Original Article

Archives of Clinical & Experimental Surgery

Evaluation of Early and Late Term Outcomes of Radiofrequency Surgery in the Treatment of Inferior Turbinate Hypertrophy

Murat Salihoglu, Ibrahim Engin Cekin, Enver Cesmeci, Bulent Evren Erkul

Department of Otorhinolaryngology
Gulhane Military
Medical Academy
Haydarpasa Training Hospital
Istanbul, Turkey

Recevied: July 30, 2013
Accepted: September 06, 2013
Arch Clin Exp Surg 2014;3:34-39
DOI:10.5455/aces.20130906062613

Corresponding author:
Enver Cesmeci, MD
Department of Otorhinolaryngology
Gulhane Military
Medical Academy
Haydarpasa Training Hospital
Istanbul, Turkey
envercesmeci@hotmail.com

Abstract

Introduction: Inferior turbinate hypertrophy (ITH) plays an important role in the complaint of nasal obstruction. Surgical procedures are preferred to reduce the inferior turbinate if medical treatments fail to achieve satisfactory results. Numerous surgical techniques have been tried for inferior turbinate surgery. Recently, inferior turbinate radiofrequency ablation (RFA) has come forward among these surgical techniques. The aim of this study was to evaluate results of inferior turbinate RFA in patients who did not benefit from medical therapy.

Patients and Methods: The study included 32 patients who are suffering from nasal obstruction because of ITH. All the patients did not benefit from medical therapy. Topical and infiltrative anesthesia was performed before the application. Severities of the patients' complaint of nasal obstruction were subjectively evaluated by using a visual analogue scale (VAS) preoperatively, and postoperatively on six weeks and one year. The effects of inferior turbinate RFA on mucociliary activity were evaluated in the same period by a saccharin test.

Results: The mean preoperative VAS score was 6.47. The mean postoperative 6-week and 1-year VAS scores were 4.13 (P<0.001) and 4.47 (P<0.001), respectively. There was a statistically significant decrease in postoperative VAS scores compared to preoperative VAS scores. The average saccharin test results for the right nasal cavity preoperatively, 6 weeks postoperatively, and 1 year postoperatively were 11.03 minutes, 11.75 minutes (P=0.054), and 11.69 minutes (P=0.074), respectively. The average saccharin test results for the left nasal cavity preoperatively, 6 weeks postoperatively, and 1 year postoperatively were 10.91 minutes, 11.22 minutes (P=0.268), and 11.59 minutes (P=0.187), respectively. There were no statistically significant differences between preoperative and postoperative saccharin test results for each nasal cavity.

Conclusion: Inferior turbinate RFA can be used alone effectively in the treatment of nasal obstruction caused by ITH. Results of inferior turbinate RFA are satisfactory for at least one year without causing impairment in physiologic mucociliary activity or other adverse effects.

Key words: *Turbinates, hypertrophy, radiofrequency, visual analogue scale, saccharin*

Introduction

Inferior turbinate hypertrophy (ITH) plays an important role in the complaint of nasal obstruction. The common causes of ITH are compensatory inferior turbinate hypertrophy secondary to nasal septal deviation and allergic and vasomotor rhinitis [1]. Medical treatments are generally preferred initially in the treatment of ITH. In many cases, intranasal topical steroids,

antihistamines and decongestants often yield good results. Surgical procedures are preferred to reduce the inferior turbinate if medical treatments fail to achieve satisfactory results. To date, numerous surgical techniques have been tried for inferior turbinate surgery. While performing these techniques, several problems were observed such as bleeding, crusting, synechiae, mucosal damage, atrophic rhinitis, prolonged recovery times, unsuccessful surgery, and excessive cost [2-4]. Studies are still underway to determine the ideal surgical method. Recently, inferior turbinate radiofrequency ablation (RFA) has come forward among these surgical techniques. The early outcomes of inferior turbinate RFA have been evaluated in many studies but there are few studies that evaluate both early and late outcomes of inferior turbinate RFA together [5,6]. The aim of this study was to evaluate early and one-year follow-up results of inferior turbinate RFA in patients who did not benefit from medical therapy.

Material and Methods

This study was approved by the Izmir Clinical Research Ethics Committee (24.12.2009-78) and conducted in the Department of Otorhinolaryngology at the Izmir Military Hospital between December 2009 and May 2011. Informed consent was obtained from all patients. Patients suffering from nasal obstruction because of inferior turbinate hypertrophy and who did not benefit from medical therapy were included in this study. Patients that have not seen significant improvement in their nasal obstruction complaint despite using medical treatment for at least three months were assessed, as they had no benefit from medical treatment. Exclusion criteria were as follows: smokers, patients with a severe deviated septum or nasal polyps on nasal endoscopic examination, upper and lower respiratory infection in previous month, or previous history of inferior turbinate surgery. This study included 32 patients (30 were male, 2 were female). The mean age of the patients was 26.59, ranging: 20 to 48 years old. Inferior turbinate RFA was performed with an RFA device (Gyrus® G3 model, temperature-controlled radio frequency, plasmacision generator, USA). Topical and infiltrative anesthesia was performed before the application. Epinephrine-free 10% pantocain impregnated cotton pledgets were placed in both nasal cavities and were removed after five minutes. 1ml lidocaine HCL (Jetokain Simplex® 20 mg, 2 ml, Adeka, Turkey) injections were performed in each of the inferior turbinates. No vasoconstrictive agents were used. After five minutes, the radiofrequency (RF) electrode was placed submucosally within the anterior portion of the inferior turbinate and advanced toward the posterior part of the inferior turbinate as far as possible under direct vision using a fiber optic headlight. Our goal was to deliver the RF energy in a single session in these patients. The active 10mm portion of the electrode was buried within the inferior turbinate so that at least 3 mm of the inactive electrode was in contact with mucosa to protect the mucosa from injury. RF energy was delivered to the inferior turbinates bilaterally at a maximum temperature of 75°C and to a maximum energy of 800 Joule in a single session. The RF electrode was removed by pulling back slowly while RF energy was delivering. We carefully delivered the RF energy, particularly avoiding inadvertent injury to the internal nasal valve region during the procedure. We were able to move the RF electrode from the anterior part of the inferior turbinate to the posterior part in 11 patients. We delivered the entire RF energy in two sessions in 21 patients because we could not advance the RF electrode successfully. We placed the RF electrode in the anterior and the middle part of inferior turbinate in these patients. A nasal package was not used after the procedure. Nasal irrigation with isotonic saline solution was recommended to patients. Antibiotics were not prescribed. Nasal endoscopic examination was performed preoperatively and postoperatively at 6 weeks and 1 year. In our department we did not have any device such as rhinomanometry or acoustic rhinomanometry for objective assessment of nasal obstruction severity; therefore, we evaluated nasal obstruction severity by using a VAS scale.

Severities of the patients' complaint of nasal obstruction were subjectively evaluated by using a visual analogue scale (VAS) preoperatively, and postoperatively at six weeks and one year. Patients were asked to rate their complaints on a 10-point VAS form (0: very comfortable breathing; 10: severe nasal obstruction). The effects of inferior turbinate RFA on mucociliary activity were evaluated by a saccharin test preopera-

tively, and postoperatively at six weeks and one year. One quarter of a saccharin tablet was placed in the medial side of the anterior inferior turbinate with the aid of forceps. Patients were asked to swallow in 1-minute intervals and to report when they tasted the saccharin. The saccharin test was performed separately for each nasal cavity, with the elapsed time being recorded in minutes. An SPSS for Windows 11.5.0 statistical program was used to evaluate the data, and the Wilcoxon sign test method was used for comparison. P <0.05 was considered significant.

Results

The mean preoperative VAS score was 6.47. The mean postoperative 6-week and 1-year VAS scores were 4.13 (P<0.001) and 4.47 (P<0.001), respectively (Figure 1). There was a statistically significant decrease in postoperative VAS scores compared to preoperative VAS scores (Figure 2a,b). There was no significant difference between postoperative 6-week and 1-year VAS scores (P=0.147). A saccharin test was evaluated separately for each nasal cavity (Figure 3). The average saccharin test results for the right nasal cavity preoperatively, 6 weeks postoperatively, and 1 year postoperatively were 11.03 minutes, 11.75 minutes (P=0.054), and 11.69 minutes (P=0.074), respectively. The average saccharin test results for the left nasal cavity preoperatively, 6 weeks postoperatively, and 1 year postoperatively were 10.91 minutes, 11.22 minutes (P=0.268), and 11.59 minutes (P=0.187), respectively. There were no statistically significant differences between preoperative and postoperative saccharin test results for each nasal cavity. There was no statistically significant difference between postoperative 6-week and 1-year results for each nasal cavity with the saccharin test (right: P=0.954, and left: P=0.27).

Based on the saccharin test results, nasal mucosal activity was preserved at six weeks and one year after the inferior turbinate RFA. When we looked at complications of inferior turbinate RFA, we found that there were no remarkable complications with inferior turbinate RFA. Bleeding was not observed during or after inferior turbinate RFA. Five patients fainted during ad-

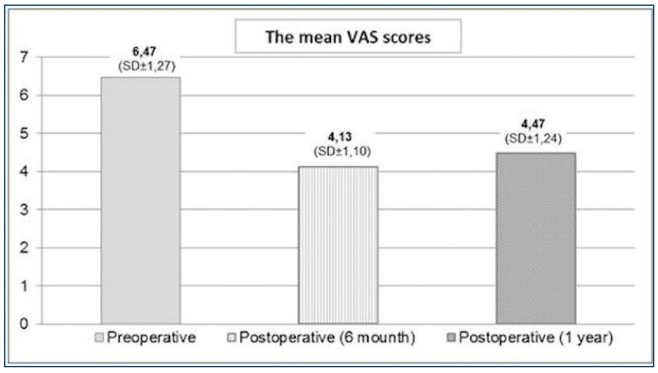

Figure 1. The mean visual analogue scale scores. There was a statistically significant decrease in postoperative VAS scores compared to preoperative VAS scores (P<0.001). There was no significant difference between postoperative 6-week and 1-year VAS scores (P=0.147).

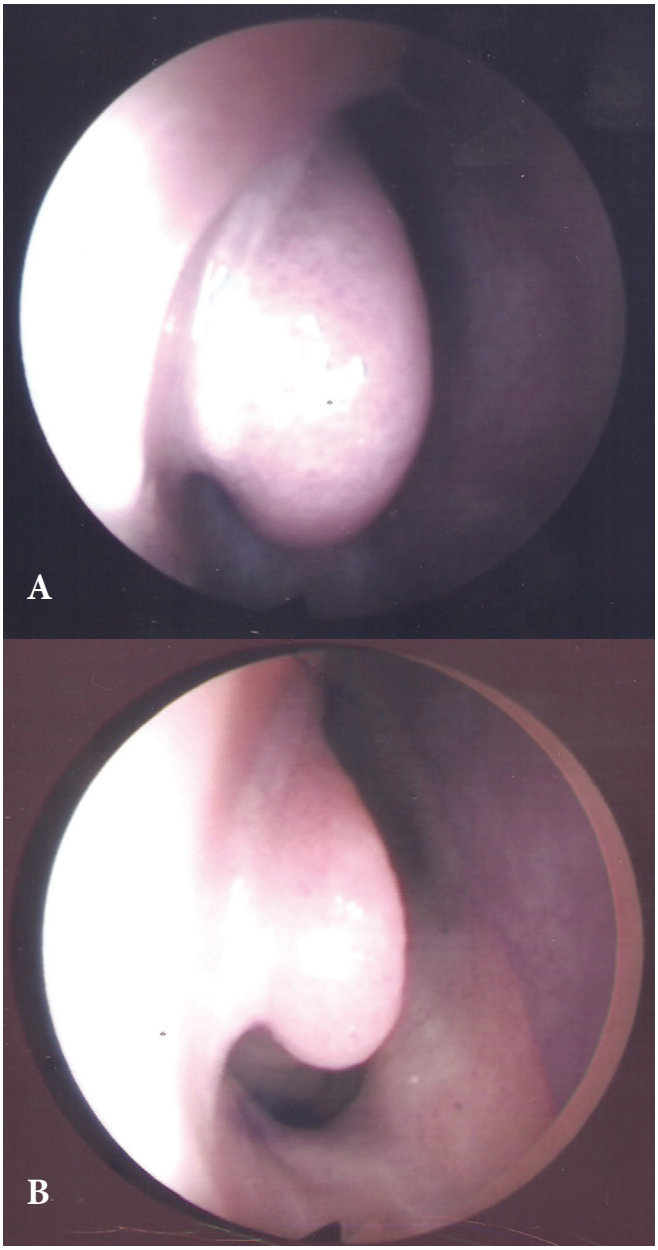

Figure 2. A. Preoperative view of the patient's left inferior turbinate in nasal endoscopic examination. The patient's preoperative VAS score was 7. **B.** Postoperative 1-year view of the patient's left inferior turbinate in nasal endoscopic examination. There was a significant volume reduction between preoperative and postoperative 1-year inferior turbinate volumes. The patient's postoperative 1-year VAS score was 4.

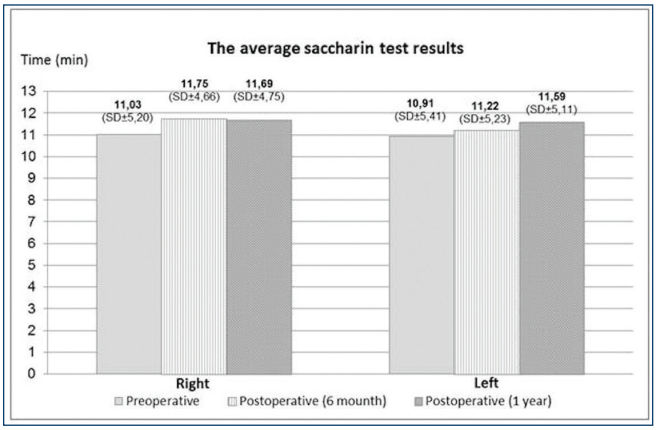

Figure 3. The average saccharin test results for the right nasal cavity preoperatively, 6 weeks postoperatively, and 1 year postoperatively were 11.03 minutes, 11.75 minutes (P=0.054), and 11.69 minutes (P=0.074), respectively. The average saccharin test results for the left nasal cavity preoperatively, 6 weeks postoperatively, and 1 year postoperatively were 10.91 minutes, 11.22 minutes (P=0.268), and 11.59 minutes (P=0.187), respectively. There were no statistically significant differences between preoperative and postoperative saccharin test results for each nasal cavity.

ministration of local anesthesia but inferior turbinate RFA was completed successfully in these patients. 11 patients complained of mild pain after the procedure but this improved with a single dose of 500mg paracetamol (Parol®, Atabay, Turkey). Seven patients complained of sneezing for one day after the procedure. 12 patients complained of mild itching in the nasal cavity and mild nasal obstruction that lasted five days after the procedure.

Discussion

Surgical methods for ITH should preserve physiologic nasal mucosal functions and ensure adequate tissue reduction to improve the nasal airway. In addition to these, surgical methods should be easily applicable, repeatable and have minimal complications. Many surgical techniques such as electrocautery, chemical cautery, cryosurgery, subtotal or total turbinectomy, and laser applications are not recommended today. It is not possible to avoid complications and preserve nasal mucosal functions such as mucociliary activity via these surgical methods. Mucosal sparing techniques such as inferior turbinoplasty and inferior turbinate RFA are recommended [2,4-6]. Nasal septal surgery should be applied for better functional outcomes in the presence of a deviated septum accompanying ITH [3]. We excluded patients that had a severe deviated septum in our study. Cavaliere et al. compared the effects of inferior turbinate RFA and submucous turbinate resection (STR) on mucociliary transport time in their study. Mucociliary transport time was found to be prolonged in patients one week after undergoing STR, but there was no statistically significant difference between RFA and STR groups at the one-month follow-up [7]. RFA and STR techniques both have similar effects in reducing nasal obstruction. However, STR techniques can cause infection, bleeding, crusting, synechiae, and excessive tissue loss. These complications occur much less frequently in microdebrider turbinoplasty [3].

Focal submucosal coagulation necrosis, fibrosis and contraction occur respectively after inferior turbinate RFA. Finally, tissue volume is reduced. Function and structure of mucosa are preserved [6,7]. RFA does not cause high temperature in the tissue. RFA generates 75–85°C temperature in the tissue, while electrocautery generates 800°C. RFA is applicable in the office environment with minimal patient discomfort. RFA does not cause bleeding, crusting, ulceration, mucosal damage or secretion increment. There is no need for nasal packing, and the results are easy to maintain after the procedure. Pre-syncope was reported during and after RFA, but this complication can be easily avoided [3,8,9]. Pre-syncope developed in five patients (15%) during local anesthetic injection in our study, but this situation did not prevent the completion of the procedure. Bleeding complication was not seen in any of the patients. Mild pain was seen in 11 patients (34%) after RFA, but it was successfully treated with single-dose oral analgesic. Sneezing developed in seven (21%) patients but this resolved within the first day after RFA. A total of 12 (37%) patients complained of mild itching in the nasal cavity and mild nasal obstruction that lasted seven days after the procedure. These complaints were temporary side effects and should not be considered complications.

There is a variety of RF devices and probes that are manufactured to be utilized in inferior turbinate RFA. Cavaliere et al. followed patients that had İTH for 20 months and compared results of bipolar and monopolar inferior turbinate RFA in their study. They found a significant decrease in nasal obstruction one week after bipolar RFA, while there was a significant decrease in nasal obstruction one month after monopolar RFA.

Despite the early benefits of the bipolar RF probe, there was an increase in nasal volume and a simultaneous decrease in nasal resistance that peaked one month after the procedure in both groups. Acceptable outcomes had been preserved in both groups during the 20-month follow-up period. There was no significant difference between the groups [7]. Porter et al. assessed nasal obstruction severity, frequency, and overall ability to breathe in patients after inferior turbinate RFA in a prospective, randomized, single-blind, placebo-controlled study. They assessed patients using the Visual Analog Scale (VAS) before RFA and at eight weeks, six months, one year, and two years after RFA. Significant improvements were seen in all parameters eight weeks after the RFA. There was no statistically significant difference between postoperative 8-week and 2-year results. There was no significant symptom two years after the RFA [8]. In another study, patients' complaints were assessed preoperatively and postoperatively in the short and long term using VAS. According to the study, inferior turbinate RFA is a safe, effective and easily applicable procedure in obstructive ITH [10].

It has also been shown that better results may be obtained by applying RFA to two different locations of the inferior turbinate instead of one location [5]. We used a monopolar RF probe in our study. The RF probe was placed submucosally within the anterior portion of the inferior turbinate and then moved to the posterior aspect. The RF probe was removed by pulling back slowly while RF energy was still being delivered. We took special care to avoid injuring the internal nasal valve region during the procedure. We tried to apply RFA through one point as much as possible to minimize mucosal injury. We were able to move the RF probe from the anterior part of the inferior turbinate to the posterior part in 11 patients. We delivered the RF energy in a single session in these patients. We delivered the RF energy in two sessions in 21 patients in which we couldn't move the RF electrode from the anterior part of the inferior turbinate to the posterior part. Nasal obstruction can be assessed by VAS safely [1,4,5]. We evaluated nasal obstruction with VAS. VAS scores were improved significantly (starting from six weeks after the RFA and preserved until one year after the RFA). Our study has some limitations. Firstly, our study group consists of only young adults and we have no data about older patients. Secondly, we used VAS to evaluate nasal obstruction severity because we did not have chance to use objective tests such as rhinomanometry or acoustic rhinomanometry for objective assessment of nasal obstruction severity.

Cukurova et al. examined long-term results of inferior turbinate RFA histologically in their study. They found that RFA did not cause carbonization and osteitis of the inferior turbinate after 60-month follow-up. Minor tissue damage developed, while fibrosis in the tissue resulted in volume reduction of the inferior turbinate [11]. Coste et al. showed that ciliated cells in the superficial epithelium were still intact and had normal beat frequency using the saccharin test one week following RFA [9]. This study shows how mucociliary clearance activity is maintained and that the saccharin test can be used to assess clearance function after RFA. Back et al. applied RFA to the inferior turbinate and assessed severity and frequency of nasal obstruction and patient satisfaction with VAS in their study. Significant improvements were seen in severity and frequency of nasal obstruction and patient satisfaction parameters and were preserved at 12 months follow-up without impairment of saccharin testing and smell functions [12]. We showed in our study that there was no significant difference between early- and late-term saccharin test results, and mucociliary activity was preserved in our study.

Conclusion

Inferior turbinate RFA can be used alone effectively in the treatment of nasal obstruction caused by ITH. Inferior turbinate RFA can retain its early-term result for at least one year without causing impairment in physiologic mucociliary activity or other adverse complications.

Conflicts of interest statement

The authors declare that they have had no conflict of interest or financial support in this study.

References

1. Bahadir O, Kosucu P. Quantitative measurement of radiofrequency volumetric tissue reduction by multidetector CT in patients with inferior turbinate hypertrophy. Auris Nasus Larynx 2012;39:588-592.
2. Bran GM, Hünnebeck S, Herr RM, Hörmann K,

Stuck BA. Bipolar radiofrequency volumetric tissue reduction of the inferior turbinates: evaluation of short-term efficacy in a prospective, randomized, single-blinded, placebo-controlled crossover trial. Eur Arch Otorhinolaryngol 2013;270:595-601.
3. Garzaro M, Landolfo V, Pezzoli M, Defilippi S, Campisi P, Giordano C, et al. Radiofrequency volume turbinate reduction versus partial turbinectomy:clinical and histological features. Am J Rhinol Allergy 2012;26:321-325.
4. Sözen E, Tansuker D, Yildirim Ö, Uçal YO, Coşkun BU. Effects of radiofrequency and intranasal steroid treatments on respiratory and olfactory functions in nasal obstruction. J Craniofac Surg 2013;24:e314-e318.
5. Safiruddin F, Vroegop AV, Ravesloot MJ, de Vries N. Long-term self-reported treatment effects and experience of radiofrequency-induced thermotherapy of the inferior turbinates performed under local anesthesia: a retrospective analysis. Eur Arch Otorhinolaryngol 2013;270:1849-1853.
6. 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.
7. Cavaliere M, Mottola G, Iemma M. Comparison of the effectiveness and safety of radiofrequency turbinoplasty and traditional surgical technique in treatment of inferior turbinate hypertrophy. Otolaryngol Head Neck Surg 2005;133:972-978.
8. Porter MW, Hales NW, Nease CJ, Krempl GA. Long-term results of inferior turbinate hypertrophy with radiofrequency treatment: a new standard of care? Laryngoscope 2006;116:554-557.
9. Coste A, Yona L, Blumen M, Louis B, Zerah F, Rugina M, et al. Radiofrequency is a safe and effective treatment of turbinate hypertrophy. Laryngoscope 2001;111:894-899.
10. Nease CJ, Krempl GA. Radiofrequency treatment of turbinate hypertrophy: a randomized, blinded, placebo-controlled clinical trial. Otolaryngol Head Neck Surg 2004;130:291-299.
11. Cukurova I, Cetinkaya EA, Demirhan E, Avci A. Long-term histological examination of inferior concha after radiofrequency thermal ablation. J Laryngol Otol 2011;125:158-161.
12. Bäck LJ, Hytönen ML, Malmberg HO, Ylikoski JS. Submucosal bipolar radiofrequency thermal ablation of inferior turbinates: a long-term follow-up with subjective and objective assessment. Laryngoscope 2002;112:1806-1812.

DOI:10.5455/aces.20130906062613