

Acoustic Rhinometry Evaluation in Allergic Rhinitis Patients before and after Turbinate Radiofrequency Ablation

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Objective: To evaluate the outcome of turbinate radiofrequency ablation (RFA) by acoustic rhinometry.

Material and Method: Thirty allergic rhinitis (AR) patients aged 19-62 years old were recruited for this cross sectional prospective study. They all underwent radiofrequency turbinate ablation for chronic nasal obstruction. The acoustic rhinometry evaluation, total nasal symptom score, and nasal obstruction score before and after surgery were analyzed at second, fourth, and eighth week.

Results: The mean age of the 30 AR patients was 39.5 years old and two patients required a second operation. After surgery, the total nasal symptom score (TSS) and the difference mean of cross-section area (CSA) I were improved in 2-4 weeks and 4-8 weeks respectively but total nasal volume was not changed.

Conclusion: The authors can use acoustic rhinometry to evaluate short-term result of turbinate radiofrequency ablation. The subjective symptoms were prominently seen in 2-4 weeks after surgery and before the objective result by acoustic rhinometry shown at 4-8 weeks.

Keywords: Turbinate radiofrequency ablation, Nasal obstruction, Allergic rhinitis

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Allergic rhinitis (AR) is a common chronic disease among Thai people and tends to increase in populations⁽¹⁾. Characteristics of AR are nasal obstruction, rhinorrhea, and sneezing. In Thai people, the persistent AR is found much more than the intermittent one and the most important symptom of persistent AR is nasal obstruction. The diagnosis of IgE mediated AR includes history, physical examination, skin test, and RAST test for identifying the specific IgE. Typically, diagnosis is based on familial and personal medical history of allergy. The presence of asthma, skin eczema, and pollen- or food-related allergies are highly indicated⁽²⁾. A definitive diagnosis can then be made either with skin prick test using standardized allergen extract, or by the measurement of allergen specific IgE in the serum by either RAST or ELISA method. The treatments are avoidance, pharmacotherapy, and specific immunotherapy if indicated.

Further symptomatic relief may be required in some patients, e.g. ipratropium bromide for watery nasal discharge. Immunotherapy is indicated in patients with a limited spectrum of allergies (one or at the most two clinically relevant allergens) and in whom pharmacotherapy and avoidance measures are ineffective. If these measures fail to relieve nasal obstruction because of hyperplasia or pronounced hypertrophy of the inferior turbinates, a surgical reduction of the inferior turbinate should be performed⁽³⁾.

Procedures such as turbinectomy, laser turbinectomy, electrical cautery, removal of turbinate tissues by debrider and radiofrequency ablation (RFA) of the inferior turbinate have been studied to increase the cross sectional area of the nasal cavity⁽⁴⁾.

The narrowest intra nasal cross-sectional area is at the nasal valve. It is bordered by the lower edge of the upper lateral cartilages, the anterior end of the inferior turbinate and the adjacent nasal septum, together with the surrounding soft tissues. This is the main site of nasal resistance to airflow. The nasal airway resistance changes according to variation in the bulk

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of the inferior turbinate, this in turn is determined by cycles of swelling and constriction of the venous sinuses of the inferior turbinate and the nasal septum^(5,6). Therefore, the logical conclusion is that reducing the bulk of inferior turbinate would, by increasing cross sectional area of the nasal valve, reduce nasal resistance and increase nasal airflow⁽⁷⁾.

Radiofrequency ablation is currently the method of choice for turbinate reduction surgery in an attempt to increase the cross sectional area of nasal valve. In the present study, the authors used acoustic rhinometry to objectively assess the outcome of RFA for inferior turbinate reduction, the subjective response, and the complications of the procedure.

Material and Method

The present study is a prospective descriptive study and was approved by the Ethics committee for researches involved in human subjects of the Bangkok metropolitan administrations. The present study was performed at the allergy clinic department of otolaryngology BMA medical college and Vajira Hospital between November 1, 2007 and February 23, 2010.

All patients (AR) with chronic nasal obstruction were evaluated objectively by acoustic rhinometry and subjectively by nasal symptom score (visual analog score 0-6) preoperatively and at 2, 4, 8-weeks post-operatively. All patients underwent RF inferior turbinate ablation⁽⁸⁾.

Methods

Patients with AR of any age with nasal obstruction that resisted to maximal medical treatment for three months and needed RFA were included. Diagnosis of allergic rhinitis was confirmed either with skin prick tests using standardized allergen extract, or by the measurement of serum allergen-specific IgE (RAST). Maximal medical treatment was defined as instituting a combination of antihistamines, nasal decongestant and nasal steroids, or immunotherapy in addition to allergen avoidance measures in all the patients. The above measures had to be continued for at least three months.

The patients with no AR, could not use medication during research, could not communicate, had contraindication for RFA, or could not be measured by acoustic rhinometry were excluded. All patients were evaluated by acoustic rhinometry and nasal symptom score before and after RFA were recorded. The results of acoustic rhinometry pre- and post-operation were

analyzed using the larger side and comparing the difference means. Major complications such as bleeding, infection, or synechia were recorded.

Surgical technique

All RFA were performed in the operating room by clobator, and the bipolar radiofrequency probe.

After applying local anesthesia, the authors used a radiofrequency probe (Clobator Probe) applied to the anterior end of the inferior turbinate on three sites, and each time used 350-400 KJ for 60 seconds. They packed the nasal cavities by kaltostat, which remained one day after surgery.

Patients were monitored in hospital for at least 24 hrs and the acoustic rhinometry and nasal symptoms were reevaluated at 2, 4, 8 weeks post-operatively.

Statistical analysis

SPSS 13.0 was used for analysis Paired t-test was used to compare the difference between the groups means at before and after surgery 2, 4, and 8 weeks respectively. The mean $\pm$ standard deviation (SD) were entered including age, sex, height, and weight etc. P-value of <0.05 was considered statistically significant.

Results

Thirty-two acoustic rhinometry were done peri-operatively in 30 patients, two patients underwent two procedures. All patients underwent postoperative acoustic rhinometry at 2, 4, and 8 weeks. The patients' characteristics are listed in Table 1. Two of 30 patients had a second surgery. All patients had to complete the study for evaluation eight weeks after surgery. The mean energy used in the present study was 349 ± 70.9 joules, three applications to each turbinate. The patients recruited in the present study totaled 30, female: male = 17: 13. Mean weight and height were 56.2 ± 8.4 Kgs and 152.6 ± 11.1 cm respectively (Table 1).

The pre-operative mean of cross-sectional area 1 (CSA1) of the smallest side of all (n = 30) subjects

Table 1. Demographic data

Patient characteristics (n = 30)	
Characteristic	Mean $\pm$ SD (range)
Age (yr)	39.5 ± 15.5 (19-62)
Weight (Kg)	56.2 ± 8.4 (38-78)
Height (CM)	152.6 ± 11.1 (132-172)
Female/Male	17/13

Table 2. Comparison of acoustic rhinometry value at cross sectional area1 (CSA1) before decongestion and after decongestion at before surgery (left column) and at after surgery (right column) (n = 30)

BS				AS		
BD	AD	p-value		BD	AD	p-value
0.50 ± 0.13	0.54 ± 0.12	0.158	2 weeks	0.51 ± 0.13	0.54 ± 0.17	0.32
			4 weeks	0.5 ± 0.20	0.55 ± 0.23	0.00
			8 weeks	0.34 ± 0.21	0.35 ± 0.30	0.00

BS = before surgery, AS = after surgery, BD = before decongestion, AD = after decongestion

before decongestant and after decongestant were 0.50 ± 0.13 and 0.54 ± 0.12 cm², respectively, and were not statistically significant ($p = 0.158$) (Table 2). The pre-operative mean of total volume (TV) of all subjects before decongestant was 2.02 ± 0.44 (Table 3).

Post-operative acoustic rhinometry was done at 2, 4, and 8 weeks in all subjects. The comparisons for the pre-operative and post-operative values of all measured areas (CSA1) in these 30 subjects are listed in Table 2 at 2-weeks. There were no statistically significant changes in CSA1 ($p = 0.32$) (Table 2) and total volume (TV) comparing pre-operative and post-operative values ($p = 0.194$) (Table 3). Therefore, the authors found that the mean of CSA1 improved significantly after surgery at 4 and 8 weeks (Table 2) but the total volume of nasal cavity did not significantly change after surgery at 2, 4, or 8 weeks (Table 3).

The pre-operative mean total nasal symptom score (TSS) in all subjects (n = 30) was 13.38 ± 6.46 . The post-operative TSS at 2, 4, and 8 weeks were 5.88 ± 4.85 , 3.00 ± 2.93 , and 5.50 ± 3.41 respectively. The changes of TSS before and after surgery were statistically significant at 2 and 4 weeks ($p = 0.003$ and $p = 0.007$) but not significant at 8 weeks ($p = 0.114$) (Table 4).

However, the nasal obstruction score (NOS) was significantly decreased in all post-operative periods ($p < 0.05$) (Table 4).

Post operative side-effects

Two patients reported mild crusting in the nose. There was no nasal obstruction, bleeding, or severe pain after surgery.

Discussion

The present study was designed to assess the outcome of radiofrequency ablation of the inferior turbinate with acoustic rhinometry evaluation. Subjective assessment of post-operative results in the

Table 3. Preoperative total volume of nasal cavity (TV); postoperative TV at 2, 4 and 8 weeks (n = 30)

	TV (mean) cc	p-value
Preoperative	2.02 ± 0.44	
2 weeks postoperative	1.97 ± 0.24	0.194
4 weeks postoperative	2.08 ± 0.45	0.238
8 weeks postoperative	1.96 ± 0.27	0.269*

TV = total nasal volume

* Comparison between preoperative and 8-weeks post-operative

present study showed from the nasal symptom scores that the patients were satisfied with the radiofrequency ablation procedure. The objective assessment done with the acoustic rhinometry showed a significant widening of CSA following surgery.

Most of the cavernous and erectile tissues in the nose are located in the lateral nasal wall and turbinate. The difference between baseline and decongested CSA and volume value measurements reflects the amount of reversible mucosal congestion⁽⁹⁾. Studies have shown previously that these differences, rather than absolute values, are more clinically relevant^(10,11).

The preoperative values of all subjects for CSA1 are listed in Table 2. The patients who had undergone turbinate reduction surgery had increased CSA1 at four and eight weeks. All subjects had the complaint of congestion pre-operatively.

CSA1 and the total volume did not show significant differences from the pre-operative values (Table 2, 3). Objective measurements of nasal obstruction were assessed in another study of radiofrequency turbinate reduction. This study showed a significant improvement in minimal cross sectional area⁽⁴⁾. The present results also showed signs

Table 4. The preoperative and postoperative total nasal symptom score (TSS) and nasal obstructive score (NOS) (n = 30)

	TSS	p-value*	NOS	p-value**
Preoperative	13.38 ± 6.46		4.00 ± 0.58	
2 weeks postoperative	5.88 ± 4.85	0.003	1.57 ± 1.81	0.004
4 weeks postoperative	3.00 ± 2.93	0.007	0.20 ± 0.45	0.000
8 weeks postoperative	5.50 ± 3.41	0.114	1.20 ± 1.64	0.019

* Comparison between preoperative and postoperative TSS (at 2, 4 and 8 weeks)

** Comparison between preoperative and postoperative NOS (at 2, 4 and 8 weeks)

of improvement at four and eight weeks but the second week may be too early to evaluate this outcome.

After surgery, the authors found improvement on nasal obstruction by subjective assessment (TSS, nasal obstruction score) and objective assessment (acoustic rhinometry). Maybe the lack of significant change between the pre- and post-operation is from the erectile tissue effect.

In the present study, the authors used the actual distances of 2 cm for the evaluation of CSA1. It is possible that the actual change in CSA1 may shift to the right or may occur at a slightly different distance, such as 2.4 cm⁽¹²⁾. The minimal CSA could also shift from CSA1 to CSA2. Other possible reasons for the discrepancy could be compensatory enlargement of the middle turbinate. Other possible causes could include a loss of sensation in nerve endings of inferior turbinate mucosa, which could result in significant improvement in subjective symptoms⁽¹²⁾.

Radiofrequency may direct effect to CSA1 and TSS on 1-2 months after surgery and may decrease the response of the erectile tissue to stimuli, which results in improvement of nasal congestion symptoms post-operatively.

In conclusion, 30 patients undergoing 32 radiofrequency ablation procedures were satisfied with the outcome. Evaluation with acoustic rhinometry showed decrease in smaller area and volume.

Factors other than volume and area change, such as a possible loss of sensation or decreased response to stimuli may contribute to the success of the procedure in relieving the subjects' improvement in the sensation of obstruction.

Potential conflicts of interest

None.

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การใช้ acoustic rhinometry ประเมินผลการรักษาผู้ป่วยโรคภูมิแพ้ที่มีอาการคัดจมูกเรื้อรังด้วย radiofrequency ablation (RFA) turbinate

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วัตถุประสงค์: เพื่อประเมินผลการทำ radiofrequency ablation (RFA) turbinate โดยการใช้ acoustic rhinometry และใช้ total nasal symptom score (TSS) ประเมินผลระยะสั้นที่เกิดขึ้น

วัสดุและวิธีการ: เป็นการศึกษาแบบตัดขวางไปข้างหน้าในผู้ป่วยโรคภูมิแพ้ อายุ 19-62 ปี จำนวน 30 ราย ที่มารับการรักษาในคลินิกโรคภูมิแพ้ ภาควิชา โสต ศอ นาสิกวิทยา วิทยาลัยแพทยศาสตร์กรุงเทพมหานครและวชิรพยาบาล โดยใช้ผลการตรวจ acoustic rhinometry และอาการทางจมูก (TSS) ในการประเมินผลการรักษา อาการคัดจมูก ก่อนและหลังการผ่าตัด

ผลการศึกษา: การใช้ RFA ในการรักษาผู้ป่วย 30 ราย พบว่า CSA1 ดีขึ้นหลังการรักษาได้ 4-8 สัปดาห์ และ TSS ดีขึ้นตั้งแต่ 2-4 สัปดาห์ หลังการผ่าตัด

สรุป: การใช้ RFA มีประสิทธิภาพในการรักษา nasal obstruction เมื่อประเมินโดย acoustic rhinometry และพบว่า อาการผู้ป่วยจะดีขึ้นใน 2-4 สัปดาห์หลังการผ่าตัด ส่วนผลการตรวจโดย acoustic rhinometry พบว่าจะดีขึ้นหลังผ่าตัดแล้ว 4-8 สัปดาห์
