

Inferior Turbinate Reduction Methods: A Comparative Study

Authors:

Dr. Rinki J Pomson^{1*}, Dr. Karthik Shamanna², Dr. Spandana S Pardikar³

¹Assistant Professor, Department of ENT and Head and Neck Surgery, Shri Atal Bihari Vajpayee Medical College and Research Institute, Bengaluru, Karnataka, India.

²Professor, Department of ENT and Head and Neck Surgery, Bangalore Medical College and Research Institute, Bengaluru, Karnataka, India.

³Assistant Professor, Department of ENT and Head and Neck Surgery, Shri Atal Bihari Vajpayee Medical College and Research Institute, Bengaluru, Karnataka, India.

*Corresponding Author:

Dr. Rinki J Pomson, Assistant Professor, Department of ENT and Head and Neck Surgery, Shri Atal Bihari Vajpayee Medical College and Research Institute, Bengaluru, Karnataka, India

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ABSTRACT

Background: Inferior turbinate is an important structure in nasal physiology. It plays a role in various functions like filtration, warming, humidification of air and modifying nasal airway resistance. Turbinate hypertrophy either due to allergic or non allergic causes is a common cause of nasal obstruction. Though various conservative methods have been used like intranasal sprays, antihistamines, systemic decongestants, mast cell stabilizers and allergic desensitization, these means usually lead only to slight improvement and surgical reduction of the inferior turbinates is the most effective treatment. **Objectives:** To compare the efficacy of 4 different techniques i.e turbinoplasty, partial turbinectomy, complete turbinectomy and cauterization in management of inferior turbinate hypertrophy. **Methodology:** This is a prospective and comparative study with 100 patients conducted between September 2017 to March 2020, in the Department of Otorhinolaryngology, Bangalore medical college and research institute. **Results:** Our study included (68%) males and (32%) females. The mean age of the patient was reported to be 31.5 years. On follow up the mean reduction in postoperative nasal obstruction was found to be 53.40 ± 3.45 in first week and 14.40 ± 3.90 on third month using turbinoplasty, and 64.00 ± 2.88 on first week and 40.00 ± 4.08 third month respectively using partial turbinectomy; and 41.60 ± 3.74 and 24.60 ± 3.51 on first week and third month respectively by complete turbinectomy; 67.80 ± 2.53 and on first week and 28.80 ± 3.61 third month respectively by monopolar cautery. Postoperative complications like postoperative pain, post-operative bleeding and crusting was more in complete turbinectomy than compared to other procedures. **Conclusion:** Surgical reduction of the inferior turbinates is an effective treatment modality for patients with chronic nasal obstruction due to inferior turbinate enlargement. In our study we have compared 4 different techniques: turbinoplasty, partial turbinectomy, complete turbinectomy and monopolar cautery. Each technique has its own advantages and disadvantages. But on comparing the postoperative outcomes, turbinoplasty is found to be a safe and better technique in reducing inferior turbinate size reduction by preserving mucosal surface hence preserving physiologic function and lowering crust formation.

Keywords: Turbinoplasty, Partial turbinectomy, Complete Turbinectomy, Monopolar cautery

INTRODUCTION

Inferior turbinate is an important structure in nasal physiology. It plays a role in various functions like filtration, warming, humidification of air and modifying nasal airway resistance [1]. Turbinate hypertrophy either due to allergic or non allergic causes is a common cause

of nasal obstruction [2]. It may also occur on the opposite side of a long-standing septal deviation [3,4]. The physiological basis on which reduction of inferior turbinate rests is the Poiseuille's Law which states that the laminar flow rate of air along a pipe is proportional to the fourth power of its radius and hence a small

change in the inferior turbinate will dramatically affect the nasal airflow[5,6]. Though various conservative methods have been used like intranasal sprays, antihistamines, systemic decongestants, mast cell stabilizers and allergic desensitization, these means usually lead only to slight improvement and surgical reduction of the inferior turbinates is the most effective treatment.[7,8]

Various techniques for inferior turbinate reduction which include partial and total turbinectomy, submucosal diathermy, submucosal resection of the inferior turbinate, outfracture of the turbinates, laser turbinectomy, microdebrider assisted turbinectomy and cryo-turbinectomy are used. Recently, radiofrequency, coblation and ultrasound have also been introduced.[9,10,11]. The main goal of turbinate surgery is to relieve the patient's symptoms along with preserving the physiologic function.

Objective of the study

To compare the efficacy of 4 different techniques i.e turbinoplasty, partial turbinectomy, complete turbinectomy and cauterization in management of inferior turbinate hypertrophy.

MATERIALS AND METHODS

This is a prospective and comparative study conducted between September 2017 to March 2020, in the Department of Otorhinolaryngology, Bangalore medical college and research institute.

A total of 100 patients were enrolled in this study, after taking an informed consent and acquiring the ethical committee clearance. A total of 68 males and 32 females between 19- 50 years of age with complaints of nasal obstruction (assessed with NOSE score)[12]. who had inferior turbinate hypertrophy were selected and divided into four groups. Each group consists of 25 patients.

Over the past ONE month, how much of a problem were the following conditions for you?

	Not a Problem	Very Mild Problem	Moderate Problem	Fairly Bad Problem	Severe Problem
Nasal congestion or stuffiness	0	1	2	3	4
Nasal blockage or obstruction	0	1	2	3	4
Trouble breathing through my nose	0	1	2	3	4
Trouble sleeping	0	1	2	3	4
Unable to get enough air through my nose during exercise or exertion	0	1	2	3	4

NOSE Score (Multiply your total score x5)

NASAL OBSTRUCTION SEVERITY CLASSIFICATION:

Mild (5-25)

Moderate (30-50)

Severe (55-75)

Extreme (80-100)

A score of 0 means no problems with nasal obstruction and a score of 100 means the worst possible problems with nasal obstruction. Instrument was not designed to be used with individual patient data or to predict outcome on individuals. Otolaryngology-Head and Neck Surgery: 162-163 STEWART et al February 2004.

Lipan MJ1, Most SP. Development of a severity classification system for subjective nasal obstruction. JAMA Facial Plast Surg. 2013 15(5):358-61.

Stewart MG, Smith TL, Weaver EM et al. Outcomes after nasal septoplasty: results from the Nasal Obstruction Septoplasty Effectiveness (NOSE) study. Otolaryngol Head Neck Surg; 2004; 130(3):283-90.

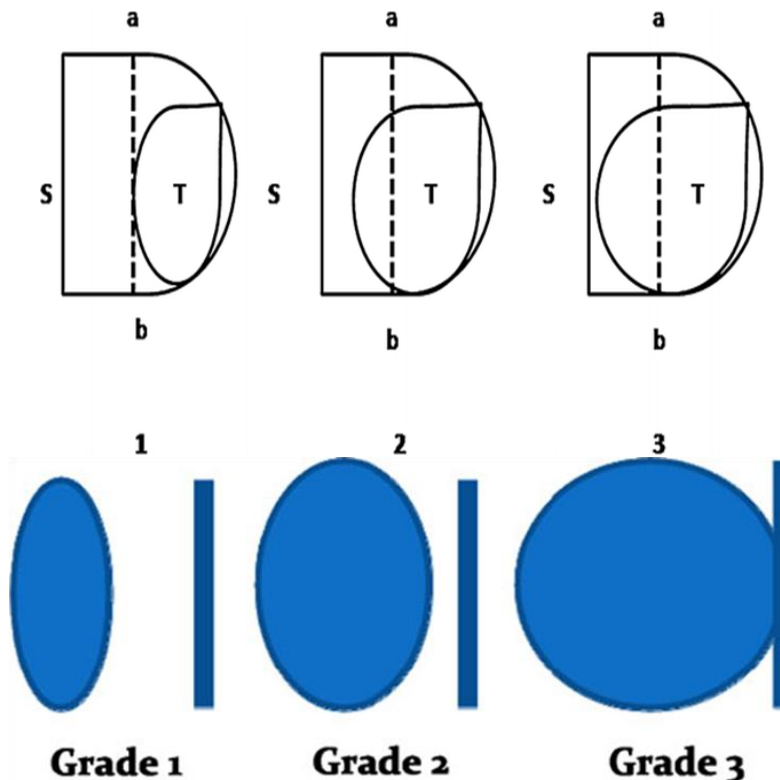
All patients were evaluated by detailed history taking, complete ENT examination by anterior rhinoscopy, cold spatula test, cotton wisp test, Cottle's test and diagnostic nasal endoscopy and systemic examination.

The endoscopic grading of turbinate size was done relative to visibility of the posterior choana by using an imaginary vertical line bisecting each choana (Friedman grading)[11].

Grade-1 Posterior wall of nasopharynx can be seen through >50% of posterior choana (Score = 1)

Grade-2 Posterior wall of nasopharynx can be seen through <50% of posterior choana (Score = 2)

Grade-3 Posterior wall of nasopharynx not visible at all (Score = 3).



Inclusion Criteria

- Patients aged between 18 and 50 years of either gender, with nasal obstruction and inferior turbinate hypertrophy not responding to medical treatment

Exclusion Criteria

- Patients aged below 18 years
- Patients with extensive nasal polyposis, neoplastic and chronic inflammatory condition
- Previous history of nasal or paranasal surgeries
- Patients with medical comorbidities like diabetes mellitus, hypertension, bleeding disorders and cardiac disease.

Procedure

All patients were operated by the same surgeon under general anesthesia.

Group A comprises 13 males and 12 females, underwent lower turbinate turbinoplasty. Under 0° endoscopic guidance a superior-to-inferior incision was made on the anterior surface of the lower turbinate with a no:15 blade, and this incision was extended posteriorly along the inferior surface. The medial side of turbinate was elevated. The turbinate mucosa and bony turbinate were excised while preserving the medial flap. Bleeding was controlled with gauze dipped in botroclet with an adrenaline solution. The flap was repositioned. Gel foam was rolled and placed between the flap and the lateral nasal wall.

Group B comprises 15 males and 10 females, underwent partial turbinectomy. A small portion (1.5-2.0cm) of full-thickness tissue at the head of the inferior turbinate in the region of the internal nasal valve which is the region of greatest nasal airway resistance is removed using a through cutting instrument or microdebrider. This lowers the risk of hemorrhage secondary to injury to posterior lateral nasal artery, a branch of sphenopalatine artery.

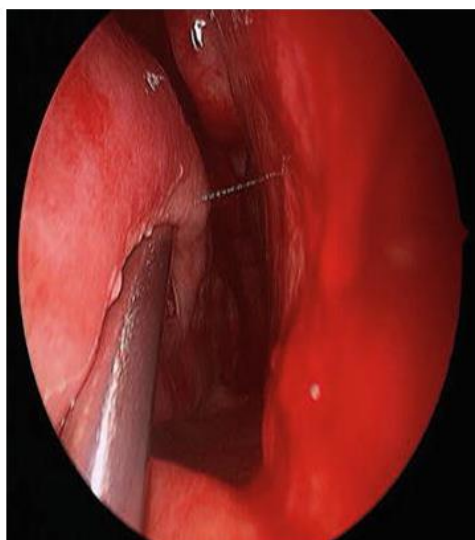
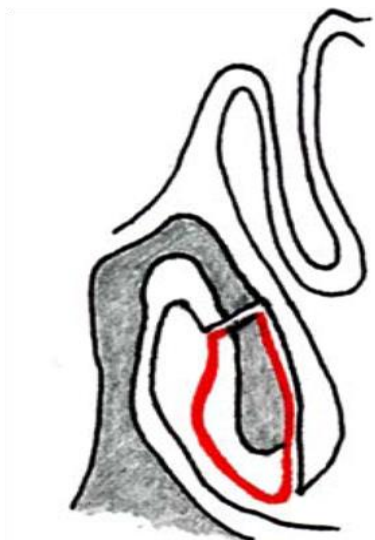
Group C comprises 19 males and 6 females, underwent complete turbinectomy. In this complete resection of the inferior turbinate is done using heavy scissors to detach it directly at its site of attachment to the lateral nasal wall.

Group D comprises of 21 males and 4 females, underwent submucosal resection using monopolar cautery. The monopolar probe is inserted longitudinally into the anterior end of inferior turbinate inferior surface and the cautery was operated with foot switch control till the anterior end of turbinate blanches. Same repeated in medial and superior surfaces.

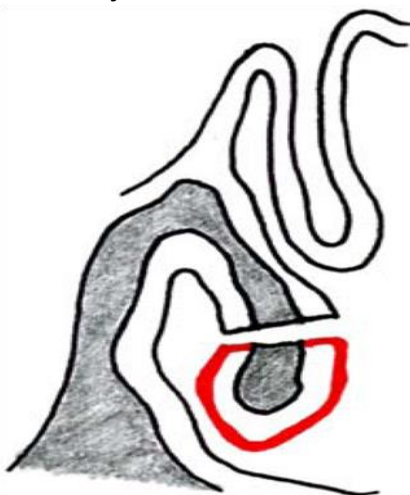
Merocel pack was placed in all cases and pack was removed after 48 hrs. Patients were reviewed after 1 week (7-10 days after surgery) and at the end of 3-6 months.

The patients were evaluated by symptomatic relief in nasal obstruction using NOSE score, inferior turbinate size reduction endoscopically and postoperative complications like bleeding, pain and crust formation.

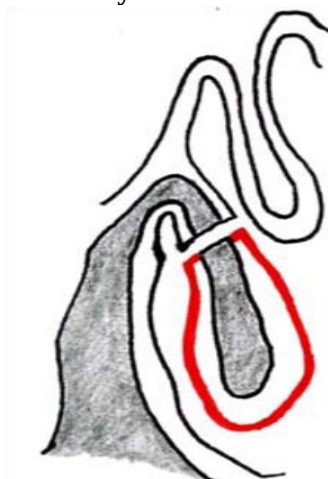
Group A: Turbinoplasty



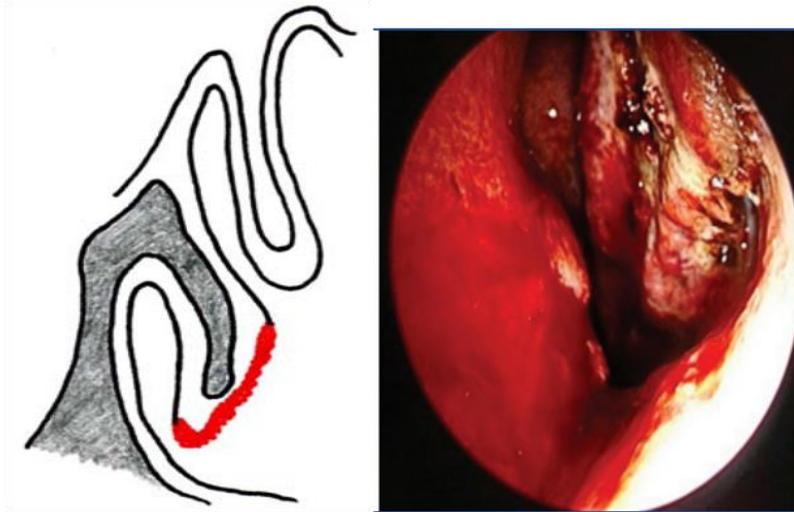
Group B: Partial Turbinectomy



Group C: Complete turbinectomy



Group D: Monopolar cautery



Sample Size Calculation

The sample size was estimated using G power software v.3.1.9.2

Analysis: A priori: Compute required sample size- given α , power and effect size

Tests family: F tests

Statistical test: ANOVA: Fixed effects, omnibus, oneway

Input:

Effect size $f = 0.40$

α error = 0.05

Power $(1-\beta) = 0.80$

Number of groups = 4

Output:

Noncentrality parameter $\lambda = 12.1600000$

Critical $F = 2.7318070$

Numerator $df = 3$

Denominator $df = 72$

Total sample size = 76

Actual power = 0.8234006

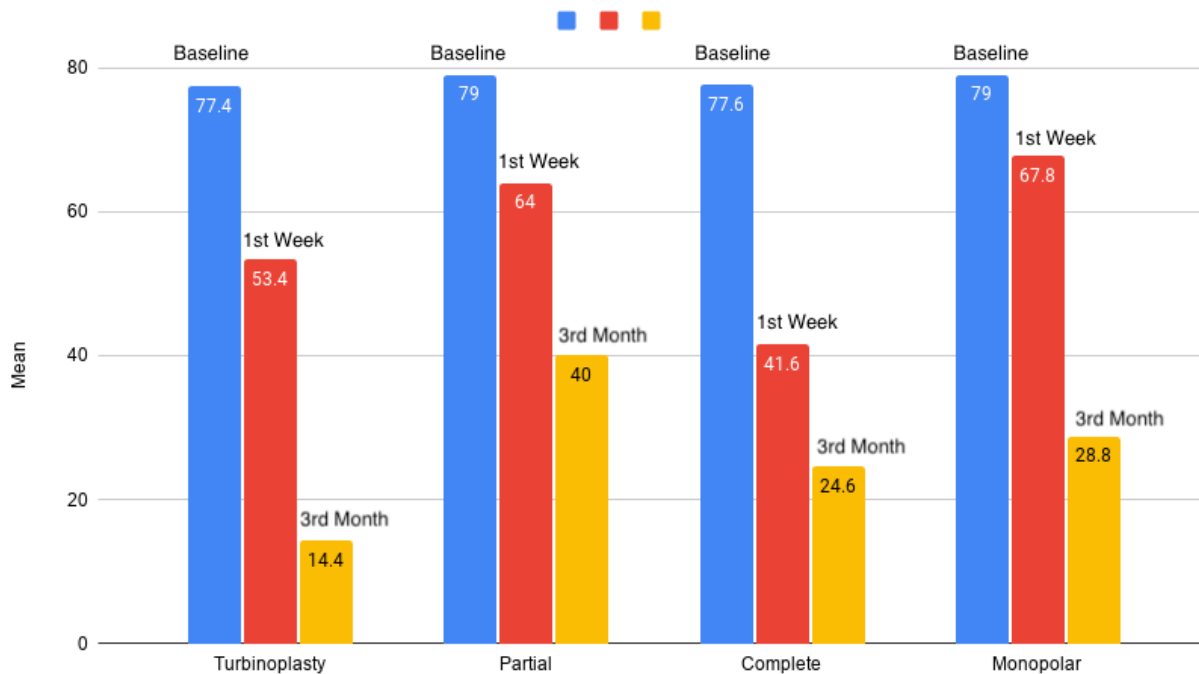
Considering the loss to follow up at 10% total sample size was rounded to 100 with 25 in each group.

STATISTICAL ANALYSIS

Data was analyzed using the Statistical Package for Social Sciences (SPSS) version 20 (SPSS 22.0, IBM, Armonk, NY, USA). Percentages, means and standard deviations (SD) were computed for descriptive purposes. Normality of data was assessed and appropriate statistical tests were applied. ANOVA followed by post hoc analysis by Bonferroni test was used to compare the difference in nose score between the groups. A p -value < 0.05 was considered statistically significant at 95% CI.

RESULTS

Mean Reduction in Nasal Obstruction



On follow up the mean reduction in postoperative nasal obstruction was found to be 53.40 ± 3.45 in first week and 14.40 ± 3.90 on third month using turbinoplasty; and 64.00 ± 2.88 on first week and 40.00 ± 4.08 third month respectively using partial turbinectomy; and 41.60 ± 3.74 and 24.60 ± 3.51 on first week and third month respectively by complete turbinectomy; 67.80 ± 2.53 and on first week and 28.80 ± 3.61 third month respectively by monopolar cautery.

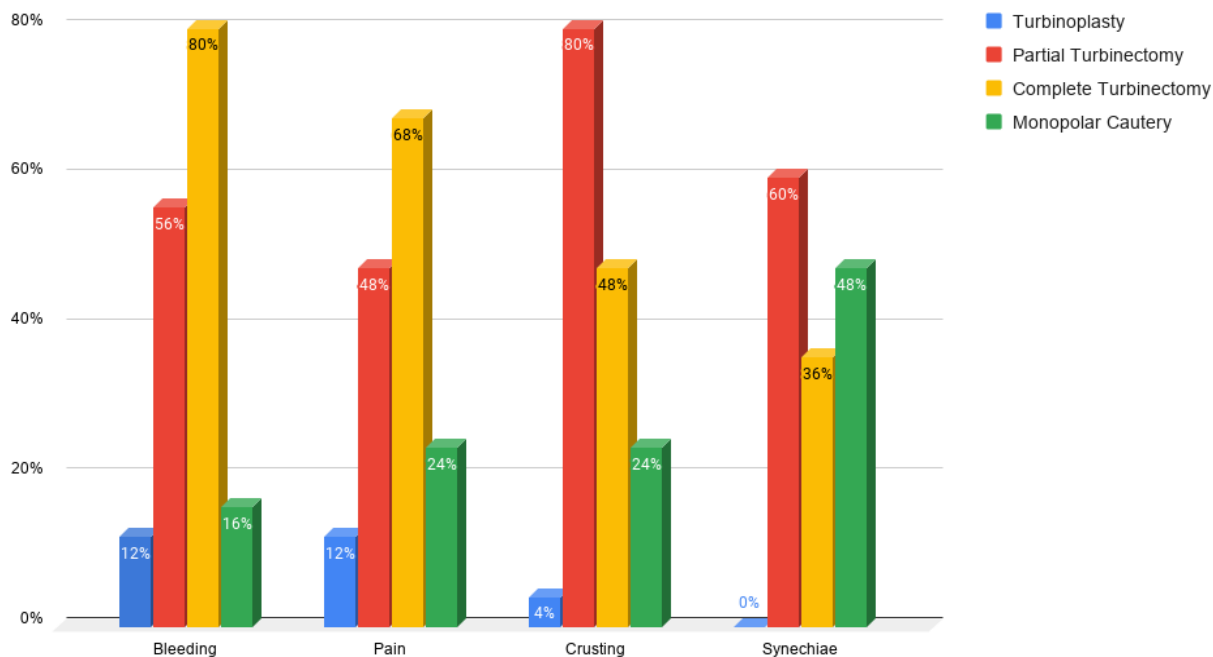
Inferior turbinate size reduction

		Turbinoplasty	Partial turbinectomy	Complete turbinectomy	Monopolar
Preoperative	Grade 1	2(8%)	1(4%)	3(12%)	0(0)
	Grade 2	13(52%)	15(60%)	12(48%)	10(40%)
	Grade 3	10(40%)	9(36%)	10(40%)	15(60%)
Post operative (1st week)	Grade 1	18(72%)	6(24%)	25(100%)	4(16%)
	Grade 2	7(28%)	19(76%)	0(0)	18(72%)

	Grade 3	0(0)	0(0)	0(0)	3(12%)
Post operative (3rd month)	Grade 1	21(84%)	9(36%)	25(100%)	8(32%)
	Grade 2	4(16%)	16(64%)	0(0)	16(64%)
	Grade 3	0(0)	0(0)	0(0)	1(4%)

The maximum reduction in inferior turbinate size is seen with complete turbinectomy followed by turbinoplasty ,partial turbinectomy and least with monopolar cautery.

Post-operative Complications



- Postoperative complications like pain(80%) and bleeding(68%) were more common in complete turbinectomy whereas crusting (80%)and synechiae(60%) in partial turbinectomy.
- All postoperative complications were less common with monopolar cautery except synechiae formation which accounts for 40% cases.
- Turbinoplasty was associated with least postoperative complications.

DISCUSSION

Nasal obstruction occurs in about 30% of the population and the most common cause being hypertrophied inferior turbinate.

• Surgery for inferior turbinate hypertrophy was pioneered by Jones and Holmes. Since then, various methods of surgical management of hypertrophied inferior turbinates. Whatever the surgical technique may be, none of it has been found to be perfect and each is

associated with long term or short term complications. The common complications encountered are epistaxis, atrophic rhinitis, crusting, synechiae formation and nasal discharge.

• Hence the goal of surgery of inferior turbinate is to enhance patency of nasal fossa by reducing the size of the inferior turbinate but preserving the physiological function of the turbinate such as humidification & temperature regulation of inspired air.

- Rai et al. [13] found that there was 100% improvement in nasal obstruction in the turbinoplasty group as compared to 94% in the conventional partial turbinectomy group. These findings agree with those of the present study, which also found that there was a statistically significant reduction in nasal obstruction between turbinoplasty and each of the other procedures after 1 week and 3 months.

- In a study by Kumar et al. [14] found that crusting and synechiae was present in 10% patients in turbinoplasty group and 100% patients in partial turbinectomy during the first follow-up visit and subsequently, none of the turbinoplasty patients were found to have crusting by the 3rd and 4th follow-ups, while few patients in partial turbinectomy were found to have crusting even in the 4th follow-up visit. This is comparable with our study showing crusting in 4% patients in turbinoplasty and 80% patients in partial turbinectomy. None of the patients in the turbinoplasty group were found to have synechiae in any of the follow-up visits, whereas 60% of patients in the partial inferior turbinectomy group were found to have mild synechiae. The absence of synechiae in the turbinoplasty group may be ascribed to the use of mucosal preservation techniques.

- Santhosh et al. did a prospective study of different methods of inferior turbinate reduction and found out mean reduction in nasal obstruction using bipolar cautery was better (78%), when compared to monopolar cautery (63%), complete turbinectomy (49%) and inj. sodium tetradecyl sulfate (48%) infiltration. Postoperative pain, bleeding, crusting and synechiae formation was seen maximum in complete turbinectomy patients. This is comparable to our present study.

Strengths

1. The prospective comparative design allowed systematic evaluation of four commonly used inferior turbinate reduction techniques.
2. The study included 100 patients, with 25 patients allocated to each treatment group, allowing comparison of postoperative outcomes across the four surgical techniques.
3. Both subjective and objective outcomes were assessed. Patient-reported improvement in nasal obstruction was evaluated using the validated NOSE score, while inferior turbinate size was assessed endoscopically using standardized grading.
4. Patients were followed at defined postoperative intervals, including the first postoperative week and the third month, allowing assessment of both early and intermediate postoperative outcomes.
5. The study evaluated clinically relevant postoperative complications, including pain,

bleeding, crusting, and synechiae, providing a broader assessment of the safety profile of the different procedures.

6. All patients were operated on by the same surgeon under general anesthesia, which helped reduce variation related to surgical technique and operator experience.

Limitations

1. The study was conducted at a single institution, which may limit the generalizability of the findings to other centers and patient populations.
2. The sample size was relatively modest, with 25 patients in each treatment group, which may limit the statistical power for detecting smaller differences between individual techniques.
3. The follow-up period was limited to a maximum of 3–6 months; therefore, long-term outcomes and late complications could not be adequately assessed.
4. The study focused primarily on nasal obstruction, turbinate size reduction, and selected postoperative complications. Other potentially relevant outcomes, such as long-term mucociliary function, olfactory function, quality of life, and objective nasal airflow measurements, were not comprehensively evaluated.
5. Although the study used a prospective comparative design, the manuscript does not clearly describe a randomized allocation method. Therefore, the possibility of selection bias and differences between treatment groups cannot be completely excluded.
6. The study was performed in patients with inferior turbinate hypertrophy who had not responded adequately to medical treatment; therefore, the findings may not be directly applicable to all patients with nasal obstruction or inferior turbinate enlargement.

Future Research

Future studies should include larger multicenter populations to improve the generalizability of findings and to account for variations in patient characteristics and surgical practices. Randomized controlled trials with adequate allocation concealment are required to provide stronger evidence regarding the comparative effectiveness of different inferior turbinate reduction techniques.

Long-term follow-up studies extending beyond one year are recommended to evaluate the durability of symptom relief, recurrence of turbinate hypertrophy, and late postoperative complications. Future research should also incorporate objective assessments of nasal airflow, such

as acoustic rhinometry, rhinomanometry, and mucociliary clearance tests, in addition to patient-reported outcome measures like the NOSE score.

Further studies should assess the effects of various surgical techniques on olfactory function, quality of life, and patient satisfaction. Cost-effectiveness analyses may also help determine the most practical and beneficial turbinate reduction method in different healthcare settings.

In addition, future research may investigate the role of newer minimally invasive technologies and combined treatment approaches to optimize functional outcomes while minimizing complications.

CONCLUSION

Surgical reduction of the inferior turbinates is an effective treatment modality for patients with chronic nasal obstruction due to inferior turbinate enlargement.

- In our study we have compared 4 different techniques : turbinoplasty, partial turbinectomy, complete turbinectomy and monopolar cautery.
- Each technique has its own advantages and disadvantages.
- But on comparing the postoperative outcomes, turbinoplasty is found to be a safe and better technique in reducing inferior turbinate size reduction by preserving mucosal surface hence preserving physiologic function and lowering crust formation.

Declarations

Ethics Approval

The study was conducted in accordance with the ethical standards of the institutional and/or national research committee and with the principles applicable to research involving human participants. Ethical approval was obtained from the appropriate institutional ethics committee before commencement of the study.

Informed Consent

Written informed consent was obtained from all individual participants included in the study.

Consent for Publication

Consent for publication was obtained from the participants where applicable. No identifiable personal information or images that could reveal the identity of individual participants are included in this manuscript.

Conflict of Interest

The authors declare that they have no conflicts of interest related to this study, its findings, or the publication of this manuscript.

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Author Contributions

Dr. Rinki J Pomson contributed to the conception and design of the study, data collection, analysis and interpretation of findings, and manuscript preparation. Dr. Karthik Shamanna and Dr. Spandana S Pardikar contributed to the clinical supervision, interpretation of results, critical revision of the manuscript, and approval of the final version. All authors have read and approved the final manuscript and agree to be accountable for all aspects of the work.

Data Availability

The data generated and/or analyzed during the present study are available from the corresponding author on reasonable request, subject to applicable ethical and institutional restrictions.

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AI Use Disclosure

The authors declare that no generative artificial intelligence tools were used to generate or substantially modify the scientific content of this manuscript.

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