economic costs.9 In the conjunctival epithelium, an early type 1 hypersensitivity reaction occurs after allergen exposure. Progression to late-phase response, with recurrence of symptoms and infiltration of inflammatory cells, may occur 4 to 8 hours later.10 Baroody et al11 performed a double-blind, placebo-controlled clinical trial on 20 patients with allergic rhinitis challenged in 1 nostril with antigen. The response was monitored in both nostrils and in both eyes. They found that nasal allergen challenge releases histamine at the site of the challenge, which probably initiates both a nasoasal and a nasal ocular reflex. These reflexes are reduced by the application of an H1-receptor antagonist at the site of the challenge. Reflex mechanisms within the nose have been shown to occur universally in response to nasal challenges with antigen. Nasal challenge with antigen induces a reflex in the contralateral nasal cavity, known as the nasonasal reflex. This reflex can be initiated by nasal challenge with cold, dry air, and histamine.12,13 The eye symptoms of patients with allergic rhinitis arise via a combination of mechanisms, including direct contact of natural pollen with the conjunctiva and in response to stimulation originating in the nose via the nasoocular reflex. Our clinical data indicate that the decrease of eye symptoms in 43 of the 101 patients (42.6%) with allergic rhinitis can be achieved by RF turbinoplasty 5 years after the surgery. Mechanisms of relief of allergic ocular symptoms following RF turbinoplasty include the following possibilities: (1) RF tissue volume reduction of the turbinates decreases the superficial surface area available for allergen contact. (2) Radiofrequency energy transduction within the submucosa of the inferior turbinate leads to scar formation, obliteration of the submucosal small vessels, and destruction of the submucosal glands. As the superficial submucosal layer of the inferior turbinate is thought to be the site of the allergic reaction,14 disruption of this layer by RF may contribute to its effects on allergic ocular symptoms. (3) In addition, an inhibitory effect on the local immune response or nasoocular reflex or disruption of the pas-

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Pretreatment</th>
<th>6 Months</th>
<th>5 Years</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nasal obstruction</td>
<td>6.65 (1.92)</td>
<td>2.74 (1.72)</td>
<td>4.45 (2.54)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Rhinorrhea</td>
<td>5.90 (2.79)</td>
<td>2.84 (2.47)</td>
<td>3.79 (2.97)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Sneezing</td>
<td>5.15 (2.77)</td>
<td>2.51 (2.12)</td>
<td>3.50 (2.77)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Itchy nose</td>
<td>3.67 (3.03)</td>
<td>1.51 (1.87)</td>
<td>2.41 (2.30)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Itchy eyes</td>
<td>2.94 (3.02)</td>
<td>1.09 (0.69)</td>
<td>2.02 (2.42)</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

Abbreviation: VAS, standard 0 to 10 visual analog scale.
a Data are given as mean (SD) unless otherwise specified.
b By repeated measures of analysis of variance.
sage of allergen and allergic mediators toward the eyes via nasolacrimal system may occur. Further investigations are needed.

The study suffered from many limitations. This is a prospective study in which patients served as their own control. The symptomatic improvements were compared with pretreatment levels of their allergic burdens. An ideal study would have been a prospective, double-blinded, controlled study, which is difficult and impractical to perform over the long term. A second limitation of this study is the number of patients who were lost to follow-up. Based on an “intent-to-treat” analysis of all 146 patients, the 5-year response rate drops to 49.3%. However, we believe that the “true” response rate after RF turbinoplasty is closer to the stated 60.5%. Though we have no data to support this, it is conceivable that many patients who were cured of their allergic symptoms were also those least likely to participate in long-term follow-up. Another limitation of this study was that we did not include long-term changes of objective nasal function or local allergic mediators to validate the clinical benefits after RF turbinoplasty. Ciprandi et al13 have reported that a significant, very strong correlation has been observed between VAS scores for allergic symptoms and nasal airflow resistance via rhinomanometry. They concluded that the VAS for assessing allergic symptoms, especially in nasal obstruction, may be considered a reliable predictor in the absence of objective rhinologic examinations. Their study provides evidence to support the use of the VAS as an outcome variable in clinical practice or research. In this study, we used the VAS to quantify the improvement of the patients’ allergic symptoms after RF turbinoplasty. The 6-month and 5-year response rates were 77.3% and 60.5%, respectively. More objective studies should be conducted to validate the clinical results in the future.

Although the outcome of RF turbinoplasty for patients with allergic rhinitis responding poorly to medical therapy declines with time, we found that the improvement in symptom scores in the group as a whole was still significant 5 years after the surgery. This study demonstrates the value of RF turbinoplasty as an effective and safe tool for treating allergic rhinitis refractory to medical therapy over the long-term.

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Author Contributions: Dr H.-C. Lin had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: H.-C. Lin. Acquisition of data: H.-C. Lin, P.-W. Lin, Su, and Chen. Analysis and interpretation of data: H.-C. Lin, Friedman, Chang, and Pulver. Drafting of the manuscript: H.-C. Lin, P.-W. Lin, Su, and Chen. Critical revision of the manuscript for important intellectual content: Friedman, Chang, and Pulver. Statistical analysis: Chang. Administrative, technical, and material support: H.-C. Lin, P.-W. Lin, Su, and Chen.

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REFERENCES