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Long-Term Effect of Submucous Turbinectomy in Patients With Perennial Allergic Rhinitis

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Objectives: **The long-term effect of submucous turbinectomy for patients with perennial allergic rhinitis was assessed.** ***Study Design:*** **A cohort study of 45 patients with severe perennial allergic rhinitis who underwent submucous turbinectomy and were followed up after surgery for more than 3 years was performed. We investigated quality of life in 30 of 45 patients who had passed over 5 years after the surgery.** ***Methods:*** **Nasal symptoms were assessed with a standard symptom score by diary cards. Nasal congestion was evaluated by rhinometry. Nasal challenge tests in vivo were performed to evaluate allergic reactions. These examinations were performed before surgery and at 1 year, more than 3 years, and more than 5 years after submucous turbinectomy. We determined the symptom scores and the quality of life using card questionnaires in 30 patients at the time point of more than 5 years after surgery.** ***Results:*** **The mean [± SD] total nasal symptom score (maximum 9) was significantly lower at 1 year after surgery (7.5 ± 1.6 vs. 1.8 ± 1.8, *P* <.0001) compared with before surgery. A significant improvement in nasal symptoms was noted at the 3-year (2.8 ± 2.3, *P* <.0001) and 5-year (3.3 ± 1.6, *P* <.0001) time points. A significant increase in total nasal airflow value was noted at each time point after surgery, with a gradual reduction in the total nasal symptom score as well (before surgery, 269.4 ± 249.5 cm^3/s; 1 y after surgery, 450.1 ± 197.7cm^3/s; more than 3 y after surgery, 385.1 ± 182.3 cm^3/s). The nasal challenge test score was also reduced 1 year after surgery (2.1 ± 1.0 vs. 0.6 ± 0.7, *P* <.0001). However, there was no further significant increase at the 3-year time point (0.4 ± 0.7, *P* <.0001) after surgery. In regard to postoperative quality of life, according to the results of the card questionnaire, 50% of the patients had not been receiving antiallergic treatments in the postoperative period.** ***Conclusion:*** **Our results suggest that submucous turbinectomy is a useful strategy for the long-term management of nasal allergic reaction and contributes to the improvement in quality of life.** ***Key Words:*** **Submucous turbinectomy, allergic rhinitis, turbinate surgery, long-term effect.**

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INTRODUCTION

Turbinate surgery is a useful treatment for perennial allergic rhinitis.[1] Various methods of turbinate surgery, including laser treatment (CO_2,[2–4] Ho:YAG,[5] potassium-titanyl phosphate[6]), chemical treatment (trichloroacetic acid[7]), and the submucosal technique,[1,8] have been established with good outcomes for allergic rhinitis. Because surgery is more invasive than other types of treatments, such as medication or immunotherapy, it is important that the surgery results in sustained improvement in the patient's quality of life (QOL). However, few reports have described the long-term effects of surgery for allergic rhinitis.[6,8–10]

We previously reported that a form of turbinate surgery, submucous turbinectomy (ST), has an excellent effect in reducing not only nasal congestion[8,11,12] but also sneezing and rhinorrhea in patients with perennial allergic rhinitis.[1] The advantages of this method are that the fibrous tissue occupied the entire inferior turbinate from the deep layer and that the infiltration of various inflammatory or allergy-related cells was reduced.[1] When we followed up patients who had treatment with ST, we found that their nasal condition remained satisfactory over the long term. The purposes of the current study were to determine whether the effectiveness of ST for severe perennial allergic rhinitis continues for more than 3 years and to investigate whether ST contributes to QOL in the management of nasal allergy.

PATIENTS AND METHODS

Clinical Cases and Submucous Turbinectomy Procedures

A total of 45 patients (30 men and 15 women; mean age, 25.7 y) with perennial allergic rhinitis caused by house dust mites (HDM)

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underwent ST at Fukui Red Cross Hospital (Fukui, Japan) between 1992 and 1994, and at Fukui Medical University (Fukui, Japan) between 1994 and 1996. All patients were completely followed up after surgery. Thirty of 45 patients (66.7%) passed the time point of more than 5 years after ST, and the other patients (15 cases [33.3% of patients]) were followed up for at least 3 years. None of the patients has been lost to follow-up after the surgery.

All patients with perennial allergic rhinitis had a high titer of anti-*Dermatophagoides pteronyssinus*–specific immunoglobulin E (IgE) antibodies. Thirteen of 45 patients also had a high titer of Japanese cedar pollen (*Cryptomeria japonica)*–specific IgE antibodies. They also had positive reactions on skin tests and positive reactions on provocation tests using HDM. They had a history of perennial nasal allergic symptoms that were resistant to various antihistamines and to intranasal spray of topical corticosteroids. We excluded the patients who had sinusitis, nasal polyps, or aspirin intolerance. We also excluded patients who were treated with tranquilizers. None had a history of HDM-specific immunotherapy before or after ST. Informed consent was obtained from all patients before surgery.

Procedures of ST were previously described in detail.[1] Briefly, incision of the nasal mucosa was performed along the edge of the apertura piriformis with the patient under local anesthesia by injection with 0.5% lidocaine and 1:10,000 adrenaline, and the turbinate bone was isolated and removed.

Periods for Evaluation

All patients were referred to our clinic at 1 year and more than 3 years (average period, 3.6 y) after surgery. In four cases, we could not estimate the nasal condition at the 1-year period after ST with their busy life. However, all four patients came to our clinic 3 years after ST. The daily grade of nasal congestion and the frequency of both sneezing and nasal blowing were recorded for 2 weeks just before their coming to us. We called the patients 1 month before their visiting us. Patients were free of postoperative medications for allergies, in principle. We permitted the patients to use an intranasal inhalation of beclomethasone dipropionate occasionally, when the symptoms of nasal allergy occurred within a year of ST. A year after ST, oral antihistamine was administrated to patients on appropriate days. In patients treated with an antihistamine or topical corticosteroid, or both, the medications were stopped at least 2 weeks before their visiting us. For the patients with a high titer of Japanese cedar pollen, we avoided the pollen season (March and April) when evaluating their nasal conditions.

Evaluation of Sneezing, Rhinorrhea, Subjective Nasal Congestion Score, and Total Nasal Symptom Score

Mean values for the daily frequency of sneezing and nasal blowing and a subjective grade for nasal congestion were evaluated using a numerical scoring system[1,13] as follows: for both sneezing and nasal blowing, grades were 0 (none), 1 (1–4 times per day), 2 (5–9 times per day), and 3 (more than 10 times per day); and for nasal congestion, grades were 0 (none), 1 (mild), 2 (moderate) and 3 (severe). Total nasal symptom score was expressed as the sum of the three scores. The maximum possible score was 9.

Evaluation of Nasal Airflow Value

Total nasal airflow was measured using a rhinomanometer (model MPR-2100, Nihon Koden, Tokyo, Japan) by the anterior method with the patient in a sitting position. The International Committee of Standardization of nasal functionary examination suggested that nasal expiratory flow should be evaluated at a pressure of 150 Pa. However, our Japanese physique is smaller than that of Westerners. The pressure at the nasopharynx in Japanese individuals cannot often exceed 150 Pa. Thus, the value of expirations per second has been evaluated at the pressure of 50 or 100 Pa in the previous report[1–3,7] from Japan. We also evaluated the nasal airflow value at the pressure of 100 Pa in the current study.

Nasal Challenge Test

A nasal challenge test was performed using a disk that contained HDM (Torii, Tokyo, Japan) on the mucosa of the anterior site of the inferior turbinate[1,13] by a physician who had not participated the nasal surgery. When nasal challenge tests were performed after the surgery, the challenged site was apart from the incision scar. The grades for nasal challenge test results were as follows: 0, no allergic symptom or one of three allergic symptoms (local edema of the mucosa, sneezing, and rhinorrhea) occurred within 15 min after challenge; 1, two allergic symptoms; 2, all three allergic symptoms; and 3 (all three allergic symptoms with more than six sneezes).

Investigation of Quality of Life With Card Questionnaire

For 30 patients who were observed for at least 5 years (average period, 5.6 y) after the surgery, we investigated their QOL, as well as their nasal symptom scores, using an anonymous mail questionnaire. The daily grade of nasal congestion and the frequency of both sneezing and nasal blowing were recorded for 2 weeks in the same manner. In addition, two questions and selectable answers were as follows:

1) What do you think about your nasal allergic symptoms now in comparison with those before the operation? a) Excellent, b) Good, c) Not changed, d) Worse.
2) Have you needed postoperative treatments with your nasal allergy? a) No, b) Take medicine occasionally when some symptoms occurred without consultation of an otorhinolaryngology clinic, c) Sometimes consult (one or two times per a few months) an otorhinolaryngology clinic, d) Now receiving treatment from an otorhinolaryngology clinic (more than one time per month).

Statistical Analysis

All data were analyzed with the Mann-Whitney *U* test. Macintosh computers (Statview software, Abacus Concepts, Inc., Berkeley, CA) were used for all statistical analyses.

RESULTS

Rhinoscopic Findings

Intranasal findings before and 5 years after ST are shown in Fig. 1A and B. The reduction of the volume of the inferior turbinate continued, and constriction at the surgical scar in the turbinate mucosa was also detected.

Subjective Symptom Scores

The mean (± SD) total nasal symptom score was 7.5 ± 1.6 before ST, and this score was significantly reduced to low levels 1 year after ST. At 3 years and 5 years after ST, although the score gradually increased, the mean score was still lower than before ST (Table I). The rates of patients without nasal symptoms (score 0) at the periods of 1 and more than 3 years after ST were 36.6% (15 patients) and 20.0% (9 patients), respectively. After 5 years, no patients were free of symptoms, but a low-level score (a score less than 3) was maintained in 70.0% (21 of 30 patients). In regard to individual symptoms, we found that the scores of all items increased gradually; however,

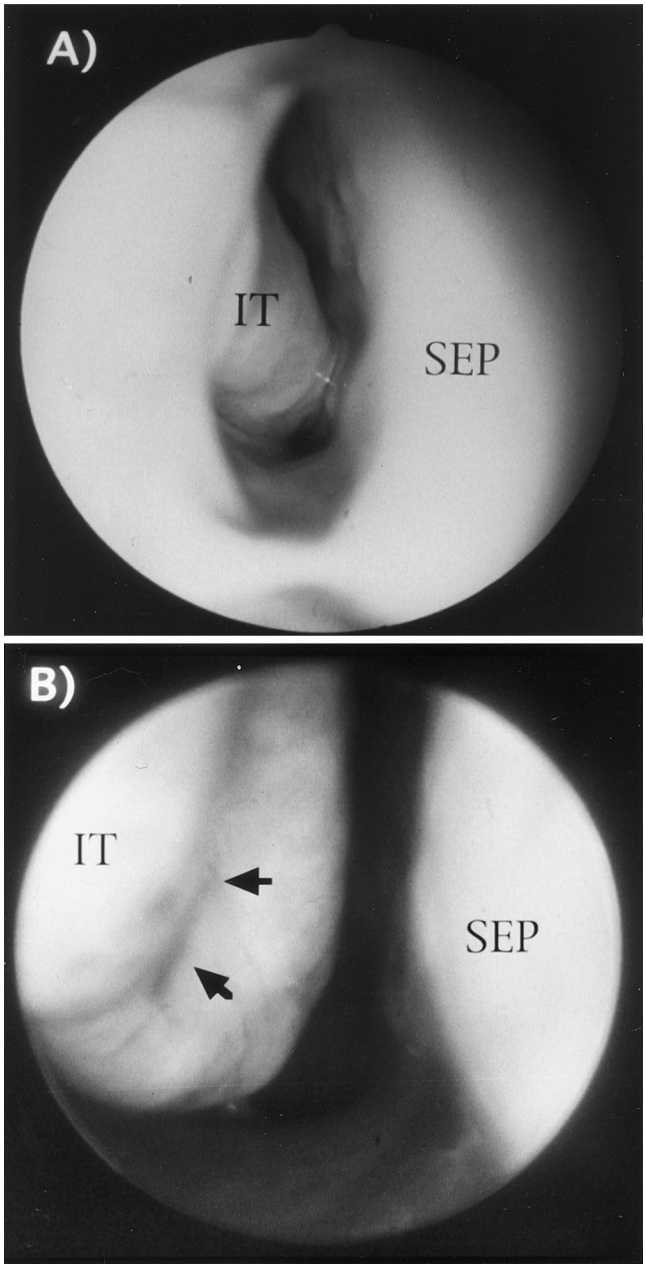

Fig. 1. Intranasal findings (**A**) before and (**B**) 5 years after submucous turbinectomy. The reduction of the volume of the inferior turbinate and scar formation with constriction had remained. The arrow indicates scar. IT = inferior turbinate; SEP = nasal septum.

TABLE I.
Improvements in Nasal Symptom Scores From Diary Cards.

	No.	Score (mean ± SD)	P*
Total symptom score			
Before	45	7.5 ± 1.6	
1 y after	41	1.8 ± 1.8	<.0001
>3 y after	45	2.8 ± 2.3	<.0001
>5 y after	30	2.8 ± 2.3	<.0001
Nasal congestion			
Before	45	2.8 ± 0.4	
1 y after	41	0.4 ± 0.6	<.0001
>3 y after	45	0.8 ± 0.8	<.0001
>5 y after	30	1.0 ± 0.7	<.0001
Sneezing			
Before	45	2.1 ± 1.0	
1 y after	41	0.6 ± 0.7	<.0001
>3 y after	45	0.8 ± 0.9	<.0001
>5 y after	30	1.0 ± 0.9	<.0001
Rhinorrhea			
Before	45	2.4 ± 0.8	
1 y after	41	0.9 ± 0.9	<.0001
>3 y after	45	1.3 ± 1.0	<.0001
>5 y after	30	1.3 ± 0.7	<.0001

*Compared with before.
SD = standard deviation.

for all symptoms at 3 and 5 years after ST the scores were significantly lower than before ST ($P < .0001$).

The number of patients with severe sneezing (more than five times per day) was 36 (80.0%) before ST. This number was markedly reduced to 3 (7.0%), 5 (11.1%), and 5 (16.6%) at 1 year, more than 3 years, and more than 5 years after ST, respectively. Twenty patients (44.4%) and 10 patients (33.3%) were free of sneezing for at least 3 years and 5 years after ST, respectively. The number of patients with severe nasal blowing (more than five times per day) was 39 (86.6%) before ST. This number decreased to 9 (22.0%), 14 (31.1%), and 8 (26.7%) at the periods of 1 year, more than 3 years, and more than 5 years after ST, respectively. Eighteen patients (43.9%) and eight patients (17.8%) were free of rhinorrhea at 1 year and 3 years, respectively. Only one patient (3.4%) had no rhinorrhea at more than 5 years. Thus, rhinorrhea was the most difficult factor to control (score 0 for the time period of more than 5 y) by ST. There were no differences in the improvement of symptom scores in patients with and without seasonal allergies.

Total Nasal Airflow Value

Before ST, mean (± SD) nasal airflow value was 269.4 ± 249.5 cm^3/s (Table II). A significant improvement in the nasal airflow value by ST was found at 1 year (450.1 ± 197.7 cm^3/s, $P < .0001$) and at more than 3 years (385.1 ± 182.3 cm^3/s, $P < .005$) after ST, compared with before ST, although these values gradually decreased.

Nasal Challenge Test

To evaluate in vivo allergic reaction in the patients, nasal challenge tests using a disk containing HDM were performed both before and after ST. The mean (± SD) preoperative nasal challenge test score was 2.1 ± 1.0. At 1 year after ST this score was significantly improved ($P < .0001$), and this low level was maintained for more than 3 years ($P < .0001$) after ST (Table II). A positive reaction to nasal allergen challenge test occurred in 43 of 45 patients (95.5%) before ST. Markedly strong reactions (grade 3) occurred in 46.6% of the patients (21 cases) before ST. After ST, 56.1% of the patients (23 of 41) at 1 year and 72.5% (29 of 40) at more

than 3 years were free of nasal allergic reactions according to the results of the nasal allergen challenge. A strong reaction (grade 3) was not found in any patients at more than 3 years after surgery. No patient had stronger reactions postoperatively than preoperatively (Table II).

Results of Quality of Life Investigation With Card Questionnaire

For the question "What do you think about your nasal allergic symptoms now in comparison with before the operation?," 18 patients answered "excellent," 9 patients answered "good," 3 patients answered "not changed," and no patient answered "worse." Regarding the question "Have you needed postoperative treatments with your nasal allergy?," 15 patients answered "no" for the entire 5-year period, 6 patients had occasionally taken medication without consulting an otorhinolaryngology clinic for 5 years, and 9 patients sometimes (one or two times per a few months) needed or continuously (more than one time per month) needed antiallergic medications (histamine type 1 blockers or topical corticosteroid, or both) after ST and consulted an otorhinolaryngology clinic (Table III).

TABLE III.
Result of the Investigation of QOL With a Card Questionnaire.

	No.	Percentage
Present nasal allergic symptoms in comparison with those at preoperative state		
Excellent	18	60.0
Good	9	30.0
Not changed	3	10.0
Worth	0	0.0
Requirements for the postoperative treatments of nasal allergy		
Nothing	15	50.0
Take medicine occasionally without consultation of an ENT clinic	6	20.0
Sometimes consult an ENT clinic	5	16.7
Now receiving treatment from an ENT clinic	4	13.3

QOL = quality of life; ENT = ear, nose and throat.

DISCUSSION

Nasal congestion is the most serious symptom in the management of chronic rhinitis. Patients who are resistant to various treatments such as corticosteroids[14,15] or α-stimulant[16] have good indications for turbinate surgeries. However, because surgery is the most invasive treatment for patients with nasal allergy, surgical therapy requires a better outcome than other, conservative forms of therapy.

In Japan, perennial allergic rhinitis caused by HDM involves a large proportion of patients with chronic rhinitis. Ogino et al.[17] reported that 32.7% of Japanese medical students had symptoms of nasal allergies and 66.4% of them were caused by HDM. Turbinate surgery including lasers[2,3] and a chemical agent (trichloroacetic acid[7]) is widely used in Japan to reduce not only the turbinate volumes but also the mucosal reactions by allergens in Japan.[1] Various methods of turbinate surgery have been established with good outcomes for nasal congestion.[1–12,18,19] However, the selection of the surgical techniques appears to be based more on the surgeon's preference than on a critical assessment of the outcomes for the treatment.[8] In addition, there have been few reports describing the long-term effects of surgery.[8–10]

Passali et al.[8] suggested that submucosal resection was superior to other forms of turbinate surgery, with the lowest risk of complications, based on data from a number of comparative studies of various turbinate surgeries. Submucous turbinectomy is characterized by the induction of permanent changes of the skeleton of the inferior turbinate and scar formation from the deep layer.[1] Because ST is technically more difficult than surgery by laser or chemosurgery,[1,8] many surgeons avoid the use of ST; however, we consider that ST is a simple and useful turbinate surgery.

Previously, we suggested that the good clinical outcome of ST was attributable to the scar formation from the deep position of the lamina propria with the reduction of infiltrating immunocompetent cells,[1] and the rhinoscopic findings showed that the internal scarring on the inferior turbinate had existed for more than 5 years after ST. Collagen fibrous tissue usually disappears gradually with the normal process of wound healing.[20] In the current study, the subjective symptoms of nasal allergy gradually increased after surgery. On the other hand, the low provocation test scores continued for more than 3 years. In addition, all of the symptom scores at 5 years after ST were significantly lower than those before ST. Moreover, the results of the card questionnaire showed that 70.0% of the patients with severe allergic rhinitis had not visited otorhinolaryngology clinics for more than 5 years postoperatively. Based on these results, we think that ST is useful for improving the QOL of patients with perennial allergic rhinitis.

We recently performed ST under endoscopy to resect the backward turbinate bone completely, and using this technique we found a nerve fiber at the subperiosteum (Fig. 2A and B) that on immunohistochemical study was positive for tyrosine hydroxylase, vasoactive intestinal peptide, and substance P (data not shown). Thus, this nerve fiber was considered to be a branch of the postnasal nerve. The postnasal nerve originates from the sphenopal-

TABLE II.
Improvements in Nasal Airflow and Nasal Challenge Test Score

	No.	Score (mean ± SD)	*P*†
Total nasal airflow value*			
Before	45	269.4 ± 249.5	
1 y after	41	450.1 ± 197.7	<.0001
>3 y after	45	385.1 ± 182.3	<.005
Nasal challenge test score			
Before	45	2.1 ± 1.0	
1 y after	41	0.6 ± 0.7	<.0001
>3 y after	45	0.4 ± 0.7	<.0001

*The value of expiration per second at the pressure of 100 pascal in the nasopharynx.
†Compared with before.
SD = standard deviation.

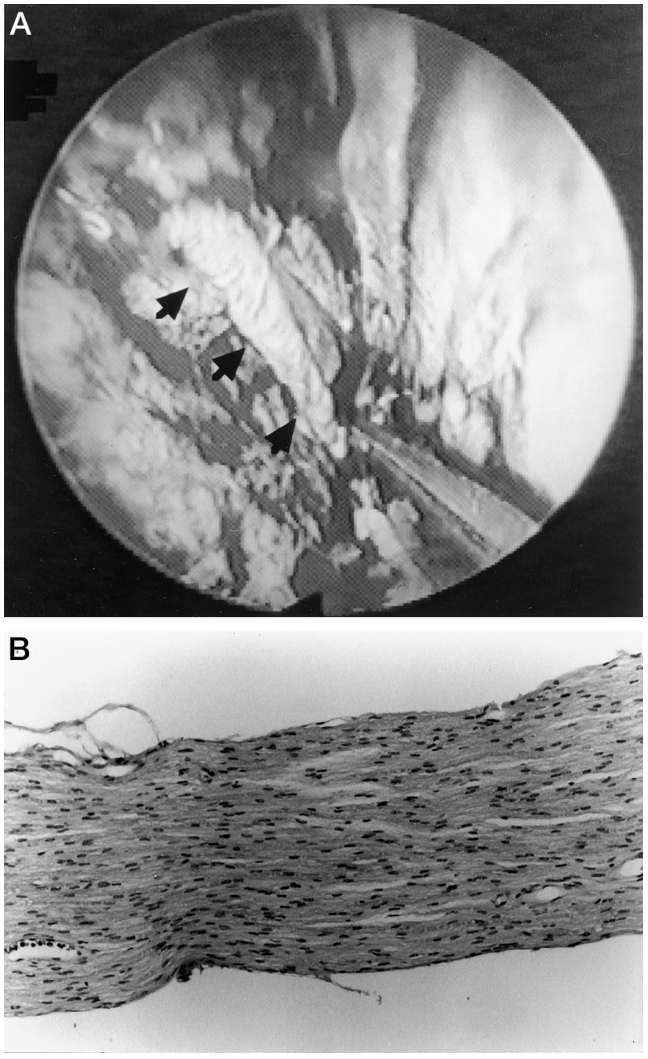

Fig. 2. (**A**) Endoscopic findings during submucous turbinectomy. Arrow indicates postnasal nerve in the submucosa of the inferior turbinate. (**B**) H&E staining of the fiber shown in (**A**). It was determined to be a nervous tissue.

atine foramen and branches into the inferior turbinate mucosa, and this branch of the postnasal nerve plays a crucial role in causing sneezing and hypersecretion. Although patients in the current study were operated on without endoscopy, we speculate that this previously undetected fiber may have been cut in numerous cases, and we consider that surgically induced damage to this peripheral nerve fiber may have been a major cause of the decrease in allergic symptoms after ST.[1] Because we currently are able to accurately endoscopically detect and cut this fiber, we consider that we will be able to obtain better results in the future than those in the present study.

CONCLUSION

Submucous turbinectomy inhibited allergic reaction in the inferior turbinate of patients with perennial allergy to HDM for more than 5 years. Furthermore, ST contributed to improving the QOL in patients with severe nasal allergy.

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