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ARTICLE



Efficacy of posterior nasal neurectomy for allergic rhinitis combined with chronic rhinosinusitis with nasal polyps

Song Li^a, Jinzhang Cheng^a, Jingpu Yang^a, Yin Zhao^{a,b}, Zhiling Zhu^a, Chang Zhao^a and Zonggui Wang^a

^aDepartment of Otorhinolaryngology-Head and Neck Surgery, Second Hospital of Jilin University, Changchun, Jilin, China; ^bAdelaide ENT Surgery, The University of Adelaide, Adelaide, SA, Australia

ABSTRACT

Background: Allergic rhinitis combined with chronic rhinosinusitis with nasal polyps (ARwCRSwNP) is very common clinically. Conventionally, the treatment for these patients is surgical method for CRSwNP followed by treatment with a nasal steroid spray or other antiallergic drugs to control AR. In recent years, some rhinologists introduced vidian neurectomy (VN) or posterior nasal neurectomy (PNN) into endoscopy to treat refractory AR and reported an encouraging outcome. Furthermore, we explore the control of recurrence of nasal polyps and improvement in symptoms after endoscopic PNN for the treatment of ARwCRSwNP.

Objective: To investigate the control of recurrence of nasal polyps and improvement in symptoms after endoscopic PNN for the treatment of ARwCRSwNP.

Methods: Eighty-five patients with ARwCRSwNP who were admitted to our hospital from November 2016 to July 2018 were enrolled in two groups. Group A underwent conventional functional endoscopic sinusitis surgery (FESS) combined with PNN; group B underwent conventional FESS alone. VAS, RQLQ, SNOT-22 and postoperative nasal endoscopy were used to evaluate the improvement in symptoms and the recurrence of nasal polyps.

Results: The experimental group had better control of sneezing ($p < .05$) and rhinorrhea ($p < .01$) than the control group. For those who underwent surgery more than 6 months prior in both groups, the recurrence rate was 29.6% (8/27) in the experimental group and 44.4% (8/18) in the control group, and there was no significant difference ($\chi^2 = .483, p = .487$).

Conclusion: FESS combined with PNN can improve the symptoms of sneezing and rhinorrhea caused by ARwCRSwNP more obviously than FESS alone, but there is no clear statistical advantage of this procedure for improving the overall symptoms and controlling the recurrence of nasal polyps.

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Allergic rhinitis; nasal polyps; recurrence; sneezing; rhinorrhea

Introduction

Allergic rhinitis (AR) is a noninfectious chronic inflammatory disease of the nasal mucosa mediated by IgE after exposure to allergens. CRSwNP is mainly treated by surgery, but the recurrence rate is high, especially in patients with AR. Traditionally, the treatment for patients with AR combined with CRSwNP (ARwCRSwNP) was surgical method followed by treatment with a nasal steroid spray or other antiallergic drugs to control AR. In recent years, some rhinologists introduced VN or PNN into endoscopy to treat refractory AR; and reported an encouraging outcome [1–3]. To explore whether patients with ARwCRSwNP can benefit from PNN (such as reducing the postoperative recurrence rate of nasal polyps, more obvious improvement in postoperative symptoms), we considered the simultaneous implementation of PNN during the course of functional endoscopic sinusitis surgery (FESS).

We collected relevant clinical data to clarify the above problems and reported our findings. This study was approved by the Institutional Ethics Committee of the Second Hospital of Jilin University, Changchun, Jilin, China.

Patients and methods

Patient information

Eighty-five patients with ARwCRSwNP older than 18 years old, who were admitted to the Department of Otorhinolaryngology Head and Neck Surgery at the Second Hospital of Jilin University from October 2016 to July 2018, were enrolled. The diagnostic criteria for AR referred to the Chinese Guidelines for Diagnosis and Treatment of Allergic Rhinitis [4]. It is mainly based on symptoms, signs and allergen detection. Patient's symptoms include itching of nose and eye, sneezing, watery rhinorrhea, nasal congestion. The symptoms of sneezing and watery rhinorrhea are most important. Signs include pale and edematous mucosa, watery secretions in the nasal cavity. Allergen-specific IgE antibody detection kit from the Mediawiss Analytic GmbH Company was used to perform the diagnostic test for allergy. All patients underwent allergen skin test, based on symptoms on exposure to the relevant allergen. The critical value of the serum-specific IgE level is 0.35 kU/L. The test was defined as positive if the test result is greater than or

equal to this value, indicating that the body is sensitized [5]. CRSwNP was diagnosed according to the Guidelines for the Diagnosis and Treatment of Chronic Rhinosinusitis (2012, Kunming) [6]. All patients enrolled had a disease history of more than 3 months, and their response to medical treatment was poor. Nasal symptoms significantly affected patients' daily lives. The preoperative visual analog scale (VAS) score was no less than 6 points, and all patients underwent surgery performed by the same surgeon. Preoperatively, patients routinely answered the Rhinoconjunctivitis Quality of Life Questionnaire (RQLQ), VAS and 22-item Sino-Nasal Outcomes Test (SNOT-22). A total of 85 patients were divided into two groups. The attending physician explained the advantages and disadvantages of the two surgical methods to each selected patient in detail, and each patient decided which group to enter (the patient's right of informed consent made it impossible to perform randomized grouping). Group A (experimental group) underwent conventional FESS combined with PNN, and group B (control group) underwent conventional FESS alone. Fifty-nine patients were included in group A, and 26 patients were included in group B. At the end of the follow-up in October 2018, there were 70 patients with complete data. There were 48 patients in group A (28 males, 20 females) and 22 patients in group B (16 males and 6 females), and 15 patients (17.6%) were lost in the two groups. The patients' basic information is shown in Table 1. There were no significant differences in gender, age, course

of disease, or preoperative VAS, RQLQ or SNOT-22 scores between the two groups ($P > .05$).

Treatment

Operative methods

PNN. Radiofrequency ablation instruments were used to complete coagulation around the posterior end of middle turbinate attachment to reduce bleeding during the following operation. The mucosa was ablated to the bone surface along the long axis of the middle turbinate at a slight anterior position, and then the mucosa was ablated and peeled to the tail end of the middle turbinate to expose the sphenopalatine foramen. In some cases, if the tail end of the middle turbinate significantly occluded the operative field of vision, the tail end of the middle turbinate was removed for better exposure. The neurovascular bundle penetrating the sphenopalatine foramen was exposed and fully coagulated, and then the sphenopalatine foramen was contoured (Figure 1). During the process of contouring, careful attention is needed during the incision of the superior turbinate branch because this branch is often present in the bone suture between the ethmoidal crest and the lateral wall of the nasal cavity. Needle electrodes could be used to assist when the incision was made. The sphenopalatine foramen and the incised end of the neurovascular bundle were re-coagulated to ensure hemostasis.

FESS. The polyps were removed from the nasal passages with polyp forceps and submitted for pathological analysis. A suction device was used to remove the residual polyps in the nasal cavity and the uncinate process. The maxillary sinus, ethmoid sinus, frontal sinus and sphenoid sinus were opened separately according to each specific patient's condition, and the contents were also removed. Septal plasty and turbinatoplasty (depending on the specific condition of each patient): Septal plasty was achieved with conventional three-line reduction to remove deflected bone and cartilage tissue. Turbinatoplasty: The mucosa of the inferior turbinate was incised longitudinally along the long axis of the inferior

Table 1. Characteristics of patients in each group.

	Group A	Group B	<i>p</i> -value
Number of patients	48	22	
Sex (male:female)	28:20	16:6	0.247 ($\chi^2 = 1.339$)
Age (years)	45.3 $\pm$ 11.8	47.8 $\pm$ 12.2	0.409 ($T = 0.831$)
Course of disease (years)	7.30 $\pm$ 7.11	5.42 $\pm$ 5.59	0.279 ($T = 1.090$)
Preoperative score			
VAS	8.19 $\pm$ 1.33	7.77 $\pm$ 1.34	0.232 ($T = 1.207$)
RQLQ	3.19 $\pm$ 1.09	2.68 $\pm$ 0.94	0.061 ($T = 1.903$)
SNOT-22	2.47 $\pm$ 0.87	2.25 $\pm$ 0.83	0.358 ($T = 0.925$)

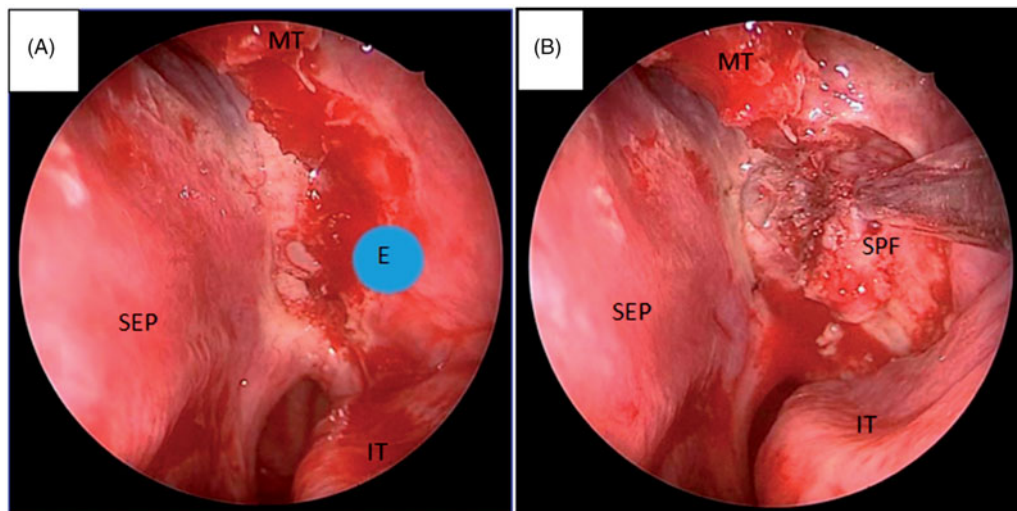


Figure 1. (A) Exposure of surgical area. (B) Sphenopalatine foramen contouring. SEP, septum; IT, inferior turbinate; MT, middle turbinate; SPF, sphenopalatine foramen; E, estimated location of sphenopalatine foramen.

turbinate. After the mucosa and inferior turbinate bone were dissected, the inferior turbinate bone was resected, and the mucosa of the incision margin was sutured.

All patients were treated with a nasal steroid spray and daily nasal irrigation for 1–3 months after surgery, depending on the condition of the nasal mucosa and severity of symptoms.

Follow-up. Patients were followed-up at 2 weeks, 1 month, 3 months, 6 months and 1 year postoperatively and then every 6 months. In patients with poor nasal mucosa, such as obvious edema and vesicle formation, patients were followed-up monthly or every other month. Follow-up statistics of these surgical patients were recorded, and regular telephone contact was made. Nasal endoscopy is the main reason for patients to come to the hospital for follow-up, and the patients were required to complete the VAS, RQLQ, and SNOT-22 again. Nasal endoscopy was performed by an associate professor-level physician in an endoscopy room (the physician performing the endoscopy was unaware of the preoperative group of the patient).

Efficacy evaluation

The RQLQ, VAS and SNOT-22 were used in our study to evaluate the quality of life of patients before and after surgery. The RQLQ includes seven aspects including nasal symptoms, eye symptoms, nonnasal symptoms, movement limitations, sleep disorders, practical difficulties and affective disorders, with 28 items scored from 0 to 6 for each item. The VAS requires patients to indicate the severity of the overall nasal symptoms on a 10-point scale, with 0 indicating no symptoms and 10 indicating the most serious symptoms. The higher the score, the more severe the symptoms are. The SNOT-22 contains 22 items, which are classified into two dimensions: physiological problems (items 1–12) and health-related quality of life (items 13–22). Each item is divided into six grades of 0–5: the higher the score is, the worse the symptoms are. The recurrence rate of nasal polyps is compared between the two groups, criteria for determining recurrence of nasal polyps: Extensive edema of nasal mucosa accompanied by local polypoid formation, which is confirmed after removal with polyp forceps, are seen under endoscopy. Because the recurrence in the first half year is rare and has little significance, we only count the cases 6 months after the operation.

Statistical analysis

SPSS20.0 was used for statistical analysis. All the above scales were scored and classified as measurement data. Before performing statistical analysis of the results, a normal distribution test of each score was carried out (SPSS20.0 P–P chart method). When the normal distribution was satisfied, the independent sample *t*-test was used to examine the results of the experimental group and the control group. The matched sample *t*-test was used to compare the preoperative and postoperative efficacy within the same group. The Mann–Whitney *U* test was used for nonnormally

distributed data. The recurrence rate of nasal polyps was counted; thus, the chi-squared test was used for statistical analysis. Differences were considered significant when the *p*-value was $<.05$.

Results

The characteristics of the patients in each group are shown in Table 1. There were no significant differences in gender, age, duration of disease, preoperative VAS score, RQLQ score, or SNOT-22 score between the two groups ($p > .05$, Table 1).

The overall relief of postoperative symptoms in the experimental group was compared with that in the control group. Statistical results are shown in Table 2. There were no significant differences in the VAS score, RQLQ score or SNOT-22 score between the two groups at all stages after surgery ($p > .05$), and symptoms were alleviated in both groups postoperatively compared with preoperatively ($p < .01$).

The sneezing, rhinorrhea, nasal obstruction and hyposmia scores were screened from the RQLQ and SNOT-22 scales. Statistical analysis of the two groups showed that the above symptoms were significantly relieved after surgery in both groups ($p < .01$), and there was no significant difference in the scores of the above symptoms before surgery between the two groups. The control of sneezing and rhinorrhea was better in the experimental group, especially for rhinorrhea ($p < .01$), but there were no significant differences in nasal obstruction and hyposmia between the two groups ($p > .05$), as shown in Table 3.

Table 2. Nasal symptom scores before and after operations.

	Preoperative score	≤6 moths	7–17 months	≥18 months
VAS				
Group A	8.19 ± 1.33	3.00 ± 1.97	3.37 ± 2.22	3.93 ± 3.20
Group B	7.77 ± 1.34	2.36 ± 2.04	2.67 ± 2.25	3.10 ± 2.23
<i>T</i> -value	1.207	1.242	1.036	0.704
<i>p</i> -value	0.232	0.218	0.306	0.489
RQLQ				
Group A	3.19 ± 1.09	1.17 ± 0.80	1.20 ± 0.84	1.50 ± 1.11
Group B	2.68 ± 0.94	1.11 ± 0.73	1.04 ± 0.59	1.25 ± 0.90
<i>T</i> -value	1.903	0.309	0.691	0.591
<i>p</i> -value	0.061	0.758	0.494	0.561
SNOT-22				
Group A	2.47 ± 0.87	0.82 ± 0.73	0.86 ± 0.68	1.13 ± 0.90
Group B	2.25 ± 0.83	0.86 ± 0.67	0.85 ± 0.66	1.06 ± 0.96
<i>T</i> -value	0.925	0.190	0.059	0.177
<i>p</i> -value	0.358	0.850	0.953	0.861

Table 3. Comparison of sneezing, rhinorrhea, nasal obstruction and hyposmia symptoms between two groups before and after operation.

	Sneezing	Rhinorrhea	Nasal obstruction	Hyposmia
Preoperation				
Group A	4.19 ± 1.45	4.40 ± 1.48	4.81 ± 1.25	4.04 ± 1.41
Group B	3.77 ± 1.54	4.22 ± 1.34	4.54 ± 1.22	3.86 ± 1.46
<i>T</i> -value	1.088	0.454	0.836	0.485
<i>p</i> -value	0.281	0.651	0.406	0.630
End point of follow-up				
Group A	1.75 ± 1.45	1.35 ± 1.30	1.60 ± 1.40	2.13 ± 1.75
Group B	2.50 ± 1.10	2.59 ± 1.14	1.86 ± 1.61	2.41 ± 1.18
<i>T</i> -value	2.153	3.842	0.688	0.693
<i>p</i> -value	0.035	$p < 0.01$	0.494	0.491

For patients who underwent surgery more than 6 months prior, the recurrence rates were 29.6% (8/27) and 44.4% (8/18) in the experimental and control groups, respectively, and there was no significant difference between the two groups ($\chi^2 = .483$, $p = .487$).

Complication. There were no obvious dry eye symptoms after surgery in either group. Two female patients in the experimental group reported fewer tears in one eye when they were sad or cried after surgery compared with pre-operatively. The ratio of upper lip/palate numbness in the experimental group and the control group was 16.7% (8/48) and 9.1% (2/22), respectively, and all of these patients improved within 3 months after surgery without special treatment. One patient in the experimental group had unilateral nasal hemorrhage after surgery and required hemostasis in the disposal room. No orbital or cranial nerve injury or other serious complications occurred in either group.

Discussion

Recurrence of CRSwNP after FESS is a major problem that plagues the rhinologist. Although traditional snare polypectomies can improve the symptoms of nasal congestion and rhinorrhea, the long-term recurrence rate is still as high as 75% [7]. The introduction of endoscopic techniques in recent years has made intraoperative treatment more direct and effective, and the recurrence of nasal polyps has been accordingly reduced to some extent. However, the recurrence rate reported in the literature is still not as good as expected. Wynn and Har-El reported a 60% recurrence rate after endoscopic sinus surgery in 118 patients with severe nasal polyposis during a 12- to 168-month follow-up period [8]. Tosun's research showed an average recurrence rate of 53.4% [9]. Albu-S reported a study of 227 samples of nasal polyps with a recurrence rate of 24%, and nonsteroidal anti-inflammatory drug (NSAID) intolerance, asthma, revision surgery and polyp extension were considered to be associated with recidivism [10]. For ARwCRSwNP, the recurrence rate of nasal polyps is higher than CRSwNP. We found that the persistent edema of nasal mucosa and polypoid degeneration were much more common postoperatively in these patients of ARwCRSwNP as compared with CRSwNP. It is possible that allergens not directly invade the epithelium of nasal sinus mucosa because of the barrier function of mucosa. However, in patients undergoing FESS, the barrier function is damaged; thus, allergens are more likely to invade leading to gland secretions and edema. Some rhinologists reported that vidian neurectomy (VN) or posterior nasal neurectomy (PNN) using endoscopy to treat refractory AR is associated with an improved outcome [1–3].

The mechanism of this surgery is to destroy the vidian nerve and block most of the parasympathetic innervation of the nasal mucosa so that the responses of nasal submucosal vessels and glands to external stimuli are reduced, which results in reduced gland secretions and inhibited submucosal vessels dilation, ultimately leading to relieve the symptoms of AR. The mechanism of nasal polyposis is not fully

understood, but is related to long-term inflammation of the nasal cavity, persistent edema of the nasal mucosa and polypoid degeneration. Before the study began, we hypothesized that when most of the parasympathetic innervation to the nasal cavity is lost after the vidian nerve is excised, vasodilation, exudation and gland secretions of the nasal mucosa would be reduced; thus, the mucosa of the nasal cavity would be in a relatively “dry” state, and mucosal edema could be alleviated. Theoretically, we thought before this research, it is possible to partially alter the nasal mucosal state and reduce the recurrence rate of nasal polyps. However, the result shows that the recurrence rate of nasal polyps is 29.6% in the experimental group and 44.4% in the control group, indicating no significant difference between the two groups. It maybe possibly due to the dominance of local inflammation, which is not able to be alleviated by PNN, in the recurrence of nasal polyps.

In the course of post-operative statistics, we found there is an interesting phenomenon: for these pathologically reported local eosinophilic infiltration cases, including 35 cases in the experimental group and 16 cases in the control group, the recurrence rates of polyps are 17.1% (6/35) and 43.8% (7/16), respectively. Pearson chi-squared test showed significant difference between the two groups ($\chi^2 = 4.093$, $p = .043$). This may not be the final result, but it could be considered as a new research direction in the future to investigate whether PNN reduces the recurrence rate of nasal polyps with local eosinophilic infiltration?

These results suggest that the occurrence and recurrence of nasal polyps are the result of multiple factors. Although the overall symptoms of patients in the two groups are obviously relieved after surgery, there is no significant difference between them. Furthermore, the improvement in nasal obstruction and olfaction in the experimental group show no statistical difference compared with those in the control group, except that sneezing and rhinorrhea symptoms are more relieved in patients in the experimental group than in patients in the control group ($p < .05$).

Conclusion

FESS combined with PNN for the treatment of ARwCRSwNP can significantly improve the symptoms of sneezing and rhinorrhea after surgery compared with FESS alone; however, there is no significant difference between the two groups in the improvement of overall symptoms after surgery or the control of recurrence of nasal polyps. Whether or not the PNN should be performed during FESS should depend on the degree of interference of sneezing and rhinorrhea discharge to the patient's daily life, and adequate communication before surgery is necessary. However, the conclusions should be further clarified in a study with a larger sample size and a longer follow-up time.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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