



Original Research Article

COMPARATIVE STUDY OF VARIOUS METHODS OF TURBINOPLASTY IN THE MANAGEMENT OF HYPERTROPHIED INFERIOR TURBINATE

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ABSTRACT

Background: Otolaryngologists address chronic nasal blockage as the most common complaints from the patients in their daily practice, which can lead to seriously impairment of one's quality of life. One of the most frequent reason for nasal obstruction is inferior turbinate hypertrophy, in the diseases like allergic rhinitis, chronic rhinosinusitis, vasomotor rhinitis, compensatory inferior turbinate hypertrophy with or without DNS, noticed. Initially all the patients treated conservative or medical management with antihistamines, decongestant, antibiotics and local systemic steroids, but the patients satisfaction is not well noticed, therefore various turbinate reduction surgeries might be tried for such patients, the powered motorized instruments micro debriders rotatory motor which is compatible with various dulls and dissector allows it to remove all the diseased soft tissue and bone with minimum loss of 3 major nasal mucosal function as a resistor, refuser and defence mechanism. **Aims of the study:** This study aimed to compare the efficacy and outcome of the various turbino-plasty methods for hypertropied inferior turbinates specially microdebrider assisted turbino-plasty (MAT), coablation assisted turbino-plasty(CAT), Submucosal resection turbino-plasty (SMR), Submucous diathermy(SMD), and laser assisted turbino-plasty (LAT), by analysing the subjective and objective assessment by symptoms improvement, DNE, Mucociliary clearance time test.

Materials v Methods: Observational study conducted at Govt ENT hospital ped waltiar Visakhapatnam, AP during July 2025 to December 2025, 100 participants with their willing consent included, who had symptoms of nasal obstruction of Grade II and Grade III Inferior turbinate hypertrophy (**Fridman grading**¹), and who were poorly responded to conservative, medical management. Inclusion criteria: Age between 18-50 years old, both gender excluding other causes for nasal obstruction like nasal mass, swelling etc., and history of any prior nasal surgery, and with approval of all ethical guidelines. Pre OP assessment done for all the patients under the following criteria with grading. **.a)** Four point symptomatic scale i.e., nasal obstruction none (zero grade), moderate-severe grade (IV), nasal discharge (0-IV), Hyposmia (0-IV) headache (0-IV) grading. **b)** Mucociliary clearance timing test (sacchrine test), **c)** Inferior turbinate grading only IInd to IIIrd grade. After 12 weeks of post op, these all criteria compared in all patients. Data entry done with statistical package for social sciences [SPSS IBM] version 21. Required tests of significance chi square test and t test applied. The p value of <0.05 using a two tailed test was considered a significant value, by analysing the data with SPSS. **Results:** In the study, majority of the cases between the age of 21-30 years (45%) and least was 18-20 year age group (6%), with more predominance (69%) compare to female 31% (2:23:1). 4 point symptoms scale indicates

significant improvement across all the 5 groups in all type of surgeries but most favourable outcome observed with MAT, second favourable outcome observed with CAT. MAT, CAT pts reduced to grade I hypertrophy of IT (90%). (Post op followup in DNE, followed by SMR, LAT, SMD. The mean mucociliary clearance time(MCT)there is statistically significant difference observed in MCT, among the all 5 study groups post operatively, but there was a noticeable reduction in MCT, across in all groups (SMR 13:5, MAC-13.5m, SMD-13.5m, CAT-13.8m LAT 142.Post op synechiae mostly observed with SMR, due to greater mucosal damage, where CAT and MAT reported least. **Conclusion:** Post operatively, subjective or objective assessment measures showed a significant difference between coblation assisted turbinoplasties, microdebrider assisted turbinoplasties and conventional SMR procedure. CAT, MAT demonstrate the greatest benefit, most effective with least complications. where as SMD procedure shows least benefit procedure. **Keywords:** Turbinoplasties, Microdebrider, Coablation, Diathermy, Laser.

INTRODUCTION

In their daily practice, otolaryngologists address chronic nasal blockage as the most common complaint. Even though nasal-obstruction is not fatal, it can still seriously impair one's quality of life. Of which the most frequent reason for nasal blockage is inferior turbinate hypertrophy Fridman1. In diseases like allergic rhinitis, chronic hypertrophic rhinitis, vasomotor rhinitis, or compensatory hypertrophy brought on by septal deviations, it is valued. The most common treatment advised for inferior turbinate hypertrophy due to various reasons are topical & systemic decongestants, anti- histamines and corticosteroids. The primary goal of these medications is to reduce the size of the inferior-turbinate while also helping to restore nasal function. Even Nevertheless, some patients react to medical treatment quite badly. While some patients are unable to manage the aforementioned medical conditions, they continue to visit the outpatient department on a regular basis due to their chronic symptoms. There are various inferior turbinate reduction surgical methods that might be tried for such patients. In individuals who present with persistent allergic rhinitis, submucosal resection of the turbinate has proven to be an excellent approach for relieving nasal blockage, rhinorrhoea, and sneezing. The powered motorized instrument microdebrider rotating motor, which is compatible with various drills and dissectors, allows it to remove soft tissue in addition to bone very well. Furthermore, this incredible instrument allows us to achieve excellent surgical visualization because the aspirator that is attached to it efficiently eliminates blood and any resected material, clearing the field of debris and expanding the working area. Additionally, because the refrigerants are perfused inside the protective tube, it significantly lessens the harm that would otherwise be done to the nearby tissue. The surgeon should pay close attention to the vital and essential roles played by the turbinate when evaluating the various turbinate surgery techniques. The inferior turbinate performs various crucial roles, including the following ones.

Resistor function.^[2] Most importantly, the inspiratory resistance plays a part in regular breathing and is influenced by the inferior turbinate. The negative intrathoracic pressure required during the regular portion of the inspiratory cycle increases with nasal resistance. Therefore, as negative pressure rises, pulmonary ventilation and venous backflow to the heart & lungs are also improved.

Diffusor function: The diffusor function is the next in line. It is a component of nasal valve region. The inspiratory lamellar airstream is transformed into a turbulent air flow via the inferior turbinate. The turbulence in the outer layers of air increases the interaction between air and nasal mucosa. As a result, the air's ability to warm, humidify, and purify itself is greatly improved. The inferior turbinate's broad blood supply and vast mucosal surface are thought to be responsible for this function.

Defence function: Last but not the least, they Have an essential role in the defence of the nasal cavity, which includes humoral, cellular, and mucociliary transport, in maintaining the integrity of the airway. The current methods for turbinate reduction concentrate on decreasing submucosal tissue, which inevitably causes mucosal injury due to a lack of broader working environment. Therefore, the main goal of inferior turbinate reduction surgery is to reverse the obstruction of the nose while maintaining as much mucosa as possible to enable the turbinate to function again.

Aims & Objectives

To assess the safety, outcome and efficacy of the various methods of turbinoplasty in patients with inferior-turbinate hypertrophy. The methods of turbinoplasty we have studied are SMR, MAT, CAT, LAT & SMD. The following outcomes of inferior-turbinate reduction surgeries are compared:

1. Subjective improvement of the patient
2. Objective improvement as noted in DNE
3. Mucociliary clearance time

Review of Literature

THE TURBINATE^[2]

Three turbinates, with the possible presence of a fourth, denote the lateral wall of the nose. With their shell-like appearance, the turbinates are typically

curved toward the lateral wall. Ciliated columnar epithelium often lines the mucosa of turbinates. The meatus is a small channel located lateral to and behind each turbinate. As it helps to create high nasal resistance and so enhance the negative intrathoracic pressure, which is necessary for the process of inspiration during regular breathing, the inferior-turbinate plays a vital indirect role in respiration. The nasal passage must be divided into several sections since the vestibulum nasi, isthmus nasi, turbinates, and choana all significantly affect the airflow during inspiration. The isthmus, which is the narrowest portion of nasal cavity, adds to the highest nasal resistance to airflow. This maintains a continuous, laminar flow throughout the segment. The nasal-valve is the term for this. The nasal valve's range extends from the inner ostium to the pyriform aperture, but not much farther. The nasal valve segment is more affected when the inferior-turbinate is congested and enlarged.

ANATOMY OF INFERIOR TURBINATE / CONCHA^[2]

The inferior-turbinate is a distinctive nasal structure that forms a separate bone.

Its surface is characterized by irregularities and numerous pores dispersed across it. Vascular structures traverse through these pores on the surface, which are covered by the mucoperiosteum. The turbinate features various processes that articulate with neighbouring structures; for instance, the maxillary process articulates with the lower-edge of the maxillary hiatus. Other articulations include connections with the palatine bone, ethmoids, and lacrimal bones, where it extends as the medial wall of the nasolacrimal duct. The lining epithelium comprises respiratory columnar epithelium. The highest concentration of goblet cells is observed at the anterior end of the inferior-turbinate (approximately 8 per square millimetre), decreasing in number towards the posterior region.

Physics behind Inferior Turbinate

According to Poiseuille's law, a small increase (about 10%) in the cross-sectional area of nasal cavity can lead to a 21% increase in airflow. The volume of nasal passage increases by 35% when the nose is decongested. The inferior-turbinate plays an essential role in nasal function. It is lined with pseudostratified columnar epithelium containing abundant goblet cells and a well-organized basement membrane. The submucosa contains arteries, arteriovenous anastomosis, venous sinusoids, and numerous secreting glands. Smooth muscle fibres surrounding venous sinusoids are controlled by the autonomic nervous system, allowing for vasodilation and vasoconstriction as needed. Hypertrophy of the inferior-turbinate affects airway and olfaction due to collagen deposition beneath the sinonasal mucosa's basement membrane and hypertrophy of mucous glands.

PHYSIOLOGY RELEVANT TO INFERIOR TURBINATE

The respiratory epithelium is primarily composed of ciliated & non-ciliated pseudostratified columnar cells, along with basal pluripotential stem cells and goblet cells. Each cell possesses around 300-400 microvilli, which greatly increases the surface area and prevent the mucosa from drying out. Each cell typically hosts approximately 50-100 cilia. The cilia are structurally composed of nine peripheral doublet and two central single microtubules. Hexin links connect each peripheral pair to the adjacent doublet and to the central microtubule. Dynein arms, which contain ATPase, are present on the cilia and are essential for the ciliary beat movement, facilitating the rhythmic motion that helps clear the airways.

Nasal airway resistance

The nose contributes to approximately half of the total airway resistance. Nasal resistance is influenced by two parallel resistors in each cavity, with variability due to the nasal cycle. This resistance comprises two components: a primarily fixed element consisting of bone, cartilage, and attached muscles, and a variable element represented by the mucosa. In infants, nasal resistance is high as they are obligatory nose breathers initially. Even in adults, who preferentially breathe through the nose at rest, there remains a notable level of resistance.

Nasal cycle

The nasal cycle involves alternating periods of nasal blockage and passage. These changes are primarily driven by vascular activity, particularly variations in the volume 3 to 5 cc of blood within the venous sinusoids, which are capacitance vessels. The cycle typically oscillates between four to twelve-hour intervals and remains relatively constant for each individual.

The hypertrophied turbinates

Diagnosis of enlarged turbinate has traditionally been based on exclusion criteria, as no standardized definition exists for quantifying enlargement objectively. Often, diagnosis is made retrospectively based on the treatment provided to improve airway patency. It remains unclear whether the causal factor of hypertrophied turbinate is the bone or mucosa, as both can be enlarged. Distinguishing between pathological and normal enlargement for a given patient is challenging, leading to controversy in treatment approaches for symptomatic individuals. Enlargement of nasal mucosa is a normal physiological process known as the nasal cycle, which involves periodic changes that may fluctuate from side to side or occur simultaneously in both nasal cavities, or even irregularly. These cyclical changes are particularly evident in the inferior concha, as well as in the mucosa of middle turbinate, septum, and ethmoid sinus.

MEDICAL TREATMENT

The management of hypertrophied turbinate has evolved over time with various medical & surgical techniques emerging in the late nineteenth century. Intranasal topical corticosteroids are commonly the

first-line treatment for nasal obstruction, provided that tumours and abnormal skeletal deformities have been ruled out. Corticosteroids have shown Greater Effectiveness compared to antihistamines. Vasoconstrictors are also used for similar purposes, but patients should be cautioned about the long-term risk of developing rhinitis medicamentosa. Isotonic saline nasal spray is recommended as supportive treatment for the management of chronic nasal obstruction.

SURGICAL TREATMENT

Practical indications for implementing inferior-turbinate reduction surgery in patients with chronic nasal obstruction include: Absence of signs of infection on diagnostic nasal endoscopy Lack of response to medical management over a sufficient interval.

The surgical management of inferior-turbinate hypertrophy has been a subject of debate for over a century, with more recent focus on technical advancements. However, evidence regarding the effectiveness of various surgical procedures remains controversial. The primary goal of any surgical treatment for inferior turbinate hypertrophy is to improve nasal obstruction while minimizing short- and long-term complications. Surgical procedures for turbinate reduction can be classified into destructive procedures, mechanical procedures, and turbinate resection procedures. Complications of turbinate reduction surgery may include primary or secondary haemorrhage, crusting, and post-operative synechiae formation. Reviews evaluating the benefits and risks of different techniques offer conflicting recommendations. While some support turbinate reduction assisted by LASER for its relatively effective outcomes with minimal morbidity Bingham B3, et al, others caution against highly destructive procedures such as chemo cautery, electrocautery, partial turbinectomy, LASER surgery, and cryosurgery However, it seems that the preferred method is intra turbinal turbinate reduction Gray H4, et al. A prospective randomized study analysing various techniques, including submucosal resection with and without lateral displacement, cryotherapy, electrocautery, LASER cautery, and subtotal turbinectomy, found that submucosal resection with lateral displacement achieved long-term improvement in nasal passage with stabilization of mucociliary clearance time and less post-operative bleeding.

METHODS OF INFERIOR TURBINATE REDUCTION:

INFERIOR TURBINOPLASTY

Inferior turbinoplasty, a surgical procedure aimed at reducing the size of the inferior turbinate, has evolved to incorporate newer techniques that prioritize preserving the normal functioning of the mucous membrane while still achieving turbinate reduction. Traditional methods such as cautery, laser reduction, steroid injection, cryosurgery, or surgical resection have limitations, including insufficient long-term relief or prolonged recovery times. Two modern

techniques, powered inferior turbinoplasty and coblation-assisted inferior turbinate reduction, offer advantages in terms of effectiveness and post-operative recovery. Powered inferior turbinoplasty employs a specialized tool called a microdebrider, which is inserted beneath the mucous membrane of the turbinate to remove excess tissue. This technique allows for nearly complete removal of turbinate bulk and faster healing compared to traditional methods. It is often performed as an outpatient procedure, taking around 20 minutes. Oblation-assisted inferior turbinate reduction involves the use of a radiofrequency probe inserted into the submucosal plane to reduce the underlying turbinate tissue. This procedure quick, taking less time, and can also be performed on an outpatient basis. Both coblation and microdebrider-assisted techniques result in minimal post-operative discomfort and have been shown to significantly improve nasal obstruction. Submucosal diathermy:

Submucosal diathermy (SMD) remains a primary technique for reducing inferior turbinate size in surgical procedures. The principle of SMD involves inducing fibrosis of the submucosal tissue by coagulating the venous sinusoids within the turbinate Hilberg O5, Irfan M,6. This process leads to the formation of an area of coagulation necrosis along the electrode passage, which is replaced with sclerotic connective tissue. This results in a stable reduction of the enlarged turbinate Jun BC7, Hytonen ML,8. Laser-assisted turbinate surgery induces submucosal scarring and obliterates venous sinusoids, which can shrink turbinate tissue and relieve nasal obstruction. Most commonly used lasers are Diode and carbon dioxide (CO₂) laser.

MATERIALS AND METHODS

This observational study from JULY 2025 to DECEMBER 2025,100 participants were included who had nasal obstruction from hypertrophied inferior turbinates that was unresponsive to medication. The following groups of patients were randomly assigned: coblation assisted turbinoplasty (n=20), laser assisted turbinoplasty (n=20), submucosal diathermy (n=20), conventional submucosal resection (n=20), study conducted in the Government E.N.T hospital, pedawaltair, Visakhapatnam which is allied to Andhra medical college, Visakhapatnam.

Inclusion Criteria: Participants of both gender who are in the age group of 18 to 50 years old with willing informed consent, having nasal obstruction with inferior turbinate hypertrophy (Friedmann I grading) refractory to medical management, with or without DNS.

Exclusion Criteria: Pregnant women and other individuals who are having nasal obstruction due to other causes like nasal mass, swelling, granulomatous disease, individuals who have had prior nasal surgeries. Study conducted after all ethical

clearance and approval with informed and willing consent of the participant

SURGICAL PROCEDURES: (i)conventional submucosal resection (SMR),(ii)submucosal diathermy (SMD),(iii)coblation assisted turbinoplasty (CAT),(iv) microdebrider assisted turbinoplasty (MAT),(v) laser assisted turbinoplasty (LAT).

INVESTIGATIONS: Haematological like complete blood picture, blood sugar, LFT, RFT, BT, CT, viral markers, blood grouping, chest x ray, ECG, CT-PNS. prior to surgery a subjective and objective evaluation was done for inferior turbinate hypertrophy grading(DNE), sachharine mucociliary clearance time test, and four point symptomatic scale grading(0-3). CT paranasal sinus was done for all patients in order to rule out other causes of nasal obstruction and to serve as an anatomical guide for surgery.



Figure 1: CT PNS ITH Axial view



Figure 2: CT PNS ITH Coronal view

PRE OP AND POST OP ASSESSMENT / COMPARISION

Pre op and post op assessment or comparision was done under these three criterias at the time of pre op and post op of the last visit i.e at the 12th week (although patients were assessed at the time of first visit i.e after one week and second visit i.e after 4th week but only last visit findings were taken for comparision)

1. Diagnostic nasal endoscopy(DNE) for grading of the inferior turbinate (Fridman1 grading I,II & III),only second and third grading patients were selected for turbinoplasty.

2. Saccharine test in order to evaluate the mucociliary clearance time. After the saccharine palate kept at the anterior end of inferior turbinate the patient was instructed to report as soon as he/she could taste sweet in the throat, starting and ending time noted, generally ten to twenty minutes is the average clearance time.
3. Four point symptomatic scale improvement analysis by subjective assessment.

ANAESTHESIA: Surgery was planned under GA/LA under proper xylocaine sensitivity test and patients were instructed fasting after 10pm with a course of antibiotic before the operation, regardless of GA/LA anaesthesia in all cases, inferior turbinates infiltrated with 2% lignocaine with adrenaline (1:1,00,000 dilution).

SURGICAL PROCEDURES

All the above mentioned surgeries like SMR, SMD, CAT, MAT, LAT done in equal number, 20 in each group (n=20), in five groups

1.MICRODEBRIDER ASSISTED TURBINOPLASTY



Figure 3: PRE OP DNE



Figure 4: 12TH WEEK OF FOLLOW UP

2.SUBMUCOSAL RESECTION (SMR)



Figure 5: PRE OP DNE



Figure 6: 12TH WEEK FOLLOW UP DNE

4. SUBMUCOSAL DIATHERMY (SMD)



Figure 7: PRE OP DNE



Figure 8: 12TH WEEK OF FOLLOW UP

4. COBLATION ASSISTED TURBINOPLASTY



Figure 9: PRE OP DNE



Figure 10: 12th WEEK OF FOLLOW UP

5. LASER ASSISTED TURBINOPLASTY

After local infiltration, topical anaesthesia was administered for approximately 10 minutes using cotton pads soaked in a 4% xylocaine with adrenaline solution. Documentation was facilitated using a rigid endoscope (0° optic, OD 4 mm) coupled with photo and video documentation devices. The laser treatment was conducted in "contact" mode using a flexible, plastic-clad silica fibre (400-µm core diameter) inserted into a specially designed laser fibre guidance system (Karl Storz GmbH, Tuttlingen, FRG). The laser output power was set between 10–14 W in continuous-wave mode. The fibre was drawn from the posterior to the anterior part of the inferior turbinate, with three to four applications of laser light. Additional laser spots were applied to the turbinate heads as needed to vaporize tissue.



Figure 11: 12TH WEEK POST OP

Post op follow up done after proper post op care, patients follow up observation done at 1st week, 4th week and at last 12 weeks. The last visit (12th week) observation findings were only compared with pre-operative subjective and objective assessment grading in all criteria like a) turbinate grading b) saccharine clearance time test c) 4 point symptomatic scale (nasal obstruction, nasal discharge, headache and hyposmia).

Statistical Method: The data was calculated as the mean \pm SD or the median, depending on their distribution. Frequencies were expressed in percentages. The chi square test was used to determine differences in categorical variables between groups. A p value of < 0.05 using a two tailed test was

considered as significant for all statistical test. The qualitative data will be expressed as numbers and percentages, and quantitative data as means and standard deviation.

RESULTS

i. Demographic data

According to studies by Khan et al,^[9] Saad Bin Qamar et al,^[9] and Ahmed Hesham et al,^[10] the mean age

group of patients with hypertrophic inferior turbinate was 30–40 years. Which aligns with the our findings. Majority of cases were between the age group of 21 to 30 years old (45%), least common were 18 to 20 (6%) with male pre dominance.(2.2 : Van Delden et al¹¹, Ahmed Hesham et al,^[10] Khan et al,^[9] observed that the incidence of turbinate hypertrophy is higher in males, which is consistent with the results of the present study.

II. Pre op and post op ITH grading under DNE

Table 1: Pre-op DNE grading of ITH (person Chi- square tests)

PRE OP DNE GRADING		METHODS OF SURGERY				
		SMR	MAT	SMD	CAT	LAT
GRADE 2	FREQUENCY	6	4	7	4	6
	PERCENTAGE	30%	20%	35%	20%	30%
GRADE 3	FREQUENCY	14	16	13	16	14
	PERCENTAGE	70%	80%	65%	80%	70%

27 patients had grade 2 ITH chosen for surgery. Of which 30% underwent SMR, 20% MAIT, 35% SMD, 20% CAT, 30% LAT, Remaining 73 patients had grade 3 ITH. Of which 70% - SMR, 80% - MAIT, 65% - SMD, 80% CAT, 70% LAT.

Table 2: POST OP DNE grading of ITH at visit 3

Post op DNE GRADING OF ITH VISIT 3		METHODS OF SURGERY					P VALUE
		SMD	CAT	MAT	SMR	LAT	
GRADE I	FREQUENCY	12	19	19	18	14	0.007
	PERCENTAGE	60%	95%	95%	90%	70%	
GRADE II	FREQUENCY	8	1	1	2	6	
	PERCENTAGE	40%	5%	5%	10%	30%	

Post-operative findings at Visit 3

- **SMR:** 90% of patients were classified in grade 1 and 10% in grade 2.
- **MAT:** 95% were in grade 1 and 5% in grade 2.
- **LAT:** 70% were in grade 1 and 30% in grade 2.
- **CAT:** 95% were in grade 1 and 5% in grade 2.
- **SMD:** 60% were in grade 1 and 40% in grade 2.

Current study shows similar outcome as El Henawi et al,^[12,] Kawamura et al,^[13] in their comparative study, observed a reduction in turbinate size in 95.7% of patients who underwent powered turbinectomy and in 91.3% of patients who underwent submucosal resection of the inferior turbinate

III. PRE OP AND POST OP MUCOCILIARY CLEARANCE TIME TES

Table 3: PRE OP MUCOCILIARY TRANSIT TIME BY SACCHARIN TEST

METHODS OF SURGERY	N	MEAN ±	STD.	P VALUE
SMR	20	18.55 ± 1.6		0.92
MAT	20	18.75 ± 1.6		
SMD	20	18.85 ± 1.7		
CAT	20	18.55 ± 1.7		
LAT	20	18.4 ± 1.8		
TOTAL	100	18.6 ± 1.7		

Table 4: Post op Saccharin test and mucociliary clearance time VISIT III

DEPENDENT VARIABLE	METHODS OF SURGERY	N	MEAN	SD	P VALUE
POST OP SACCHARIN VISIT III	LAT	20	14.25	1.3	0.163
	CAT	20	13.85	0.87	
	MAT	20	13.55	0.94	
	SMR	20	13.5	0.8	
	SMD	20	13.8	1.1	
	TOTAL	100	13.79	1.04	

This current study shows similar to, chen YL et al,^[14] Back et al,^[15] also observed similar outcomes in their study. A study published in “The Laryngoscope” in 2006 66 compared microdebrider and radiofrequency-assisted inferior turbinoplasty, focusing on subjective symptom assessments, mean nasal resistance, and mucociliary clearance using the saccharin test.

This study indicates that, while there were no statistically significant differences in mucociliary clearance times among the five study groups after surgery, all groups experienced a noticeable

reduction in clearance time. The mucociliary clearance duration for MAT, SMR, and CAT was similar.

iv] PRE OP AND POST OP FOUR POINT SYMPTOM SCALE:

The four primary symptoms of inferior turbinate hypertrophy are considered when recording the patient's complaints. headaches, nasal blockage, nasal discharge and hyposmia are the symptoms. Each of these symptoms is GRADED using a four-point symptom scale.

FOUR POINT SCALE FOR SUBJECTIVE ASSESSMENT

Table 5 (1): For nasal obstruction

Grade	Nasal obstruction
0	No Nasal obstruction
1	Mild obstruction (no disturbance in daily life)
2	Moderate obstruction (requires mouth breathing)
3	Severe obstruction (sleep disturbances, voice changes)

2. For nasal discharge

Grade	NASAL DISCHARGE
0	No nasal discharge
1	Mild nasal discharge (1-4 blowing per day)
2	Moderate nasal discharge (5-10 blowing per day)
3	Severe nasal discharge (continuous discharge)

3. For headache

Grade	HEADACHE
0	No headache
1	Mild headache (no analgesics required)
2	Moderate headache(non narcotic analgesics required)
3	Severe headache (narcotic analgesics required)

4. For hyposmia

Grade	HYPOSMIA
0	No hyposmia
1	Mild hyposmia
2	Moderate hyposmia
3	Severe hyposmia

The assessment of symptoms has proven most effective in gauging subjective improvement, reliant on patients' medical histories. This method of quantification, presentation, and interpretation enhances our understanding of the procedure's efficacy and achievement of study objectives. Additionally, it aids in selecting the most suitable technique for the procedure. Symptoms were recorded using a four-point scale across three visits. Mean values on the four-point symptom scale for the SMR study group during post-operative visits 1, 2, and 3 were 5.8, 3.4, and 2.65 respectively. For the MAT group, these values were 5.85, 2.5, and 1.0, while for the LAT group they were 7.05, 4.6, and 4.4. SMD group 6.65, 5.3 and 5.1, in CAT group 5.75, 1.6,

1.05. These findings indicate significant symptom improvement across all study groups, with the most favourable outcomes observed in the MAT study group second favourable outcome observed in the CAT group. Following that, the SMR group showed the next highest improvement, followed by the LAT group, with the least improvement observed in the SMD group

Friedman et al,^[11] Chen et al,^[4] Rahman and Hossain et al(2010),^[16] Lippert and Werner et al,^[17] all in their studies observed similar analysis Lee JY,^[18] Lee JD et al,^[18] Comparative study on the long-term effectiveness between coblation-and microdebrider-assisted partial turbinoplasty. Both groups showed a statistically significant degree of improvement.

Table 6: Post op Four point symptom scale (One way ANOVA test) VISIT III

DEPENDENT VARIABLE	METHOD S OF SURGERY	N	MEAN	SD	95% CI		P VALUE
					LOWER BOUND	UPPER BOUND	
POST OP FOUR POINT SCALE- VISIT III	SMD	20	5.1	1.7	4.28	5.92	<0.001
	CAT	20	1.05	0.68	0.73	1.37	
	MAT	20	1.0	0.65	0.7	1.3	
	SMR	20	2.65	0.6	2.38	2.92	
	LAT	20	4.4	1.7	3.56	5.24	
	TOTAL	100	2.84	2.1	2.43	3.25	

Mean values on the four- point symptom scale for the SMR study group during post-operative visits 1,2 and 3 were 5.8,3.4, and 2.65 respectively. For the MAT group, these values were 5.85, 2.5, and 1.0, while for the LAT group they were 7.05,4.6, and 4.4. SMD group 6.65, 5.3 and 5.1, in CAT group 5.75, 1.6, 1.05. the reports show more significant (P value <0.001) improvement of symptoms in all the study groups with the best result in MAT & CAT group.

DISCUSSION

Surgical techniques aimed at improving nasal airflow through intervention on the inferior turbinates have a long history dating back to a century ago. From the radical total turbinectomy of earlier times to modern turbinoplasty techniques employing microdebriders, coblator, laser a variety of methods have been employed. Hol et al 19, in their comprehensive review of these approaches, noted that while many techniques effectively reduce turbinate size, they often compromise the mucosal lining, altering its function and potentially leading to secondary nasal obstruction. Their analysis favoured "infra-turbinal turbinoplasty" as the preferred method, emphasizing preservation of mucosal integrity. The concept of "mucosa preserving turbinoplasty" emerged with advancements in technologies like Radiofrequency, coblation, microdebrider and laser. Ongoing research aims to discover the most suitable surgical method for treating inferior turbinate hypertrophy (ITH) that minimizes trauma and offers durable, effective volume reduction. LAT, CAT, SMD are an easy technique with a shorter operation time. In contrast to conventional devices that required more time to control bleeding, microdebriders are more effective at sucking blood and tissues simultaneously, providing a superior bloodless field and greater visibility. comparing microdebrider assisted turbinoplasty with conventional SMR,LAT,SMD,CAT methods, it becomes evident that CAT,LAT and SMD result in less blood loss than SMR. The present study did not show any recurrence in all 5 study groups i.e CAT,MAT,LAT,SMR & SMD. However long term follow up may be necessary to observe any potential recurrence.

CONCLUSION

Based on this study, the simplest method to use while under local anaesthesia is CAT, LAT, SMD & SMR requires far more deft and skilled hands. Subjective and objective assessment measures at the postoperative stage showed a statistically significant difference between standard submucosal resection, coblation assisted, microdebrider assisted inferior turbinoplasty. The surgery was performed by LAT, CAT, SMD in a very short amount of time, and MAT could also may be finished quickly. Complications such as synechiae and crusting appeared to be more common in the SMR & LAT group. This may be explained by the same patient group's elevation of mucosal flaps, which resulted in a raw surface in SMR & surface application of laser beam leads raw surface in LAT group. When comparing the coblator, microdebrider and SMD to the traditional approach, there is less crusting. Regarding the mucociliary clearance time in the postoperative phase, there was no statistically significant difference between the FIVE approaches. Amazing features and increased surgeon ease of use have been brought about by the powered tool microdebrider and the specific blade for inferior turbinate. Microdebrider-assisted turbinoplasty (MAT) and coblation-assisted turbinoplasty (CAT) groups show better efficacy and outcomes, both subjectively and objectively, compared to other study groups. very minimal differences were identified between the microdebrider-assisted turbinoplasty (MAT) and coblation-assisted turbinoplasty (CAT) groups compared to the submucosal resection turbinoplasty (SMR) group. The results, in order of efficacy are MAT and CAT, followed by SMR, and then LAT. Submucous diathermy (SMD) has the least benefits but is still the most commonly used method.

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