OUTCOMES OF DIFFERENT SURGICAL TECHNIQUES FOR INFERIOR TIRBINATE HYPERTROPHY: A COMPARATIVE ANALYSIS

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ABSTRACT

Background: The inferior turbinate is one of the most common causes of nasal obstruction. Sometimes individuals have difficulty in concentrating at work or school, doing exercises, or engaging in social activities due to nasal obstruction. Nasal obstruction is initially treated conservatively. Nevertheless, numerous patients continue to experience symptoms, so the next step is surgical intervention.

Objective: We compare outcomes of various surgical techniques for inferior turbinate hypertrophy.

METHODS: A prospective observational study will be carried out on 80 patients from July 2023 to June 2025 with hypertrophied inferior turbinates. Four surgical techniques include Partial Turbinectomy, Turbinoplasty, Submucosal Diathermy and Outfracture of Inferior Turbinate in patients. Twenty patients were involved in each surgical technique randomly. Comparison of outcomes of various surgical techniques done using the Nasal Obstruction Symptom Scale (NOSE) scoring System.

Result: More symptomatic relief by turbinoplasty and partial turbinectomy as compared to submucosal diathermy and outfracture of the inferior turbinate. After 3 months of follow-up, the patients who underwent partial turbinectomy and turbinoplasty showed significant improvement in NOS(nasal obstruction score). In patients who underwent submucosal diathermy, outfracture of the inferior turbinate also showed improvement in extreme cases (Nasal Obstruction Score).

Conclusion: The superior surgical method for treating inferior turbinate hypertrophy, according to my research, is inferior turbinoplasty when compared with other conventional surgical techniques, based on its effectiveness in improving preoperative symptoms and causing fewer complications.

INTRODUCTION

Various anatomical or pathological causes can result in chronic nasal blockage.

www.ajmrhs.com
eISSN: 2583-7761

Date of Received: 09-06-2026
Date Acceptance: 17-06-2026
Date of Publication: 16-06-2026

Chronic nasal obstruction results in various symptoms, including breathing difficulty, nasal congestion, and a reduced sense of smell. Sometimes individuals have difficulty in concentrating at work or school, doing exercises, or engaging in social activities due to nasal obstruction. Chronic nasal obstruction also interferes with the function of the respiratory, olfactory, gustatory, phonatory and ventilation of the paranasal sinuses. [1] The inferior turbinate is one of the most common causes of nasal obstruction. Nasal blockage can be of 3 types: acute, intermittent and chronic. A patient with chronic nasal obstruction may have a

compensated hypertrophied inferior turbinate. There are several classification systems for inferior turbinate hypertrophy. Camacho et al. [2] categorised the size of the inferior turbinate into four grades, determined by its position within the overall nasal airway space as observed through nasoendoscopic evaluation. When the inferior turbinate takes up 0 to 25% of the total airway space, it is classified as grade 1; grade 2 corresponds to 26% to 50%; grade 3 is assigned to 51% to 75%; and grade 4 is designated for 76% to 100% (Figure 1).

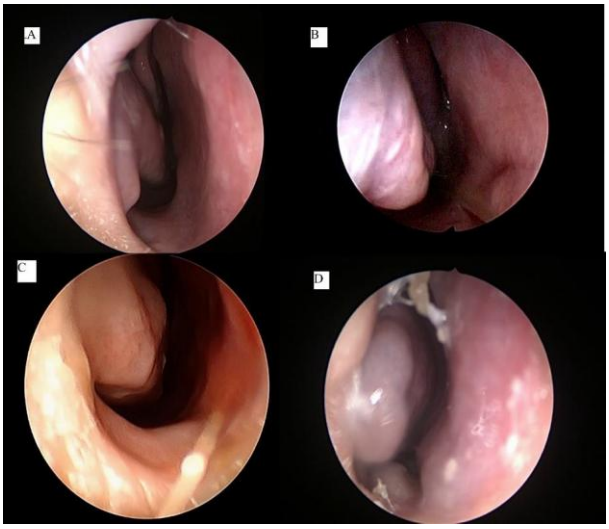

Figure 1. Nasoendoscopic grading system of inferior turbinate hypertrophy; (A)grade 1 is 0–25% of total airway space occupied, (B) grade 2 is 26–50% occupied,(C) grade 3 is 51–75% occupied,(D) grade 4 is 76–100% occupied.

Nasal obstruction is initially treated conservatively. The primary treatment consists of antihistamines, along with systemic or topical decongestants and corticosteroids [3]. Nevertheless, numerous patients continue to experience symptoms, so the next step is surgical intervention. The surgical approach for nferior turbinate hypertrophy involves tissue volume reduction surgery, a procedure reducing the volume of the inferior turbinates [3]. Depending on the surgical technique employed, the procedure focuses on both the bone and the submucosal tissue. The fibrosis in the submucosal tissue reduces turbinate engorgement, whereas reduced bone enhances the intranasal space, thereby alleviating nasal obstruction. [4].

Typically, the therapeutic strategy is primarily addressing the underlying cause. For instance, the therapeutic approach aims to regulate the primary inflammatory response and related indicators in allergic rhinitis [5]. However, the patients were advised to avoid exposure to allergens. Medical management is usually given to control the present symptoms [6].

In contrast, various surgical interventions exist for nasal obstruction when medical treatments prove ineffective. Nonetheless, a continuous discussion persists concerning the most effective technique. The primary classifications of the available methods include conventional and the latest surgical procedures. [7].

Various surgical techniques for turbinate reduction have been studied.

1. **Partial Turbinectomy** - A partial turbinectomy is a surgical procedure in which part of the nasal turbinates is removed to improve airflow and treat conditions like nasal obstruction. [8]
2. **Turbinoplasty:** Turbinoplasty is a surgical procedure that reshapes or reduces the size of the nasal turbinates to improve airflow and alleviate nasal obstruction.[8]
3. **Outfracture of the inferior turbinate**: Outfracture of the inferior turbinate is a surgical technique where the turbinate is displaced laterally to open the nasal airway and alleviate nasal obstruction.[8]
4. **Submucosal diathermy** - Submucosal diathermy is a surgical procedure that uses heat to shrink or remove tissue beneath the mucous membrane, often performed on the nasal turbinates to treat chronic nasal obstruction.[8]

Each technique offers a different approach to alleviating nasal obstruction caused by turbinate enlargement. This study aims to compare various techniques in the surgical management of inferior turbinate hypertrophy. The following are the objectives of this study:

1. To evaluate the causes of inferior turbinate hypertrophy.
2. To study and compare the surgical outcome of Partial turbinectomy, Turbinoplasty,

Outfracture of the inferior turbinate and Submucosal diathermy.

3. To compare surgical outcomes of these surgical procedures in relation to bleeding, crusting, and synechiae formation.

MATERIALS AND METHODS

A prospective observational study will be carried out on 80 patients with nasal obstruction attending the Otolaryngology-Head and Neck Surgery Department of the tertiary care centre. Each patient received a consent form, and the confidentiality and protection of data were upheld. The study spans from July 2023 to June 2025. Those with inferior turbinate hypertrophy are classified and graded using the NOSE (Nasal Obstruction Symptom Evaluation) scale and are therefore included in the study.

Inclusion Criteria

All patients aged between 10 to 70 years with nasal obstruction and inferior turbinate hypertrophy, with or without allergic rhinitis and with or without septal deviation, not responding to medical treatment were included in this study. A total of 80 patients were included in the study. Among them, 30 patients had allergic rhinitis with inferior turbinate hypertrophy, 15 patients had chronic sinusitis with inferior turbinate hypertrophy, and 25 patients had a deviated nasal septum with inferior turbinate hypertrophy. The remaining 10 patients had isolated inferior turbinate hypertrophy and did not respond to medical treatment.

Exclusion Criteria

1. Patients below 10 years, above 70 years,
2. Patients with systemic diseases like diabetes, hypertension, coronary artery disease, liver or kidney disease or a bleeding disorder, coagulation disorders, chronic granulomatous disorders and immunocompromised patients (HIV I and II) were excluded from this study.
3. Patients with Atrophic rhinitis.

METHODOLOGY

A detailed medical history was taken, followed by a thorough general, systemic, and local and nasal endoscopic examination. The obstructive symptom score is assessed using the Nasal Obstruction Symptom Evaluation (NOSE) Scale. Lipan and Most established a classification system for the severity of obstructive symptoms according to the NOSE Scale score, categorising nasal obstruction as mild (score range of 5-25), moderate (score range of 30-50), severe (score range of 55-75), or extreme (score range of 80-100). [9,10] The patients were treated with topical decongestants, antihistamines, and steroids for a period of six weeks.

Pre-Operative Assessment: Routine blood investigations include complete blood count, ESR, Viral Markers (HIV, HBsAg, HCV), Random Blood Sugar, X-Ray PNS (Waters' view), and CT PNS in selected cases.

Surgical Techniques Used for Inferior Turbinate Reduction: Patients included in this study underwent these procedures in a randomised manner and were then divided into 4 groups of 20 cases each.

The procedures performed were as follows

1. Partial Turbinectomy.
2. Turbinoplasty.
3. Outfracture of the inferior turbinate
4. Submucosal diathermy

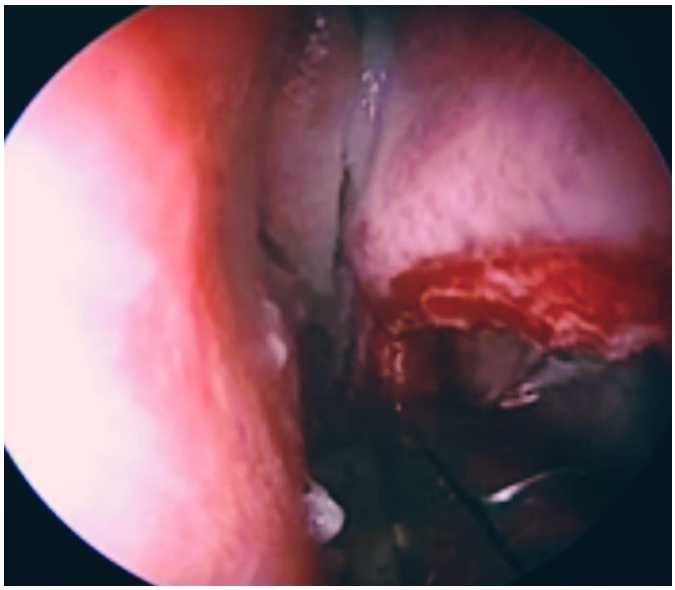

FIGURE 2 - Partial Turbinectomy of Inferior Turbinate

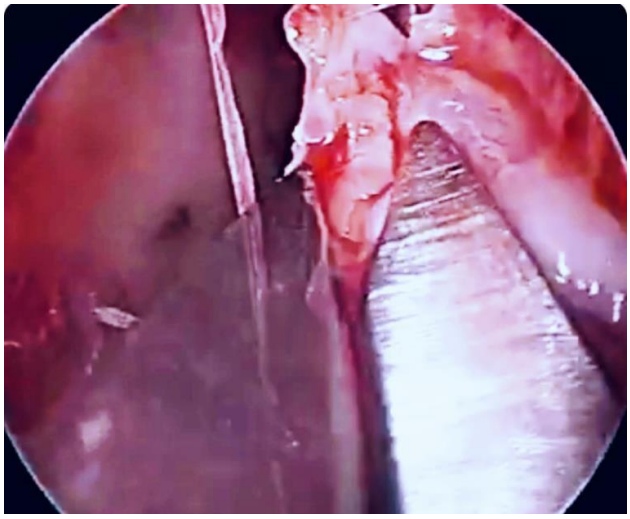

FIGURE 3: Inferior Turbinoplasty

FIGURE 4: Outfracture of Inferior Turbinate

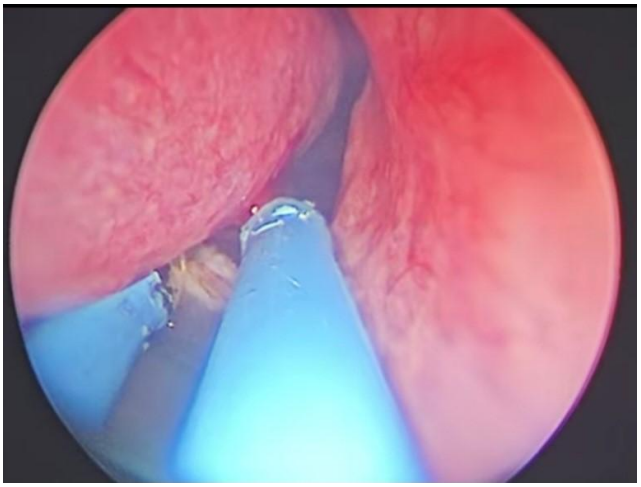

FIGURE 5*:* Submucosal Diathermy of Inferior Turbinate

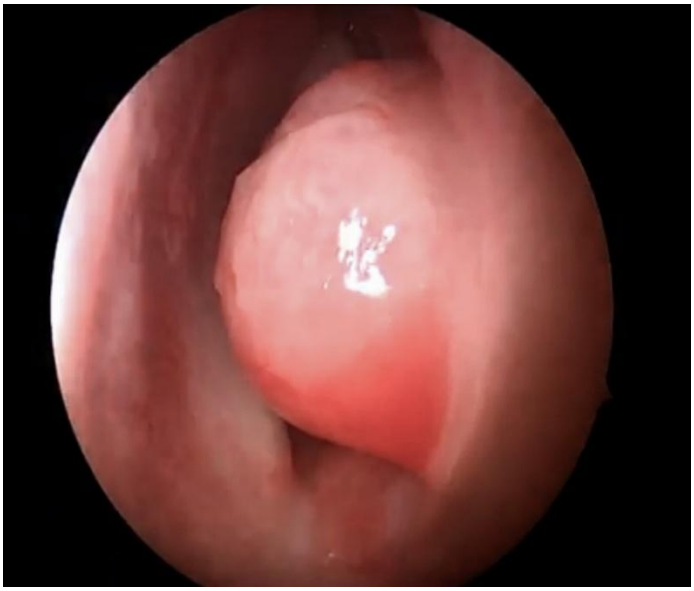

FIGURE 6: Preoperative Endoscopic Image of the Left Hypertrophied Inferior Turbinate

FIGURE 7: Postoperative (3 months)Endoscopic Image of the Left Inferior Turbinate

Patients with a deviated nasal septum and inferior turbinate hypertrophy underwent septoplasty along with inferior turbinate reduction. In patients with chronic sinusitis, endoscopic sinus surgery was performed in addition to inferior turbinate reduction. As the primary focus of this study was the evaluation of inferior turbinate reduction techniques, only these techniques and their outcomes were analysed and discussed. The data collected from patients and the subsequent analysis on enhancing the nasal airway, and the occurrence of postoperative synechiae, haemorrhage, crust formation, facial oedema, and postoperative pain. Follow-up data are collected at 3-weeks, 1 month, and 3 months following the operation to evaluate short-term and intermediate outcomes.

Statistical Analysis: Descriptive statistics were used to summarise the data in SPSS v23. A comparative analysis among the surgical groups will be performed utilising statistical tests such as Student's t-test for continuous data and Fisher's Exact Test or $\chi 2$ test for categorical data.

RESULT: The results are summarised in the following table. The majority of patients in our study belong to the 26-40 years age group, comprising 40% (n=32), followed by 41-55 years – 32.5% (n=26), 10-25 years and 56 – 70 years – 13.75% (n= 11). 47.5% (n=38) of patients in our study had Extreme Symptoms, 41.25% (n=33) of patients had Severe Symptoms, and 11.25% (n = 9) of patients had Moderate Symptoms.

DISCUSSION AND RESULTS

The age distribution of the present study (Table 1) was characterised by a mean age of 28.03±12.847 years, with a median age of 23.50 years. In this study, the minimum age was 10 years, and the maximum age was 70 years. Out of 80 cases, the majority, 32 cases (40%), were in the 26-40 years age group. This correlates with the findings of Datta R. K. (2018) [11], where the mean age was higher at 33.69 years, and the most common age group was 26-35 years and in Shiv Kumar's (2020) [12] study, the most common age group was 20-30 years.

The present study reports varying success rates for different nasal surgical procedures (Table 3). Partial turbinectomy showed a 90% success rate, and Turbinoplasty had a success rate of 100% after 3 months of surgery. In a study by Shiv Kumar (2020) [12], 30 patients underwent inferior turbinectomy, with 95% recovery at the end of 6 months of follow-up, and inferior turbinoplasty was done in 30 patients, with 98% recovery. In the present study, Submucosal diathermy demonstrated a 75% success rate, while outfracture of the inferior turbinate had a 70% success rate. These findings underscore the high effectiveness of turbinoplasty in particular, with the other procedures also showing considerable success rates. There was a statistically significant difference in success rates among the four surgical procedures ($p<0.001$).

In the present study, as per Table 4, all 80 patients had a complaint of nasal obstruction; out of 80 patients, 86.25% got relieved after 3 months postoperatively. Sneezing was reported by 50 patients preoperatively, resulting in an 88% improvement. Rhinorrhoea affected 60 patients before the operation, resulting in a 91.7% improvement. Itching was present in 3 patients preoperatively and was absent postoperatively, with 100% improvement. Similarly, headaches, reported by 12 patients preoperatively, were completely absent postoperatively, showing a 100% improvement. In a study by Shiv Kumar (2020) [12], the effectiveness of a treatment regimen was assessed based on its impact on various nasal symptoms. The results demonstrated significant improvement rates across key symptoms: nasal obstruction showed a remarkable 86.25% improvement, while sneezing and rhinorrhoea (runny nose) improved by 88% and 91.7%, respectively. Itching and headache, associated with nasal conditions, both saw complete improvement rates of 100%. There was a statistically significant reduction in nasal obstruction, sneezing, rhinorrhoea and headache following surgery ($p<0.05$). The reduction in itching was not statistically significant because of the small number of affected patients ($p>0.05$).

Table 5 summarises post-operative complications for four nasal surgical procedures performed on 20 patients each. Immediate complications were most notable for bleeding, observed in 20% of partial turbinectomy cases, 15% of turbinoplasty, and 10% in both outfracture of the inferior turbinate and submucosal diathermy, with facial oedema exclusively reported in 20% of submucosal diathermy cases. Delayed complications predominantly involved crusting, highest in submucosal diathermy (40%) and partial turbinectomy (40%), followed by turbinoplasty (15%) and outfracture of the inferior turbinate(10%). Synechiae were observed only in 10% of partial turbinectomy cases, while delayed bleeding and pain were rare, affecting ≤10% across procedures. These findings highlight crusting as the most common delayed complication, particularly in less invasive procedures, while bleeding is more associated with immediate post-operative outcomes in invasive techniques. A statistically significant difference was observed among the surgical techniques with respect to facial oedema ($p<0.05$) and crusting ($p<0.05$). No significant difference was noted for bleeding synechiae or pain ($p>0.05$). In a study conducted by Ahmad Abdul Khabeer in 2023 [13], among the complications, bleeding was observed in 53% of partial turbinectomy and 36% of turbinoplasty; crusting was observed in 76% of partial turbinectomy, 13% of turbinoplasty and 70% of submucosal diathermy; whereas synechiae, pain and facial oedema were not reported in any operative procedure. The study by Menon et al (14) found that bleeding is more common in turbinectomy(10%) compared to turbinoplasty(3.3%), which is similar to this study. Similarly, post-operative crusting is more in turbinectomy(50%) than in the turbinoplasty group (30%) in this study. In the study by Rodrigues et al (15), bleeding was slightly more in the turbinoplasty group (33.3%) than in the turbinectomy group (26.6%).

After 3 months of follow-up, the patients who underwent partial turbinectomy and turbinoplasty showed significant improvement in NOS(nasal obstruction score), and endoscopically, there is improvement in nasal patency. In patients who underwent submucosal diathermy and outfracture of the inferior turbinate also showed improvement in extreme cases (Nasal Obstruction Score). There was a statistically significant difference in symptom severity at one and 3 months postoperatively

($p<0.001$), with total turbinoplasty demonstrating the most favourable outcomes.

In the study done by Ahmad Abdul Khabeer(13), at the end of 1 year of surgery, In the group of patients where Partial turbinectomy and turbinoplasty was done, NOS was reduced significantly and Endoscopy showed reduction of size of turbinates by 50%, while In the group of patients where Out fracturing method is chosen NOS(nasal obstruction score) were the same and in Endoscopy there is no reduction in bulk of turbinate.

The study by Menon et al (11) showed improvement in both the turbinoplasty and turbinectomy group with a mean post-operative NOSE score of 11.77 and 35.50, respectively. The study by Rodrigues et al. (11) showed mean post-operative NOSE scores of 33.88 in turbinoplasty and 35.50 in the turbinectomy group, which is significant.

CONCLUSION

The primary objectives of surgically reducing inferior turbinate hypertrophy are to alleviate nasal obstruction. Surgical reduction of inferior turbinate hypertrophy is indicated and may be the treatment of choice when nasal obstruction persists despite medical management. As per our study, the success rate of outfracture of the inferior turbinate is 70%, and the success rate of submucosal diathermy is 75%. success rate of partial turbinectomy is 90%, and the success rate of turbinoplasty is 100%. Inferior turbinoplasty aids in preserving normal nasal physiology compared to partial turbinectomy. The improvement in postoperative symptoms in turbinoplasty cases is reported to be 100%. Along with this, postoperative potential complications, such as bleeding, crusting and excessive pain, were least seen with this technique. Thus, inferior turbinoplasty is the superior surgical method for treating inferior turbinate hypertrophy compared with other conventional surgical techniques, based on its effectiveness in improving preoperative symptoms and its lower complication rate.

RESULT: The results are summarised in the following table:

Table 1: Age distribution of the cases

Age group	Frequency	Percent
10 – 25 years	11	13.75
26 - 40 years	32	40
41 - 55 years	26	32.5
56- 70 years	11	13.75
Total	80	100.0

Table 2: Distribution of Patients according to Symptom Score (NOSE)

Grade	Number	Percentage(%)
Moderate(30-50)	9	11.25
Severe (55-75)	33	41.25
Extreme (80-100)	38	47.5

Table 3: Success Rate Of Partial Turbinectomy, Turbinoplasty, Submucosal Diathermy and Outfracture Of Inferior Turbinate

Procedure	Success Rate	
	N	%
Partial Turbinectomy (n=20)	**18**	**90**
Total Turbinoplasty (n=20)	**20**	**100**
Outfracture of Inferior Turbinate (n=20)	**15**	**75**
Submucosal Dithermy (n=20)	**14**	**70**

Table 4: Pre-Operative Symptoms Vs Post-Operative Symptoms

Symptoms	Pre-operative (n=80)	Post-operative (after 3 months)	Improvement	%
Nasal obstruction	80	11	69	86.25%
Sneezing	50	06	44	88%
Rhinorrhoea	60	05	55	91.7%
Itching	03	00	03	100%
Headache	12	00	12	100%

Table 5: Postoperative complications

Postoperative complication		Partial Turbinectomy (N=20)	Turbinoplasty (N=20)	Outfracture Of Inferior Turbinate (N=20)	Submucosal Diathermy (N=20)
Immediate	Bleeding	4	3	2	2
	Facial oedema	0	0	0	4
Delayed	Crusting	8	3	2	8
	Synechiae	2	0	0	0
	Bleeding	1	1	0	1
	Pain	0	0	0	1

Table 6: Comparison of each procedure according to Pre and Post Operative Scores at the end of 1 month and 3 months

Procedure	Pre Operative			1 month Post Operative				3 months Post Operative			
	Moderate (n=09)	Severe (n=32)	Extreme (n=39)	Mild (n=17)	Moderate (n=23)	Severe (n=24)	Extreme (n=16)	Mild (n=33)	Moderate (n=22)	Severe (n=15)	Extreme (n=10)
Partial Turbinectomy (n=20)	2	7	11	1	6	9	4	14	6	0	0
Total Turbinoplasty (n=20)	1	7	12	15	5	0	0	17	3	0	0
Outfracture of Inferior Turbinate (n=20)	3	11	6	0	7	9	4	2	7	7	4
Submucosal Dithermy (n=20)	3	7	10	1	5	6	8	0	6	8	6

Ethical Approval: This research complies with the ethical guidelines set forth by the institutional review board. Approval was obtained from the institutional ethics committee of the Government Medical College, Sagar (India); the approval number is 1503.

Funding: The authors received no financial support for the research, authorship, and/or publication of this article.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

REFERENCES

1. Scheithauer MO. Surgery of the turbinates and "empty nose" syndrome. GMS Curr Top Otorhinolaryngol Head Neck Surg. 2010;9:Doc03. 10.3205/cto000067. Epub 2011 Apr 27. PMID: 22073107; PMCID: PMC3199827.
2. Camacho, M.; Zaghi, S.; Certal, V.; Abdullatif, J.; Means, C.; Acevedo, J.; Liu, S.; Brietzke, S.E.; Kushida, C.A.; Capasso, R. Inferior turbinate classification system, grades 1 to 4: Development and validation study. Laryngoscope 2015, 125, 296–302.
3. Aslan G: Postnasal drip due to inferior turbinate perforation after radiofrequency turbinate surgery: a case report. Allergy Rhinol (Providence). 2013, 4:e17-20. 10.2500/ar.2013.4.0046
4. Singh S, Ramli RR, Wan Mohammad Z, Abdullah B: Coblation versus microdebrider-assisted turbinoplasty for endoscopic inferior turbinates reduction. Auris Nasus Larynx. 2020, 47:593-60 10.1016/j.anl.2020.02.003
5. Passali D, Lauriello M, Anselmi M (1999) Treatment of hypertrophy of the inferior turbinate: long-term results in 382 patients randomly assigned to therapy. Ann Otol Rhinol Laryngol 103:569–575.

6. Quine SM, Aitken PM, Eccles R (1999) Effect of submucosal diathermy to the inferior turbinates on unilateral and total nasal airflow in patients with rhinitis. Acta Otolaryngol 119:911–915.
7. Romano A, Orabona GDA, Salzano G, Abbate V, Iaconetta G, Califano L (2015) Comparative study between partial inferior turbinotomy and microdebrider-assisted inferior turbinoplasty. Journal of Craniofacial Surgery 26(3):e235–e238.
8. Abdullah B, Singh S. Surgical Interventions for Inferior Turbinate Hypertrophy: A Comprehensive Review of Current Techniques and Technologies. Int J Environ Res Public Health. 2021 Mar 26;18(7):3441. PMID: 33810309; PMCID: PMC8038107.
9. Stewart MG, Witsell DL, Smith TL, *et al.* Development and validation of the Nasal Obstruction Symptom Evaluation (NOSE) Scale. *Otolaryngol Head Neck Surg*. 2004; 130: 157- 163.
10. Lipan M, Most S. Development of a severity classification system for subjective nasal obstruction. JAMA Facial Plast Surg. 2013; 15: 358- 361.
11. Datta RK, Ramya B, Vinay SR. Comparative study between partial inferior turbinectomy and submucosal diathermy for treatment of inferior turbinate hypertrophy due to allergic rhinitis. Int J Otorhinolaryngol Head Neck Surg 2018; 4:362-7.
12. Shiv Kumar, Shashikant Kumawat, Sidharth Sharma, Tvarita Bharsaksle. A comparative study of inferior turbinoplasty with microdebrider and conventional partial turbinectomy. MedPulse International Journal of ENT. May 2020; 14(2): 31- 36. https://www.medpulse.in/ENT/
13. Ahmad Abdul Khabeer1, CH Bhanu Pratap Chander2, D. Venkatesh3, Pavan Kumar M4, I Phani Bhushan5, Juveria Suman6 A STUDY TO COMPARE EFFICIENCY OF DIFFERENT SURGICAL TECHNIQUES FOR INFERIOR TURBINATE REDUCTION Int J Acad Med Pharm 2023; 5 (3); 1398-1402; ISSN (O): 2687-5365; ISSN (P): 2753-6556
14. Menon, A. (2021) "Benefits of Turbinectomy vs Turbinoplasty – A Prospective Study," Bengal Journal of Otolaryngology and Head Neck Surgery. Bengal Journal of Otolaryngology and Head Neck Surgery. doi: 10.47210/BJOHNS.2021.V29I2.435. https://doi.org/10.47210/bjohns.2021.v29i2.435
15. Rodrigues M, Dibbern R, Oliveira L, Marques M. Comparação entre turbinoplastia e turbinectomia endoscópicas: eficácia e parâmetros clínicos. Arquivos Internacionais de Otorrinolaringologia (Impresso) 2011; 15(4):426-30

How to cite this article: Dr. Khushboo Yadav, Dr. Yagika Pareek, Dr. Joshna Thakur, Dr. Anandraj M., Dr. Shashwat Singh, OUTCOMES OF DIFFERENT SURGICAL TECHNIQUES FOR INFERIOR TIRBINATE HYPERTROPHY: A COMPARATIVE ANALYSIS, Asian J. Med. Res. Health Sci., 2026; 4 (2):2219-2227.
Source of Support: Nil, Conflicts of Interest: None declared.