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• Article •

Preliminary study on radiofrequency thermocoagulation of the posterior inferior nerve, anterior ethmoidal nerve, and inferior turbinate under nasal endoscopy for the treatment of perennial allergic rhinitis *

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Abstract: Objective To study a new method for improving the treatment of perennial allergic rhinitis (PAR). **Method** Eighty patients with perennial allergic rhinitis were randomly divided into two groups. The observation group included 40 patients who received radiofrequency thermocoagulation of the posterior inferior nerve, anterior ethmoidal nerve, and inferior turbinate under nasal endoscopy; the control group included 40 patients who received radiofrequency thermocoagulation of the sphenopalatine nerve under nasal endoscopy. The mid-term efficacy between the two groups was compared. **Results** The patients were followed up with for half a year, and the total effective rate in the observation group was 100% (36 patients achieved significant efficacy), while the control group achieved 67.5% (10 patients achieved significant efficacy). The total effective rate between the two groups showed significant differences ($P< 0.01$) according to the x^2 test. There were no complications in the observation group, while there were 3 cases of intraoperative bleeding in the control group. **Conclusion** Radiofrequency thermocoagulation of the posterior inferior nerve, anterior ethmoidal nerve, and inferior turbinate under nasal endoscopy for the treatment of PAR has advantages such as significant therapeutic effects, simple operation, and no side effects, with high clinical application values.

Keywords: Perennial allergic rhinitis; Posterior inferior nasal nerve; Sphenopalatine nerve; Anterior ethmoidal nerve; Radiofrequency
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Radiofrequency treatment of nasal posterior-under nerve, ethmoidal nerve and infraturbinal for perennial allergic rhinitis under nasal endoscope *

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Abstract:[Objective] To study a new method for perennial allergic rhinitis (PAR). **[Methods]** 80 cases of PAR randomly divided into 2 groups receive: observation group 40 cases treated with nasal posterior-under nerve, ethmoidal nerve and infraturbinal radiofrequency under nasal endoscope; control group 40 cases treated with sphenopalatine nerves radiofrequency under nasal endoscope. **[Results]** All the cases were follow-up half year postoperatively. The total effective rate was 100% in observation group (excellent 90%) and 67.5% in control group (excellent 25%). There was significant difference ($P< 0.01$) between the group in efficacy. The complication was not observed in observation group and massive intraoperation hemorrhage ($n = 3$) was observed in control group. **[Conclusions]** The method that is treating PAR with nasal posterior-under nerve, ethmoidal nerve and infraturbinal radiofrequency under nasal endoscope is highly effective, easy to perform and few complications, so it is a good way to treat PAR.

Key words:perennial allergic rhinitis; nasal posterior-under nerve; sphenopalatine nerve; ethmoidal nerve; radiofrequency

Abnormal increase in excitability of the nasal parasympathetic nerve plays an important role in the pathogenesis of perennial allergic rhinitis (PAR). In the past, pterygoid canal neurotomy was used to treat PAR. Although the long-term effective rate could reach76.0%[1] due to severe trauma and the possibility of postoperative complications such as dry eyes, its use was limited to some extent. In view of this, we made improvements to this surgery. From September 2002 to March 2003, 40 patients with PAR (observation group) were treated with radiofrequency

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NEURENT 1044

thermocoagulation of the posterior inferior nasal nerve, anterior ethmoidal nerve, and inferior turbinate under nasal endoscopy, and comparison was made with another group (control group) of 40 patients with PAR treated with only radiofrequency thermocoagulation of the sphenopalatine nerve under nasal endoscopy in order to study the new method to improve the therapeutic effect of PAR. After six months of follow-up, the therapeutic effect was significant. Now, a report is given as follows:

1 Data and Methods

1.1 General data

According to the revised "Diagnostic Criteria and Efficacy Evaluation Criteria for Allergic Rhinitis"[2] at the 1997 Haikou Conference, there were 80 patients with PAR, including 37 males and 43 females. They were randomly divided into two groups: the observation group having 40 patients, including 18 males and 22 females, aged at 16-60 years old, with a disease course of 1-20a and a symptom grading score of (8.27 ± 1.73) points, and the control group having 40 patients, including 19 males and 21 females, aged at 16-60 years old, with a disease course of 1-18a and a symptom grading score of (8.35 ± 1.65) points. The gender of the patients in the two groups was tested using x^2, and there was no significant difference in age and course of disease by the *t* test ($P > 0.05$), showing that there was comparability.

1.2 Methods

Observation group: The patients were put in the supine position and subjected to nasal surface anesthesia using 2% tetracaine adrenaline cotton pads under direct nasal endoscopy, and 5 mL of 1% lidocaine added with 1 drop of 1‰ adrenaline was used for mucosal infiltration anesthesia around the posterior middle turbinate and the sphenopalatine foramen. Then, the probe of the KD 618 radiofrequency ionization comprehensive therapy instrument, which had been adjusted to Level 3, was directly contacted with the route and distribution area of the posterior inferior nasal nerve and the anterior ethmoidal nerve. The treatment for the former involved placing the probe on the lateral wall of the nasal cavity between the posterior end of the middle and inferior turbinate, making a strip-shaped thermocoagulation from the top to the bottom with a length of about 2.5 cm, a width of 0.5 cm, and a depth up to the bone wall; the treatment for the latter involved thermocoagulation using the probe on the nasal ridge and the corresponding anterior upper mucosa of the nasal septum with a range of approximately 1.2 cm², allowing the local tissues to coagulate for 3 seconds, except for 2 seconds for the nasal septum. Repeated thermocoagulation was allowed, with the local mucosa appearing as white patches. Spot-like thermocoagulation was also performed on the anterior and medial mucosa of the inferior turbinate.

Control group: The anesthesia method and power selection were the same as those for the observation group. Under nasal endoscopy, the radiofrequency probe was placed at the posterior upper sphenopalatine nerve foramen above the middle turbinate for thermocoagulation treatment, with a diameter of about 1.0 cm and a depth up to the bone wall to block the sphenopalatine nerve. After treatment, 1% ephedrine solution was given to drop into the nasal cavity, and oral antibiotics were administered for 3-5 days to reduce mucosal reactive swelling and prevent infection. During the period of treatment, antihistamines and other drugs were not used to avoid interfering with the observation of the therapeutic effects. Within one week after treatment, all the patients underwent a follow-up examination every other day to remove nasal exudates and cellulose membranes to prevent local adhesions. Follow-up examination was carried out half a year after treatment concerning the improvement of nasal symptoms and the findings from nasal examination. All the patients were treated only once.

1.3 Evaluation criteria for efficacy

References were made to the "Diagnostic Criteria and Efficacy Evaluation Criteria for Allergic Rhinitis" revised at the 1997 Haikou Conference.[2]

1.4 Statistical processing

The measurement data were expressed as mean ± standard deviation, the comparison of measurement data was performed using the *t* test, and the comparison of numeration data was performed using the x^2 test. The follow-up results after half a year of treatment were used as the basis for mid-term efficacy evaluation.

2 Results

2.1 The comparison of the therapeutic effects between the observation group and the control group at 6 months after the surgery is shown in the table below. The total effective rate of the control group was 67.5%, while that of the observation group was 100.0%. The two groups showed significant differences after statistical analysis. The therapeutic effect of the observation group was significantly better than that of the control group.

Table Comparison of therapeutic effects between the observation group and the control group at half a year after the surgery, in number of patients (%)

Group	Number of patients	Significant	Effective	Ineffective	Total effective rate
Control group	40	10 (25.0)	17 (42.5)	13 (32.5)	67.5
Observation group	40	36 (90.0)	4 (10.0)	0 (0)	100.0

Note: $x^2 = 13.23$, $P < 0.01$

2.2 After receiving radiofrequency thermocoagulation of the posterior inferior nerve, anterior ethmoidal nerve, and inferior turbinate for 2-5 days, the patients in the observation group might experience symptoms such as nasal congestion and runny nose due to reactive edema and exudation of the nasal mucosa. A small number of patients might have bloody streaks in their nasal mucus, which were gradually improved after 1 week. Three patients in the control group experienced intraoperative bleeding in the sphenopalatine artery area, which was cured using endoscopic radiofrequency hemostasis. All the patients were followed up with for 6 months. In the observation group, there were 2 cases of recurrence at 4 months after treatment and 2 cases of recurrence at 6 months after treatment, but the symptoms were milder than those before the surgery. All the patients had no complications such as nasal septal perforation, dry eyes, decreased vision, or nasal dryness.

3 Discussions

Although the pathogenesis of allergic rhinitis is mainly antigen-antibody reactions, the occurrence of its three main symptoms is closely related to the imbalance of the sensory nerves innervating the nasal mucosa and the two types of vegetative nerves, that is, it is related to parasympathetic hyperfunction. The parasympathetic nerves in the nasal cavity mainly originate from the sphenopalatine nerves (which branch into the nasal cavity along with the posterior inferior nasal nerves in the pterygopalatine canal) and the medial branch of the anterior ethmoidal nerves. In the inferior turbinate, there are cholinergic nerves and parasympathetic nerve plexus.[3] The use of radiofrequency thermocoagulation of the posterior inferior nasal nerve, anterior ethmoidal nerves, and inferior turbinate under nasal endoscopy for the treatment of PAR can widely block the source of the parasympathetic nerves in the nasal cavity and reduce the excitability of the parasympathetic nerves, the sensitivity of the nasal mucosa to sensitive areas, and the sensory-parasympathetic reflex. This can disrupt the sneezing reflex arc input pathway, reduce the sensitivity of the nasal mucosa to external stimuli, reduce vascular dilation, reduce the gland secretion, and reduce the swelling of the nasal mucosa, which can thereby alleviate or eliminate symptoms such as nasal itching, sneezing, nasal congestion, and runny nose in…

(to be continued on page 243)

the contact surface of the drug is increased, and, due to the stimulation of the lesion during the clearance process, the local congestion and blood flow of the lesion are accelerated, which facilitates drug absorption and can increase the local blood drug concentration.[4] Most MDR-TB cases have a long course of disease and multiple symptoms. The pathology is mainly characterized by degeneration, necrosis, and fiber proliferation, resulting in sparse blood vessels, limited local blood circulation, mucosal congestion and edema at the lesion site, and an increase in local necrotic tissues and secretions. Using only chemotherapy makes it difficult for drugs to penetrate the lesion, and even if some blood flow can pass through the bronchopulmonary barrier, it is difficult for drugs to reach effective concentrations that inhibit and kill tuberculosis bacteria,[5] and the therapeutic effect is often not ideal, and the disease even persists for a long time. The bronchial mucosa at all levels has a strong ability to absorb drugs, and the alveolar capillary membrane is the optimal site for drug absorption. Drugs locally injected through fiberoptic bronchoscopy are absorbed in a short period of time, producing a strong bactericidal effect on secondary bacterial infections on the lungs or other parts and quickly alleviating respiratory and systemic symptoms. The related basic studies have shown that alveolar epithelial type II cells transport Na^+ from the alveolar surface to the basal side through their surface amiloride hydrochloride hydrate sensitive sodium channel, and then pump Na^+ into the pulmonary interstitium through the Na^+-K^+-ATPase of the basal membrane. The active transport of ions drives the absorption of liquid in the alveoli. The active transport and liquid reabsorption functions of the alveolar epithelium enable the alveoli to remain dry and undergo effective gas exchange during normal conditions.[6] When the injection fluid fills the alveoli, the normal alveoli or slightly damaged alveoli can actively transport and absorb the drug fluid in a short period of time without causing fluid retention in the alveoli.[7] In this study, amikacin, levofloxacin, and isoniazid were used in combination with fiberoptic bronchoscopy to treat MDR-TB. The 9-month sputum negative conversion rate was 85.79%, lesion absorption improvement rate was 88.1%, and cavity closure rate was 40.5%, which were significantly higher than 64.1%, 66.7%, and 17.9% in the control group. In summary, local drug injection through fiberoptic bronchoscopy is currently an effective method for treating MDR-TB, which has the effect of purifying cavities, promoting sputum bacteria to turn negative, and closing cavities. The development of this therapy will play an important role in reducing the source of infection, reducing the epidemic condition of tuberculosis, and controlling the prevalence of tuberculosis. It has the advantages of safety, no obvious toxic and side effects, and few complications, and is worthy of clinical use.

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(continued from page 240)

…patients, achieving the objective of treating PAR. The pterygoid canal nerve, as the main parasympathetic nerve innervating the nasal mucosa, can effectively control the symptoms of watery nasal discharge and congestion in allergic rhinitis after being cut off, which has been confirmed by domestic and foreign scholars.[1,4] The posterior inferior nasal nerve is derived from the postganglionic fibers of the pterygoid canal nerve and the sensory fibers of the maxillary nerve in the sphenopalatine ganglion. Therefore, cutting off the nerve can not only achieve a similar therapeutic effect as that of the pterygoid canal nerve cutting surgery, but also effectively alleviate symptoms of sneezing and nasal itching. Moreover, the posterior inferior nasal nerve does not contain parasympathetic nerve fibers that innervate the lacrimal gland, so it will not cause dry eye symptoms like those of pterygoid canal nerve cutting surgery.[5] The anterior ethmoidal nerve contains both the sensory nerve fibers of the first branch of the trigeminal nerve and the parasympathetic nerve fibers originating from the oculomotor nucleus. Therefore, cutting off this nerve can also play a certain role in alleviating the three major nasal symptoms. In the opinions of the authors, the mechanism of radiofrequency thermocoagulation of the inferior turbinate mucosa is not only related to the reduction of inferior turbinate volume and improvement of nasal ventilation, but also to the destruction of the microganglia and parasympathetic plexus in the inferior turbinate, resulting in a decrease in acetylcholine release.[6]

In this study, there was a significant difference in the efficacy between the observation group and the control group after 6 months of surgery, indicating that radiofrequency thermocoagulation of the posterior inferior nasal nerve, anterior ethmoidal nerve, and inferior turbinate for the treatment of PAR is significantly superior to the method of thermocoagulation of the sphenopalatine nerve only, but with further observation needed for its long-term efficacy. This method has the advantages of significant therapeutic effect, simple operation, and no side effects, and is worthy of clinical use.

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