Egyptian Journal of Medical Research

Print ISSN: 2682-4396 / Online ISSN: 2682-440X

Original article

Microdebrider-Assisted Turbinoplasty versus Bipolar Cautery in Treatment of Inferior Turbinate Hypertrophy

Ashraf Mahmoud Khaled[a], Ramez Sabry Fahim[a], Dina Mohamed Naguib[b] & Khaled Abd Elmoaty Hafez[a]

[a] *Otorhinolaryngology Department, Faculty of Medicine, Beni-Suef University*

[b] *Otorhinolaryngology resident at Agouza Police Hospital*

Article Info

Article history:

Received 14 March 2024

Accepted 9 June 2024

Corresponding Author:

Dina Mohamed Naguib

dr.tekitoka@gmail.com

Keywords

Microdebrider

Assisted Turbinoplasty

Bipolar Cautery

Inferior Turbinate Hypertrophy

Abstract

Background: Nasal Obstruction is a prevalent sign which affects 25% of people. Nasal obstruction is often caused by septal deviation, middle and inferior turbinate hypertrophy, nasal polyposis, or pharyngeal tonsils hypertrophy. Among these causes, inferior turbinate hypertrophy is the most prevalent etiology of nasal obstruction. **Aim of the Work:** To compare the results of microdebrider assisted inferior turbinoplasty (MAIT) and bipolar cautery in treatment of inferior turbinate hypertrophy and post operative morbidity. **Patients and Methods:** Twenty cases from the ENT outpatient clinic in the Beni Suef hospital were recruited. All patients had the following surgical procedures performed in order to relieve their nasal obstruction. In every patient, on the Right side, the hypertrophic inferior turbinate was reduced using MAIT (Group A operation). A submucosal diathermy (SMD) using bipolar was performed on the Left side (Group B operation). **Results:** There was no significant difference in crust at 1, 2 and 3 weeks post operative between the studied groups but there was a significant decrease in frequency of crust among Group I compared to II from 4 week post operative till end of follow up. Also, there was no significant difference between 1- and 8-week post treatment in Groups II but there was a significant decrease in frequency of crust between 1 and 8 weeks in Group I. **Conclusion:** As inferior turbinates hypertrophy is a prevalent cause of nasal obstruction, it is seen with relative frequency in ENT clinics. Most patients are effective for the treatment with topical steroids and/or antihistamines. Conversely, some cases exhibit resistance to medical treatment. Proper history taking with proper diagnosis and treatment of laryngopharyngeal reflux (LPR) is important before proceeding to trurbinate surgery.

1. Introduction:

Vasomotor rhinitis, allergic rhinitis, and septal deviation (compensatory hypertrophy) are identified as the primary etiologies of inferior turbinate hypertrophy [1].

Nasal obstruction is a sign which significantly impairs the quality of life. Nasal obstruction disrupts physical activity and sleep quality, resulting in irritability and tiredness. Patency is critical for craniofacial enhancement in children; in particular, children who breathe via their mouths are prone to developing retrognathia, a long face, and a high arched palate, all of which contribute to the development of nasal obstruction in adulthood [2].

Clinical therapy options for inferior turbinates hypertrophy are diverse. The primary medications used are antihistamines, topical nasal corticosteroids, and saline solution. Vasoconstrictors and corticosteroid injections are not frequently used due to their possible adverse effects [1].

When conventional management fails, surgical intervention to minimize the inferior turbinate size is often advised. Total or partial turbinectomy, turbinoplasty, laser-assisted turbinoplasty, submucous resection, cryosurgery, infrared light therapy, AgNO3 topical application, argon plasma surgery, volumetric tissue reduction by radiofrequency, and monopolar and bipolar electrocautery are the primary techniques described [3].

During a turbinectomy, which is often applied to alleviate nasal obstruction, part or all of the turbinate bones in the nasal passage are removed [4].

There are two primary methods that are classified as turbinoplasty. A tool is used in the outfracture procedure to reposition the turbinate laterally and enhance the patency of the airway. The submucous resection procedure involves the creation of an incision at the turbinate head. The turbinate tissue is then extracted using a blunt dissector and a microdebrider. Following this, the mucosa is reattached and let to recover over a lessened turbinate bone. Poor incision apex or perforation of the mucosal flap may lead to the development of crusts, synechiae, and bleeding [5].

2. Patients and Methods:

Patients

Twenty patients from the ENT outpatient clinic in the Beni-suef University Hospital and Police Hospital were recruited; their ages ranged from 18 to 60 years. All of them had nasal obstruction because of inferior turbinate hypertrophy (Approval No.; FMBSUREC/02012024/Naguib).

CT scan was applied to exclude associated sinus illness, all patients have persistent manifestations that are not or only briefly alleviated by medicinal treatment (topical corticosteroids, antihistamines, decongestants, and topical anticholinergic drugs).

Exclusion criteria:

1. Any patient with previous turbinate surgery.
2. Any patient with history or signs suggestive of chronic rhinosinusitis.
3. Patients with nasal polyps, nasal masses, and previous nasal surgery.
4. Deviated septum.

Cases were equally divided into two groups A and B (10 patients in each one):

Group (A): treated by microdebrider assisted inferior turbinoplasty (MAIT).

Group (B): treated by submucosal diathermy (SMD) using bipolar cautery in inferior turbinate reduction.

All patients were subjected to a preoperative assessment protocol that included:

1. History taking

Detailed history taking. Clinical manifestations of the patient were obtained. Every patient had to answer several questions as the following:

a. Onset, course and duration of nasal obstruction.
b. Site of nasal obstruction whether unilateral, bilaterally equal, bilaterally unequal or alternating.
   - Subjective signs such as nasal obstruction and nasal discharge.
c. Whether this nasal obstruction shows any seasonal variations.
d. Whether nasal obstruction is accompanied by any symptoms suggestive of allergic rhinitis or any allergic systemic conditions.
e. Factors provoking and relieving nasal obstruction.

f. History of applying any topical decongestants or corticosteroids.

g. History of taking any systemic decongestants or any other drug intake.

h. History of previous nasal or sinus surgeries.

i. Proper treatment of laryngopharyngeal reflux (LPR) if present.

2. Examination

A standard physical examination of the ear, nose, and throat, with an emphasis on detailed nasal examination, every case was subjected to endoscopic nasal assessment using 0 and 30 nasal endoscopes to exclude also any patient with deviated septum, nasal polyps, sinusitis, nasal masses or synechiae and assessment of inferior turbinate.

3. CT scan was done preoperative for all patients.

Surgical procedures

All patients had the following surgical procedures performed in order to relieve their nasal obstruction.

1. All operations were performed while the patients were supine and with a modest elevation of the head while under general hypotensive anesthesia.
2. Preparing the nasal cavity using nasal packs saturated with a saline epinephrine solution.
3. Infiltrated turbinates with a saline epinephrine solution combination.
4. Every surgical maneuver was performed with endoscopes with angles of 0 and 30 degrees, in addition to endoscopic sinus surgery sets.

A “Xomed XPS 3000” unit (Medtronics/ Xomed, Jacksonville, FL, USA) was utilized for MAIT. Bipolar device was used for bipolar turbinectomy.

Group (A):

Using a typical 15 blade, an antero-inferior submucosal pocket was created on the inferior turbinate. Setting the microdebrider to oscillate at 3000 rpm. The inferior turbinate size was reduced, particularly from the anterior head, by using an "inferior turbinate 2 mm blade" while maintaining strict adherence to the submucosal plane [Figs. 1-6].

Group (B):

Following the preparation of the nasal cavity, a specialized pointed needle, which was insulated with the exception of a 5mm mark at its tip, was linked to a standard surgical coagulation diathermy source earthed to the thigh. The needle was inserted into the turbinate parallel to the floor of the nose while the diathermy circuit was closed. This was done under endoscopic guidance with visualization of the entire turbinate. As the needle was gradually withdrawn, a linear burn was inflicted upon the mucosa. Two to three runs were often required to reduce the size of turbinate [Fig. 6].

Postoperative follow up:

Postoperatively, all cases were followed up in the outpatient clinic every week for the 1st month, then every 2 weeks for the 2nd month postoperatively. Follow up sessions included detailed history taking and full otorhino-laryngology examination.

Figure (1): Rt side creating an antero-inferior submucosal pocket & elevation of mucosal flap.

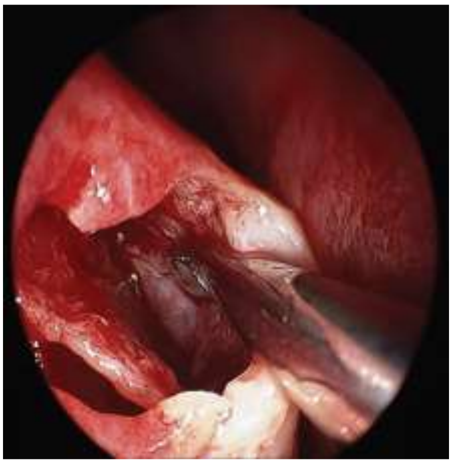

Figure (2): Rt side microdebrider used to reduce turbinate size submucosally.

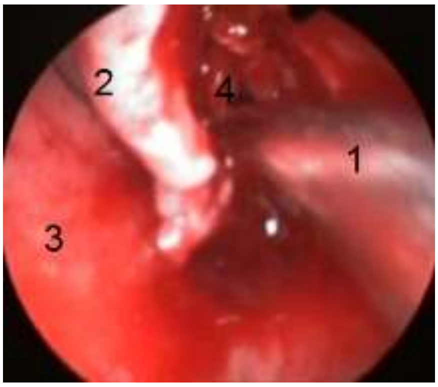

Figure (3): Powered turbinoplasty; Lt. Side. 1; the microdebrider. 2; the lateral mucosal flab. 3; nasal septum. 4; submucosal layer and bony turbinate.

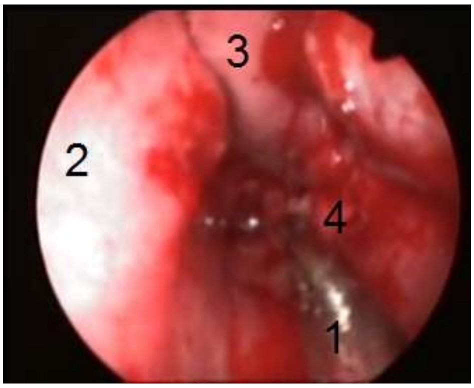

Figure (4): Powered turbinoplasty; Lt. Side. 1; the microdebrider. 2; Nasal septum. 3; middle turbinate. 4; lateral mucosal flab covering raw area.

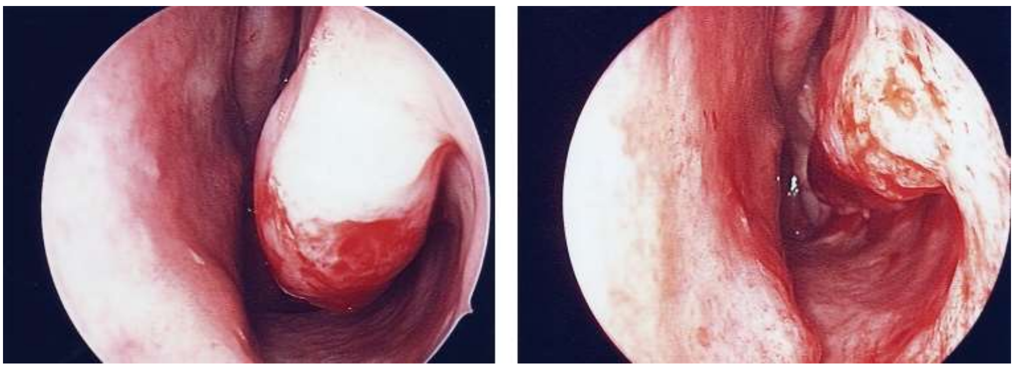

Figure (5): Pre and post-operative Powered turbinoplasty.

Figure (6): Bipolar turbinectomy end of operation view.

Post-operative analysis:

1. Subjective: Symptoms Questionnaire

The first assessment was a subjective evaluation of signs. Nasal discharge and obstruction were assessed using the following subjective scoring system for each side:

Nasal obstruction (0 = breathing freely; 1= intermittent blockage; 2 =continuous blockage).

Nasal discharge (0 =no discharge; 1 =moderate discharge; 2= heavy discharge and postnasal drip) [6].

Pain according to Numeric Rating Scale (NRS)

The NRS is an eleven-point scale used by patients to self-report pain. It is intended for children and adults aged 10 or older.

ADLs=activities of daily living

Rating	Pain Level
0	No Pain
1–3	Mild Pain (nagging, annoying, interfering little with ADLs)
4–6	Moderate Pain (interferes significantly with ADLs)
7–10	Severe Pain (disabling; unable to perform ADLs)

2. Objective:

Endoscopic examination:

The second outcome measurement used rigid nasal endoscopy-based objective endoscopic evaluation (0° degree). The presence of blood clots, crusting, and turbinate hypertrophy was assessed in each nostril. A score system was developed to assess the performance of each process.

Turbinate hypertrophy (0= small turbinate with nasal air way > 6mm, 1= no turbinate hypertrophy with nasal air way 4-6mm, 2= turbinate hypertrophy with nasal air way 1-4mm, 3= turbinate hypertrophy with nasal air way <1mm).

Crusting (0= no crustation, 1= few isolated crusts, 2= <50% of turbinate crusted, 3= >50% of turbinate crusted).

Blood Clots (0= no blood clots, 1= few blood clots, 2= severe blood clots)

3. Results:

Table (1): Comparison of demographic data of the studied groups

Variable	Group I (*n*=10)		Group II (*n*=10)		t	P
Age (years)						
Mean ± SD	42.35 ± 10.54		41.26 ± 11.09		0.23	0.82
Range	18 - 60		19 - 57			NS
	No	**%**	**No**	**%**	**Test**	**p**
Sex						
Male	5	50	6	60	F	0.98
Female	5	50	4	40		NS

SD: Stander deviation, t: Independent t test, F: Fisher exact test.
NS: Non significant (P>0.05)

There was no significant difference among the studied groups in age or sex distribution.

Table (2): Evaluation of turbinate hypertrophy among the studied groups at different times

Variable	Group I (*n*=10)		Group II (*n*=10)		P^
	No	**%**	**No**	**%**	
Preoperative:					
Turbinate hypertrophy with nasal air way 1-4mm	2	20	2	20	1
Turbinate hypertrophy with nasal air way <1mm	8	80	8	80	NS
1 week post operative:					
Small turbinate with nasal air way > 6mm	4	40	4	40	1
No turbinate hypertrophy with nasal air way 4-6mm	6	60	6	60	NS
2 week post operative:					
Small turbinate with nasal air way > 6mm	4	40	4	40	1
No turbinate hypertrophy with nasal air way 4-6mm	6	60	6	60	NS
3 week post operative:					
Small turbinate with nasal air way > 6mm	5	50	4	40	0.98
No turbinate hypertrophy with nasal air way 4-6mm	5	50	6	60	NS
4 week post operative:					
Small turbinate with nasal air way > 6mm	5	50	4	40	0.98
No turbinate hypertrophy with nasal air way 4-6mm	5	50	6	60	NS
6 week post operative:					
Small turbinate with nasal air way > 6mm	5	50	4	40	0.98
No turbinate hypertrophy with nasal air way 4-6mm	5	50	6	60	NS
8 week post operative:					
Small turbinate with nasal air way > 6mm	5	50	4	40	0.98
No turbinate hypertrophy with nasal air way 4-6mm	5	50	6	60	NS
P#	**<0.001****		**<0.001****		

^: Fisher exact test. #: McNemmar test NS: Non significant (p>0.05) **: Highly significant (p<0.01)

There was no significant difference among the studied groups in turbinate hypertrophy at any time of follow up. But there was a significant elevation in frequency of improvement in Group I & II 8 weeks post treatment compared to pretreatment.

Table (3): Evaluation of nasal obstruction among the studied groups at different times

Variable	Group I (*n*=10)		Group II (*n*=10)		P^
	No	%	No	%	
Preoperative:					
Continuous blockage	10	100	10	100	---
Immediately post operative:					
Intermittent blockage	2	20	1	10	0.98
Continuous blockage	8	80	9	90	NS
1 week post operative:					
Breathing freely	4	40	1	10	
Intermittent blockage	5	50	5	50	**0.04***
Continuous blockage	1	10	4	40	
2 week post operative:					
Breathing freely	4	40	3	30	0.52
Intermittent blockage	5	50	5	50	NS
Continuous blockage	1	10	2	20	
3 week post operative:					
Breathing freely	5	50	3	30	0.35
Intermittent blockage	4	40	5	50	NS
Continuous blockage	1	10	2	20	
4 week post operative:					
Breathing freely	5	50	3	30	0.35
Intermittent blockage	4	40	5	50	NS
Continuous blockage	1	10	2	20	
6 week post operative:					
Breathing freely	5	50	4	40	0.98
Intermittent blockage	5	50	6	60	NS
8 week post operative:					
Breathing freely	6	60	5	50	0.98
Intermittent blockage	4	40	5	50	NS
P#	<0.001**		<0.001**		

^: Fisher exact test. #: McNemmar test NS: Non significant (p>0.05) *: Significant (p<0.05) **: Highly significant (p<0.01)

There was no significant difference among the studied groups in nasal discharge at any time of follow up except at 1st week post operative there was an increase in continues blockage among Group II. But there was a significant elevation in frequency of improvement in Group I & II 8 weeks post treatment compared to pretreatment.

Table (4): Evaluation of nasal discharge among the studied groups at different times

Variable	Group I (*n*=10) No	Group I (*n*=10) %	Group II (*n*=10) No	Group II (*n*=10) %	P^
Preoperative:					
No discharge	4	40	3	30	0.79 NS
Moderate discharge	3	30	4	40	
Heavy discharge and postnasal drip	3	30	3	30	
Immediately post operative:					
Moderate discharge	4	40	3	30	0.98 NS
Heavy discharge and postnasal drip	6	60	7	70	
1 week post operative:					
No discharge	4	40	1	10	0.28 NS
Moderate discharge	4	40	5	50	
Heavy discharge and postnasal drip	2	20	4	40	
2 week post operative:					
No discharge	7	70	2	20	**0.04***
Moderate discharge	3	30	5	50	
Heavy discharge and postnasal drip	0	0	3	30	
3 week post operative:					
No discharge	8	80	2	20	**0.03***
Moderate discharge	2	20	7	70	
Heavy discharge and postnasal drip	0	0	1	10	
4 week post operative:					
No discharge	8	80	2	20	**0.03***
Moderate discharge	2	20	7	70	
Heavy discharge and postnasal drip	0	0	1	10	
6 week post operative:					
No discharge	9	90	3	30	**0.02***
Moderate discharge	1	10	6	60	
Heavy discharge and postnasal drip	0	0	1	10	
8 week post operative:					
No discharge	9	90	3	30	**0.02***
Moderate discharge	1	10	6	60	
Heavy discharge and postnasal drip	0	0	1	10	
P#	**0.04***		0.16 NS		

^: Fisher exact test. #: McNemmar test NS: Non significant (p>0.05) *: Significant (P<0.05)

There was no significant difference among the two studied groups in nasal discharge at preoperative, immediately and 1 week post operative but there was a significant reduction in frequency of discharge among Group I compared to II from 2 week post operative till end of follow up. Also, there was no significant difference among pre and 8-week post treatment in Groups II but there was a significant decrease in frequency of discharge between pre and 8 weeks in Group I.

Table (5): Evaluation of blood clot among the studied groups at different times

Variable	Group I (*n*=10)		Group II (*n*=10)		P^
	No	%	No	%	
Immediately post operative:					
Few blood clots	8	80	3	30	**0.02***
Severe blood clots	2	20	7	70	
1 week post operative:					
No blood clots	9	90	5	50	**0.04***
Few blood clots	1	10	5	50	
2 week post operative:					
No blood clots	10	100	10	100	---
3 week post operative:					
No blood clots	10	100	10	100	---
P#	<0.001**		<0.001**		

^: Fisher exact test. #: McNemmar test NS: Non significant (p>0.05)
**: Highly significant (p<0.01)

There was a significant decrease in blood clot among Group I compared to Group II immediately and 1 week after operation but there was no difference between them after 2 and 3 weeks of the operation. Also, there was a significant reduction in frequency of clot in Group I & II 3 weeks post treatment compared to immediately after treatment.

Table (6): Evaluation of Pain among the studied groups at different times

Variable	Group I (*n*=10)		Group II (*n*=10)		P^
	No	%	No	%	
Immediately post operative:					
Mild	7	70	2	20	**0.03***
Moderate	3	30	4	40	
Sever	0	0	4	40	
1 week post operative:					
No	6	60	1	10	**0.04***
Mild	3	30	5	50	
Moderate	1	10	4	40	
2 week post operative:					
No	8	80	6	60	0.63 NS
Mild	2	20	4	40	
3 week post operative:					
No	10	100	10	100	---
P#	<0.001**		<0.001**		

^: Fisher exact test. #: McNemmar test NS: Non significant (p>0.05)
**: Highly significant (p<0.01)

There was a significant decrease in pain severity among Group I compared to Group II immediately and 1 week after operation but there was no difference between them after 2 and 3 weeks of the operation. Also, there was a significant elevation in frequency of improvement in Group I & II 3 weeks post treatment compared to immediately after treatment.

Table (7): Evaluation of crust among the two studied groups at different times

Variable	Group I (*n*=10)		Group II (*n*=10)		P^
	No	%	No	%	
1 week post operative:					
No crustation	4	40	4	40	0.50 NS
Few isolated crusts	6	60	4	40	
<50% of turbinate crusted	0	0	2	20	
2 week post operative:					
No crustation	4	40	4	40	0.50 NS
Few isolated crusts	6	60	4	40	
<50% of turbinate crusted	0	0	2	20	
3 week post operative:					
No crustation	5	50	4	40	0.32 NS
Few isolated crusts	5	50	4	40	
<50% of turbinate crusted	0	0	2	20	
4 week post operative:					
No crustation	6	60	2	20	**0.04***
Few isolated crusts	4	40	4	40	
<50% of turbinate crusted	0	0	4	40	
6 week post operative:					
No crustation	7	70	2	20	**0.03***
Few isolated crusts	3	30	4	40	
<50% of turbinate crusted	0	0	4	40	
8 week post operative:					
No crustation	7	70	2	20	**0.03***
Few isolated crusts	3	30	4	40	
<50% of turbinate crusted	0	0	4	40	
P#	**0.04***		0.85 NS		

^: Fisher exact test. #: McNemmar test NS: Non significant (p>0.05)

There was no significant difference among the studied groups in crust at 1, 2 and 3 weeks post operative but there was a significant reduction in frequency of crust among Group I compared to II from 4 week post operative till end of follow up. Also, there was no significant difference among 1- and 8-week post treatment in Groups II but there was a significant decrease in frequency of crust between 1 and 8 weeks in Group I.

4. Discussion:

Surgical treatment of the inferior turbinates has been performed since the early 1900s in an effort to alleviate nasal obstruction and thus enhance respiratory function. Considering the critical activities of the covering mucosa and the dynamic ventilation that the nasal turbinate performs in its physiology [7], numerous surgical techniques, have been proposed over the years to reduce the inferior turbinates hypertrophy [3].

Hol and Huizing [3] concluded that numerous strategies can impair the functionality of the turbinate mucosa without alleviating nasal obstruction. They preferred the ‘‘infra-tubinal turbinoplasty’ method. Consequently, the objective of turbinate surgery ought to be to lower the inferior turbinate volume while preserving the nasal mucosa in order to fulfil the turbinates' functions of heating and humidifying breathed air [8].

The microdebrider, which had been in use for endoscopic sinonasal surgery since the 1990s, was included into turbinate surgery via a submucosa corridor. This modification allowed for the preservation of the nasal mucosa's functionality [9, 10].

Davis and Nishioka [11]. Lee and Chen [8] reported that MAIT is a safe and efficacious minimally invasive procedure used to treat hypertrophic rhinitis and inferior turbinate hypertrophy. In addition, Cingi et al. [12] demonstrated the efficacy of this method in resolving nasal obstruction and restoring breathing. Neri et al. [13] documented what had been previously stated and elucidated how a sustained resolution of nasal obstruction and its accompanying symptoms may be attained after MAIT surgery by maintaining the mucociliary functioning of the nasal turbinate mucosa.

A straightforward and efficient method for performing reduction operation on the hypertrophied inferior turbinate is SMD. It was shown to be very efficacious in mitigating chronic nasal obstruction caused by inferior turbinate hypertrophy. In 1907, SMD of inferior turbinates was first recorded. It functions by reducing the volume of the nasal cavity that is occupied by the hypertrophied inferior turbinate [14].

The effects of two alternative surgical modalities for turbinate surgery— MAIT and SMD—on nasal obstruction, bleeding, pain, discharge, and crustation were compared in this research.

In this research, both groups showed no significant difference in sex, age, and nasal obstruction.

There was no significant difference among the studied groups in turbinate hypertrophy at any time of follow up. But there was a significant elevation in frequency of improvement in Group I & II 8 weeks post treatment compared to pretreatment.

There was no significant difference among the studied groups in nasal discharge at any time of follow up except at 1st week post operative. There was an increase in continues blockage among Group II. But there was a significant elevation in frequency of improvement in Group I & II 8 weeks post treatment compared to pretreatment.

There was no significant difference among the studied groups in nasal discharge at preoperative, immediately and 1 week post operative but there was a significant reduction in frequency of discharge among Group I compared to II from 2 week post operative till end of follow up. Also, there was no significant difference among pre and 8-week post treatment in Groups II but there was a significant decrease in frequency of discharge between pre and 8 weeks in Group I.

There was a significant decrease in blood clot among Group I compared to Group II immediately and 1 week after operation but there was no difference between them after 2 and 3 weeks of the operation. Also, there was a significant reduction in frequency of clot in Group I & II 3 weeks post treatment compared to immediately after therapy.

There was a significant reduction in pain severity among Group I compared to Group II immediately and 1 week after operation but there was no difference between them after 2 and 3 weeks from surgery. Also, there was a significant elevation in frequency of improvement in Group I & II 3 weeks post treatment compared to immediately after treatment.

There was no significant difference among the studied groups in crust at 1, 2 and 3 weeks post operative but there was a significant reduction in frequency of crust among Group I compared to II from 4 week post operative till end of follow up. Also, there was no significant difference among 1- and 8-week post treatment in Groups II but there was a significant decrease in frequency of crust between 1 and 8 weeks in Group I.

SMD and MAIT are both effective treatments for nasal obstruction caused by inferior turbinate hypertrophy. Complication rates for both surgeries are comparable. Nevertheless, if feasible, the microdebrider should be favored over the SMD group due to the demonstrated superiority in subjective and objective nasal obstruction improvement between the two. Additionally, the MAIT group experiences less postoperative pain and bleeding compared to the SMD group. The selection of the surgical procedure must be assessed on an individual basis for each patient. Effectiveness was seen with both modalities assessed in this research for surgical treatment of the inferior turbinate.

5. Conclusion:

As inferior turbinates hypertrophy is a prevalent cause of nasal obstruction, it is seen with relative frequency in ENT clinics. Most patients are effective for the treatment with topical steroids and/or antihistamines. Conversely, some cases exhibit resistance to medical treatment. Proper history taking with proper diagnosis and treatment of laryngopharyngeal reflux (LPR) is important before proceeding to trurbinate surgery.

MAIT and SMD are established as procedures in inferior turbinate hypertrophy cases who do not respond to medical therapy.

6. References:

1. Jackson, L. E., & Koch, J. R. (1999). Controversies in the management of inferior turbinate hypertrophy: a comprehensive review. *Plastic and reconstructive surgery*, *103*(1), 300-312.

2. Camelo-Nunes, I. C., & Solé, D. (2010). Allergic rhinitis: indicators of quality of life. *Jornal Brasileiro de Pneumologia*, *36*, 124-133.

3. Hol, M. K., & Huizing, E. H. (2000). Treatment of inferior turbinate pathology: a review and critical evaluation of the

different techniques. *Rhinology, 38*(4), 157-166.

4. Ye, T., & Zhou, B. (2015). Update on surgical management of adult inferior turbinate hypertrophy. *Current opinion in otolaryngology & head and neck surgery, 23*(1), 29-33.

5. Bhandarkar, N. D., & Smith, T. L. (2010). Outcomes of surgery for inferior turbinate hypertrophy. *Current opinion in otolaryngology & head and neck surgery, 18*(1), 49-53.

6. Wormald, P. J. (2013). Endoscopic sinus surgery. *Stuttgart, New York: Thieme, 5*, 28-44.

7. Passàli, D., Anselmi, M., Lauriello, M., & Bellussi, L. (1999). Treatment of hypertrophy of the inferior turbinate: long-term results in 382 patients randomly assigned to therapy. *Annals of Otology, Rhinology & Laryngology, 108*(6), 569-575.

8. Lee, C. F., & Chen, T. A. (2004). Power microdebrider-assisted modification of endoscopic inferior turbinoplasty: a preliminary report. *Chang Gung medical journal, 27*(5), 359-365.

9. Yáñez, C. (1998). New technique for turbinate reduction in chronic hypertrophic rhinitis: intraturbinate stroma removal using the microdebrider. *Operative Techniques in Otolaryngology-Head and Neck Surgery, 9*(3), 135-137.

10. Van Delden, M. R., Cook, P. R., & Davis, W. E. (1999). Endoscopic partial inferior turbinoplasty. *Otolaryngology-Head and Neck Surgery, 121*(4), 406-409.

11. Davis, W. E., & Nishioka, G. J. (1996). Endoscopic partial inferior turbinectomy using a power microcutting instrument. *Ear, nose & throat journal, 75*(1), 49-50.

12. Cingi, C., Ure, B., Cakli, H. A. M. D. İ., & Ozudogru, E. (2010). Microdebrider-assisted versus radiofrequency-assisted inferior turbinoplasty: a prospective study with objective and subjective outcome measures. *ACTA otorhinolaryngologica italica, 30*(3), 138-143.

13. Neri, G., Mastronardi, V., Traini, T., D'Orazio, F., Pugliese, M., & Cazzato, F. (2013). Respecting nasal mucosa during turbinate surgery: end of the dogma. *Rhinology, 51*(4), 368-375.

14. Passàli, D., Passàli, F. M., Passàli, G. C., Damiani, V., & Bellussi, L. (2003). Treatment of inferior turbinate hypertrophy: a randomized clinical trial. *Annals of Otology, Rhinology & Laryngology, 112*(8), 683-688.