

Radiofrequency turbinoplasty for nonallergic rhinitis in geriatric patients

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ABSTRACT

Background and Objective: Radiofrequency (RF) turbinoplasty may be effective in treating nonallergic rhinitis in elderly patients. The present study evaluated the efficacy of nasal turbinate surgery with RF for the treatment of nonallergic rhinitis in elderly patients refractory to medical therapy.

Methods: A total of 35 consecutive patients older than 65 years of age (mean subject age, 75.5 ± 9.6 [standard deviation] years) with nonallergic rhinitis refractory to medical therapy who underwent RF turbinate surgery were enrolled in this study. The efficacy of RF turbinoplasty in treating nonallergic rhinitis in elderly patients was evaluated by using rhinoscopy and a visual analog scale score of nasal symptoms.

Results: The response rate of primary RF turbinate surgery for nonallergic rhinitis refractory to medical therapy was 68.6%. Postoperative symptom scores for rhinorrhea and nasal obstruction were significantly improved. Persistent crust formation developed in seven patients (20.0%). No patient experienced major complications (e.g., septal hematoma, abscess, septal perforation), but partial bone necrosis was observed in one patient.

Conclusion: RF turbinoplasty appeared to be effective for treating some nonallergic rhinitis symptoms in elderly patients, including rhinorrhea and nasal obstruction. These preliminary results are encouraging and warrant further investigation.

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Over the past few decades, the geriatric population and its related medical problems have gained more attention because of increased life expectancy around the globe.¹ The increasing numbers of the geriatric population have caused various specific health problems related to advanced age. Among these health problems, rhinologic diseases are important and largely related to normal physiologic changes, with age, in the nose.^{1–5} The aging process can also aggravate rhinorrhea and cholinergic hyperactivity, and can cause structural and anatomic changes in the nose and paranasal sinuses, which are more common in elderly patients. The mucociliary system may not function properly in the elderly because of decreased body water content and goblet cell degeneration, which may cause rhinorrhea in this population.^{1,6–8}

Nonallergic rhinitis represents a group of disorders that share non-immunoglobulin E mediated symptoms that are typical of rhinitis. These include clear rhinorrhea and congestion with a lower prevalence of sneezing and itching.^{4,9–11} Three types of nonallergic rhinitis commonly occur in older patients, although no formal classification system exists. Vasomotor rhinitis is one such type and is thought to be caused by increased cholinergic activity. Gustatory rhinitis is another type and is associated with profuse, watery rhinorrhea that may be exacerbated by eating. The last of the three types is α -adrenergic hyperactivity, which is stimulated by the regular use of antihypertensives.^{4,10,12} The incidence of allergic rhinitis decreases with age, but vasomotor rhinitis is the most common form of nonallergic rhinitis, which increases in prevalence with age.^{4,7,13,14} More than 60% of rhinitis cases of patients older than age 50 years have a nonallergic etiology.¹⁵ Nevertheless, substantially less research has been conducted on the pathophysiology and treatment of nonallergic rhinitis than on allergic rhinitis in older patients. Moreover, elderly patients often have limitations on adding new medications because they may already be taking multiple medications for multiple comor-

bid conditions.⁴ Therefore, alternative treatment modalities for nonallergic rhinitis are greatly needed in elderly patients.

The use of RF surgery has been increasing in popularity for the treatment of otolaryngologic diseases, including simple snoring, sleep-related disorders, nasal obstruction due to turbinate hypertrophy, and tonsillar hypertrophy.^{16–19} The RF procedure causes fibrosis of the underlying stroma, while leaving surface epithelium intact.^{16,17} The targeted, finely controlled RF energy creates ionic agitation in the surrounding tissue, which induces submucosal necrosis. The circumscribed area of submucosal necrosis is replaced by fibroblasts, which results in an overall reduction and stiffening of the treated area.^{16,20} The safety and efficacy of RF turbinate surgery for allergic rhinitis has been well established with respect to subjective improvement of nasal symptoms, including rhinorrhea.^{16,17,21,22}

We hypothesized that RF turbinoplasty may also be effective in treating nonallergic rhinitis in elderly patients. To the best of our knowledge, the feasibility and efficacy of RF turbinate surgery in elderly patients with nonallergic rhinitis has not been fully addressed in the literature. The aim of the current study was to evaluate the efficacy and safety of RF turbinoplasty for the treatment of nonallergic rhinitis in geriatric patients that is refractory to medical therapy.

METHODS

Study Design

The medical records of patients who were at least 65 years old and who underwent RF turbinoplasty between August 2011 and August 2014 at the Konkuk University Chungju Hospital were reviewed. Thirty-five consecutive patients with nonallergic rhinitis refractory to medical treatment were enrolled in the study. Rhinorrhea was the chief concern. All the patients underwent RF surgery of the inferior turbinates and were observed postoperatively for at least 6 months. The patients also had been previously treated with conventional medical management (e.g., oral antihistamines, decongestants, ipratropium bromide nasal spray, and topical corticosteroids) but did not have a satisfactory improvement in symptoms for at least 3 months before surgery. All the patients were at least 65 years old and had nasal symptoms, including rhinorrhea, for more than 3 months.

Patient inclusion criteria were (1) a history of chronic rhinitis symptoms for at least 1 year and a diagnosis of nonallergic rhinitis, (2) negative skin tests for a mixed panel of allergens (e.g., dust mite, cat, dog, cockroach, indigenous tree, grass, mold, regional weed mixes),

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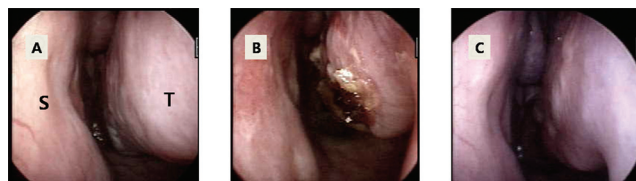


Figure 1. Endoscopic findings in an 85-year-old man treated with RF energy application on the left inferior turbinate. Photographs were taken before surgery (A) and 4 days (B) and 3 months (C) after surgery. S = septum, T = inferior turbinate.

(3) a normal sinus radiograph, and (4) no clinically significant nasal anatomic deformities. Patients were excluded from analyses if they had previous turbinate surgery, infectious rhinitis, sinusitis, nasal polyposis, atrophic rhinitis, a postoperative follow-up period shorter than 6 months, or severe septal deviation. Septal deviation was identified on nasal endoscopy. The degree of deviation was classified as mild, moderate, or severe based on the distance measured between an imaginary midline and the corresponding lateral nasal wall. The degree was classified as mild when the most deviated portion of the septum did not reach half that distance. In cases in which the most deviated portion of the septum had a physical contact with the lateral nasal wall, the degree was classified as severe. In the present study, patients with mild deviation that did not affect the nasal obstruction were included. However, this study excluded patients with unilateral nasal obstruction due to severe septal deviation. Patients who were taking medications that could have caused rhinorrhea (e.g., diuretics, antihypertensives, anxiolytics, β -blockers) were also excluded from analyses. This study was approved by the Konkuk University Chungju Hospital Institutional Review Board.

Surgical Technique

All surgical procedures were performed in an outpatient clinic with the patient under local anesthesia induced with 2% lidocaine injected into the anterior and middle portion of each inferior turbinate. The RF energy was delivered at 400 J by an RF unit (RF-Generator BM-780; Select-Sutter Medizintechnik, Freiburg, Germany) and an SP 1100 turbinate handpiece (Select-Sutter Medizintechnik), a 40-mm-long needle electrode made up of a 10-mm-long active portion, a 30-mm-long insulated portion, and two thermocouples. The active portion of the electrode and at least 2 mm of the insulated portion were placed submucosally within the anterior and middle portions of each inferior turbinate under direct visualization by using nasal endoscopy. A total of three punctures were made per turbinate, with two facing toward the anterior turbinate and one facing toward the middle portion of the turbinate.

After completing the procedure, cotton pledgets soaked with a 1:1 mixture of 4% lidocaine and 0.1% epinephrine were placed over the puncture sites for 5 to 10 minutes. All the patients were discharged with no restrictions on normal daily activities. Nasal packing was not administered after the procedure. Antibiotics and analgesics were prescribed for 3 days after surgery. Local nasal cavity findings and treatment efficacy assessments were recorded in detail at each follow-up session (Fig. 1). The patients were asked not to use oral steroids, antihistamines, decongestants, anticholinergics, and topical nasal sprays that contained corticosteroids or mast cell stabilizers during the follow-up period.

Surgical Outcome Assessment

Subjective symptoms, including rhinorrhea, sneezing, nasal obstruction, and postnasal drip, were measured by using a standard 10-point visual analog scale (VAS). The patients were asked to subjectively rate their symptoms from 0 (none) to 10 (most severe) by placing a cross on a line in the location that corresponded to the perceived symptom severity. Baseline VAS scores were compared

with those obtained 1, 3, and 6 months after surgery. Surgical success was determined by using subjective satisfaction, which was defined as a reduction from baseline in the rhinorrhea VAS score of >50% at 1 month after surgery. Objective evaluations were also performed and included intranasal findings as assessed by anterior rhinoscopy. The incidence of postoperative complications, including bleeding, crust formation, synechia, and infection, were also examined.

Saccharin transit time (STT) was measured to evaluate the effect of RF turbinoplasty on nasal mucociliary clearance in elderly patients. The STT was measured by placing saccharin particles on the anterior inferior border of the inferior turbinate. The time until the patient experienced the first sweet taste at the posterior nasopharynx was recorded in minutes.²³

Statistical Analysis

Statistical analyses were performed by using the commercially available Statistical Package for the Social Sciences (version 18.0 for Windows; SPSS, Inc., Chicago, IL). Subjective symptom scores were compared by using repeated measures of analysis of variance. The Wilcoxon signed rank test was used to compare STT results. Statistical significance was defined as $p < 0.05$.

RESULTS

A total of 35 patients (26 men, 9 women) with a mean (standard deviation [SD]) age of 75.5 ± 9.6 years (range, 65–89 years) were included in analyses. The mean (SD) follow-up duration was 8.7 ± 3.6 months (range, 6–18 months). All the patients had rhinorrhea before surgery. Other presenting symptoms included nasal obstruction ($n = 27$ patients [77.1%]), postnasal drip ($n = 25$ patients [71.4%]), sneezing ($n = 18$ patients [51.4%]), and itching ($n = 13$ patients [37.1%]). The RF turbinate surgery successfully reduced rhinorrhea in 24 patients (68.6%), had a poor response in 8 patients (22.9%), and had no effect in 3 patients (8.6%). Among the 11 patients with poor or no response, 5 patients underwent a secondary RF turbinoplasty. Of these five procedures, three of them successfully reduced rhinorrhea. The mean (SD) rhinorrhea VAS score improved from 8.25 ± 1.85 before surgery to 3.05 ± 2.54 at 6 months after surgery ($p < 0.001$). Nasal obstruction improved from 6.79 ± 2.81 at baseline to 2.84 ± 2.61 at 6 months after surgery ($p < 0.001$). No significant VAS score changes were observed 6 months after surgery in itching (from 2.86 ± 2.75 to 2.88 ± 2.62 , $p > 0.05$), sneezing (from 3.67 ± 3.01 to 3.25 ± 3.30 , $p > 0.05$), or postnasal drip (from 5.56 ± 3.04 to 5.15 ± 3.29 , $p > 0.05$) (Table 1). The STT was performed before and after surgery in 24 of 35 patients (68.6%) and was 11.4 ± 3.1 minutes and 11.8 ± 2.6 minutes, respectively. This small difference was not statistically significant ($p > 0.05$) (Fig. 2).

Postoperative bleeding and infection were not observed in any patient during the follow-up period. Postoperative crusting formation, with a duration of 2–4 weeks, occurred in seven patients (20.0%) but eventually subsided. Partial necrosis of the turbinate bone also developed in one patient (2.9%). No other complications (e.g., synechia, atrophic rhinitis, olfactory change) were observed in the postoperative period.

DISCUSSION

The present study evaluated the efficacy and safety of RF turbinoplasty for the treatment of nonallergic rhinitis in geriatric patients. Our results indicated that minimally invasive RF turbinoplasty is well tolerated in these patients and had encouraging relatively long-term (6 months) results, which indicated that RF turbinoplasty may be a useful alternative for treating nonallergic rhinitis in elderly patients. In addition, no major complications associated with RF turbinoplasty were observed, including synechia, atrophic rhinitis, and uncontrolled bleeding. To the best of our knowledge, this study is the first to examine the effect of RF turbinoplasty on rhinorrhea and nasal obstruction symptoms in elderly patients with nonallergic rhinitis.

Table 1 The mean (SD) VAS scores* of the symptoms of nonallergic rhinitis at each follow-up time

Parameters	Before Surgery	2 Weeks	1 Month	3 Months	6 Months
Rhinorrhea*	8.25 ± 1.85	4.38 ± 2.27	4.12 ± 2.16	3.27 ± 2.27	3.05 ± 2.53
Nasal obstruction*	6.79 ± 2.81	4.58 ± 2.58	3.19 ± 2.24	2.68 ± 1.97	2.84 ± 2.61
Postnasal drip	5.56 ± 3.04	4.89 ± 2.55	4.04 ± 3.14	4.22 ± 3.12	5.15 ± 3.29
Sneezing	3.67 ± 3.01	3.08 ± 2.84	3.28 ± 2.54	3.51 ± 3.14	3.25 ± 3.30
Itching	2.86 ± 2.75	2.91 ± 2.36	2.70 ± 2.26	2.52 ± 2.45	2.88 ± 2.62

*Standard 0–10 VAS scores.

* $p < 0.05$, overall significance by repeated measures of analysis of variance.

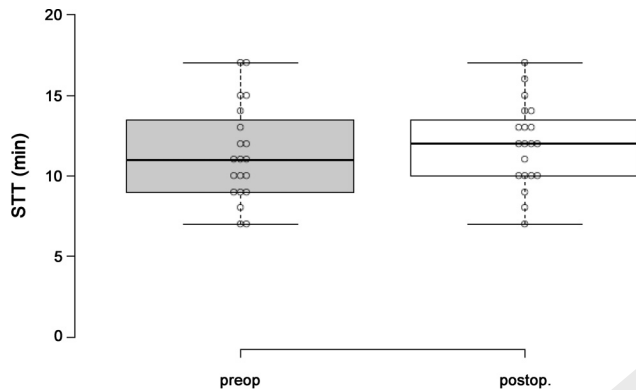


Figure 2. STT measured before and after RF turbinoplasty. Mean (SD) STT before and after surgery was 11.4 ± 3.1 minutes and 11.8 ± 2.6 minutes, respectively, a slight difference that was not statistically significant ($p > 0.05$).

It remains unclear how RF turbinate surgery reduces rhinorrhea and nasal obstruction symptoms in elderly patients with nonallergic rhinitis. However, we do expect that the mechanism by which RF improves nonallergic rhinitis is similar to that of allergic rhinitis. It has been speculated that patients with nonallergic rhinitis have dysregulation of sympathetic, parasympathetic, and nociceptive nerves that innervate the nasal mucosa and are important in regulating nasal mucosal vascularity and glandular secretion. Nasal hyperresponsiveness to irritants is thought to reflect neurogenic inflammation, which is mediated by neuropeptides released from type C nerve fibers. This further activates co-localized receptors on trigeminal sensory nerves in the nasal epithelium and mucosa.^{15,24} The application of RF energy to the inferior turbinate submucosa induces circumferential scar formation, submucosal small vessel obliteration, and submucosal gland destruction, all of which are thought to play major roles in the beneficial effects of RF application for nonallergic and allergic rhinitis.^{17,22} We assume that RF turbinoplasty decreases both the superficial surface area for irritants to contact and the total number of submucosal glands for producing nasal secretions. In addition, there might be a reaction that inhibits local autonomic responses and the passage of histochemical mediators.^{17,22} Further investigation is warranted to better characterize histomorphologic changes within the turbinate in elderly patients undergoing RF turbinoplasty.

RF turbinoplasty offers several advantages to elderly patients with nonallergic rhinitis. This technique is quite simple to perform and, as in the present study, can be performed in the clinical setting as an outpatient procedure. Our study showed that rhinorrhea and nasal obstruction were the most common symptoms experienced by elderly patients with nonallergic rhinitis and those most decreased by RF turbinoplasty. Therefore, a successful RF turbinoplasty procedure can reduce medication use, which is important in elderly patients who often have limitations regarding the multiple medications used to treat multiple comorbid conditions.⁴

Many clinical studies demonstrated that RF turbinate surgery is effective and safe.^{16,17,20,22,25–27} Energy from RF causes fibrosis of the underlying stroma, while leaving the surface epithelium intact. In agreement with our results, Rhee *et al.*²⁵ found that STT and ciliary beat frequency were preserved after RF turbinate surgery. Lin *et al.*¹⁷ also reported no adverse reactions (e.g., bleeding, infection, adhesion, dryness, synechia) after RF turbinate surgery.

In contrast, our study showed that RF turbinoplasty was associated with a relatively high rate of persistent crust formation (20%). This should be noted even though crust formation is not considered a severe complication. One of our subjects experienced partial necrosis of the turbinate bone. We assumed that this occurred because tissue in elderly patients may be more susceptible than in younger patients to heat generated by RF systems. As a result, mucosal damage may occur more easily in elderly patients than in younger ones. For these reasons, we recommend taking great care to avoid damaging the mucosal surface and turbinate bone during RF needle electrode insertion in elderly patients. The RF energy administered should also be finely controlled. It would be useful to know whether or not an association between RF energy amounts and complication rates exists in elderly patients. This type of study should be performed to better characterize histomorphologic changes within the turbinate tissue in patients undergoing RF turbinoplasty.

This study had some limitations. First, the study was limited by its design, including its relatively small sample size, nonrandomized design, and relatively short follow-up period. An ideal study to accurately determine the efficacy and safety of RF turbinoplasty in elderly patients with nonallergic rhinitis would have randomized patients into control and surgery groups, included a larger number of patients, and had a longer follow-up period. Second, a high proportion of our study population was men. The aging process of the nose can differ between men and women, and these differences may have impacted our outcomes after RF surgery. Lastly, the patients were not stratified by nonallergic rhinitis subtype; therefore, differences in surgical outcomes between subtypes cannot be determined from our study.

CONCLUSION

The RF turbinoplasty procedure appeared to be effective for treating rhinorrhea and nasal obstruction associated with nonallergic rhinitis in elderly patients. This is the first study, to our knowledge, to investigate the efficacy and safety of RF turbinoplasty for treating nonallergic rhinitis in elderly patients. These preliminary results are encouraging. However, the applied RF energy must be carefully controlled to prevent tissue damage in elderly patients. Long-term follow-up studies are needed to determine recurrence and complication rates.

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