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Original Article

Comparison Between the Effect of Turbinoplasty With and Without Posterior Nasal Nerve Neuroectomy in Patients of Allergic Rhinitis Not Responding to Medical Treatment

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ABSTRACT

Background: Allergic rhinitis is a common condition that can be challenging to manage, especially when patients do not respond to standard medical treatments. Turbinoplasty is a surgical procedure commonly used to address nasal obstruction in these patients. Posterior nasal nerve neuroectomy is an emerging technique that aims to provide additional symptom relief by targeting nerve endings in the nasal cavity. However, the comparative efficacy of turbinoplasty with and without posterior nasal nerve neuroectomy remains understudied.

The aim of the work: This study aims to compare the effectiveness of turbinoplasty with and without posterior nasal nerve neuroectomy in improving symptoms and quality of life in patients with allergic rhinitis who have not responded adequately to medical treatment.

Patients and Methods: A prospective comparative study was conducted on a cohort of 60 allergic rhinitis patients who underwent either turbinoplasty alone [30 patients] or turbinoplasty with posterior nasal nerve neuroectomy [30 patients]. Symptom scores and complications were evaluated preoperatively and postoperatively to compare the outcomes between the two groups.

Results: There is a statistically significant difference between the studied groups. All cases in both Group A and Group B were relieved from nasal obstruction after the operation. In Group A, 56.7% of patients still had rhinorrhea, while none of the cases in Group B experienced rhinorrhea. Additionally, 46.7% of patients in Group A complained of sneezing after turbinoplasty alone, whereas only 3.3% of cases in Group B had sneezing. Furthermore, 30% of patients in Group A still reported itching after turbinoplasty alone, while 20% of cases in Group B experienced itching.

Conclusion: The addition of posterior nasal nerve neuroectomy to turbinoplasty appears to provide superior symptom relief in patients with allergic rhinitis resistant to medical treatment. This combined approach may offer a promising surgical option for patients with persistent allergic rhinitis symptoms.

Keywords: Allergic Rhinitis; Turbinoplasty; Neuroectomy.

INTRODUCTION

Allergic rhinitis [AR] is on the rise globally and is recognized as a significant public health concern. The incidence of AR is growing worldwide. Initial treatments for AR typically include drugs like antihistamines and topical corticosteroids. However, in some cases, patients may not respond well to medication for AR and vasomotor rhinitis, prompting the consideration of surgical intervention as a treatment option [1].

Allergic rhinitis can negatively impact quality of life, disrupt sleep patterns and social engagements, leading to decreased work productivity and missed school days. Poor sleep quality as a result of AR can cause daytime sleepiness. The extent of these effects is related to the severity of AR symptoms. AR often coexists with various other health conditions [2].

Treatment options for allergic rhinitis include allergen avoidance, local corticosteroids, leukotriene receptor antagonists, medications that suppress Th2 cytokines, and nasal antihistamines. Despite these treatments being available, their effectiveness is limited and long-term use can be costly [3].

In patients with severe rhinitis that is not responding to other treatments, surgical options can be explored due to the presence of para-sympathetic nerve fibers in the nasal cavity's inferior and middle meatus. Various surgical procedures, such as vidian neurectomy and reducing the size of the inferior turbinate, have been reported with different degrees of success [4, 5].

Golding-Wood initially introduced Vidian neurectomy as a treatment for allergic and vaso-motor rhinitis. However, this procedure resulted in a significant number of postoperative complications, including altered tear production and feelings of numbness in the cheek and gums [5].

Patients with drug-resistant allergic rhinitis often undergo posterior nasal nerve resection as a surgical treatment. This procedure, derived from Vidian neurectomy, effectively decreases excessive secretion and hypersensitivity by removing the Vidian nerve through a transantral approach. Nevertheless, Vidian neurectomy may lead to lasting side effects like decreased tear production and numbness in the upper lip [6].

A modern alternative method called posterior nasal neurectomy involves the targeted cutting or cauterization of neural bundles at the spheno-palatine foramen under direct visualization. This technique allows for the prevention of surgical complications, specifically avoiding decreased tear production [6].

The aim of the present work is to compare between [Turbinoplasty alone or with Posterior Nasal Nerve Neuroectomy] used in treatment of allergic rhinitis not responding to medical treatment.

PATIENTS AND METHODS

This Prospective study was conducted on 60 patients diagnosed with allergic rhinitis and referred to the outpatient clinic of Al Zahraa University Hospital and Military Hospitals from 2020-2023. They divided randomly into two equal groups: Group [A]: patients will be treated with turbinoplasty alone [30 candidates], Group [B]: patients will be treated with turbinoplasty with posterior nasal nerve neurectomy [30 candidates].

The inclusion criteria: [1] Patients between 20 and 60 years old who have been diagnosed with allergic rhinitis were included in the study after providing consent, [2] Patients with rhinitis symptoms that did not respond to the most effective medical treatments and whose quality of life was significantly affected, and [3] Patients with allergic history, increasing total immunoglobulin E [IgE] levels and increasing Eosinophilic count in CBC test.

The exclusion criteria: [1] Patients with history of previous sinus or Nasal surgery, [2] Patients with any underlying disease of nasal and paranasal sinuses including benign or malignant neoplasms, sino nasal polyposis, retention cysts, antro-choanal polyps, mucoceles and fungal sinusitis, and [3] Patients with history of previous nasal trauma [CSF Rhinorrhea].

Pre-operative clinical Evaluation

All patients were submitted to the following items, full history taking including personal history, complain, ENT history to all symptoms of allergy like sneezing, itching, nasal obstruction, rhinorrhea who had been unresponsive to the most intensive medical therapy for a minimum of one year and whose quality of life had been notably impacted were included. The history also included patient questioning [TNSS], Examination including general and ENT examination, the nose is examined using anterior rhinoscope and nasal endoscope.

All patients enrolled in the study underwent a computed tomography scan of the nose and paranasal sinuses to identify any anatomical irregularities.

Investigation including eosinophilic count in CBC, total [IgE], routine pre-operative laboratory investigation. The patients were briefed about the surgical procedures and signed an informed consent form.

Surgical technique

Preoperative preparation: Administration of topical vasoconstrictor [pack with 0.05% xylometazoline].

Anesthesia: General endotracheal intubation anesthesia used for all patients in supine position.

Group A [Turbinoplasty]

Removal of preoperative nasal pack, a 0 or 30 rigid endoscope the nasal cavity is examined and administration of topical vasoconstrictor [pack with 0.05% xylometazoline] or alternative drug [pack soaked with 1/200000 adrenaline].

Cauterizing the surface of inferior turbinate: During the endoscopic examination of the lower nasal turbinate, a Valleylab bipolar cautery tip was utilized with the Valleylab Force 2 electrosurgical system. The procedure included two passes [medial and inferior] over the surface of the lower turbinate while avoiding the front end. The bipolar setting was adjusted to a power level ranging between 15 and 20 j/s, and each probe was activated and held in position for a precise duration of 2 to 4 seconds [with 100 J applied during each pass], or discontinued in less than 4 seconds if mucosal blanching was observed. Linear cautery of the lower turbinate was performed from the back to the front with a 2 mm spacing. No packs were required.

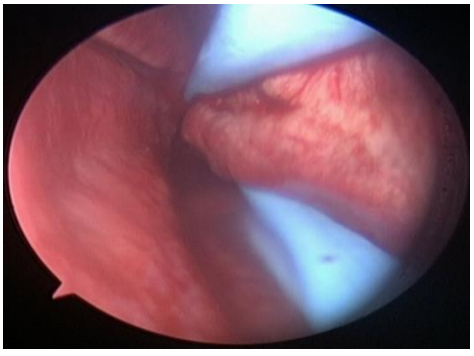

Figure [1]: Cauterization of the surface of inferior turbinate

Group B [posterior Nasal nerve neurectomy with Turbinoplasty: The patient was positioned supine on the operating table, with the table angled at a minimum of 15 degrees up to 30 degrees in an anti-Trendelenburg position. The patient's head was maintained in a neutral position, neither flexed nor extended. A 0 or 30 rigid endoscope was used to examine the nasal cavity, and a topical vasoconstrictor [packed with 0.05% xylometazoline] was administered. The middle turbinate was gently medialized to allow access to the posterior middle meatus. About 1-2 ml of 1% lidocaine with 1:100,000 epinephrine was injected into the submucosa of the posterior lateral wall of the middle meatus to facilitate the dissection of the mucoperiosteal flap. A vertical incision was made behind the posterior fontanelle, identifying its posterior end through palpation with an elevator. Just behind this point, a vertical incision was made on the lateral nasal wall, extending down to the attachment of the inferior turbinate. A prior uncinectomy and maxillary antrostomy could have been performed to aid in locating the posterior wall of the maxillary antrum, although it was not always necessary. If a maxillary antrostomy was conducted, the posterior wall of the maxillary antrum might have served as the anterior boundary for dissection toward the sphenopalatine foramen. A subperiosteal flap was extensively elevated from the lateral nasal wall in the subperiosteal plane using a suction-free technique. The flap elevation was continued broadly in an anterior to posterior direction for the identification of the crista ethmoidalis and then the sphenopalatine foramen along with the accompanying neurovascular bundle. The superior and inferior nasal nerves were identified, dissected from the artery, cut, and both ends were cauterized. The flaps were then repositioned into place, and no post-operative nasal packing was utilized.

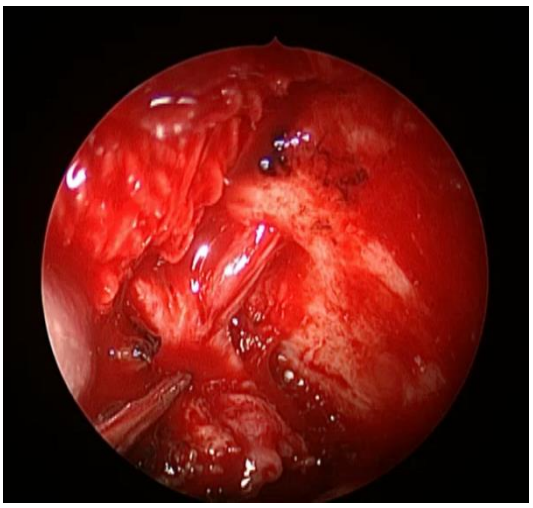

Figure 2: Sphenopalatin artery detection

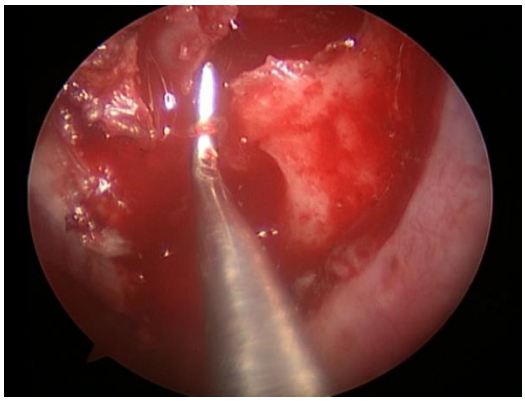

Figure 3: Posterior nasal nerve dissection

Postoperative follow up: Following the surgical procedure, regular follow-up appointments involved weekly anterior rhinoscopy and endoscopic nasal examinations for the initial month, followed by monthly appointments up to six months. Patients were prescribed systemic antibiotics. They were instructed to uphold proper nasal hygiene by using nasal saline spray and irrigation, particularly in the first two weeks post-surgery, to reduce post-operative crusting and adhesions. Periodic follow up evaluation of the patients clinically, endoscopic and radiological was done to detect and manage postoperative complication synechiae, nasal crustation and bleeding.

Statistical analysis: Statistical analysis was performed using SPSS version 26.0. Numeric variables were presented as mean ± standard deviation [SD] if normally distributed or median and interquartile range [IQR] if not normally distributed. Frequencies and percentages were used to present categorical variables. The normality of distribution was assessed using the Kolmogorov-Smirnov test. Independent samples t-test was used to compare normally distributed numeric variables between two groups, while the Mann-Whitney U test was used for non-normally distributed numeric variables. Chi-square test or Fisher's exact test [if more than 20% of cells have expected count less than 5] was used to examine the relations between categorical variables. Paired samples t-test was used to compare related numeric variables within the same group if normally distributed, while Wilcoxon signed-rank test was used for non-normally distributed paired variables. P values less than 0.05 were considered statistically significant.

RESULTS

Table [1] shows that there were no significant differences between studied groups regarding age, IgE and eosinophilic count.

Table [2] shows that all cases in both group A and B complained from nasal obstruction, 18 [60%] patients in group [A] had rhinorrhea while 24[80%] in group [B] had rhinorrhea, 16 [53.3%] patients in group [A] had sneezing while 12 [40%] cases in group [B] had sneezing, 10 [33.3%] patients in group [A] had itching while 9 [30%] cases in group [B] had itching.

Table [3] shows that all cases was relived from nasal obstruction, 17[56.7%] case still had rhinorrhea, 14 [46.7%] still had sneezing, 9 [30%] still had nasal itching.

Table [4] show all cases was relived from nasal obstruction, no cases still had rhinorrhea, 1 [3.3%] cases still had sneezing, and 6 [20%] cases still had nasal itching.

Table [5] shows that all cases in both group A and B was relieved from nasal obstruction after operation, 17 [56.7%] patients in group [A] still had rhinorrhea while none of cases in group [B] had rhinorrhea, 14 [46.7%] patients in group [A] still complained from sneezing after turbinoplasty alone while 1[3.3%]cases in group [B] had sneezing , 9 [30%] patients in group [A] still complained from itching after turbinoplasty alone while 6[20%] cases still had in group [B] had itching.

Table [6] demonstrates that there was no significant difference between both groups regarding frequency of complications.

Table [1]: Demographic and laboratory data of studied cases

Variable		Group [A] [n=30]	Group [B] [n=30]	Sig.
Age [years]	Mean± SD	28.13 ± 5.39	26.45 ±4.97	0.21
	Median [IQR]	26.0 [25.0-33.0]	22.0 [21.0- 25.0]	
	Range	22.0- 40.0	20.0- 38.0	
IgE	Median [IQR]	124 [112 – 223]	140 [105 – 220]	0.982
	Range	75 – 630	80 – 1000	
Eosinophilia	Median [IQR]	23 [12 – 30]	22 [15 – 28]	0.882
	Range	3 – 150	5 – 450	

Table [2]: Comparison between the two groups preoperative

Pre		Group [A]	Group [B]	Test value	P-value
		No. = 30	No. = 30		
Obstruction	No	0 [0.0%]	0 [0.0%]	–	–
	Yes	30 [100.0%]	30 [100.0%]		
Rhinorrhea	No	12 [40.0%]	6 [20.0%]	2.857	0.091
	Yes	18 [60.0%]	24 [80.0%]		
Sneezing	No	14 [46.7%]	18 [60.0%]	1.071	0.301
	Yes	16 [53.3%]	12 [40.0%]		
Itching	No	20 [66.7%]	21 [70.0%]	0.077	0.781
	Yes	10 [33.3%]	9 [30.0%]		

Table [3]: Comparison between pre-operative and post-operative in group [A]

		Group [A]		Test value	P-value
		Pre	Post		
Obstruction	No	0 [0.0%]	30 [100.0%]	60.000	0.000
	Yes	30 [100.0%]	0 [0.0%]		
Rhinorrhea	No	12 [40.0%]	13 [43.3%]	0.069	0.793
	Yes	18 [60.0%]	17 [56.7%]		
Sneezing	No	14 [46.7%]	16 [53.3%]	0.267	0.605
	Yes	16 [53.3%]	14 [46.7%]		
Itching	No	20 [66.7%]	21 [70.0%]	0.077	0.781
	Yes	10 [33.3%]	9 [30.0%]		

Table [4]: Comparison between pre and post-operative in group [B]

		Pre	Post	Test value	P-value
Obstruction	No	0 [0.0%]	30 [100.0%]	60.000	**0.000**
	Yes	30 [100.0%]	0 [0.0%]		
Rhinorrhea	No	6 [20.0%]	30 [100.0%]	40.000	**0.000**
	Yes	24 [80.0%]	0 [0.0%]		
Sneezing	No	18 [60.0%]	29 [96.7%]	11.882	**0.001**
	Yes	12 [40.0%]	1 [3.3%]		
Itching	No	21 [70.0%]	24 [80.0%]	0.800	0.371
	Yes	19[31.7%]	15[25.0%]		

Table [5]: Comparison between the two groups postoperative

Post		Group [A]	Group [B]	Test value	P-value
		No. = 30	No. = 30		
Obstruction	No	30 [100.0%]	30 [100.0%]	–	–
	Yes	0 [0.0%]	0 [0.0%]		
Rhinorrhea	No	13 [43.3%]	30 [100.0%]	23.721	0.000
	Yes	17 [56.7%]	0 [0.0%]		
Sneezing	No	16 [53.3%]	29 [96.7%]	15.022	0.000
	Yes	14 [46.7%]	1 [3.3%]		
Itching	No	21 [70.0%]	24 [80.0%]	0.800	0.371
	Yes	9 [30.0%]	6 [20.0%]		

Table [6]: Comparison between two groups regarding post-operative complication

	Group [A]	Group [B]	Test value	P-value
	No. = 30	No. = 30		
Crustation 1 week	30 [100.0%]	30 [100.0%]	–	–
Crustation after 1 month	24 [80.0%]	22 [73.3%]	0.373	0.542
Crustation after 3 months	4 [13.3%]	2 [6.7%]	0.741	0.389
Synechiae	5 [16.7%]	3 [10.0%]	0.577	0.448
Bleeding	0 [0.0%]	0 [0.0%]	–	–

DISCUSSION

The posterior nasal nerve provides most of the parasympathetic, sympathetic, and sensory fibers that control the nasal respiratory mucosa. Thus, conducting a posterior nasal neurectomy [PNN] can lead to a loss of nerve supply to the nasal mucosa, potentially alleviating symptoms of allergic rhinitis [AR]. By removing nerve fibers, choline acetyltransferase and neuropeptides in the nasal mucosa, PNN may help in reducing the allergic response in AR [7].

This study evaluated turbinoplasty techniques in patients with allergic rhinitis who had not responded adequately to medical management. Allergic rhinitis is a common condition that can significantly impair quality of life. While pharmacological treatments are usually first-line, some patients continue to experience bothersome symptoms that impact their daily activities and sleep. Surgery may be recommended in these refractory cases where medical therapy has failed to control nasal congestion and obstruction [3-5]. Younger patients with many remaining years of potential rhinitis symptoms as well as those with significant nasal anatomical abnormalities seen on examination are most likely to benefit from a surgical approach aiming to improve nasal airflow. Turbinoplasty procedures assessed in this study provide an option for symptom relief in allergic rhinitis patients in whom lifestyle and functional limitations persist despite optimized medical therapy. Careful patient selection is important to help identify those most suitable for and likely to gain the greatest benefit from adding a surgical intervention.

In the current study, the mean age of the studied patients was 28.13 ± 5.39 years and 26.45 ±4.97 years in group [A] and group [B] respectively. All cases were males in both group A and B. The findings of this study are consistent with **Zaghloul [8]'s** research, which aimed to assess the impact of posterior nasal nerve resection on endoscopic posterior nasal neurectomy for persistent allergic rhinitis. The study encompassed individuals aged between 17 and 44 years, with the mean age ± standard deviation [28.02 ± 5.43 years]. The majority of patients were male, accounting for 60.3% of the participant pool.

In group [A], all 30 participants [100%] experienced nasal obstruction, 18 participants [60%] had rhinorrhea, 10 participants [33.3%] had itching, and 16 participants [53.3%] had sneezing. All cases of nasal obstruction were relieved, but 17 participants [56.7%] still had rhinorrhea, 14 participants [46.7%] still had sneezing, and 9 participants [30%] still had nasal itching. In the study conducted by **Türk *et al.*** [9], it was shown that there was a statistically notable improvement in symptoms such as runny nose, itching, and sneezing following radiofrequency ablation [RFA]. The reduction in sneezing symptoms post-RFA was linked to the eradication of the post-nasal nerve branches. Nonetheless, it is important to note that the posterior nasal nerve, which plays a role in innervating the nasal mucosa, is distributed throughout the entire nasal mucosa. In the study by **Hamerschmidt *et al.*** [10], it was found that 94.7% of patients experienced significant improvement in nasal obstruction following surgery. The advantages of addressing the inferior turbinate surgically extend beyond just resolving nasal obstruction; they also extend to alleviating other symptoms of rhinitis, particularly sneezing. Over 85% of patients who commonly experienced itching, sneezing, and a runny nose reported achieving moderate to complete recovery in these symptoms.

In group [B], all 30 participants [100%] reported nasal obstruction, 24 participants [80%] had rhinorrhea, 9 participants [30%] experienced itching, and 12 participants [40%] had sneezing. All cases of nasal obstruction were relieved, with no participants still experiencing rhinorrhea. Only 1 participant [3.3%] still had sneezing, and 6 participants [20%] were still experiencing nasal itching. In their respective studies, **Ahilasamy and Dinesh** [11] demonstrated notable improvement in nasal symptoms such as sneezing [90%] and rhinorrhea [92%] following posterior nasal nerve neurectomy, with minimal to no complications reported. **Kobayashi *et al.*** [12] analyzed the effectiveness and safety of posterior nasal neurectomy in managing allergic rhinitis that is unresponsive to medical therapy. They attributed the treatment's efficacy in addressing rhinorrhea to the inhibition of nasal secretion through the disruption of parasympathetic nerve supply to the nasal mucosa. **Nishijima *et al.*** [7] affirmed the effectiveness of posterior nasal nerve neurectomy in significantly improving clinical symptoms with a low rate of complications, noting improvements in sneezing [68.3%], nasal itching [81%], rhinorrhea [88.9%], and nasal obstruction [79%]. **Kawamura *et al.*** [13] observed subjective improvement in nasal obstruction,

sneezing, and nasal discharge in 100%, 90%, and 75% of patients, respectively, following submucosal turbinectomy combined with posterior-superior nasal neurectomy.

In the current study concerning posto-perative outcomes, all cases in both group A and B were relieved from nasal obstruction after the operation. Furthermore, 60% of patients in group A had rhinorrhea, while none of the cases in group B had rhinorrhea. Group B exhibited a statistically significant decrease in the rate of rhinorrhea compared to group A [p < 0.001]. Our results supported by **Albu *et al.*** [14] who reported that there was statistical significance regarding to nasal obstruction and rhinorrhea relative to post-operative after Endoscopic microdebrider-assisted inferior turbinoplasty with and without posterior nasal neurectomy. These results supported by **Ikeda *et al.*** [15] who aimed to evaluate Functional inferior turbine-surgery for the treatment of resistant chronic rhinitis. Who reported that rhinorrhea improved significantly postoperative PNN. Our results supported by Our results supported by **Wang *et al.*** [16] who aimed to evaluate effect of posterior nasal neurectomy in suppression of allergic rhinitis. Post-operative rhinitis and sneezing improve significantly relative to post-operative, postoperative rhinorrhea [6.03 ± 1.31 preoperative vs 2.12 ± 1.40 postoperative, P < 0.001] and sneezing [5.53 ± 1.25 vs 2.04 ± 1.29, P < 0.001].

The present study showed that [53.3%] patients in group [A] still complained from sneezing after turbinoplasty alone while none of cases in group [B] had sneezing. Group [B] showed statistically significant decrease in rate of sneezing compared to group [A] [p<0.001]. These results supported by **Kobayashi *et al.*** [12] who reported that there was statistical significance between groups regarding to sneezing post-operative. Also, our results supported by **Ikeda *et al.*,** [15] who reported that sneezing improved scientifically post-operative PNN. This study supported with **Mori *et al.*** [17] who aimed to assess the long-term effect of submucous turbinectomy for patients with perennial allergic rhinitis. The study included 30 patients. Nasal symptom of patients improves scientifically post-operative, total nasal symptom score was significantly lower at 1 year after surgery [7.5 ± 1.6 preoperative vs. 1.8 ± 1.8 postoperative, P <.0001] compared with before surgery. Our findings align with those of **Ogi *et al.*** [18] who conducted a study to assess the long-term effects of combined submucous turbinectomy and posterior nasal neurectomy in patients with allergic rhinitis. The research included 127 patients who had undergone endoscopic ST along with PNN. Following the surgery, there was a significant improvement in nasal symptoms, as indicated by considerably lower symptom scores compared to preoperative values for nasal sneezing [1.03 ± 0.20 preoperative vs. 0.56 ± 0.13 post-operative, P < 0.01], rhinorrhea [1.92 ± 0.19 preoperative vs. 1.14 ± 0.14 postoperative, P < 0.01], and nasal obstruction [2.42 ± 0.15 pre-operative vs. 1.22 ± 0.14 postoperative, P < 0.01].

In this study there was no statistically significant difference between Two groups regarding to synechiae, 5 [16.7%] in group [A] and 3 [10 %] in group [B]. **Alzobir *et al.*** [19] found that there was a similar rate of post-operative synechiae between both groups, with approximately 10% to 20% prevalence in each group following Turbinoplasty surgery, and this difference was not statistically significant. Our results supported by **Albu *et al.*** [14] who reported that there was statistical significance [preoperative vs. postoperative] [p<0.001] in Endoscopic microdebrider-assisted inferior turbinoplasty with and without posterior nasal neurectomy.

The posterior nasal nerve, a peripheral branch of the vidian nerve, and procedures like PNN and VN are designed to effectively reduce nasal hypersecretion by interrupting the function of autonomic vidian nerve fibers, while also addressing hypersensitivity by blocking sensory nerve fibers [20]. So, PNN offers a different option from VN, potentially preventing dry eyes. We carried out a backward-looking analysis of the patients' medical files. Consistent with **Ahilasamy** [11]'s results, there was a notable improvement in symptoms [sneezing and runny nose] accompanied by minor issues like numbing of the lips and adhesions in the nose. Numbness in the lips may result from performing neurectomy with electrocoagulation near the sphenopalatine foramen.

Neuropeptides, a type of neurotransmitter found throughout the peripheral nervous system, had many functions in immune and vascular regulations [21]. When neuropeptides are released locally, they trigger vasodilation in the nasal mucosa, with levels elevated in allergic rhinitis [22]. Studies indicate that neuropeptides can attract

dendritic cells to the airway and drive a type-2 immune response [23]. The surgical approach involves blocking much of the parasympathetic and sympathetic nerve supply to the nasal mucosa, reducing neuropeptide levels, and consequently alleviating allergic rhinitis symptoms [6]. **Wang *et al.*** [16]'s research revealed that PNN-induced denervation of the nasal mucosa effectively decreased NPY and SP expression in the nasal fluid layer as detected by ELISA.

Allergic rhinitis [AR] is a well-known condition driven by Th2 immune responses, prominently featuring signature type 2 cytokines such as IL-5 and periostin. Periostin, produced by airway epithelial cells, is stimulated by IL-4 and IL-13, both crucial in AR pathogenesis [24]. To gauge PNN's impact on nasal allergic inflammation, it is essential to investigate whether PNN hinders the production of these cytokines. By reducing IL-5 and periostin levels, it may be possible to regulate AR at its root [16]. Therefore, further research is needed to ascertain if neuropeptides in the nasal mucosa can induce Th2 cytokines and elucidate the underlying mechanisms.

Conclusion: Posterior nasal nerve neurectomy is a better surgical intervention for treatment of cases with allergic rhinitis not responding to medical treatment.

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