The effect of radiofrequency turbinoplasty vs two other methods in the management of polypoid changes of the middle turbinate: a randomized trial

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Background: **The aim of this study was to evaluate the effectiveness of middle turbinate radiofrequency (RF) turbinoplasty for the management of the polypoid middle turbinate compared to middle turbinate resection and middle turbinate medialization.**

Methods: **The study was performed on 90 patients at a tertiary referral hospital with nasal polyposis resistant to maximal medical treatment. At the time of functional endoscopic sinus surgery (FESS), patients were randomized into 3 groups with respect to the management of the middle turbinate: middle turbinate turbinoplasty by RF; partial resection of the middle turbinate; and medialization of the middle turbinate by scarification to the septum. We evaluated the patients' symptoms according to the 22-item Sino-Nasal Outcome Test (SNOT-22) preoperatively and 1 year after surgery. Additionally, polyp recurrence and complications were compared among the 3 groups.**

Result: **One year after surgery, there was no significant difference in SNOT-22 scores between the groups. However, the RF group had a significantly lower polyp recurrence rate when compared to other groups ($p < 0.05$).**

Conclusion: **RF middle turbinate turbinoplasty could be considered an alternative to other common approaches, but it needs further long-term studies before widespread usage.** © 2014 ARS-AAOA, LLC.

Key Words:
Nasal polyposis; sinusitis; recurrence; FESS; clinical trial; middle turbinate; radio frequency

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The optimal management of the middle turbinate in the treatment of nasal polyposis remains a matter of debate. On one hand, middle turbinate resection can improve surgical access and can possibly reduce the recurrence rate of nasal polyposis.[1,2] On the other hand, there have been reports of anosmia, empty nose syndrome, synechia, and difficulties in revision surgery.[3] Even with middle turbinate preservation, synechia, lateralization, and polyp recurrence can be possible outcomes.[1,4]

Among different modalities, radiofrequency (RF) has gained popularity as a surgical tool that can treat mucosal hypertrophy without tissue removal. Its use in the inferior turbinate is well described for decreasing nasal obstruction. RF treatment of the inferior turbinate may also be beneficial for refractory allergic rhinitis, which is related not only to reducing nasal obstruction but also to modulating the expression of allergic mediators.[5,6] When compared to other treatments for turbinates, RF spares the overlying mucosa, which can result in faster healing and possibly reduced morbidities.[7–12]

Considering the factors in the previous paragraph, RF may have a role in treating polypoid changes of the middle turbinate, potentially preserving the mucociliary function of the mucosal layer. Therefore, we performed a randomized clinical trial to compare middle turbinate treatment with RF and 2 established methods of middle turbinate management: partial resection by

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microdebrider, and medialization by scarification to the nasal septum.

Patients and methods

Ethical approval

The study protocol was approved by the institutional review board of Tehran University of Medical Sciences. Detailed information about the study was provided to the participants in writing, and informed consent was obtained from each participant. All aspects of the study were conducted according to the Declaration of Helsinki.

Enrollment

Ninety patients referred to Imam Khomeini Medical Center, a tertiary academic referral hospital affiliated with Tehran University, between April 2010 and December 2012 were enrolled in the study. In addition to obtaining demographic data, we evaluated the duration of sinusitis, history of asthma, and aspirin sensitivity in every patient. All patients were diagnosed with nasal polyposis that was resistant to maximal medical treatment (ie, 1 puff of fluticasone nasal spray twice daily plus amoxicillin clavulanic acid 625-mg tablet 3 times daily for at least 1 month). All patients also received complete nasal examinations including nasal endoscopy, to determine the presence of polyps, septal deviation, and other anatomical variations. Patients were candidates for enrollment if they had nasal polyposis and showed polypoid changes or some degrees of middle turbinate mucosal hypertrophy. Stammberger's classification was used to grade the extent of the polyposis (I = polyps limited to the middle meatus; II = polyps partially occupying the nasal space but not reaching the inferior meatus; and III = polyps reaching the inferior meatus). All patients underwent axial and coronal computed tomography scanning before surgery, and the images were scored according to the Lund-Mackay system prior to surgery. All images were assessed and reported by the same radiologist.

We excluded the patients who were noted to have "floppy" change of the middle turbinate at the end of surgery from the study. Other criteria for exclusion were systemic disease (eg, hypertension, Wegener's granulomatosis, cystic fibrosis, diabetes, and sarcoidosis), immune suppression, pregnancy, revision surgery, or concurrent septoplasty.

Blinding and randomization

The enrolled patients were randomized into 3 groups. We used a randomized block design in the allocation of participants to each of 3 groups. In the first group, partial resection of the middle turbinate was performed with a microdebrider (group A). In the second group, scar medialization of the middle turbinate was performed (group B).[13] In the third group, middle turbinate turbinoplasty was performed using RF (group C). Surgeons were blinded to the method of the middle turbinate treatment until the end of surgery when the treatment technique was revealed and performed. Because of postoperative changes after endoscopic sinus surgery (ESS), one of the authors who performed postoperative evaluations could not be blinded to the different groups.

Surgical procedures and medical treatment

All procedures were conducted using the Messerklinger method of endoscopic surgery. Before surgery, oral antibiotics and methylprednisolone were administered to all patients for at least 1 week. All procedures were performed under general anesthesia by the first author (B.S.). Complete homeostasis was achieved using disposable number 10 French suction cautery (Erbe, Tubingen, Germany); however, it was used more frequently in partial resection of the middle turbinate if there was uncontrolled bleeding. Routine cauterization of all arteries was not performed.

Temporary nasal packing was done with cottonoid pledgets soaked in phenylephedrine 0.5% (Osve, Tehran, Iran) at the end of surgery. The packing was subsequently removed before the patients were discharged (except for patients in the medial turbinate medialization group).

Partial turbinectomy was performed using a shaver (Medtronic, Minneapolis, MN). The removed part was limited to the polypoid changes and its anterior part (including mucosa and bone) to allow endoscopic access to the middle meatus and prevent turbinate lateralization. Scar medialization of the middle turbinate was performed by abrading the medial side of the middle turbinate and the adjacent septum, followed by placement of a Merocel sponge in the middle meatus to encourage mucosal adhesions to form. RF turbinoplasty was performed by using a turbinate bipolar probe (Olympus Celon, Berlin, Germany).The device power was set at 15 to 17, and the probe was placed anteriorly into the submucosal portion of the middle turbinate in the areas of significant hypertrophy or polypoid change. Subsequently, 1 or 2 passes of the turbinate probe were made according to the degree of turbinate mucosal hypertrophy.

All patients were hospitalized for at least 24 hours after surgery and were then discharged if there were no problems. Postoperatively, all patients received antibiotic prophylaxis (cephalexin 500-mg capsules [Osve] 4 times daily for 14 days). The only prescribed analgesic was acetaminophen tablets. All patients continued treatment with inhaled nasal corticosteroid spray twice daily (fluticasone propionate)—subject to change depending on endoscopic findings–and nasal saline douche 3 times daily for at least 6 months. Frequent endoscopic debridement was carried out for at least 3 months after surgery to induce and maintain a normal cavity with a uniform method in all patients. The first debridement was performed after 1 week and continued every 2 weeks for 2 months, and the last one was performed after 1 month. Also, if there was recurrence resistant to nasal corticosteroid spray, oral corticosteroid (prednisolone 0.5 mg/kg) was used for treatment.[14]

Postoperative outcome evaluation

The 22-item Sino-Nasal Outcome Test (SNOT-22) was used to calculate a subjective sinusitis symptom score at 4 points: before surgery, 3 months after surgery, 6 months after surgery, and 1 year after surgery. In addition, endoscopic evaluation of the polypoid changes of the middle turbinate was performed after surgery. Any mucosal growth more than stage I in the ethmoids sinuses was considered recurrence after surgery.

Complications, including crusting, synechia, antrostomy obstruction, and lateralization of the middle turbinate, were evaluated by postoperative nasal endoscopy at the time points listed in the previous paragraph. All evaluations were conducted by one of the authors using the same method.

Statistical method

Data was analyzed using the Statistical Package for the Social Sciences version 11.5 for Windows software program (SPSS Inc., Chicago, IL). Analysis of variance (ANOVA) and *t* test were used to evaluate preoperative and postoperative quantitative data. Also, the chi-square test was used to evaluate descriptive data. Furthermore, repeated measure ANOVA with post hoc comparisons was used to evaluate quantitative variations among groups. Values were assessed using descriptive statistical methods (mean ± standard deviation [SD]). Also, the results were considered significant if p values were less than 0.05.

Results

Ninety patients were included in this study. Group A underwent middle turbinate resection, group B received medialization, and group C was treated with RF turbinoplasty. Of the 90 patients, 56 (62.22%) were male and 34 (37.78%) were female. The mean age of the patients was 38.83 ± 10 years (minimum = 20, maximum = 60). Regarding gender and age, the preoperative characteristics of the patients in these 3 groups are summarized in Table 1. All patients completed the follow-up period, and there was no loss to follow up in our study.

TABLE 1. The preoperative characteristics of the patients in 3 groups

Characteristic	Group		*p*
Age, years	A	37.93 ± 9.97	0.80
	B	39.67 ± 10.91	
	C	38.93 ± 8.79	
Gender, males/females	A	19/11	0.36
	B	21/9	
	C	14/16	
Duration of disease, years	A	7.33 ± 4.77	0.72
	B	7.5 ± 8.45	
	C	6.8 ± 7.12	
Lund-Mackay score	A	19.33 ± 4.60	0.50
	B	20.20 ± 3.77	
	C	18.53 ± 5.84	
Stammberger's classification score	A	3.27 ± 1.11	0.3
	B	3.37 ± 1.67	
	C	3.13 ± 1.22	
SNOT-22 score	A	56.03 ± 20.92	0.02
	B	59.57 ± 20.4	
	C	40.40 ± 24.46	
Asthma history, n (%)	A	7 (23.3)	0.04
	B	7 (23.3)	
	C	4 (13.3)	

*Values are mean ± SD unless indicated otherwise.
SD = standard deviation; SNOT-22 = 22-item Sinonasal Outcome Test.

After surgery, SNOT-22 scores in all groups were compared after 3 months, 6 months, and 1 year, with no significant difference at each comparison. Their results are summarized in Table 2.

The other evaluated variable was recurrence after 1 year, which was significantly less in the RF group (group C) than the other 2 groups. These results are summarized in Table 3.

Despite the significant difference in preoperative history of asthma and SNOT-22 among groups, this factor did not have any significant relationship with recurrence ($p = 0.40$, $p = 0.67$). We evaluated the relationship between recurrence and the history of asthma and SNOT-22 to reduce its effect as a confounder, but we found no significant relationship. Therefore, the difference in the recurrence rate among the group cannot be related to differences in the asthma frequency among them.

Also, because oral prednisone administration postoperatively can affect the results as another confounding factor, it was compared in Table 4. The results showed that there was no significant difference among groups.

Another evaluated variable was the condition of the middle turbinate in postoperative evaluation, as explained in Table 5.

After the 1-year evaluation, there was no lateralization or atrophic rhinitis in the middle turbinate resection in the above mentioned groups; however, because of structural changes after middle turbinate resection, we did not add them to the normal group in Table 5. Also, there was no frontal recess or other sinuses involvement requiring intervention during the evaluation period in none of the groups.

TABLE 2. The outcome of SNOT-22 in the postoperative periods in different groups

	Group	SNOT-22 score (mean ± SD)	*p*
After 3 months	A	12.17 ± 11.82	0.72
	B	12.6 ± 11.36	
	C	15.2 ± 14.25	
	Total	12.32 ± 12.48	
After 6 months	A	9.53 ± 9.54	0.89
	B	10.17 ± 9.43	
	C	11.07 ± 11.94	
	Total	10.20 ± 10.30	
After 1 year	A	11.97 ± 9.68	0.49
	B	13.90 ± 10.27	
	C	10.33 ± 9.11	
	Total	12.07 ± 9.69	

SD = standard deviation; SNOT-22 = 22-item Sinonasal Outcome Test.

TABLE 3. Overall recurrence rate of polyposis after 1 year in different groups

Group	n (%)	*p* (ANOVA)
Group A	11 (36.67)	< 0.05
Group B	15 (50.00)	
Group C	8 (26.67)	
Total	34 (37.78)	

ANOVA = analysis of variance.

TABLE 4. Oral prednisone use in the postoperative period in different groups

Group	n (%)	*p* (ANOVA)
Group A	15 (50)	0.30
Group B	16 (53.3)	
Group C	13 (43.3)	

ANOVA = analysis of variance.

TABLE 5. Middle turbinate status after surgery

	Groups	Polypoid changes	Normal	Lateralization	*p*
After 3 months	A	–	–	–	1.00
	B	3	22	5	
	C	6	16	8	
After 6 months	A	–	–	–	0.253
	B	2	20	8	
	C	4	22	4	
After 12 months	A	–	–	–	0.537
	B	2	21	7	
	C	4	24	4	

– = not applicable.

Discussion

In recent years, a large number of researchers have published their experiences about different approaches to the management of the middle turbinate. However, there is no consensus on this topic.[4] Soler et al.[4] performed a multicenter case control trial to compare the functional ESS (FESS) results in 1 group undergoing middle turbinate resection and another group without it, and the results showed no significant difference in the quality of life between the 2 groups. Marchioni et al.[1] reported a prospective study to compare middle turbinate partial resection vs preservation in 56 patients with nasal polyposis who underwent ESS. They concluded that the turbinate resection group had better outcomes and quality of life.[1] Furthermore, Shih et al. evaluated the previous reports of middle turbinate resection and conducted a prospective study, confirming the former conclusions on the decreased recurrence in the middle turbinate resection group.[15] Finally, Wu et al.[16] confirmed the beneficial effect of middle turbinate treatment and stated that its possible mechanism was delay in nasal polyposis symptoms, enhancement of delivery of nasal medications, and the removal of the possible surface area for polyp formation. Despite some recent papers presenting middle turbinate resection as the chosen technique for the middle turbinate, some surgeons suggest that this method needs longer follow-up to be accepted as an ideal method.

Scar medialization of the middle turbinate is another popular technique for preventing middle meatus obstruction that has its own advocates.[17] Friedman et al.[17] and Shrime et al.[18] evaluated middle turbinate medialization and confirmed its safety in sinus surgery cases.

However, because manipulation of the middle turbinate can possibly have an impact on the adjacent olfactory area or cause inadvertent injury to the skull base,[19] we propose RF for middle turbinate turbinoplasty. Our results showed significantly less polyp recurrence in the RF-treated groups without any significant differences in complications or other postoperative findings. When performed carefully, RF can significantly reduce the submucosal portion of the middle turbinate mucosa with preservation of the mucosal cilia. However, RF treatment of the middle turbinate holds more challenges than RF treatment of the inferior turbinate, given the less prominent extent of mucosa relative to the underlying bone in the middle turbinate. In order to avoid sloughing of the mucosa, we

recommend that middle turbinoplasty should be applied only in cases of mucosal hypertrophy or polypoid changes.

The investigation of the pathogenesis of polyposis is currently dynamic, and no single common pathway or etiology can be associated with it. Simple ostial obstruction and infection cannot explain the whole process. The new focus is on inflammation, with infection being only the trigger factor and the host response to inflammation inducing polyp formation. Furthermore, other important factors in this process may be superantigens and bacterial biofilms.[20,21] Although the mechanism of the RF-related improvement is not known, RF middle turbinoplasty may have a beneficial effect on the progression of polyposis by clearing an important central focus of inflammation at the level of the middle meatus that, if left untreated, might propagate the development of recurrent polyps.[4]

Moreover, recent studies have reported the beneficial effects of RF in treating allergic rhinitis symptoms. The proposed mechanism is shrinkage of the submucosal area, which can be the site of the allergic reaction, and possible reduction of the mucosal surface for allergic contact.[7,8,10] The same mechanism may explain the effectiveness of RF in polypoid changes of the middle turbinate. RF turbinoplasty may also preserve mucociliary transport better than destructive techniques.[6,11,12,22]

Our current results showed that despite the insignificant difference in SNOT-22 among the 3 different groups, the RF group experienced less recurrence of polyps. Accordingly, the RF technique can be proposed as an alternative method to the usual methods for the middle turbinate. One explanation for the finding is the lower frequency of asthma and SNOT-22 in that group, but the history of asthma did not have a significant relationship with recurrence in our series. Also, there were no significant difference between groups in terms of preoperative polyp and Lund-Mackay staging.

One major concern about the use of RF on the middle turbinate may be the higher incidence of lateralization that happened in about 20% of the cases, although its difference was not significant. Some preventive measures, such as adjunctive packing or a combination of other techniques, should be considered to minimize the effects of lateralization.[13,18]

Our results showed that RF middle turbinate turbinoplasty could be an alternative technique for the treatment of middle turbinate in patients with nasal polyposis. However, it has its shortcomings. To further examine this topic, we suggest that the outcomes should be compared with a fourth group with no manipulation. Also, one of the major concerns of middle turbinate manipulation is the possible effects on olfaction, which can be evaluated in future studies.

Conclusion

Our preliminary results showed that RF middle turbinate turbinoplasty could be considered an alternative technique to other common approaches. Long-term validation is necessary before it can be recommended for widespread usage.

References

1. Marchioni D, Alicandri-Ciufelli M, Mattioli F, et al. Middle turbinate preservation versus middle turbinate resection in endoscopic surgical treatment of nasal polyposis. *Acta Otolaryngol*. 2008;128:1019–1026.
2. French C, Goyal P. Submucosal resection of the middle turbinate. *Laryngoscope*. 2013;123:1845–1848.
3. Saedi B, Sadeghi M, Yazdani N, Afshari A. Effectiveness of FESS in smell improvement of sinusitis patients. *Indian J Otolaryngol Head Neck Surg*. 2013;65(Suppl 2):283–287.
4. Soler ZM, Hwang PH, Mace J, Smith TL. Outcomes after middle turbinate resection: revisiting a controversial topic. *Laryngoscope*. 2010;120:832–837.
5. Chhabra N, Houser SM. The surgical management of allergic rhinitis. *Otolaryngol Clin North Am*. 2011;44:779–795.
6. Chhabra N, Houser SM. Surgical options for the allergic rhinitis patient. *Curr Opin Otolaryngol Head Neck Surg*. 2012;20:199–204.
7. Lin HC, Lin PW, Friedman M, et al. Long-term results of radiofrequency turbinoplasty for allergic rhinitis refractory to medical therapy. *Arch Otolaryngol Head Neck Surg*. 2011;136:892–895.
8. Lin HC, Lin PW, Su CY, Chang HW. Radiofrequency for the treatment of allergic rhinitis refractory to medical therapy. *Laryngoscope*. 2003;113:673–678.
9. George G, Ilias K, Dimitrios G, Balatsouras Aikaterini K, Dimitris K. Comparison of ultrasound turbinate reduction, radiofrequency tissue ablation and submucosal cauterization in inferior turbinate hypertrophy. *Eur Arch Otorhinolaryngol*. 2010;267:1727–1733.
10. Kivanc G, Halis U, Ali Vefa Y, Murat S. Intranasal steroids or radiofrequency turbinoplasty in persistent allergic rhinitis: effects on quality of life and objective parameters. *Eur Arch Otorhinolaryngol*. 2011;268:845–850.
11. 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.
12. Garzaro M, Landolfo V, Pezzoli M, et al. Radiofrequency volume turbinate reduction versus partial turbinectomy: clinical and histological features. *Am J Rhinol Allergy*. 2012;26:321–325.
13. Saedi B, Sadeghi M, Farschi S. Effect of polyvinyl acetal sponge nasal packing on post-operative care of nasal polyposis patients: a randomised, controlled, partly blinded study. *J Laryngol Otol*. 2012;126:380–384.
14. Hoseini SMS, Saedi B, Aghazadeh K. Meticulous endoscopic sinus surgery to prevent recurrence of massive nasal polyposis. *J Laryngol Otol*. 2012;126:789–794.
15. Shih C CG, Rice DH. Middle turbinate resection: impact on outcomes in endoscopic sinus surgery. *Ear Nose Throat J*. 2003;82(10):796–797.
16. Wu A, Platt M, Tierney H, Metson R. Factors affecting time to revision sinus surgery for nasal polyps: a 25-year experience. *Laryngoscope*. 2014;124:29–33.
17. Friedman M, Landsberg R, Tanyeri H. Middle turbinate medialization and preservation in endoscopic sinus surgery. *Otolaryngol Head Neck Surg*. 2000;123:76–80.
18. Shrime MG, Tabaee A, Hsu AK, Rickert S, Close LG. Synechia formation after endoscopic sinus surgery and middle turbinate medialization with and without FloSeal. *Am J Rhinol*. 2007;21:174–179.
19. Friedman M, Tanyeri H, Landsberg R, Caldarelli D. Effects of middle turbinate medialization on olfaction. *Laryngoscope*. 1999;109:1442–1445.
20. Sanclement JA, Webster P, Thomas J, Ramadan HH. Bacterial biofilms in surgical specimens of patients with chronic rhinosinusitis. *Laryngoscope*. 2005;115:578–582.
21. Seiberling KA, Conley DB, Tripathi A, et al. Superantigens and chronic rhinosinusitis: detection of Staphylococcal exotoxins in nasal polyps. *Laryngoscope*. 2005;115:1580–1585.
22. Gindros G, Kantas I, Balatsouras DG, Kaidoglou A, Kandiloros D. Comparison of ultrasound turbinate reduction, radiofrequency tissue ablation and submucosal cauterization in inferior turbinate hypertrophy. *Eur Arch Otorhinolaryngol*. 2010;267:1727–1733.