

Evaluation of the Effect of Cryotherapy (Cryoablation) of Posterior Nasal Nerve on the Treatment of Patients with Rhinitis

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Abstract

Introduction:

Rhinitis is a common condition that is typically treated with medical therapies. However, 10–22% of patients are resistant to these treatments. In our study, the effectiveness of cryotherapy of the posterior nasal nerve (PNN) in treating rhinitis patients who have not responded to conventional medical treatments has been evaluated.

Materials and Methods:

In this single-group interventional study (before/after), 40 patients with rhinitis referred to the ENT clinic of Baqiyatallah Hospital underwent PNN cryotherapy using a new device called Cryo Nose. To collect data, the Total Nasal Symptom Score (TNSS) questionnaire was administered before the intervention and at 1 week, 1 month, 3 months, and 6 months after the intervention.

Results:

After PNN cryotherapy, the TNSS 12-hour symptom score improved from 9.2 (± 2.3) to 6.59 (± 2.18) at 1 week later, 3.83 (± 1.88) at 1 month later, 2.58 (± 1.58) at 3 months later, and 1.98 (± 1.47) at 6 months later ($P < 0.05$). Similar results were noted for the 2-week scores, which improved from 10.38 (± 2.53) to 8.35 (± 2.32) at 1 week later, 5.95 (± 2.09) at 1 month later, 4.27 (± 1.61) at 3 months later, and 3.38 (± 1.49) at 6 months later ($P < 0.05$).

Conclusions:

PNN cryotherapy has been shown to be effective in treating rhinitis during a 6-month follow-up period, with no significant adverse events. The effect of PNN cryotherapy on the symptoms of these patients did not differ between the different types of rhinitis.

Keywords: Cryotherapy, Cryo Nose, Posterior nasal nerve, Rhinitis

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Introduction

Rhinitis, or inflammation of the nasal mucosa (1), is a term that refers to irritation and ultimately inflammation of the mucous membrane inside the nose, which is divided into three categories: allergic, non-allergic, and mixed (2). The symptoms of this condition include nasal congestion, a runny nose, an itchy nose, sneezing, sleep disorders, coughing, and even headaches (3,4).

Rhinitis generally improves with conventional medical treatments, including normal saline for nasal irrigation, antihistamines, intranasal and oral corticosteroids, and decongestants. However, approximately 10-22% of patients do not respond to medical treatment (5). The Posterior Nasal Nerve (PNN), which exits the sphenopalatine foramen, is a branch of the Vidian nerve that contains sensory and autonomic nerve components, including postganglionic nerve fibers with parasympathetic fibers. These fibers cause symptoms in patients with rhinitis (6-8).

Surgical treatments for rhinitis in patients who do not respond to medical treatments include endoscopic neurectomy of the Vidian nerve and selective parasympathectomy of pterygopalatine postganglionic fibers. The goal of these surgical methods is to disrupt the parasympathetic autonomic system of the nasal mucosa, thereby reducing secretions and congestion. General anesthesia is required for these procedures and potential risks may include dry eyes, soft palate hypoesthesia, mouth and face numbness, and postoperative bleeding (9,10).

Cryotherapy is a modern method used to treat various tissue lesions. The term is most commonly associated with surgical treatment, specifically known as cryosurgery or cryoablation. Cryosurgery involves applying extremely low temperatures to destroy abnormal or diseased tissue. The goal of cryotherapy is to reduce cellular metabolism, lower tissue surface temperatures to minimize

hypoxic cell death, and decrease inflammation, pain, edema, and muscle spasms (11).

Cryotherapy can be performed using open or closed methods with various cryogenes, including nitrous oxide (N₂O), liquid nitrogen, solid carbon dioxide, propane, chlorodifluoromethane, and dimethyl ether. In the open method, the tissue is cooled by direct contact with a cryogenic substance, such as liquid nitrogen. This method is convenient but may not maintain a consistent temperature. It is not recommended to use liquid nitrogen spray on oral and nasal mucosa due to poor temperature control and cryogen penetration depth (12).

On the other hand, the closed method involves placing a cryogen (usually nitrous oxide) in contact with the tissue using a cryoprobe. This method allows for controlled cryogen transfer, effective freezing and thawing cycles, and the maintenance of a constant low temperature. It is advisable to use the closed method for cryotherapy on the nasal and oral mucous membranes (13). In the present study, a Cryo Nose device from Tochalardarman Medical Engineering Company (Figure. 1) was used for closed cryotherapy.



Fig 1. Cryo Nose device.

Materials and Methods

In this study, which was conducted as a single-group intervention study (before/after) on 40 patients with rhinitis who were referred to the ENT clinic of Baqiyatallah Hospital, the effectiveness of cryotherapy in improving the symptoms of patients who did not respond to conventional medical treatments was evaluated.

It is worth mentioning that ethical approval has been obtained from the appropriate local ethics committee. (Ethics ID: IR. BMSU. BAQ. REC.1401.047) To collect data, the valid Total Nasal Symptom Score (TNSS) questionnaire was used (14). This questionnaire records the symptoms of rhinitis patients in four categories: none, mild, moderate, and severe (Figure 2).

1. Please rate how your nasal congestion has been over the past:			12 hours	Last 2 weeks
None	0	<input type="radio"/>	0	<input type="radio"/>
Mild (symptom clearly present but easily tolerated)	1	<input type="radio"/>	1	<input type="radio"/>
Moderate (symptom bothersome but tolerable)	2	<input type="radio"/>	2	<input type="radio"/>
Severe (symptom difficult to tolerate – interferes with activities)	3	<input type="radio"/>	3	<input type="radio"/>
2. Please rate how your runny nose has been over the past:			12 hours	Last 2 weeks
None	0	<input type="radio"/>	0	<input type="radio"/>
Mild (symptom clearly present but easily tolerated)	1	<input type="radio"/>	1	<input type="radio"/>
Moderate (symptom bothersome but tolerable)	2	<input type="radio"/>	2	<input type="radio"/>
Severe (symptom difficult to tolerate – interferes with activities)	3	<input type="radio"/>	3	<input type="radio"/>
3. Please rate how your nasal itching has been over the past:			12 hours	Last 2 weeks
None	0	<input type="radio"/>	0	<input type="radio"/>
Mild (symptom clearly present but easily tolerated)	1	<input type="radio"/>	1	<input type="radio"/>
Moderate (symptom bothersome but tolerable)	2	<input type="radio"/>	2	<input type="radio"/>
Severe (symptom difficult to tolerate – interferes with activities)	3	<input type="radio"/>	3	<input type="radio"/>
4. Please rate how your sneezing has been over the past:			12 hours	Last 2 weeks
None	0	<input type="radio"/>	0	<input type="radio"/>
Mild (symptom clearly present but easily tolerated)	1	<input type="radio"/>	1	<input type="radio"/>
Moderate (symptom bothersome but tolerable)	2	<input type="radio"/>	2	<input type="radio"/>
Severe (symptom difficult to tolerate – interferes with activities)	3	<input type="radio"/>	3	<input type="radio"/>
5. Please rate how difficult sleep has been with nasal symptoms:			Last night	Last 2 weeks
None	0	<input type="radio"/>	0	<input type="radio"/>
Mild (symptom clearly present but easily tolerated)	1	<input type="radio"/>	1	<input type="radio"/>
Moderate (symptom bothersome but tolerable)	2	<input type="radio"/>	2	<input type="radio"/>
Severe (symptom difficult to tolerate – interferes with activities)	3	<input type="radio"/>	3	<input type="radio"/>
TOTAL SCORE:			<u>0</u>	<u>0</u>

Fig 2. TNSS questionnaire. Items evaluated include nasal congestion, runny nose, nasal itching, sneezing and difficulty sleeping throughout the past 12 hours and 2 weeks.

After conducting initial examinations and investigations, including anterior rhinoscopy and nasal endoscopy, in the clinic environment under local anesthesia (administered with a mesh impregnated with epinephrine and tetracaine drops, as well as 10% lidocaine spray in the nasal cavity), cryotherapy of PNN was

performed during nasal endoscopy. The cryotherapy was performed using a Cryo Nose device, designed and produced as a result of collaboration between the authors of the article and TochalDarman Medical Engineering Company. In this method, the device's cryoprobe is positioned at the sphenopalatine

foramen. This foramen is the exit site of the Posterior Nasal Nerve, and its endoscopic landmark is located 12-13 mm behind the posterior fontanelle, or 3-4 cm posterior to the anterior head of the middle turbinate, or 0.9 cm anterior to the Choanal arch. The cryoprobe is placed on each side for approximately 30 seconds. Signs of freezing, such as mucosa whitening and the appearance of ice crystals, should be observed during this procedure. After the cryotherapy procedure, patients' symptoms were recorded at 1 week, 1 month, 3 months, and 6 months using the TNSS scoring system.

It should be noted that, to prevent bias in the research, the use of conventional medical treatments was halted during the study. Descriptive information was presented using frequency indicators, frequency percentage, mean, and standard deviation. Data analysis was conducted using paired t-tests and tests for repeated measures, such as GEE.

Inclusion criteria

- 1- Age above 18 years
- 2- Diagnosis of rhinitis (whether allergic, non-allergic, or a combination of both) is made by an ENT specialist based on the patient's history and examinations, as well as regional radioallergosorbent panel and skin prick tests.
- 3- Failure to respond to treatment with conventional medical drugs for at least 3 months

Exclusion criteria

- 1- Patients with acute or chronic sinusitis
- 2- Medicinal rhinitis (medicamentosa)
- 3- Cerebrospinal fluid leakage in the form of CSF rhinorrhea
- 4- Systemic diseases involving the sinonasal, such as granulomatous polyangiitis (Wegener), Sjogren's, cystic fibrosis (CF), and primary ciliary movement disorder (PCD)
- 5- History of frequent epistaxis, pregnancy, and coagulation disorders
- 6- Evidence of benign or malignant sinonasal neoplasms
- 7- Unwillingness and satisfaction to participate in the study at any stage

Results

In the descriptive statistics section, among the 40 patients studied, 16 were in the allergic rhinitis (AR) group, 12 in the non-allergic rhinitis (NAR) group, and 12 in the mixed rhinitis group. The demographic characteristics of these patients are as follows:

In the AR group, 9 patients (56.3%) were male and 7 (43.8%) were female; in the NAR group, 8 patients (66.7%) were male and 4 (33.3%) were female. Additionally, in the mixed rhinitis group, 9 patients (75%) were male, and 3 patients (25%) were female. Descriptive statistics of age and elapsed time from onset of rhinitis based on the type of rhinitis are shown in Table 1.

Table 1. Descriptive statistics of age and elapsed time from onset of rhinitis based on the type of rhinitis

Variable	Rhinitis type	Average	Standard Deviation	Minimum	Maximum
Age (by year)	Allergic	43.19	14.22	20	68
	Non allergic	36.17	15.05	19	73
	Mixed	38.83	11.99	24	66
Elapsed time from the onset of rhinitis (by year)	Allergic	15.13	7.06	3	30
	Non allergic	8.42	4.46	2	15
	Mixed	8.83	4.17	4	15

Previous medical therapy before the procedure included the following: in addition to antihistamine and intranasal corticosteroid treatments, 3 people (7.5%) were treated with oral corticosteroids and normal saline, 16 individuals (40%) were treated with normal saline and decongestant, and 11 individuals (27.5%) were treated with oral corticosteroids, normal saline, and decongestant. Additionally, 1 person (2.5%) was treated with normal saline, decongestant, and Turbinoplasty surgery, 2 people (5%) were treated with normal saline, decongestant, Septoplasty and Turbinoplasty surgery, 2 people (5%) were treated with oral corticosteroids, normal saline, decongestant, and FESS surgery, 1 person (2.5%) was treated with normal saline serum and septoplasty surgery, and 4 individuals (10%) were treated with normal saline serum. Cryotherapy of PNN in the AR group for 13 patients (81.3%) bilaterally, for 1 patient (6.3%) on the right side

due to septal deviation (SD), and for 2 patients (12.5%) on the left side it was done due to SD.

In the NAR group, it was performed bilaterally in 10 patients (83.3%), on the right side in 1 patient (8.3%) due to SD, and on the left side in 1 patient (8.3%) due to SD. In the mixed rhinitis group, it was performed bilaterally in 10 patients (83.3%), on the right side in 1 patient (8.3%) due to SD, and on the left side in 1 patient (8.3%) due to SD.

Based on the TNSS questionnaire (Figure 2), patients' symptoms were evaluated at 1-week, 1-month, 3-month, and 6-month intervals. It was clarified that, during each interval, the specific symptom was assessed for occurrences in the past 12 hours and the previous 2 weeks. The effect of PNN cryotherapy on dependent variables was analyzed using inferential statistics. This was accomplished by performing a repeated-measures analysis of variance (Figures. 3, 4).

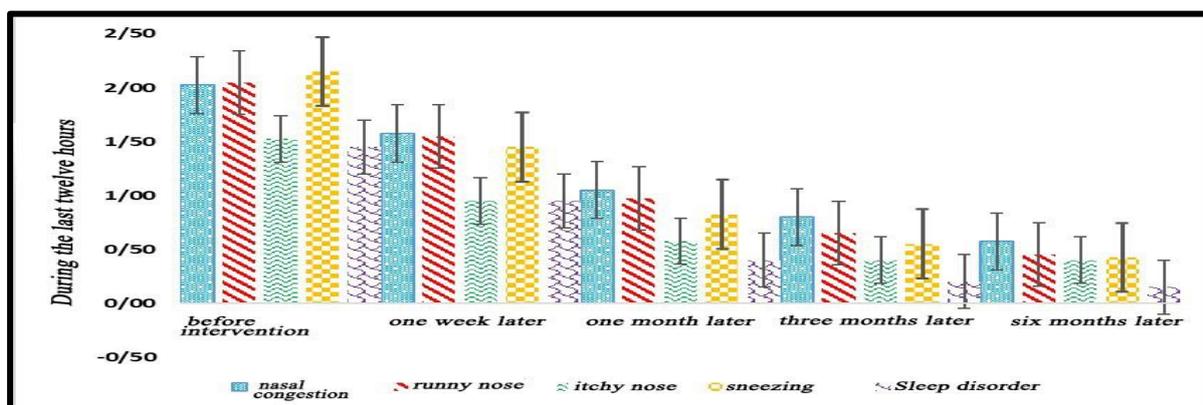


Fig 3. Bar graph of the average error of the variables during the last 12 hours by time.

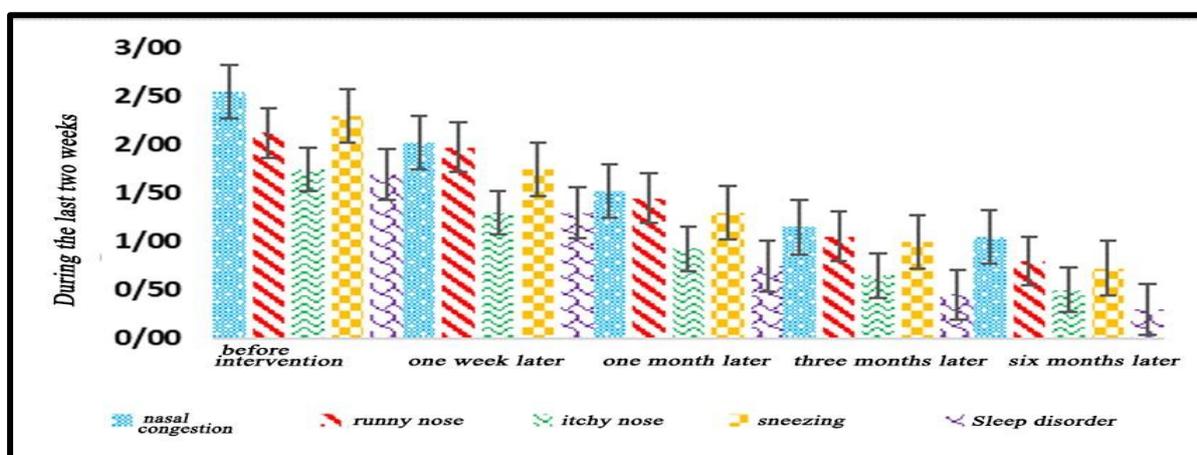


Fig 4. Bar graph of the average error of the variables during the last 2 weeks by time.

A) When examining the effect of PNN cryotherapy on nasal congestion using an analysis of variance with repeated measures during specific time intervals, both within the last 12 hours and over the past 2 weeks, patients exhibited a significant difference ($P < 0.05$) in nasal congestion at various times.

B) When examining the effect of PNN cryotherapy on runny nose using an analysis of variance with repeated measures during specific time intervals, both within the last 12 hours and over the last 2 weeks, patients exhibited a significant difference ($P < 0.05$) in runny nose at different times.

C) When examining the effect of PNN cryotherapy on nasal itching using an analysis of variance with repeated measures during specific time intervals, both within the last 12 hours and over the past 2 weeks, patients exhibited a significant difference ($P < 0.05$) in nasal itching at different times.

D) When examining the effect of PNN cryotherapy on sneezing using an analysis of variance with repeated measures during specific time intervals, both within the last 12 hours and over the past 2 weeks, patients exhibited a significant difference ($P < 0.05$) in sneezing at different times.

E) When examining the effect of PNN cryotherapy on sleep disorders using an analysis of variance with repeated measures

during specific time intervals, both within the last 12 hours and over the past 2 weeks, patients exhibited a significant difference ($P < 0.05$) in sleep disorders at different times.

According to the results of the post hoc Bonferroni test investigating the influence of rhinitis type on nasal congestion, runny nose, sneezing, and sleep disorders in the last 12 hours and over the last 2 weeks with PNN cryotherapy, there is no significant difference in these symptoms among patients ($P > 0.05$). In terms of the influence of rhinitis type on nasal itching by post hoc Bonferroni test, both in the last 12 hours and over the last 2 weeks with PNN cryotherapy, there is only a significant difference between allergic rhinitis and mixed rhinitis ($P < 0.05$).

In general, it can be said that with PNN cryotherapy during the last 12 hours, the total TNSS scores of the patients went from 9.2 (± 2.3) to 6.59 (± 2.18) in 1 week later, to 3.83 (± 1.88) in the next 1 month, it reached 2.58 (± 1.58) in the next 3 months and 1.98 (± 1.47) in the next 6 months ($P < 0.05$). Similarly, during the last 2 weeks, the total TNSS scores of the patients went from 10.38 (± 2.53) to 8.35 (± 2.32) in the next 1 week, to 5.95 (± 2.09) in the next 1 month, it reached 4.27 (± 1.61) in the next 3 months and 3.38 (± 1.49) in the next 6 months ($P < 0.05$) (Figures. 5,6).

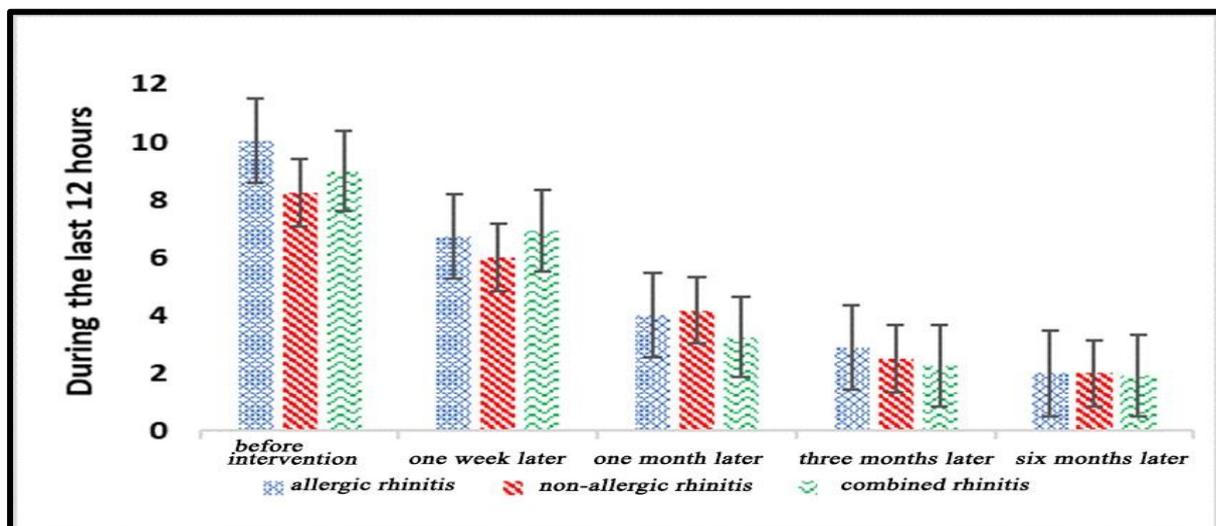


Fig 5. Bar graph of average error of total TNSS scores during the last 12 hours by time and type of rhinitis.

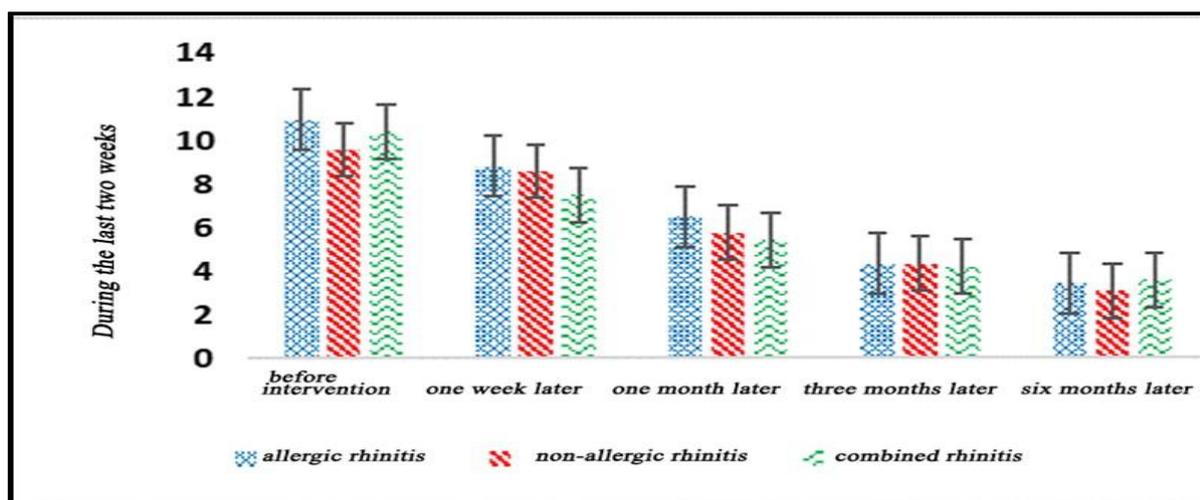


Fig 6. Bar graph of the mean error of the total TNSS scores during the last 2 weeks by time and type of rhinitis

Discussion

In many patients with rhinitis, medical treatment has not led to a decrease in symptoms or an enhancement in quality of life. It should be noted that some patients are unable to use medical treatment regularly or cannot tolerate the side effects of intranasal sprays, such as epistaxis and nasal irritation. Furthermore, most patients are not inclined to opt for surgical methods due to the need for general anesthesia and the presence of potential risks.

A recently proposed method for treating patients with rhinitis is cryotherapy of the posterior nasal nerve (PNN). This procedure is conducted in a clinical setting under local anesthesia.

The innovation in this study lies in the use of a new device, Cryo Nose (Figure. 1), for cryotherapy of the posterior nasal nerve.

A cryoprobe is used to achieve a cold temperature of approximately -35 degrees Celsius during nasal endoscopy. The probe is placed on the sphenopalatine foramen on each side of the nose for about 30 seconds.

It appears that cryoablation of PNN is an effective method for destroying nerve networks that cause symptoms around the inferior turbinate, leading to increased nasal sensitivity and excessive nasal secretions in patients with rhinitis. The study found no significant difference in the effectiveness of PNN

cryotherapy on symptoms across different types of rhinitis (allergic, non-allergic, mixed), except for nasal itching, for which only allergic rhinitis showed a significant difference compared to mixed rhinitis at the 6-month follow-up.

Complications caused by PNN cryotherapy, as seen in previous studies, include: headache, facial pain, pain in the jaw and occiput area, epistaxis, mild dry eyes and mouth, numbness of the palate, and sinusitis.)¹¹⁻¹⁵ (Based on the opinion of the executors of the above research projects, the occurrence of these complications can be related to the cryotherapy device used or the way PNN cryotherapy is performed. In the present study, the side effects of cryotherapy were limited to mild facial pain (which resolved within 1-2 days) and mild bleeding at the PNN cryotherapy site.

The results of the current research are in line with the study that was conducted in 2021 as a prospective single-group clinical trial by John A. Gerka Stuyt and colleagues in California (12), with the difference that was identified in their study, in patients with non-allergic rhinitis, the effect of PNN cryotherapy on improving symptoms is more than other types of rhinitis, while in our study, no significant difference was observed between the type of rhinitis and the effect of PNN cryotherapy on improving symptoms.

Based on endoscopic examination, no wound or nasal mucosal necrosis was observed at the cryotherapy site during the three- and six-month follow-ups of the studied patients. In addition, during the 6-month follow-up after cryotherapy, in most patients whose symptoms had improved with this method, evidence of rhinitis, such as paleness of the nasal mucosa, watery secretions, and hypertrophy of the inferior turbinate, decreased significantly.

It should be noted that, as in previous studies, PNN cryotherapy has a significant effect on improving nasal congestion and a runny nose. Additionally, it also affects other symptoms experienced by rhinitis patients, including itchy nose, sneezing, and sleep disorders (11,13,15).

An important consideration in PNN cryotherapy is selecting patients with suitable conditions. In patients with severe septal deviation or significant inferior turbinate hypertrophy associated with rhinitis, a surgical approach combined with PNN cryotherapy can be beneficial.

The limitations of this study include a small sample size and a short follow-up period after cryotherapy. Despite these limitations, the study's results align with previous research and demonstrate the effectiveness of cryotherapy on the posterior nasal nerve for treating rhinitis. To further validate these findings and assess recurrence rates and potential complications, it is recommended that future studies be conducted in a multi-center setting with a larger sample size and extended follow-up period. Additionally, results should be consolidated through secondary studies such as systematic reviews and meta-analyses.

Conclusions

Cryotherapy of the posterior nasal nerve has been found to be effective in treating rhinitis symptoms during a 6-month follow-up, with no significant adverse events. The effect of PNN cryotherapy on the symptoms of these patients, excluding nasal itching, did not differ across the three types of rhinitis (allergic, non-allergic, and mixed).

Ethical considerations: The patient information in the files of patients referred to the ENT clinic at Baqiyatallah Hospital remained confidential and protected, and was not made available to others. The provisions of the Helsinki Convention were observed, and written consent was obtained from the patients.

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Disclosure statement: No potential conflict of interest was reported by the author(s).

Statement of Human and Animal Rights: The study adhered to good clinical practices and ethical standards.

Statement of Informed Consent: All the participants received verbal and/or written information and provided informed consent.

References

1. Dykewicz MS, Hamilos DL. Rhinitis and sinusitis. *Journal of Allergy and Clinical Immunology*. 2010;125(2):S103-S15.
2. Greiwe JC, Bernstein JA. Allergic and mixed rhinitis: diagnosis and natural evolution. *Journal of Clinical Medicine*. 2019;8(11):2019.
3. Quillen DM, Feller DB. Diagnosing rhinitis: allergic vs. nonallergic. *American family physician*. 2006; 73(9):1583-90.
4. Marshall PS, O'Hara C, Steinberg P. Effects of seasonal allergic rhinitis on selected cognitive abilities. *Annals of Allergy, Asthma & Immunology*. 2000; 84(4):403-10.
5. Lieberman P, Kaliner MA, Wheeler WJ. Open-label evaluation of azelastine nasal spray in patients with seasonal allergic rhinitis and nonallergic vasomotor rhinitis. *Current medical research and opinion*. 2005;21(4):611-8.
6. Ma Y, Tan G, Zhao Z, Li W, Huang L, Liu G. Therapeutic effectiveness of endoscopic vidian neurectomy for the treatment of vasomotor rhinitis. *Acta Oto-Laryngologica*. 2014;134(3):260-7.
7. Li S, Cheng J, Yang J, Zhao Y, Zhu Z, Zhao C, et al. Efficacy of posterior nasal neurectomy for allergic rhinitis combined with chronic rhinosinusitis with nasal polyps. *Acta oto-laryngologica*. 2019; 139(10): 890-4.
8. Bleier BS, Schlosser RJ, editors. Endoscopic anatomy of the postganglionic pterygopalatine innervation of the posterolateral nasal mucosa.

International forum of allergy & rhinology; 2011: Wiley Online Library.

9. Yan CH, Hwang PH. Surgical management of nonallergic rhinitis. *Otolaryngologic Clinics of North America*. 2018;51(5):945-55.

10. Marshak T, Yun W, Hazout C, Sacks R, Harvey R. A systematic review of the evidence base for vidian neurectomy in managing rhinitis. *The Journal of Laryngology & Otology*. 2016;130(S4):S7-S28.

11. Chang MT, Song S, Hwang PH. Cryosurgical ablation for treatment of rhinitis: a prospective multicenter study. *The Laryngoscope*. 2020; 130(8):1877-84.

12. Gerka Stuyt JA, Luk L, Keschner D, Garg R. Evaluation of in-office cryoablation of posterior nasal

nerves for the treatment of rhinitis. *Allergy & Rhinology*. 2021;12:2152656720988565.

13. Hwang PH, Lin B, Weiss R, Atkins J, Johnson J, editors. Cryosurgical posterior nasal tissue ablation for the treatment of rhinitis. *International forum of allergy & rhinology*; 2017: Wiley Online Library.

14. M. Yen D, B. Conley D, O'Malley EM, Byerly TA, Johnson J. Multiple site cryoablation treatment of the posterior nasal nerve for treatment of chronic rhinitis: an observational feasibility study. *Allergy & Rhinology*. 2020;11:2152656720946996.

15. Takahara D, Takeno S, Hamamoto T, Ishino T, Hirakawa K. Management of intractable nasal hyperreactivity by selective resection of posterior nasal nerve branches. *International journal of otolaryngology*. 2017;2017(1):1907862.