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ORIGINAL ARTICLE

Posterior Nasal Nerve Section versus Surface Coblation for treatment of intractable Rhinorrhea

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Abstract

Background: Intractable rhinitis either due to allergic rhinitis or vasomotor rhinitis could affect patient lifestyle and quality of lifesurgical therapy is recommended if symptoms are not adequately controlled by medications. This study aims to examine the outcomes of posterior nasal neurectomy and surface coblation in order to alleviate the symptoms of intractable rhinorrhea.

Patients and methods: This prospective non-randomized clinical study included 18 patients above age of 12 who have intractable rhinorrhea, not respond to medical treatment and admitted to ORL-HNS department, Zagazig University. Included patients were classified into two groups; the posterior nasal nerve(PNN) was excised endoscopically in the first group, while surface coblation was used to ablatethe posterior nasal nerve region in the second group.

Results: There was significant improvement in rhinorrhea, sneezing, nasal obstruction, itching, smell and gustatory rhinorrhea after treatment in both group. Repeated measures of rhinorrhea, sneezing, nasal obstruction and itchingwere lower in the (PNN) section group compared to the surface coblation group but there was no statistically significant difference between both groups regarding repeated assessment for smell and gustatory rhinorrhea.

Conclusion: Intractable rhinitis symptoms, especially rhinorrhea, sneezing and nasal obstruction, can be significantly relieved by either endoscopic resection of the posterior nasal nerve or endoscopic ablation of the posterior nasal nerve area using surface coblation . Although symptoms of both groups improved , the post-operative results of PNN section were better than surface coblation but the technique of surface coblation is simpler ,safer and time saver .

Keywords: Allergic rhinitis, intractable rhinorrhea, posterior nasal neurectomy, Surgical Treatment of Rhinitis.

Introduction

Ten to twenty percent of people have rhinorrhea, nasal congestion, sneezing, and post-nasal discharge as signs of rhinitis, an inflammatory disorder of the nasal mucosa. Both allergic and nonallergic forms of non-infectious rhinitis can be distinguished based on the presence of an allergic etiology. Allergic rhinitis is the most common type of atopic illness **[1]**.

Most of literature considers the rhinitis resistant or intractable when there is a persistence of two or more of four symptoms rhinorrhea, itching, sneezing,nasal block For more than 1-2 years after maximum standard medical therapy**[2]**.

Worldwide, allergic rhinitis (AR) is a global health problem anda major cause of burden and disability

in the medical community. In fact, AR is linked to sleep issues, missing or ineffective time at work and school, and a decline in children's outdoor activity participation. Because indirect expenses are high, the economic impact of AR is sometimes underestimated**[3]**.

Runny nose, sneezing, nasal congestion, and blockage are the predominant symptoms; affected patients may also occasionally experience general symptoms (e.g., lethargy and dull headache) and signs of allergic conjunctivitis, such as itchy and watery eyes **[4]**.

A state of persistent nasal congestion and rhinorrhea that is unrelated to a particular allergen is known as nonallergic rhinitis (NAR). Vasomotor rhinitis (VMR) isthe most prevalent kind of nonallergic rhinitis **[5].**

The medical management of allergic rhinitis involves a phased approach including medications like nasal topical steroids and antihistamines.On the other hand, surgical procedures such endoscopic posterior nasal neurectomy (PNN) have been tried on patients whose allergic rhinitis is not responsive to medical treatment **[1].**

Within the sphenopalatine ganglion lies the (PNN), a peripheral branch. A distinct foramen, located 4-5 mm beneath the sphenopalatine foramen, allows it to enter the nasal cavity. With the same advantages as vidian neurectomy but none of the drawbacks, selective excision of this posterior nasal nerve eliminates the parasympathetic supply from the nasal cavity **[1].**

Intractable rhinorrhea symptoms related to nasal mucosa denervation may be alleviated by posterior nasal neurectomy.In the nasal respiratory mucosa, PNN can deplete nerve fibers, choline acetyltransferase, and neuropeptides **[6].** The purpose of this research was to compare the outcomes of posterior nasal nerve section and surface coablation in order to alleviate the symptoms of intractable rhinorrhea.

Patients and methods

After the approval of the Institutional Review Board (IRB# 10503-5-3-2023), this was prospective non randomized clinical trial study was performed on eighteen patients above age of 12. Who have intractable rhinorrheanot respond to medical treatment admitted to ORL-HNS department in Zagazig University Hospital during the period from november 2022 to may 2023 period 6 months. All of them were complaining of intractable rhinorrhea. The patients' or their relatives' signed a written formal consent was required to take part in the trial. The work was completed in accordance with the Declaration of Helsinki, the World Medical Association's code of ethics for studies involving human subjects.

Patients in this trial were divided into two groups: endoscopic assisted PNN neurectomy and endoscopic assisted PNN coblation.

In first group(PNN neurectomy):the mean age of patients in was 24.33 ± 7.53. Approximately 77.80% of the patients were female, and 22.2% were male. In the second group(PNN coblation): the mean age was 29.89± 3.75, slightly more than half of the patients (55.60%) were females and (44.40%) were males.

Inclusion criteria werepatients with History of sever rhinorrhea not responding to medical or immunological treatment more than 1 year .**Exclusion Criteria were;**people with nasal tumors, chronic sinusitis with or without polyps . Patients with bleeding tendency , heart failure , liver cirrhosis and renal failure . Patients less than 12 y old. Patients unfit for surgery.

All patients were subjected to complete history taking included symptoms of allergic rhinitis (Nasal obstruction, itching, sneezing, rhinorhea, gustatory rhinitis and headache), Clinical Examination, Endoscopic Examination of nasal cavity and Laboratory tests included Complete Blood Count (CBC) , Liver and kidney function tests, PT,PTT, INR and Random Blood Sugar (RBS).

Radiological assessment included Computerized tomography (CT) scan of the PNS (coronal, axial and sagittal) 1 mm cuts, bone window without contrast was routine for each patient. Questionnaire for symptoms & visual analogue scale (VAS) about symptoms of (rhinorrhea, Nasal obstruction, itching, sneezing and headache) patient will grade himself from (0 -5); 0 - no problem, 1 -mild and 5 -the worst symptoms.

Surgical technique:

Both procedures were done under general hypotensive anesthesia. The patient was positioned in the reverse Trendelenburg position while supine. To reduce venous return, the head end is raised to 30 degrees. Topical decongestants were used half an

hour before the procedures and packs with 1/10000 adrenaline were used during the procedure for hemostasis.

Posterior Nasal Nerve Section

Uncinectomy and middle meatal antrostomy have been performed in all cases (**Fig 1A**).In order to identify the posterior nasal nerve, the mucoperiosteum flap was gently raised using a cottle elevator or a suction freer elevator from the posterior edge of the middle meatal antrostomy (MMA) posteriorly and superiorly along the prependicular plate of the palatine bone to expose the sphenopalatine foramen **(Fig. 1B).** The flap was raised until the fibroneurovascular sleeve, which included the sphenopalatine artery and the posterior nasal nerve, was identified. During flap elevation, caution must be used to avoid damaging the sphenopalatine artery. A landmark for the sphenopalatine foramen is the crista ethmoidalis.Usually situated directly in front of the anterior-inferior portion of the sphenopalatine foramen, the crista (**Fig 1**C).As the nerve lies inferior to the vessel and the major trunk of the nerve lies anterior to the sphenopalatine artery at the sphenopalatine foramen level, it is always preferable to locate the main trunk or the proximal part of the posterior nasal nerve below the sphenopalatine foramen area **(Fig 1D).** As the nerve leaves the nasal cavity, it may split into many branches. The nerve was removed at its primary stem so as not to miss its peripheral branches. Following the identification of the nerve fibers, the nerve is meticulously drawn out **(Fig. 1E)** and either resected using microscissors or cauterized with a monopolar suction cautery or a bipolar diathermy. (**Fig 1F**). Sometimes, if there is risk of bleeding, sphenopalatine artery was cauterized in some cases.To get the best results, this process must be completed on both sides. There was no need for inferior turbinoplasty or septoplasty.

Closure;After repositioning the mucoperiosteal flap to its initial location (Fig. 1G), gelfoam was positioned between the flap and the middlel turbinate. The patients were discharged on the same day without the need for nasal packing.

Surface Coblation

Radiofrequency surface coblation (coagulation mode) was performed on area of lateral nasal wall corresponding the course of Posterior nasal nerve (PNN). Particularly, area about1 cm infront of the posterior end of middle turbinate, between middle and inferior turbinates (**fig 2**)

There was no need for inferior turbinoplasty or septoplasty

Post-operative Follow up

After the surgery, the patients were followed up clinically at specific intervals to assess their progress and evaluate the effectiveness of the treatment.

Evaluations were scheduled for two weeks, one month, three months, and six months following surgery .During the follow-up periods, no medication was administered for rhinitis other than regular saline irrigation for one month.

Statistical analysis:

The data were tabulated and statistically analyzed using Microsoft Office Excel 2010 and the Statistical Package for Social Sciences, version 27 (SPSS: An IBM Company). Independent sample t-test was used to comparing the continuous data between both groups. Categorical data were represented as event and percentage. Comparing between both groups regarding categorical data was performed using Fisher Exact test. General linear model adjusted with Bonferroni test used for assessment repeated measured continuous data. The improvement in dichotomous variables after treatment was assessed using Cochran Q test. The improvement in multinominal variables after treatment was assessed using Friedman Test.

Results:

This prospective non randomized clinical trial study was performed on eighteen patients above age of 12.Patients were divided into two groups: endoscopic assisted PNNneurectomy and endoscopic assisted surface PNNcoblation .

In first group (PNN neurectomy): The mean age of patients was 24.33 ± 7.53. Approximately 77.80% of the patients were female, and 22.2% were male. In the second group (PNN coblation) , the mean age was 29.89± 3.75, slightly more than half of the patients (55.60%) were females and (44.40%) were males.

Table (1): comparison between repeated measurements for Rhinorrhea, Sneezing and Nasal obstructionin both groups

	PNN SECTION group		surface coblation group		Mean Difference	P value
	Mean	SD	Mean	SD		
Rhinorhea						
Preoperative	5.00	.000	5.00	.000	.000	0.999
Postoperative 1 M	.44	.527	1.44	1.014	1	**.018**
3M Postoperative	.44	.527	1.44	1.014	1	**.018**
6 M Postoperative	.44	.527	1.56	1.130	1.111	**.017**
P1	**0.00**		**0.00**			
P2	**0.00**		**0.00**			
P3	**0.00**		**0.00**			
Sneezing						
Preoperative	4.56	.527	4.00	1.118	.556	.196
Postoperative 1 M	1.00	.000	1.44	.527	.444	**.022**
3M Postoperative	1.00	.000	1.78	.833	.778	**.013**
6 M Postoperative	1.00	.000	1.44	.527	.444	**0.022**
P1	**0.00**		**0.00**			
P2	**0.00**		**0.00**			
P3	**0.00**		**0.00**			
Nasal obstruction						
Preoperative	4.00	.000	3.78	.972	0.22	.503
Postoperative 1 M	.44	.527	.78	.667	0.33	.257
3M Postoperative	1.56	.527	.89	.782	0.667	**.050**
6 M Postoperative	1.00	.000	.78	.667	0.22	.332
P1	**0.00**		**0.00**			
P2	**0.00**		**0.00**			
P3	**0.00**		**0.00**			

General linear model, P1: indicate the statistically difference between preoperative and one month post-operative, P2: indicate the statistically difference between preoperative and 3 month post-operative, P3: indicate the statistically difference between preoperative and 6 month post-operative,

Table 1; demonstrated that, following therapy, there was a statistically significant improvement in both groups' rhinorrhea, sneezing, and nasal obstruction. Following treatment, the PNN section group demonstrated reduced rates of rhinorrhea, sneezing, and nasal blockage in comparison to the surface coblation group.

Table (2): Comparison between repeated assessment for **smell** and **Gustatory Rhinorrhea** in both group

	PNN section group		Surface coblation group		P value
	Mean	SD	Mean	SD	
Preoperative for smell					
Anosmia	1	11.10%	0	0.00%	.637
Hyposmia	3	33.30%	5	55.60%	
Intact	5	55.60%	4	44.40%	
Postoperative 1 M					
anosmia	1	11.10%	0	0.00%	.637
intact	4	44.40%	3	33.30%	
smell improvement	4	44.40%	6	66.70%	
3M Postoperative					

anosmia	1	11.10%	1	11.10%	.880
intact	4	44.40%	3	33.30%	
smell improvement	4	44.40%	5	55.60%	
6 M Postoperative					
anosmia	1	11.10%	1	11.10%	.793
intact	4	44.40%	2	22.20%	
smell improvement	4	44.40%	6	66.70%	
improvement after surgery					
Friedman Test Chi-Square P value	12 **.016**		11.859 **.005**		
Gustatory Rhinorrhea					
Preoperative	3	33.3%	4	44.4%	0.99
Postoperative 1 M	2	22.2%	2	22.2%	0.99
3M Postoperative	2	22.2%	2	22.2%	0.99
6 M Postoperative	1	11.1%	1	11.1%	0.99
improvement after surgery					
Cochran's Q P value	2.4 0.875		6.333 .188		

Fisher's exact test; Friedman Test, **Fisher's exact test; Cochran Q test**

Table 2; showed that there were statistically significant improvement in **smell and gustatory rhinorrhea** after treatment in both groups. There were no statistically significant difference between both groups regarding repeated assessment for smell and gustatory rhinorrhea .

Table (3): Repeated measurements for **Itching** in both groups

Itching	**PNN SECTION group**		**Surface coblation group**		**Mean Difference**	**P value**
	Mean	**SD**	**Mean**	**SD**		
Preoperative	4.00	.000	3.56	1.130	.444	.255
Postoperative 1 M	.44	.527	1.22	.667	.778	**.014**
3M Postoperative	.44	.527	1.44	.726	1.000	**.004**
6 M Postoperative	.33	.500	1.22	.667	.889	**.006**
P1	**0.00**		**0.00**			
P2	**0.00**		**0.00**			
P3	**0.00**		**0.00**			

General linear model, P1: indicate the statistically difference between preoperative and one month post-operative, P2: indicate the statistically difference between preoperative and 3 month post-operative, P3: indicate the statistically difference between preoperative and 6 month post-operative,

Table 3; demonstrated that both groups' itching improved statistically significantly following therapy. Following therapy, the PNN section group experienced less itching on repeated measures than the surface coblation group.

Table (4): Repeated measurements for **Total VAS** score in both groups

Total VAS score	**PNN SECTION group**		**surface coblation group**		**Mean Difference**	**P value**
	Mean	**SD**	**Mean**	**SD**		
Preoperative	21.56	.527	19.78	3.346	1.778	.135
Postoperative 1 M	3.11	1.364	5.56	2.603	2.444	**.024**

Total VAS score	PNN SECTION group		surface coblation group		Mean Difference	P value
	Mean	SD	Mean	SD		
3M Postoperative	4.44	.726	6.44	1.740	2.000	**.006**
6 M Postoperative	3.89	1.167	5.78	2.279	1.889	**.042**
P1	**0.00**		**0.00**			
P2	**0.00**		**0.00**			
P3	**0.00**		**0.00**			

General linear model, P1: indicate the statistically difference between preoperative and one month post-operative, P2: indicate the statistically difference between preoperative and 3 month post-operative, P3: indicate the statistically difference between preoperative and 6 month post-operative

Table 4; demonstrated that both groups' overall VAS scores improved following treatment in a statistically meaningful way. Following treatment, the PNN section group's repeated Total VAS score measurements showed a lower score than those of the surface coblation group.

Discussion:

El-Sayed et al. [1] demonstrated that severing the parasympathetic supply to the nasal mucosa reduces rhinitis symptoms such as rhinorrhea, sneezing, and nasal obstruction, which is consistent with our findings. After three and six months postoperatively, the mean symptom scores for rhinorrhea reduced from pre-operative levels, and there was a highly statistically significant difference between the pre-operative and sixth-month assessments with regard to rhinorrhea. Furthermore, this study demonstrated that endoscopic posterior nasal neurectomy provides the same advantages as vidian neurectomy without the associated complications.

Our findings were consistent with those of **Zayed et al. [7]**, who noted improvements in postoperative quality of life and allergy symptoms. Prior to surgery, the average rhinorrhea score was (Mean ± SD =3.53 ± 0.52).One month later, rhinorrhea had improved (Mean ± SD = 1.33 ± 0.49), and the findings were statistically significant. Additionally, three months later, rhinorrhea improvement is still present (Mean ± SD = 0.80 ± 0.41),the preoperative sneezing score was (Mean ± SD =3.73 ± 0.46). After a month, the results were statistically significant (Mean ± SD = 3.07 ± 0.59), and there was no improvement in sneezing.

The findings were statistically significant. According to **Takahara et al. [8],** there was a substantial decrease in the mean symptom scores for rhinorrhea, nasal obstruction, and sneezing after 12 months when compared to the preoperative baseline. After the surgery, the mean TNSS also considerably dropped, falling from 8.52 to 2.54 after 12 months, a 70.2% decrease.

May et al. [10]found that posterior nasal neurectomy reduces secretagogue motor and inhibits neurogenic inflammation brought on by parasympathetic and sensory denervation, which provides evidence for the procedure's efficacy. Similar advantages for the patient following posterior nasal neurectomy were also found by **Kobayashi et al. [11].** They came to the conclusion that allergy symptoms might be improved by carefully excising posterior nerve peripheral branches.

Sonoda et al. [6] demonstrated that, in comparison to pre-surgery scores, the objective runny nose and nasal congestion scores on the CSARS II at 8 years post-surgery improved; however, in comparison to the score at 3 months post-surgery, the runny nose score at 8 years post-surgery tended to worsen, albeit this difference was not statistically significant. The following factors could cause objective symptoms of a runny nose and sneezing to get worse after surgery.. Within a few months following PNN, **Nishijima et al. [4]**cleared the reinnervation of nerve fibers into the mucosa. Consequently, nerve regeneration to the pterygopalatine ganglion may happen gradually following surgery, even when the bundle containing the PN nerve and sphenopalatine artery is severed close to the sphenopalatine foramen. Alternatively, similar to the enlargement of the anterior ethmoid nerve's innervation area, the neural network that runs through the ophthalmic (V1) nerve may become stronger during the process of nerve

regeneration. Exacerbation of perceived symptoms linked to decreased rhinitis medication use may also be a significant cause..

Nagalingeswaran et al. [12] reported similar results, indicating a significant decrease in the mean score of nasal symptoms (sneezing, rhinorrhea, and nasal obstruction) at one year as compared to the preoperative one. The majority of patients stated that their subjective improvement was outstanding. At 12 months, the mean SNOT-22 Score dropped dramatically, and 39.6% of the patients were still essentially symptom-free. There was statistical significance in these p-values. Additionally, at one year following surgery, there was a notable increase in the patients' quality of life.

Our most recent results unequivocally showed that both groups' post-treatment smell significantly improved. Regarding the repeated evaluation of smell, there was no statistically significant difference between the two groups. **Suzuki et al. [13]** who demonstrated that turbinoplasty, or the excision of the posterior nasal nerves, dramatically lowered the detection and recognition thresholds on olfactory tests, corroborated our findings. Although there were no significant changes between the two groups before to surgery, the rhinorrhea severity, detection threshold, and recognition threshold were all significantly lower following resection of the posterior nasal nerves with turbinoplasty than after turbinoplasty alone.

Our current data showed that both groups' itching improved statistically significantly following therapy. Following treatment, the PNN section group experienced less recurring itching than the surface coblation group. According to**Stolovitzky et al. [18],** the active therapy arm showed a statistically significant reduction in rhinorrhea and congestion sub-scores after three months, but the decrease in nasal itching sub-score was not statistically significant..

In the current study, we discovered that both groups' overall VAS scores improved following therapy in a statistically meaningful way. Following therapy, the PNN section group's repeated assessments of their overall VAS score showed a decrease in comparison to the surface coblation group.

Numerous studies have considered the VAS as a tool for assessing symptoms before to and following surgery, but with varying numbers of factors. Sneezing and rhinorrhea were found to be significant components of the symptoms of AR, since nearly all research included these two symptoms in their analyses in the form of various ratings or evaluations. Rhinorrhea and sneeze were the only measures used by **Wang et al. [19]** to compute VAS, and they found a considerable decrease in both at 12 months after surgery. At a 6-month follow-up, **El-Sayed et al. [1]** reported a significant improvement in the VAS utilizing three nasal symptoms: sneezing, nasal obstruction, and rhinorrhea. In their investigation of nasal VAS, **Yen et al. [14]** discovered a noteworthy decline in scores at the 3-month mark. A study was carried out by **Li et al. [20]** to evaluate the effectiveness of PNN for AR in conjunction with chronic rhinosinusitis and nasal polyps. When comparing the groups undergoing functional endoscopic sinus surgery (FESS) with PNN to the groups undergoing FESS alone, they did not detect any significant improvement; however, at the 6-month follow-up, they did find a substantial improvement in the VAS score in both groups. These investigations thus implied that PNN might be useful in reducing AR symptoms. In the **Rajdev et al. [21]** trial, all seven VAS components were completed, and the mean VAS at the first, third, and six-month follow-ups showed a substantial improvement.

According to**Rajdev et al. [21],** the benefits of PNN include the surgeon's ability to manage intraoperative bleeding without cutting the sphenopalatine artery and achieve vidian neurectomy efficacy without life-threatening side effects. Endoscopic PNN has been shown to be effective, and **Arun et al. [15]**concluded that PNN is a safe, minimally invasive surgery that is superior to vidian neurectomy since it has less adverse effects. Nevertheless, little research has been done on PNN's long-term consequences. Only **Ogi et al. [16]** have followed up with these patients over an extended period of time. According to their findings, sneeze and rhinorrhea did not significantly decrease after three years of the operation, and during the six-year follow-up, these symptoms got worse with time, indicating that PNN might not be as beneficial in the long run. Reinnervation and nerve regeneration could be the cause of this. According to **Robinson et al. [22],** in order to stop regeneration, a portion of the nerve needs to be cut off and the nerve stump cauterized. To stop

regrowth, **Jang et al. [23]** recommended using gel foam or bone wax to the removed nerve stump.

Conclusion:

Intractable rhinitis symptoms, especially rhinorrhea, sneezing and nasal obstruction, can be significantly relieved by either endoscopic resection of the posterior nasal nerve or endoscopic ablation of the posterior nasal nerve area using surface coblation . Although symptoms of both groups improved , the post-operative results of PNN section were better than surface coblation but the technique of surface coblation is simpler , safer and time saver .

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