

Therapeutic Evaluation of Outpatient Submucosal Inferior Turbinate Surgery for Patients with Severe Allergic Rhinitis

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ABSTRACT

Background: Surgical treatment for inferior turbinate (IT) is selected to treat severe allergic rhinitis (AR) that is unresponsive to conservative treatment. This study aimed to determine the clinical effects of outpatient submucosal IT surgery (OSITS) on patients with severe AR.

Methods: Between January 2008 and August 2012, 95 patients with severe AR who underwent OSITS at the Department of Otolaryngology, Hyogo College of Medicine, were retrospectively analyzed. There were 53 men and 42 women. Their mean age was 27 years (11-75 years). OSITS was bilaterally performed using a bipolar radiofrequency electrocautery under local anesthesia. Symptoms, QOL, and physical findings were evaluated using scores from both pre- and postoperative periods (average: 12.4 months), according to Practical Guideline for the Management of AR in Japan 2009.

Results: In perennial AR, all mean scores of nasal symptoms, QOL, and physical findings significantly improved after OSITS ($p < 0.05$, $n = 83$). Nasal obstruction, sleep problems, and IT congestion were the most strongly affected. Eye symptoms were not influenced by OSITS. OSITS also showed significant effects on nasal obstruction and IT congestion in seasonal AR ($p < 0.05$, $n = 12$), but not sneezing, nasal discharge, and QOL. In terms of the efficacy, OSITS was beneficial in 90% of perennial AR cases and 75% of seasonal AR cases. Epistaxis (1%), vestibulitis (1%), and IT atrophy (4%) were observed after OSITS.

Conclusions: These data indicate that OSITS using radiofrequency electrocautery could be a beneficial therapeutic option in patients with severe AR.

KEY WORDS

allergic rhinitis, inferior turbinate surgery, outpatient, radiofrequency cauterization, rhinology

INTRODUCTION

The incidence of allergic rhinitis (AR) has been increasing and it is now considered a national disease in Japan. The main clinical symptoms of AR are sneezing, serous nasal discharge, and/or nasal obstruction. Severe nasal symptoms can reduce the performance and productivity of individuals, as well as their quality of life (QOL).

For the treatment of AR, pharmacotherapy is initially selected, together with communication with patients about the avoidance of antigens.¹ When pa-

tients with severe AR do not show any responses to medication, surgical treatment is recommended to relieve their symptoms. Inferior turbinate surgery (ITS) is one of the procedures for severe AR. There are various methods of ITS for mucosal and submucosal tissues.^{2,3} For mucosal ITS, cautery has been performed with various devices, such as radiofrequency electrocoagulation surgery,^{4,9} argon plasma coagulation,¹⁰ CO₂ laser,^{11,12} yttrium-aluminum-garnet (YAG) laser,^{13,14} and chemosurgery (80% trichloroacetic acid).¹⁵ For submucosal ITS, radiofrequency cautery, resection with a micro-debrider, and IT bone resec-

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Conflict of interest: No potential conflict of interest was disclosed.

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Received 7 January 2013. Accepted for publication 13 June 2013.

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tion have been performed.^{2,3} However, it is still controversial whether or not outpatient submucosal ITS (OSITS) using radiofrequency electrocautery has significant effects on severe AR.

The purpose of this study was to investigate in detail the change of main symptoms, QOL, and intranasal findings after OSITS, and to evaluate the effects of OSITS on perennial and seasonal AR.

METHODS

PATIENTS AND DIAGNOSIS

Among patients seen between January 2008 and August 2012, 95 patients with severe AR who underwent bilateral OSITS at the Department of Otolaryngology, Hyogo College of Medicine, were retrospectively analyzed for both pre- and postoperative nasal conditions. OSITS was performed on all patients after the provision of informed consent. This study conformed to the regulations of the ethics committee of Hyogo College of Medicine (approval number: 1512). There were 53 men and 42 women. Their mean age was 27 years, ranging from 11 to 75 years. Asthma was an accompanying condition in 25 patients (26.3%), while atopic dermatitis was also present in 16 patients (16.8%). Patients who were not seen postoperatively were excluded from this study. Patients with any nasal polyps and sinusitis were also excluded.

AR was diagnosed on the basis of a detailed clinical history, three nasal symptoms (sneezing, watery rhinorrhea, and nasal obstruction), intranasal findings, and the identified causative allergen, according to the Practical Guideline for the Management of Allergic Rhinitis in Japan 2009 (referred to as the guidelines hereafter).¹ Radioimmunosorbent testing for non-specific (RIST) and specific (RAST) immunoglobulin E (IgE) antibodies was also undertaken to investigate the presence or absence of atopic disposition. Total serum IgE and specific IgE titers (house dust, mites, cedar, cypress, orchard grass, ragweed and mugwort) were measured by fluorescent enzyme immunoassay (CAP-FEIA, Phadia K.K., Tokyo, Japan). Hyperglobulinemia of IgE (173 U/ml < RIST) was found in 49 patients (51.6%). Specific IgE classes two and over were considered to indicate positive to the allergens. In total, 39 patients (24 men and 15 women, average age 27.3 years) had perennial AR alone, 12 patients (6 men and 6 women, 25.8 years) had seasonal AR alone, and the remaining 44 patients (23 men and 21 women, 28.6 years) had both perennial and seasonal AR (combined AR).

The condition in perennial AR was evaluated in the pre- ($n = 83$) and three postoperative periods. The condition in combined AR was evaluated at a time when pollen antigens were not present in the air, and was included in the category of perennial AR. The first period was between 3 and 6 months ($n = 75$, average 4.5 months), the second period was between 7 and 12 months ($n = 44$, average 11.7 months), and the

third period was between 13 and 24 months ($n = 22$, average 21.9 months) after the OSITS. Patients with seasonal AR were evaluated on an annual seasonal basis, when pollen allergens were present in the air ($n = 12$).

SURGICAL PROCEDURES OF OSITS

OSITS was bilaterally performed with 0 degree endoscopy under local anesthesia in an outpatient setting. CelonLab ENT[®] (Celon, Olympus, Tokyo, Japan), a bipolar radiofrequency-induced thermotherapy applicator designed for reduction of the submucosal IT volume, was used. No premedication was given. Before OSITS, bilateral nasal cavity was anesthetized by inserting cotton pledgets that had been immersed in 4% lidocaine hydrochloride and 0.02% epinephrine. The pledgets were placed along the IT for 30-40 minutes. A dose of 1-2 ml of 1% lidocaine hydrochloride and 0.001% epinephrine (AstraZeneca K.K., Osaka, Japan) was additionally injected into the submucosa of IT on each side. The submucosal layer of IT was cauterized at an output of 20 W. The operation took about 5 minutes on both sides. If no bleeding was observed 30 min later, the patients left hospital without bandaging.

EVALUATION OF THE CHANGES IN SYMPTOMS AND INTRANASAL FINDINGS

The Japanese Allergic Rhinitis QOL Standard Questionnaire (JRQLQ No. 1), according to the Japanese guidelines, was used for evaluation.¹⁶ The JRQLQ is composed of three parts (I-III): (I) nasal and eye symptoms; (II) a QOL-related questionnaire; and (III) an overall face scale. Differences in the JRQLQ (I-III) scores between before and after OSITS were analyzed in this study. For JRQLQ I, the nasal and eye symptoms included the six categories of runny nose, sneezing, blocked nose, itchy nose, itchy eyes, and watery eyes. Patients evaluated symptoms on a five-point scale: 0 for no symptoms, 1 for mild, 2 for moderately severe, 3 for severe, and 4 for very severe symptoms. For JRQLQ II, the QOL-related questionnaire included six domains [A-F] that consisted of 17 items (i-xvii): [A] 'usual daily activities' with five items of (i) reduced productivity at work/home/school, (ii) poor mental concentration, (iii) reduced thinking power, (iv) impaired reading of books/newspapers, and (v) reduced memory; [B] 'outdoor activities' with two items of (vi) limitation of outdoor life (e.g. sports, picnic) and (vii) limitation of going out; [C] 'social functioning' with three items of (viii) hesitation visiting friend or relatives, (ix) reduced contact with friends or others by telephone or face-to-face conversation, and (x) not an easy person to be around; [D] 'sleep problems' with one item of (xi) impaired sleeping; [E] 'general physical problems' with two items of (xii) tiredness and (xiii) fatigue; and [F] 'emotional function' with four items of (xiv) frustra-

tion, (xv) irritability, (xvi) depression, and (xvii) unhappiness. Each item was evaluated on a five-point scale: 0 for no significant problem, 1 for mild, 2 for moderately severe, 3 for severe, and 4 for a very severe problem. The mean score of each domain was calculated for analysis. For JRQLQ III, an overall face scale, including overall symptoms, condition, and feelings, was evaluated on a five-point scale from 0 for 'happy' to 4 for 'crying'.

Efficacy of OSITS was defined as a change in severity in terms of the degree of three nasal symptom scores.¹ Severity was defined using a five-point scale (0 for no symptoms, 1 for mild, 2 for moderate, 3 for severe, 4 for most severe) by a combination of blocked nose and a higher score of sneezing and nasal discharge. Efficacy was determined when there was a difference in the severity between before and after OSITS. When the severity score decreased, we considered it to reflect an improvement. The efficacy rate, which indicates the percentage of total patients showing an improvement, was calculated.

We retrospectively investigated what kinds of medicine were prescribed for all patients enrolled in this study using our clinical records. On the basis of the guideline¹ and a previous study,¹⁷ each medicine that patients were taking at the time of examination was scored. The score was 1 point for the use of oral antihistamine or leukotriene receptor antagonist, vasoconstrictors in nasal drops, or antihistamine and releasers in eye-drops. The score was 2 points for the use of corticosteroids in nasal sprays, or corticosteroid eye-drops. The use of betamethasone and d-chlorpheniramine maleate was scored as 2.5 points. If patients used more than one medicine, the total score was calculated. The usual daily dose before OSITS was considered as the standard. Differences from the preoperative standard after OSITS were analyzed.

We also applied a visual analog scale (VAS) to measure the patients' satisfaction with nasal symptoms before and after OSITS. VAS consisted of a 10 cm linear scale; the opposing ends of the scale indicated minimal (0%) and maximal levels of satisfaction with nasal symptoms (100%). The distance to the point that patients checked on the line was measured in millimeters. The value was then represented as the nasal VAS score (%).

Intranasal findings were evaluated before and after OSITS based on the guideline.¹⁸ The degree of IT congestion of the mucosa was scored on a four-point scale: 0 for no swelling; 1 for over half of the middle turbinate (MT) being visible; 2 for intermediate between points 1 and 3; and 3 for the MT not being visible.^{18,19} The amount of nasal discharge was scored on a four-point scale: 0 for no nasal discharge; 1 for a small amount of nasal discharge; 2 for intermediate between points 1 and 3; and 3 for nasal discharge filling the nasal cavity.

Nasal resistance was measured using rhinoma-

nometry by an anterior method (multi-functional spirometer HI-801, Chest, Tokyo, Japan) before and after OSITS. A resistance value of 100 Pa (Pa/cm³/s) between pressure and nasal airflow for resting respiration was adopted.

Wilcoxon signed-rank test was used for statistical analysis using the software StatView (version 5.0). Differences were considered significant if the *p* value was less than 0.05. Data are presented as mean $\pm$ standard error (S.E.).

RESULTS

PERENNIAL AR

Changes in Symptoms after OSITS

On average, all nasal symptom scores in JRQLQ I significantly improved and were maintained up to the third period after OSITS (Table 1). The preoperative runny nose score significantly improved. Improvement of sneezing score also showed significance, similar to that of runny nose. Blocked nose score was the severest of the preoperative nasal symptoms. The mean score of blocked nose strongly improved. Improvement of the score of itchy nose also showed significance. The rate of improvement of blocked nose was the best among the nasal symptoms. Taken together, the efficacy rates in the first, second, and third periods after OSITS were 90.7%, 88.6%, and 90.9%, respectively. Mean preoperative nasal VAS score of $25.3 \pm 2.0\%$ significantly improved to $63.3 \pm 3.4\%$ ($n = 75$, $p < 0.0001$) in the first period, $66.2 \pm 3.7\%$ ($n = 44$, $p < 0.0001$) in the second period, and up to $79.0 \pm 4.9\%$ ($n = 22$, $p = 0.0002$) in the third period. These data suggest that OSITS using Celon might be effective for patients with severe perennial AR in order to improve the nasal symptoms. On the other hand, eye symptom scores for itchy eyes and watery eyes did not show much improvement. Mean preoperative medication score (0.4 ± 0.1 , $n = 83$) did not show a downward trend in terms of the amount of medicine: 0.3 ± 0.2 ($n = 75$, $p = 0.6823$) in the first, 1.1 ± 0.3 ($n = 44$, $p = 0.0717$) in the second, and 0.4 ± 0.3 ($n = 22$, $p = 0.7498$) in the third period after OSITS.

Changes in QOL after OSITS

Table 2 summarizes pre- and postoperative scores in JRQLQ II and III. In JRQLQ II, the score of sleep problems was the severest in the six domains in the preoperative stage. All six domains significantly improved after OSITS, except for outdoor activities and social functioning in the second period. For JRQLQ III, overall face scale showed a significant improvement up to the second period after OSITS.

Changes in Physical Findings after OSITS

Changes in the intranasal findings are shown in Table 3. The mean score of preoperative congestion significantly improved after OSITS. Preoperative mean nasal resistance value (Pa100) of 0.6 ± 0.3 (Pa/cm³/s)

Table 1 Changes in symptom scores after OSITS in perennial AR

	Pre (n = 83)	1 st period 3-6 months (n = 75)	2 nd period 7-12 months (n = 44)	3 rd period 13-24 months (n = 22)
1. Runny nose	1.8 ± 0.1	1.1 ± 0.1 (<0.0001)** 56.0% (42/75)	1.1 ± 0.2 (0.0071)* 50.0% (22/44)	0.6 ± 0.1 (0.0007)* 68.2% (15/22)
2. Sneezing	1.2 ± 0.1	0.8 ± 0.1 (<0.0001)** 40.0% (30/75)	0.8 ± 0.2 (0.0118)* 43.2% (19/44)	0.6 ± 0.1 (0.0272)* 54.5% (12/22)
3. Blocked nose	2.7 ± 0.1	1.2 ± 0.1 (<0.0001)** 78.7% (59/75)	1.2 ± 0.2 (<0.0001)** 68.2% (30/44)	0.8 ± 0.2 (0.0001)* 81.8% (18/22)
4. Itchy nose	1.1 ± 0.1	0.7 ± 0.1 (0.0002)* 45.3% (34/75)	0.5 ± 0.1 (0.01)* 45.5% (20/44)	0.5 ± 0.2 (0.0072)* 59.1% (13/22)
5. Itchy eyes	1.0 ± 0.1	0.6 ± 0.1 (0.0001)* 38.7% (29/75)	0.5 ± 0.1 (0.2267) 22.7% (10/44)	0.4 ± 0.1 (0.0622) 36.4% (8/22)
6. Watery eyes	0.4 ± 0.1	0.3 ± 0.1 (0.1642) 21.3% (16/75)	0.2 ± 0.1 (0.7762) 13.6% (6/44)	0 (0.1573) 18.2% (4/22)
Efficacy rate		90.7% (68/75)	88.6% (39/44)	90.9% (20/22)

Nasal and eye symptom scores in JRQLQ I in the pre- and 1st, 2nd, and 3rd postoperative periods are shown. Upper lanes show the symptom scores as mean ± S.E. (*p* values), and lower lanes show their improvement rates (number of patients). Asterisks indicate significance between before and after OSITS (**p* < 0.05, ***p* < 0.0001).

Table 2 Changes in QOL scores after OSITS in perennial AR

	Pre (n = 83)	1 st period 3-6 months (n = 75)	2 nd period 7-12 months (n = 44)	3 rd period 13-24 months (n = 22)
II 1. Usual daily activities	0.9 ± 0.1	0.3 ± 0.1 (<0.0001)** 72.0% (54/75)	0.2 ± 0.1 (0.0007)* 54.5% (25/44)	0.2 ± 0.1 (0.0123)* 59.1% (13/22)
2. Outdoor activities	0.5 ± 0.1	0.2 ± 0.1 (0.0016)* 34.7% (26/75)	0.2 ± 0.1 (0.067) 31.8% (14/44)	0 (0.0031)* 50.0% (11/22)
3. Social functioning	0.5 ± 0.1	0.2 ± 0.1 (0.0004)* 33.3% (25/75)	0.2 ± 0.1 (0.0677) 34.1% (15/44)	0.1 ± 0 (0.0172)* 45.5% (10/22)
4. Sleep problem	1.3 ± 0.1	0.7 ± 0.1 (0.0003)* 53.3% (40/75)	0.5 ± 0.1 (0.0005)* 47.7% (21/44)	0 (0.0018)* 59.1% (13/22)
5. General physical problems	1.2 ± 0.1	0.5 ± 0.1 (0.0001)* 49.3% (37/75)	0.4 ± 0.1 (0.0023)* 50.0% (22/44)	0.3 ± 0.1 (0.0212)* 50.0% (11/22)
6. Emotional function	0.7 ± 0.1	0.4 ± 0.1 (0.0009)* 52.0% (39/75)	0.2 ± 0.1 (0.0009)* 50.0% (22/44)	0 (0.0007)* 68.2% (15/22)
III Overall face scale	2.3 ± 0.1	1.7 ± 0.1 (0.0001)* 58.7% (44/75)	1.8 ± 0.2 (0.021)* 50.0% (22/44)	2.0 ± 0.2 (0.4962) 36.4% (8/22)

Upper lanes show the scores as mean ± S.E. (**p* < 0.05; ***p* < 0.0001), and lower lanes show their improvement rates (number of patients).

significantly improved to 0.3 ± 0.1 (Pa/cm³/s) at an average of 4.5 months (3-9 months) in eight patients who we could examine before and after OSITS (*p* = 0.0431). The mean scores of the amount of nasal discharge also significantly decreased. The rates of improvement in IT congestion were better than those for the amount of discharge.

SEASONAL AR

The mean blocked nose score in JRQLQ I significantly improved, whereas those of runny nose and sneezing did not show significance at 12 months after

OSITS (Table 4). Efficacy in terms of the nasal symptom scores was found at a rate of 75.0%. Mean nasal VAS score also improved from $11.1 \pm 2.0\%$ to $50.9 \pm 9.7\%$ at 12 months after OSITS (*p* = 0.0029). Mean score of IT congestion significantly improved after OSITS, whereas the amount of nasal discharge did not. In total, 83% showed improvement of blocked nose and IT congestion. Meanwhile, there were no significant differences before and after OSITS in JRQLQ I in terms of eye symptoms, between II and III. Sleep problems, which showed a downward trend from 1.8 ± 0.4 to 0.7 ± 0.4 (*p* = 0.0725), were the most

Table 3 Changes in intranasal findings after OSITS in perennial AR

	Pre (n = 83)	1 st period 3-6 months (n = 75)	2 nd period 7-12 months (n = 44)	3 rd period 13-24 months (n = 22)
Congestion of IT	2.3 ± 0.1	0.6 ± 0.1 (<0.0001)** 92.0% (69/75)	0.7 ± 0.1 (<0.0001)** 86.4% (38/44)	0.8 ± 0.2 (<0.0001)** 95.5% (21/22)
Amount of discharge	1.2 ± 0.1	0.5 ± 0.1 (<0.0001)** 54.7% (41/75)	0.4 ± 0.1 (<0.0001)** 63.6% (28/44)	0.3 ± 0.1 (0.0012)* 63.6% (14/22)

Scores of mean ± S.E. (**p* < 0.05; ***p* < 0.0001) and improvement rates (number of patients) are shown in upper and lower lanes, respectively.

Table 4 Changes in symptoms and physical findings in seasonal AR

	Pre (n = 12)	12 months after OSITS
1. Runny nose	1.8 ± 0.4	1.8 ± 0.4 (0.7302) 25.0% (3/12)
2. Sneezing	1.6 ± 0.4	1.6 ± 0.3 (>0.9999) 25.0% (3/12)
3. Blocked nose	3.3 ± 0.3	1.6 ± 0.5 (0.0223)* 83.3% (10/12)
4. Itchy nose	1.2 ± 0.3	0.6 ± 0.1 (0.0845) 41.7% (5/12)
5. Itchy eyes	1.3 ± 0.3	1.4 ± 0.4 (0.6029) 25.0% (3/12)
6. Watery eyes	0.4 ± 0.2	0.4 ± 0.3 (>0.9999) 16.7% (2/12)
Efficacy rate		75% (9/12)
Congestion of IT	2.4 ± 0.2	0.5 ± 0.2 (0.0041)* 83.3% (10/12)
Amount of discharge	1.1 ± 0.3	0.7 ± 0.2 (0.1597) 41.7% (5/12)

Upper and lower lanes show the symptom scores as mean ± S.E. (*p* values) and the improvement rates (number of patients), respectively. Asterisks indicate significance between before and after OSITS (*n* = 12, **p* < 0.05).

affected among the six domains of JRQLQ II, with improvement found in 66.7% of patients (8/12). The mean preoperative medication score of 0.9 ± 0.3 changed to 1.4 ± 0.6 after OSITS, but this was not significant (*n* = 12, *p* = 0.2142).

POSTOPERATIVE COMPLICATIONS AFTER OSITS

No patients suffered from postoperative pain. In terms of early complications, all patients had nasal obstruction due to fibrin coagulation for at least 7-14 days after OSITS. Significant nasal bleeding, for which a doctor had to be consulted, was found in 1.1% of patients (1/95) (Fig. 1). This patient was a 48-year-old woman with right nasal bleeding from the external side of IT who visited our outcome office by ambulance after consultation for an hour one month af-

ter OSITS (Fig. 1A). Severe infectious nasal vestibulitis, for which intravenous administration of antibiotics was required, was also found in one patient (1.1%) 7 days after OSITS. The late complication of atrophic change of IT was observed in 4.2% (4/95) (Fig. 1B). The age distribution of these four patients was from 21 to 48 years. Four patients underwent OSITS again, after a mean interval of 27 months (12-46 months). The mean age of these patients was 23.8 years (14-49 years), and three of them were teenagers.

DISCUSSION

This study demonstrated that OSITS using radiofrequency electrocautery had beneficial effects in approximately 90% of patients with perennial AR and 75% of those with seasonal AR. Nasal obstruction, sleep problems, and IT congestion were the most strongly affected with regard to the symptoms, QOL, and physical findings, respectively, in both perennial and seasonal AR.

OSITS is intended to reduce interstitial edema causing small nasal airways in submucosal IT tissues and to induce interstitial fibrosis to improve severe nasal symptoms. A significant reduction of IT volume led to the improvement of nasal obstruction. The consequence of better nasal respiration was suggested to be a positive effect on sleep.²⁰ Both afferent and efferent fibers in the submucosa are also thought to be heat-denatured by OSITS. Sneezing and nasal discharge certainly improved, although the levels of efficacy for these variables were not as good as that for nasal obstruction. The data of nasal symptom scores were confirmed by intranasal findings.

Seeger J *et al.* reported the improvement of nasal breathing in 85% at 20 months after radiofrequency-induced thermotherapy.⁴ Nease CJ *et al.* reported that the severity of nasal obstruction improved in 47.5% at 8 weeks after radiofrequency volumetric tissue reduction.⁵ Garzaro M *et al.* reported that Nasal Obstruction Symptom Evaluation test score improved in 100% at 2 months and at 2 years after radiofrequency inferior turbinate reduction.⁷ According to our previous study on outpatient mucosal ITS using argon plasma coagulation, sneezing, nasal discharge, and nasal obstruction improved in 75%, 60%, and 75% of patients with perennial AR in the first postoperative

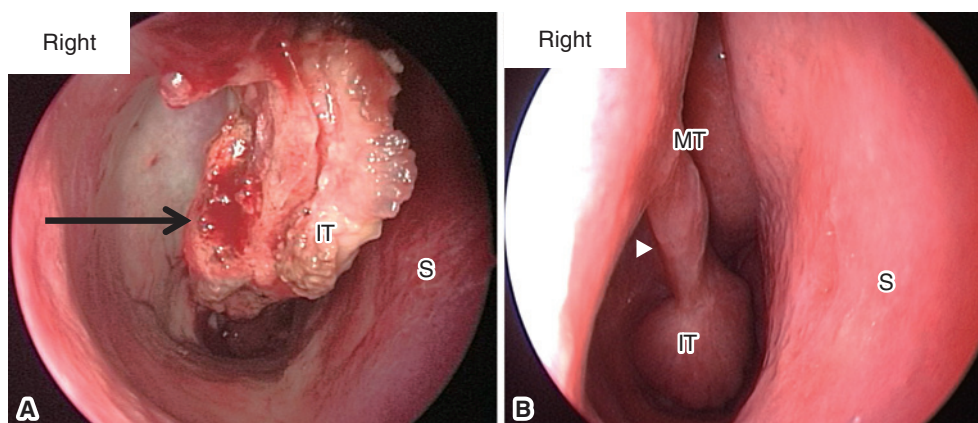


Fig. 1 Complicated changes of IT after OSITS. A 48-year-old woman. IT mucosa was necrotic and the bone was exposed (arrow) the second month after OSITS (A). IT became atrophic (arrowhead) the sixth month after OSITS (B). S, septum; IT, inferior turbinate; MT, middle turbinate.

year ($n = 95$), respectively.¹⁰ In this study, sneezing, nasal discharge, and nasal obstruction improved in 43%, 50%, and 68% in the second period after OSITS using Celon ($n = 44$), respectively. The scores in this study indicated a worse rate of failure than with mucosal ITS. Meanwhile, OSITS caused more improvement of IT congestion in this study (86%) than in mucosal ITS (64%).¹⁰

Considering the patients' QOL, all domains of JRQLQ II significantly improved after OSITS in perennial AR, but not in seasonal AR. Most patients with perennial AR might have felt better than before if their baseline level became only slightly better. In contrast, patients with seasonal AR might hope to become completely asymptomatic after OSITS, even in the presence of pollen.

OSITS using radiofrequency electrocautery, as a form of outpatient surgery, can be performed even for pediatric patients if they can sit quietly without moving during surgery. An eleven-year-old boy was the youngest patient in this study. Patients had no post-operative limitations in daily life. No significant complications of radiofrequency ITS were reported in some previous studies.^{5,7} In this study, however, we experienced nasal bleeding in 1%, as in a previous report (0.7%),²¹ severe nasal vestibulitis in 1%, and IT atrophy in 4%. The nasal vestibulitis was thought to have been caused by a heat-induced change or bacterial infection. Radiofrequency ITS cauterized the submucosal layer of IT, so we could not see the change in the submucosal tissue under direct vision. The IT atrophy was thought to have been caused by too much cauterization. Complication of IT atrophy was seen for the first 13 months only at our department. Two sessions of OSITS were required in 4% because the nasal symptoms, particularly nasal obstruction, remained or relapsed. A tendency for younger patients to show less of an effect was also observed.

We actually performed OSITS on 436 patients with

severe AR in the period focused on in this study. However, we could not follow up all of the patients, despite recommending regular postoperative observation. AR is not a life-threatening disease. As such, there might have been some patients who did not visit us when their symptoms disappeared completely, and/or who visited us only when their symptoms became severer. Therefore, statistically accurate evaluation of the longer-term therapeutic effect was difficult. These might be the reasons why our results were worse than those in previous studies.^{4,10}

Although OSITS is available for severe AR, its combination with surgery requiring hospitalization (such as septoplasty, turbinectomy, and neurotomy) is still required in patients with no beneficial effects after OSITS. Allergy cannot be completely cured by surgical treatments alone. Therefore, an effective therapy that can replace surgery is anticipated.

It is concluded that minimal surgery, namely, OSITS using radiofrequency electrocautery, had a beneficial effect in more than 75% of patients with severe AR. Patients suffering from nasal obstruction, rather than those with sneezing and nasal discharge, were satisfied with the results of OSITS.

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