

**ORIGINAL****Long-term effect of posterior nasal neurectomy for perennial allergic rhinitis**

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**Abstract : Background :** Surgical treatment is recommended for patients with severe allergic rhinitis (AR) refractory to medical treatment. Endoscopic posterior nasal neurectomy (PNN) is primarily performed to improve rhinorrhea in severe perennial AR, however studies on its long-term prognosis are lacking. **Aims/Objectives :** This study aimed to investigate the long-term prognosis of PNN. **Materials and Methods :** A questionnaire survey was administered to 17 patients (12 men and 5 women) at least 1 year after PNN. Nasal symptoms and medications, as well as patient satisfaction with surgery at the time of survey, were scored. Furthermore, scores were compared between patients with postoperative periods of > 5 years and < 5 years. **Results :** Nasal symptoms and medication scores significantly improved after surgery. There was no significant difference between patients with a postoperative period of > 5 years and < 5 years in both preoperative and postoperative nasal symptoms and medication scores. No correlation was found between patient satisfaction with surgery and postoperative period. **Conclusions and Significance :** PNN improved nasal symptoms and medication scores in patients with severe perennial AR. Furthermore, the study results suggest that the long-term effect of PNN for perennial AR lasts for > 5 years. *J. Med. Invest.* 71:62-65, February, 2024

**Keywords :** perennial allergic rhinitis, posterior nasal neurectomy, long-term effect, patient satisfaction

**INTRODUCTION**

Allergic rhinitis (AR) is a type I allergic disease that is characterized by sneezing, watery rhinorrhea, and nasal obstruction. In Japan, the prevalence of perennial AR, mainly due to mite antigens, has increased from 18.7% in 1998 to 23.4% in 2008 and 24.5% in 2019. Furthermore, the overall prevalence of AR increased from 29.8% in 1998 to 39.4% in 2008 and 49.2% in 2019. Currently, one in two Japanese people suffers from AR (1).

Surgical treatments are indicated for patients with AR that is intractable to pharmacotherapy. Posterior nasal neurectomy (PNN) is mainly performed to improve rhinorrhea in patients with perennial AR (2). At our hospital, we perform endoscopic PNN to treat patients with severe perennial AR that is resistant to pharmacotherapy and corrective surgery of the nasal cavity in patients with nasal morphological abnormalities.

As the posterior nasal nerves contain parasympathetic nerve fibres from the vidian nerve and sensory nerve fibres from the second branch of the trigeminal nerve, PNN is effective in reducing rhinorrhea and sneezing (2, 3). In addition, nasal obstruction is likely to be reduced by septoplasty and submucosal inferior turbinectomy. Although PNN was developed in Japan and numerous studies have confirmed its effectiveness, there are few reports on its long-term prognosis (4, 5). In the present study, we conducted a questionnaire survey on patients who underwent surgery at our department to examine the long-term prognosis of PNN.

**PATIENTS AND METHODS**

PNN was performed for severe perennial AR patients refractory to medical treatment. A telephone questionnaire survey was administered to patients who underwent PNN between January 2010 and December 2019 at Tokushima University Hospital. Patients less than 1 year after surgery were excluded. PNN was performed endoscopically under general anaesthesia. PNN procedure has previously described in detail (2). Briefly, a vertical incision at the posterior end of the middle nasal meatus was made. As the mucosal flap was elevated toward posterior, sphenopalatine foramen and neurovascular bundle including sphenopalatine artery and the posterior nasal nerve was identified. In six cases, only the nerves were resected as described by Kikawada *et al.* (2), while in 11 cases, neurovascular bundle including sphenopalatine artery and the posterior nasal nerve was resected as described by Kawamura *et al.* (6). A bipolar or ultrasonically activated scalpel was used for the resection. Septoplasty and submucosal inferior turbinectomy were performed in 15 patients who complained of nasal obstruction due to morphological nasal abnormalities. We asked the patients about their nasal symptoms over the phone. In detail, rhinorrhea, sneezing, and nasal obstruction over the past week were scored on a scale of 0–4, according to the 2020 Practical Guideline for the Management of Allergic Rhinitis in Japan (1). Furthermore, the total score of the three nasal symptoms was calculated as total nasal symptom score (TNSS) (7). Medications were scored based on their content and frequency of use as indicated in the 2020 Practical Guideline for the Management of Allergic Rhinitis in Japan (1). In brief, the standard daily dosage was scored as 1 for antihistamines, 2 for intranasal corticosteroid spray, and 1 for leukotriene receptor antagonists. Overall nasal symptoms were scored on a scale of 0 indicating asymptomatic and 100 indicating the most severe condition. Patient satisfaction with the surgery was scored at the time of survey on a scale of 0 to

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100, with “not satisfied at all” as 0 and “most satisfied” as 100. To examine relapse of nasal symptoms over a long period after surgery, a comparison was made between patients with postoperative periods of >5 years and <5 years.

Statistical analysis was performed using Wilcoxon’s rank-sum test to compare the preoperative and postoperative symptom scores. A t-test was used to compare symptom scores between the preoperative period, postoperative period of <5 years and postoperative period >5 years. The correlation between patient satisfaction with surgery and postoperative period was assessed using Spearman’s rank correlation coefficient.

A p value of <0.05 was considered statistically significant.

RESULTS

PNN was performed on 31 patients (23 men and 8 women, mean age was 32.1±15.3). Seventeen patients (12 men and 5 women) who responded to the telephone questionnaire survey were included in this study. No patients refused to answer the questionnaire, but 14 patients could not be contacted due to

reasons such as relocation. The mean age of 17 patients at the time of surgery was 31.5±18.1 (16–68) years, and the mean period from surgery to the survey was 62.1±39.5 (1–126) months.

The 17 patients who underwent PNN showed significantly improved rhinorrhea, sneezing, nasal obstruction scores, TNSS, medication scores, and overall nasal symptoms after surgery compared to before surgery (3.5±1.0 vs 1.5±1.5, 1.8±1.6 vs 0.5±1.0, 2.9±1.5 vs 0.6±0.9, 8.2±2.7 vs 2.6±2.7, 1.6±1.4 vs 0.4±0.7, and 80.0±17.0 vs 23.5±25.7, respectively) (Table 1). There was no significant difference between patients with a postoperative period of <5 years (n=8) and those with >5 years (n=9) in both preoperative and postoperative rhinorrhea, sneezing, nasal obstruction scores, TNSS, medication scores, and overall nasal symptom scores, but not sneezing, significantly improved compared to preoperative scores (Figure 2). No correlation was found between patient satisfaction with surgery and postoperative period (r = 0.0016, p = 0.88) (Figure 3).

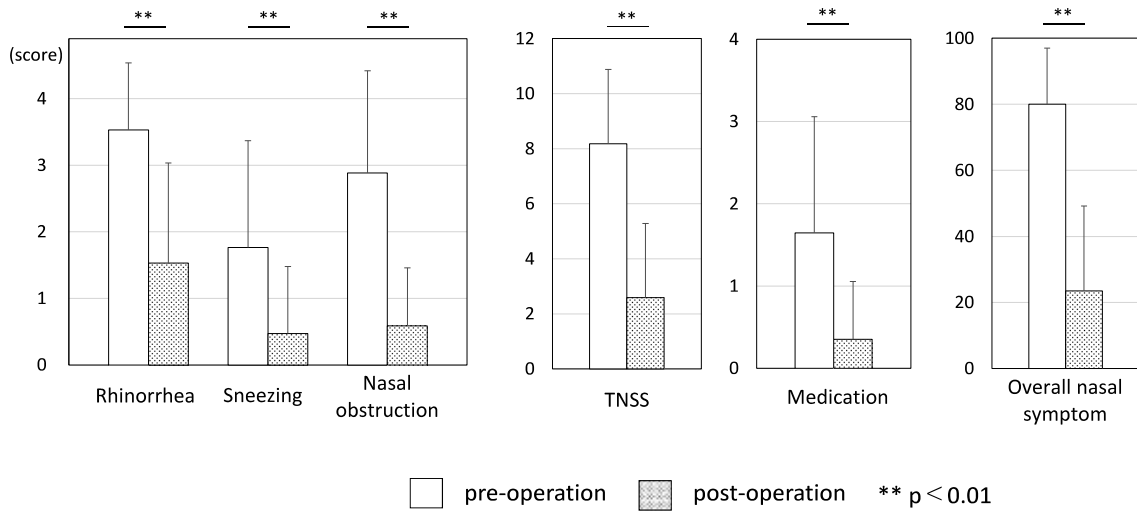


Figure 1. Changes in preoperative and postoperative rhinorrhea, sneezing, nasal obstruction, total nasal symptom, medication, and overall nasal symptom scores. All scores significantly improved after surgery compared with those before surgery (\*\*p<0.01).

Table 1. Patient characteristics and preoperative and postoperative scores of rhinorrhea, sneezing, nasal obstruction, TNSS, medication, overall nasal symptom and patient satisfaction.

	Total		within 5 year		more than 5 year	
	pre-ope	post-ope	pre-ope	post-ope	pre-ope	post-ope
Number of patients (male : female)	17 (12 : 5)		8 (4 : 4)		9 (8 : 1)	
Age	31.5 ± 18.1		31.6 ± 15.7		31.4 ± 20.9	
post-operative month	62.1 ± 39.5		30.3 ± 16.6		98.0 ± 22.0	
Scores	pre-ope	post-ope	pre-ope	post-ope	pre-ope	post-ope
Rhinorrhea	3.5 ± 1.0	1.5 ± 1.5	3.5 ± 1.1	1.0 ± 1.4	3.6 ± 1.0	2.0 ± 1.5
Sneezing	1.8 ± 1.6	0.5 ± 1.0	2.0 ± 1.7	0.3 ± 0.5	1.6 ± 1.6	0.7 ± 1.3
Nasal obstruction	2.9 ± 1.5	0.6 ± 0.9	2.9 ± 1.4	0.5 ± 1.0	2.9 ± 1.8	0.7 ± 0.9
TNSS	8.2 ± 2.7	2.6 ± 2.7	8.4 ± 2.8	1.8 ± 2.0	8.0 ± 2.8	3.3 ± 3.1
Medication	1.6 ± 1.4	0.4 ± 0.7	1.0 ± 1.3	0.3 ± 0.7	2.2 ± 1.3	0.4 ± 0.7
Overall nasal symptom	80.0 ± 17.0	23.5 ± 25.7	82.5 ± 17.5	16.3 ± 22.0	77.8 ± 17.2	30.0 ± 28.3
Patient satisfaction		84.7 ± 16.6		85.0 ± 18.5		84.4 ± 15.9

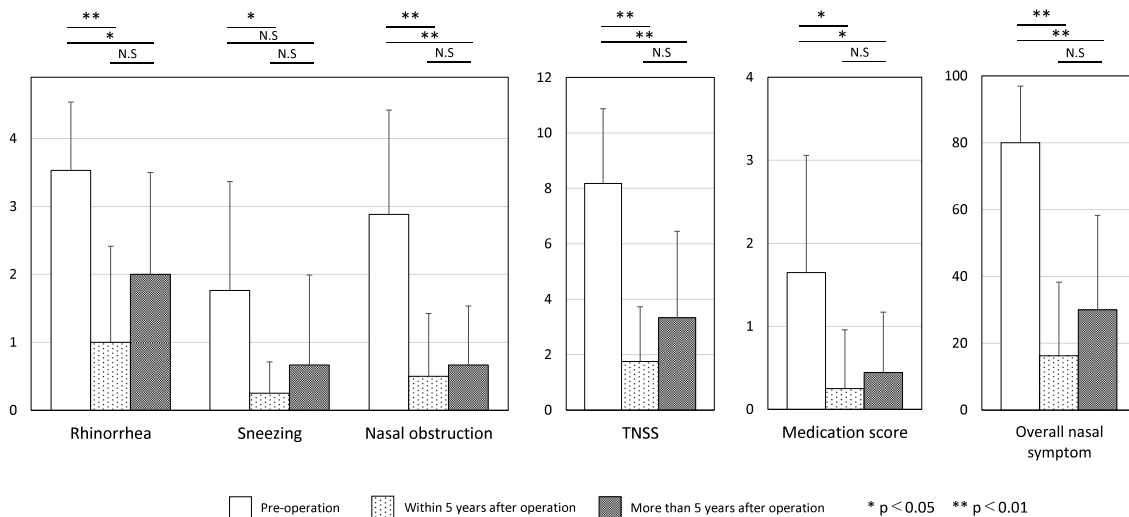


Figure 2. Changes in preoperative and postoperative scores in patients with a postoperative period of < 5 years and those with > 5 years. Postoperative rhinorrhea, nasal obstruction, total nasal symptom, medication, and overall nasal symptom scores, but not sneezing, significantly improved in patients with a postoperative period of both < 5 years and > 5 years (\*p < 0.05, \*\*p < 0.01).

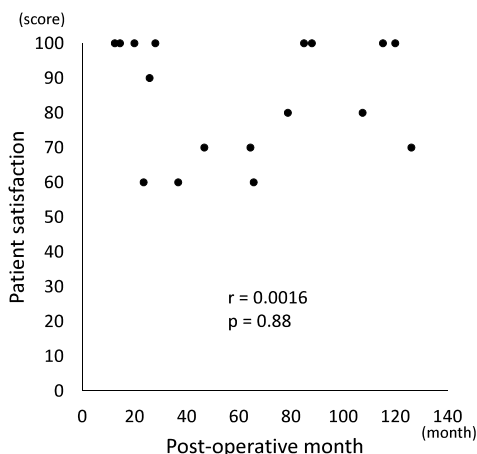


Figure 3. Correlation between patient satisfaction and postoperative month. No correlation was found between patient satisfaction with surgery and postoperative period (r = 0.0016, p = 0.88).

DISCUSSION

Postoperative rhinorrhea, sneezing, nasal obstruction scores, TNSS, medication scores, and overall nasal symptoms significantly improved in patients with severe perennial AR who underwent PNN compared with the preoperative scores. PNN was first performed by Kikawada *et al.* (2) by cutting parasympathetic nerve fibres and sensory nerve fibres derived from the vidian nerve and the second branch of the trigeminal nerve, respectively, and it has been suggested to be effective in alleviating rhinorrhea and sneezing symptoms (2, 3, 8). However, PNN has limited effect on nasal obstruction (9). Therefore, PNN with submucosal turbinectomy is indicated for patients with severe perennial AR and nasal obstruction (4, 5, 10). Submucosal inferior turbinectomy improves nasal ventilation by removing the inferior turbinate bone and is expected to effectively treat nasal obstruction (11). Moreover, submucosal inferior turbinectomy is expected to improve not only nasal obstruction but also rhinorrhea and

sneezing by reducing blood vessels and secretory glands due to fibrosis of the inferior turbinate mucosa under the basement membrane, in addition to reducing the volume of the inferior turbinate (11, 12). In this study, submucosal inferior turbinectomy was performed in 15 of the 17 patients, and it was suggested that the effect of PNN on nasal symptoms and medication scores was influenced by the suppressive effect of submucosal inferior turbinectomy, which is a limitation of this study.

In the present study, a survey was conducted over a long-term postoperative period of approximately 5 years, and nasal symptoms, medication scores, and overall nasal symptom scores remained significantly improved compared to preoperative conditions. Many studies have reported the effectiveness of PNN; however, few have examined its long-term prognosis (4, 5). This may be because PNN is less likely to form crusts in the nasal cavity than sinus surgery; the procedure quickly improves nasal symptoms, without the necessity of long-term hospital visits after surgery. Furthermore, because patients who

are indicated for PNN are relatively young, facilities frequently have difficulty tracking and evaluating their long-term course owing to changes in life, such as proceeding to higher education and relocation. In this study, the average age of the patients was 31.5 years, and 14 of the 31 patients who underwent this surgery could not be contacted because of relocation. The response rate was 54.8%, and the possibility of non-response bias cannot be denied. In the past reports, complete remission of symptoms and marked improvement 2 years after surgery have been reported in 90% of cases (10). While, other report indicated that sneezing and rhinorrhea after 6 years reverted to the preoperative conditions, which may be due to the regeneration of the posterior nasal nerve (4). In the present study, no significant difference was found between patients with a postoperative period of <5 years and those with >5 years in terms of postoperative scores of nasal symptoms and overall nasal symptoms, and there were no findings indicating recurrence due to nerve regeneration. Since nerve regeneration after PNN has been showed in a rat model (13), we put a small cartilage graft at cut end of the nerve to prevent nerve regeneration in some patients. However, the preventive effect of nerve regeneration has not been proven in humans, future studies are expected. Postoperative sneezing score was not significantly different from the preoperative sneezing score in patients with a postoperative period of >5 years. A similar trend has been reported by other studies, which suggested that because the preoperative sneezing score was lower than rhinorrhea and nasal obstruction scores and the number of patients was small, establishing a significant difference may be challenging (5). In our study, rhinorrhea score before the surgery was  $3.5 \pm 1.0$  and nasal obstruction score was  $2.9 \pm 1.5$ , but the sneezing score was  $1.8 \pm 1.6$  in all cases, which is significantly lower than the rhinorrhea and nasal obstruction scores. These findings suggest that although improvement in the sneezing score was modest >5 years after surgery, improvement in nasal symptoms after PNN continued for a long period.

In the present study, medication score was  $1.6 \pm 1.4$  before surgery and  $0.4 \pm 0.7$  after surgery. In addition, there was no significant difference in medication scores between patients with a postoperative period of <5 years ( $0.3 \pm 0.7$ ) and those with >5 years ( $0.4 \pm 0.7$ ). Considering that the medication score of 1 point corresponds to the regular used of antihistamine, patients were no longer required to use antihistamines regularly after PNN. These findings suggest that PNN reduced the need for continuous medication for perennial AR and that the effect lasted for >5 years. This outcome is also favourable from a healthcare economic viewpoint. Furthermore, the level of patient satisfaction with surgery did not decrease, even in patients with a long postoperative period, demonstrating that patient satisfaction with PNN remained high for a long period.

## CONCLUSION

PNN improved rhinorrhea, sneezing, nasal obstruction, and overall nasal symptoms in patients with severe perennial AR, eliminating the need for continuous medication after PNN. There was no significant difference between patients with a postoperative period of <5 years and those with >5 years in terms of nasal symptoms, medication scores, and patient satisfaction, suggesting that the long-term effect of PNN for perennial AR lasted for >5 years.

## DECLARATION OF INTEREST

The authors declare no conflict of interest.

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