RESEARCH PAPER

Comparative study between Microdebridder inferior turbinoplasty versus other surgical techniques

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Abstract:

Background: Inferior turbinate hypertrophy is a common cause of persistent nasal obstruction and may substantially impair sleep, daily activities, and quality of life. Surgical reduction is indicated when medical treatment fails; however, the available techniques differ in their effectiveness, healing pattern, mucosal preservation, and postoperative complications. This study aimed to compare microdebrider-assisted inferior turbinoplasty with radiofrequency tissue reduction, submucosal resection, and surface cauterization in patients with chronic inferior turbinate hypertrophy.

Methods: This comparative study included 40 patients with chronic inferior turbinate hypertrophy who underwent surgical treatment at the Otorhinolaryngology Department, Faculty of Medicine, 6th October University Hospitals, between October 2025 and April 2026. Patients were classified into a microdebrider-assisted inferior turbinoplasty group (n=14) and an other surgical techniques group (n=26), comprising radiofrequency reduction, submucosal resection, and surface cauterization. Patients were followed for two months.

Results: Healing occurred significantly earlier in the microdebrider group, with 71.4% healing within one month, whereas 61.6% of patients treated with other techniques required two months or longer (P=0.011). Improvement of nasal obstruction within two weeks was reported in 50.0% of the microdebrider group compared with 15.4% of the other techniques group (P=0.009). Postoperative crustation was absent after microdebrider turbinoplasty compared with 65.4% following other techniques (P=0.001).

Conclusion: Microdebrider-assisted inferior turbinoplasty provided faster healing and earlier improvement of nasal obstruction, with lower rates of crustation, synechiae, malodor, and turbinate atrophy. It appears to offer a favorable balance between effective tissue reduction and preservation of nasal mucosal function compared with the other evaluated techniques.

Keywords: Inferior turbinate hypertrophy; Microdebrider-assisted inferior turbinoplasty; Radiofrequency; Submucosal resection; Surface cauterization; Nasal obstruction.

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Introduction:

One of the most frequent causes of nasal blockage is inferior turbinate hypertrophy. It performs a variety of tasks, such as filtration, temperature control, humidification of inspired air, and nasal airflow modulation (1).

Numerous factors, including allergens, vasomotor dysfunctions, infections, and drugs, can cause inferior turbinate hypertrophy (2).

Nasal obstruction, which can be unilateral or bilateral and frequently becomes more apparent at night or during sleep, is a common symptom of patients with inferior turbinate hypertrophy. Mouth breathing, snoring, sleep disturbances, dry mouth and throat, and decreased tolerance to physical exertion can all be linked to the obstruction. Rhinorrhea, postnasal discharge, sneezing, nasal itching, hyposmia, headache, and a feeling of nasal blockage or heaviness are additional possible symptoms.

Chronic nasal airflow impairment can have detrimental effects on everyday activities, focus, sleep quality, and general quality of life (3).

This effect of nasal blockage on respiratory function is clinically significant even though it is not life-threatening since it significantly affects patients' quality of life through symptoms such mouth breathing, snoring, dry mouth, and nasal discharge (4).

The symptom of nasal blockage brought on by turbinate hypertrophy is treated with a variety of medicinal methods, including topical decongestants, antihistamines, and/or topical corticosteroids in combination (5).

Surgical turbinate reduction is required for certain patients with persistent symptoms who do not respond to current medical treatment options. For inferior turbinate reduction, several methods have been reported. These include radiofrequency volumetric tissue reduction, submucosal resection, electrocautery with monopolar, microdebrider assisted turbinoplasty, and surface cauterization (6).

While many of these surgical techniques yield excellent outcomes in comparison to one another, some side effects, such as bleeding, crust development, discomfort, synechiae, or atrophy of the inferior turbinate, are commonly noted after surgery. In addition to achieving a long-lasting reduction in turbinate size, an optimal surgical technique for inferior turbinate reduction should achieve the objectives of maintaining turbinate functions, with or without minimal consequences (7).

In order to retain the upper portion of the inferior turbinate's medial wall and, consequently, the airflow receptors and their function, microdebrider assisted inferior turbinoplasty was developed. Furthermore, the procedure makes it possible to reduce the inferior turbinate's size by roughly 50% without leaving a raw surface that could develop crusts during the recovery phase (8).

Methods

This cross-sectional comparative study was carried out on 40 patients underwent inferior turbinate hypertrophy admitted to Faculty of Medicine 6th October university Hospitals, Otorhinolaryngology Department in the duration from October 2025 to April 2026 after approval of ethical committee (Approval code:…….)

Inclusion criteria were age 8 to 45 years, both sexes, All of the patients exhibited inferior turbinate hypertrophy, which was demonstrated by a recent CT scan of the nose and PNS axial and coronal slices. The patients' nasal obstruction was corrected using one of the turbinoplasty techniques.

Exclusion criteria were patients Patients with uncontrolled chronic systemic diseases that raised the risk of surgery or anesthesia underwent procedures other than turbinoplasty to correct nasal obstruction, such as septoplasty or nasal polyps, either in the same setting or in different settings, and they came to us more than two days after the procedure.

Methods:

The approved residents and professors of 6th October University Hospitals collected all the data and conducted all the examinations.

A. Preoperative:

All patients were subjected to taking a complete history, finish the clinical assessment, nasal endoscopic examination and a diagnostic computed tomography scan of the paranasal and coronal and axial noses. Preoperative laboratory tests include prothrombin time (PT), partial thromboplastin time, bleeding time, hepatitis C and hepatitis B viruses, and complete blood picture (CBC).Before surgery, all patients had thorough counseling, and informed consent was obtained.

Preoperative Preparation

- Detailed nasal endoscopy and assessment of turbinate size.
- Local or general anesthesia depends on patient and surgeon preference.
- Topical decongestants and local infiltration with **lidocaine + epinephrine** to minimize bleeding. Infiltration of the inferior turbinate was done with a combined 2% xylocaine and 1:100,000 epinephrine

B. Intraoperative surgical technique:

1 - Microdebrider-assisted inferior turbinoplasty (MAIT) technique:

The MAIT procedure involved removing all of the stromal tissue from the inferior part of the turbinate using a microdebrider, dissecting the mucosal flap over the turbinate bone, cutting the inferior part of the bone, repositioning the mucosal flap, and creating hemostasis with the least amount of diathermy. During this removal procedure, special care was taken to protect the upper mucosal flap.

2 - Traditional technique:

used surgical scissors to remove the inferoposterior portion of the inferior turbinate, and a nasal pack was used to create hemostasis.

3 - Bipolar technique:

Cuterization of the inferoposterior portion of the inferior section of the inferior turbinate was done using bipolar.

4 - Radio frequency technique:

used radiofrequency to cuterize the inferior turbinate's inferoposterior region.

C. Postoperative and follow-up:

Two days after surgery, at the conclusion of the first postoperative week, once a week for the first postoperative month, and every two weeks for the second postoperative month, patients were evaluated.

In order to evaluate healing, infection, crustation, bleeding, synechiae, inferior turbinate atrophy, nasal obstruction improvement, and olfactory result, patients had clinical and endoscopic nasal examinations at each follow-up visit.

In order to assess early and intermediate outcomes after surgical therapy of persistent inferior turbinate hypertrophy, patients were monitored for two months after the procedure. The results of MAIT were compared to those of other frequently used turbinate reduction methods throughout this follow-up period.

Both a clinical examination and an endoscopic nasal evaluation were part of the postoperative evaluation. Synechiae, mucosal dryness, and aberrant secretions were assessed using endoscopic findings. The emergence of malodor, which could be a sign of infection or poor mucociliary clearance, received special attention. In order to determine long-term mucosal preservation, evidence of inferior turbinate atrophy, such as severe volume decrease or loss of typical turbinate architecture, was also particularly evaluated.

A fair comparison of MAIT and other surgical methods in terms of healing quality, complication rates, and mucosal safety was made possible by this follow-up strategy.

Primary outcome:

- Improvement of nasal obstruction after surgery.
- Degree of mucosal healing.

Secondary outcome:

- Pain
- Postoperative bleeding
- Crust formation

Ethical considerations:

The Ethics Committee of the Faculty of Medicine at 6th October University in Egypt gave its approval to the study. Every patient provided written, informed consent.

Statistical Analysis

The SPSS software (Statistical Package for Social Science) version 27.0 was used to computerize and statistically analyze the gathered data (IBM, 2020). The Chi-square test, Fisher's exact test, the independent T test was employed and Mann Whitney (MW) test were utilized.

Results

Table (1): Demographic and Baseline Clinical Characteristics of the Studied Groups

Variable	Variable	Microdebrider (n=14)	Other surgical techniques (n=26)	P value
Age	Mean± SD	31.86±8.49	29.96±8.61	0.504
	Median	34.5	29.5	
	Range	18–42	18–45	
Medical treatment duration (years)	Mean± SD	4.64±3.25	3.46±2.28	0.343
	Median	5	3	
	Range	1–10	1–10	
Sex	Male n(%)	9 (64.3%)	12 (46.2%)	0.333
	Female n(%)	5 (35.7%)	14 (53.8%)	

SD: Standard Deviation, n: Number, %: Percentage, P: Probability value.

Age, length of medical treatment, and sex distribution did not differ statistically significantly between the microdebrider inferior turbinoplasty group and other surgical procedures (P >0.05), suggesting baseline comparability between the two groups (Table 1).

Table (2): Preoperative Nasal Discharge Severity among the Studied Groups

Level	Microdebrider (n=14)	Other surgical techniques (n=26)	P value
Mild	0 (0%)	1 (3.8%)	**0.041**
Moderate	3 (21.4%)	18 (69.2%)	
Severe	11 (78.6%)	7 (26.9%)	

When it came to the severity of nasal discharge, there was a statistically significant difference between the two groups (P=0.041). The microdebrider group had more severe nasal discharge, while the other surgical procedures group had more moderate discharge (Table 2)

Table (3): Preoperative Sneezing Severity among the Studied Groups

Level	Microdebrider (n=14)	Other surgical techniques (n=26)	P value
No	0 (0%)	1 (3.8%)	0.327
Mild	4 (28.6%)	14 (53.8%)	
Moderate	10 (71.4%)	11 (42.3%)	

No statistically significant difference was detected between both groups regarding sneezing severity (P=0.327), indicating comparable distribution of sneezing symptoms before surgery. (Table 3).

Table (4): Preoperative Nasal Itching Severity among the Studied Groups

Level	Microdebrider (n=14)	Other surgical techniques (n=26)	P value
No	0 (0%)	1 (3.8%)	0.74
Mild	5 (35.7%)	10 (38.5%)	
Moderate	7 (50.0%)	12 (46.2%)	
Severe	2 (14.3%)	3 (11.5%)	

No statistically significant difference was found between the studied groups regarding nasal itching severity (P=0.74), reflecting comparable preoperative symptom burden in both groups. (Table 4).

Table (5): Preoperative Headache Severity among the Studied Groups

Level	Microdebrider (n=14)	Other surgical techniques (n=26)	P value
No	0 (0%)	1 (3.8%)	0.611
Mild	2 (14.3%)	4 (15.4%)	
Moderate	7 (50.0%)	8 (30.8%)	
Severe	3 (21.4%)	11 (42.3%)	
Present only	2 (14.3%)	2 (7.7%)	

The distribution of headache severity did not differ statistically significantly between the two groups (P=0.611), suggesting that the individuals under study had similar baseline headache symptoms. **(Table 5).**

Table (6): Preoperative Olfactory Dysfunction among the Studied Groups

Variable	Microdebrider (n=14)	Other surgical techniques (n=26)	P
No	6 (42.9%)	15 (57.7%)	0.538
Mild anosmia	3 (21.4%)	7 (26.9%)	
Weak anosmia	1 (7.1%)	2 (7.7%)	
Anosmia	4 (28.6%)	2 (7.7%)	

The degree of preoperative olfactory dysfunction did not differ statistically significantly between the two groups (P=0.538), suggesting similar smell impairment prior to surgery. (Table 6).

Table (7): Clinical Examination Findings among the Studied Groups

Clinical Examination	Microdebrider (n=14)	Other surgical techniques (n=26)	P value
Mild nasal obstruction	0 (0%)	7 (26.9%)	**0.031**
Moderate nasal obstruction	8 (57.1%)	11 (42.3%)	
Severe nasal obstruction	6 (42.9%)	8 (30.8%)	

The results of the clinical evaluation revealed a statistically significant difference between the two groups (P=0.031), with moderate and severe nasal blockage predominating in the microdebrider group and mild nasal obstruction being more common in the other techniques group. (Table 7).

Table (8): Anterior Rhinoscopy Findings among the Studied Groups

Variable	Microdebrider (n=14)	Other surgical techniques (n=26)	P value
Inferior turbinate hypertrophy	14 (100%)	26 (100%)	1.00

All patients had inferior turbinate hypertrophy, and there was no statistically significant difference (P=1.00) in the anterior rhinoscopy results between the two groups. (Table 8).

Table (9): Postoperative Healing Duration among the Studied Groups

Category	Microdebrider (n=14)	Other surgical techniques (n=26)	P
~2 weeks	3 (21.4%)	0 (0%)	**0.011**
3 weeks	1 (7.1%)	3 (11.5%)	
One month	10 (71.4%)	7 (26.9%)	
2 months	0 (0%)	12 (46.2%)	
>2 months	0 (0%)	4 (15.4%)	

The duration of postoperative healing varied considerably between the two groups (P=0.011), with patients treated with other surgical procedures more likely to experience delayed healing and the microdebrider group more likely to experience quicker healing. (Table 9).

Table (10): Postoperative Infection among the Studied Groups

Variable	Microdebrider (n=14)	Other surgical techniques (n=26)	P
No	12 (85.7%)	18 (69.2%)	0.446
Yes	2 (14.3%)	8 (30.8%)	

No statistically significant difference was found between both groups regarding postoperative infection (P=0.446), although infection tended to be less frequent in the microdebrider group. (Table 10).

Table (11): Postoperative Crustation among the Studied Groups

Variable	Microdebrider (n=14)	Other surgical techniques (n=26)	P
No	14 (100%)	9 (34.6%)	**0.001**
Yes	0 (0%)	17 (65.4%)	

When compared to other surgical procedures, postoperative crustation was much less common in the microdebrider group (P=0.001), suggesting that the microdebrider technique had a better postoperative mucosal outcome. (Table 11).

Table (12): Postoperative Hemorrhage among the Studied Groups

Level	Microdebrider (n=14)	Other surgical techniques (n=26)	P
None	8 (57.1%)	15 (57.7%)	0.88
Primary	0 (0%)	4 (15.4%)	
Secondary	4 (28.6%)	4 (15.4%)	
Mild related	2 (14.3%)	3 (11.5%)	

There was no statistically significant difference between both groups regarding postoperative hemorrhage distribution (P=0.88). (Table 12).

Table (13): Improvement Time of Nasal Obstruction among the Studied Groups

Category	Microdebrider (n=14)	Other surgical techniques (n=26)	P
2 weeks	7 (50.0%)	4 (15.4%)	**0.009**
3–6 weeks	2 (14.3%)	4 (15.4%)	
1 month	5 (35.7%)	7 (26.9%)	
2 months	0 (0%)	11 (42.3%)	

There was a statistically significant difference (P=0.009) in the improvement time of nasal blockage between the two groups, with the microdebrider group seeing early clinical improvement more commonly. (Table 13)

Table (14): Postoperative Olfactory Outcome among the Studied Groups

Variable	Microdebrider (n=14)	Other surgical techniques (n=26)	P
No complaint	14 (100%)	9 (34.6%)	**<0.001**
Bad odor	0 (0%)	17 (65.4%)	

When compared to other surgical procedures, the microdebrider group's postoperative olfactory outcome was much better (P<0.001), and the microdebrider group was the only one to report no odor complaints. (Table 14).

Table (15): Postoperative Synechiae among the Studied Groups

Variable	Microdebrider (n=14)	Other surgical techniques (n=26)	P
No	14 (100%)	17 (65.4%)	**0.016**
Yes	0 (0%)	9 (34.6%)	

When compared to other surgical procedures, postoperative synechiae were substantially less common in the microdebrider group (P=0.016), indicating a better postoperative healing profile with the microdebrider technique. (Table 15).

Table (16): Postoperative Inferior Turbinate Atrophy among the Studied Groups

Variable	Microdebrider (n=14)	Other surgical techniques (n=26)	P
No	12 (85.7%)	13 (50.0%)	**0.04**
Yes	2 (14.3%)	13 (50.0%)	

The microdebrider approach demonstrated superior turbinate structural preservation, as seen by the significantly lower incidence of inferior turbinate atrophy in the microdebrider group compared to the other surgical techniques group (P=0.04) (Table 16).

Table (17): Comparative Analysis of Clinical Outcomes Among Four Surgical Techniques for Inferior Turbinate Reduction

Variable	Microdebrider (n=14)	RF (n=6)	SMR (n=10)	Surface (n=10)	P-value
Healing					**<0.001**
~2 weeks	3 (21.4%)	0 (0%)	0 (0%)	0 (0%)	
3 weeks	1 (7.1%)	0 (0%)	3 (30 %)	0 (0%)	
1 month	10 (71.4%)	0 (0%)	7 (70 %)	0 (0%)	
2 months	0 (0%)	4 (66.7 %)	0 (0%)	8 (80%)	
>2 months	0 (0%)	2 (33.3 %)	0 (0%)	2 (20%)	
Infection	2 (14.3%)	1 (16.7 %)	1 (10 %)	6 (60%)	**0.032**
Crustation	0 (0%)	6 (100 %)	1 (10 %)	10 (100 %)	**<0.001**
Hemorrhage	6 (42.9%)	0 (0%)	9 (90 %)	2 (20%)	**0.001**
Bad odor	0 (0%)	5 (83.3 %)	2 (20 %)	10 (100 %)	**<0.001**
Synechiae	0 (0%)	2 (33.3 %)	0 (0%)	7 (70%)	**<0.001**
Atrophy	2 (14.3%)	0 (0%)	10 (100 %)	3 (30%)	**<0.001**

RF: Radiofrequency tissue reduction, SMR: Submucosal resection.

The microdebrider inferior turbinoplasty procedure showed the best overall results with 71.4% of patients recovering within a month and no occurrences of crustation, synechiae, or bad odor reported (0%). On the other hand, radiofrequency tissue reduction was linked to a high incidence of crustation (100%) and bad odor (83.3%) and demonstrated delayed healing, with the majority of patients needing more than two months. Although submucosal resection (SMR) produced satisfactory healing results (70% within a month), it was linked to a notably high rate of inferior turbinate atrophy (100%), which is the worst structural result of the methods under investigation. With the highest rates of postoperative complications, such as infection (60%), crustation (100%), bad odor (100%), and synechiae (70%), as well as delayed healing—the majority of cases requiring two months for recovery—surface cauterization showed the least favorable overall results. Healing time (P < 0.001), infection (P = 0.032), crustation (P < 0.001), bleeding (P = 0.001), bad odor (P < 0.001), synechiae (P < 0.001), and inferior turbinate atrophy (P < 0.001) all showed statistically significant differences between the four methods. In comparison to the other surgical techniques, the microdebrider inferior turbinoplasty technique was linked to quicker healing, fewer postoperative complications, and better preservation of turbinate function, suggesting that it offers the best overall balance between safety and efficacy (Table 17).

Table (18): Outcomes in Severe Nasal Obstruction According to Surgical Technique

Technique	Severe cases (n)	Crustation Yes n (%)	Delayed healing (>1 month) n (%)
Microdebrider	6	0 (0%)	0 (0%)
Radiofrequency (RF)	2	2 (100%)	2 (100%)
SMR	4	0 (0%)	0 (0%)
Surface cautery	2	2 (100%)	2 (100%)

Among patients with severe nasal obstruction, outcomes varied markedly according to the surgical technique. Surface cauterization and radiofrequency demonstrated poor outcomes, with all severe cases developing crustation and delayed healing (100%). In contrast, microdebrider inferior turbinoplasty and submucosal resection showed favorable outcomes, with no cases of crustation or delayed healing among severe patients. (Table 18)

Discussion

One of the hardest conditions to treat is persistent and resistant nasal blockage. Nasal blockage can have a major negative influence on a patient's quality of life even though it is not life-threatening. Mouth breathing, snoring, nasal blockage, and secretory retention can all result from turbinate hypertrophy. Pharmacological treatment is the first line of treatment for this condition. Surgery is required to treat inferior turbinate hypertrophy when traditional pharmacological treatment with steroids, topical decongestants, and antihistamines is insufficient. Microdebrider, laser argon, carbon dioxide laser, radiofrequency, cryocoagulation, and submucosal ablation by electrocautery are some of the surgical procedures that are available (9).

Reducing the volume of erectile submucosal tissue and the bony turbinate is the aim of turbinate surgery. In addition to reducing volume, surgery on submucosal tissue leaves scars that aid in preventing inferior turbinate engorgement. The turbinate mucosa, which is linked to an increased risk of throat dryness, nasal crusting, nasal bleeding, synechia development, osteitis, atrophic rhinitis, and insufficient volume reduction, must not be severely damaged (6).

By preserving the mucosa, normal nasal physiology—which includes preserving the balance of humidity, temperature, and air filtration—is prevented from being disturbed. Turbinoplasty has become the go-to option for reducing volume while minimizing the risks involved. One surgical method for treating hypertrophic turbinates is microdebrider-assisted inferior turbinoplasty (MAIT) (9).

In order to treat chronic inferior turbinate hypertrophy (ITH), the current study compared microdebrider inferior turbinoplasty with other surgical methods, specifically radiofrequency tissue reduction (RF), submucosal resection (SMR), and surface cauterization. It focused on postoperative healing time, complication profile, and functional outcomes, such as olfactory preservation.

In this cross-sectional study, 40 patients from 6th October University Hospital were split into two groups: one for microdebriders (n = 14) and another for other surgical methods (n = 26).

Age, sex distribution, and length of previous medical treatment were all comparable between the two groups in this investigation; no statistically significant differences were found (P > 0.05). The microdebrider group's mean age was 31.86 ± 8.49 years, while the other techniques group's mean age was 29.96 ± 8.61 years.

This finding is consistent with the study by **Chau et al. (10),** They found that patients receiving various turbinate reduction procedures did not differ statistically significantly in their baseline demographics, such as age or sex, with a mean patient age of roughly 34 years in all groups.

Similarly, **Abou Zaid et al. (11**) showed similar demographic characteristics across patients assigned to microdebrider turbinoplasty versus For hypertrophied inferior turbinates, submucosal diathermy inferior turbinate reduction supports the idea that turbinate hypertrophy affects a wide age range without sex predisposition.

In terms of preoperative symptom severity, the current study discovered a statistically significant difference in nasal discharge severity between groups (P = 0.041), with severe discharge predominating in the microdebrider group (78.6%) as opposed to the other techniques group (26.9%), where moderate discharge was more common (69.2%). This disparity can be the result of a selection bias in which the surgeon choose a more aggressive surgical strategy due to a more severe preoperative presentation. On the other hand, the distribution of sneezing severity (P = 0.327), nasal itching (P = 0.74), headache (P = 0.611), and olfactory dysfunction (P = 0.538) was similar for both groups.

This study's preoperative symptom profile is in line with research describing persistent inferior turbinate hypertrophy. According to Chau et al. (10), the most common preoperative complaints among patients referred for surgical turbinate reduction are nasal discharge, obstruction, and varying degrees of anosmia. Patients with chronic hypertrophy and concurrent allergic rhinitis are more likely to experience severe nasal discharge.

Furthermore, **SAYED et al. (12**) observed that most of our patients have moderate-to-severe nasal blockage, which is associated with a higher symptom load and often requires surgery when conservative medicinal therapy is insufficient.

A clinical examination showed a statistically significant difference in the degree of nasal obstruction between the groups (P = 0.031), with the microdebrider group exhibiting a greater percentage of moderate-to-severe obstruction (57.1% moderate, 42.9% severe) than the other techniques group (26.9% mild). This result supports the idea that individuals with higher symptoms were assigned to the microdebrider procedure more frequently. On anterior rhinoscopy, all patients in both groups had inferior turbinate hypertrophy (100%).

In concordance with these findings, **Abou Zaid et al. (11)** found that patients who were chosen for microdebrider turbinoplasty had a tendency to have more severe nasal obstruction at baseline, which is indicative of clinical decision-making that saves the procedure for instances with advanced hypertrophy when submucosal tissue reduction is thought to be required.

Similarly, **Passali et al. (13)** stressed that the choice of surgical technique should be guided by an objective assessment of nasal airway resistance, with more obstructive cases benefiting from a submucosal debulking approach like microdebrider turbinoplasty rather than surface ablative approaches.

The improved postoperative healing profile seen in the microdebrider group was one of the study's most therapeutically relevant findings. 21.4% of microdebrider patients recovered in around two weeks, while 71.4% did so in one month. Patients treated with alternative surgical methods, on the other hand, showed noticeably slower healing; 46.2% needed two months, and 15.4% needed more than two months ($P = 0.011$). The difference was even more noticeable in the four-technique subgroup analysis: surface cauterization patients nearly always needed two months or more (80% at two months, 20% beyond), radiofrequency patients mostly needed more than two months (66.7% at two months, 33.3% beyond), and microdebrider patients mostly healed within one month ($P < 0.001$).

This finding is consistent with **Chau et al. (10)** who compared microdebrider-assisted turbinoplasty with partial turbinotomy and looked at the clinical and subclinical characteristics of patients with inferior turbinate hypertrophy who needed surgery. Endoscopic examination revealed that the MAIT group had better wound healing (92.6%) compared to the PIT group (74.7%, $P = 0.005$).

Ali et al., (14) found that the sides with MAIT had significantly superior tissue healing ($P = 0.010$) than the sides with PIT at one and three months after surgery.

14.3% of patients using microdebriders and 30.8% of patients using other procedures experienced postoperative infection; however, this difference was not statistically significant ($P = 0.446$). Infection rates were 14.3% for microdebrider, 16.7% for radiofrequency, 10% for SMR, and significantly 60% for surface cauterization ($P = 0.032$) in the four-technique comparison. The development of a devitalized tissue surface that hinders mucociliary clearance and creates an environment that is favorable for bacterial colonization is probably the cause of the elevated infection rate linked to surface cauterization.

While postoperative crustation occurred in 65.4% of patients treated with other procedures, it was completely absent in the microdebrider group (0%), a finding that was highly statistically significant ($P = 0.001$). In the four-technique analysis, crustation was found in only 10% of SMR patients ($P < 0.001$), all radiofrequency (100%) and surface cauterization (100%) patients, and none of the microdebrider group. These findings highlight the special benefit of the microdebrider in preventing the denudation and eschar formation that are typical of ablative and cautery procedures while maintaining the nasal mucosa while decreasing the submucosal tissue.

This finding is strongly consistent with the study by **Rao and Sreerama, (15**), who evaluated the safety and effectiveness of microdebrider turbinoplasty, partial turbinectomy, and total turbinectomy in the treatment of inferior turbinate hypertrophy. Despite exhibiting the least improvement in nasal airway at 75%, they showed that the Microdebrider Turbinoplasty group had the lowest incidence of

Lee et al., (16) 30 of the 60 patients with inferior turbinate hypertrophy had radiofrequency treatment, whereas the remaining 30 received microdebrider treatment. In the third, sixth, and twelve months following the procedure, they assessed changes in the degree of nasal blockage. Nasal obstruction, rhinorrhea, sneezing, and itching were significantly reduced in group MD during the follow-up period (up to 6 months) postoperatively compared to their preoperative levels ($p<0.05$), and group RF was comparable to group MD. However, three cases of recurrence occurred in group RF at the 6th month of the postoperative period ($p<0.08$), which was not statistically significant. Additionally, there was no difference between the two groups' post-operative crusting or operation time.

Ali et al., (14) reported that at one and three months postoperatively, the sides with MAIT had significantly fewer crustations ($P = 0.040$) than the sides with PIT.

Khan et al. (17) reported that based on one-month postoperative visits, there was no case of nasal crusting in the MAIT group in contrast with the PIT group (P = 0,012).

Cingi et al., (18) contrasted inferior turbinoplasty with radiofrequency assistance and microdebrider assistance. In contrast to the other group's clear postoperative edema and crustations, the microdebrider group had fewer crusatations and synechie during the early preoperative phase.

However, **Chau et al. (10**) found that the percentage of instances without crusting was considerably higher in the PIT group than in the MAIT group (96.6% vs. 61.8%, P < 0.001).

Regarding postoperative hemorrhage, the current study demonstrated no statistically significant difference between the microdebrider and the group using all other procedures (P = 0.88). However, there was a significant overall difference (P = 0.001) in the four-technique analysis, with bleeding rates of 42.9% for microdebrider, 0% for radiofrequency, 90% for SMR, and 20% for surface cauterization. The more invasive nature of this procedure, which entails direct incision into the turbinate stroma with subsequent mucosal and vascular disruption, is reflected in the increased bleeding rate in the SMR group. The delayed sloughing of submucosal tissue remnant may be the cause of the microdebrider group's moderate bleeding rate, which was primarily secondary hemorrhage.

These observations are consistent with **Badran et al., (19)** evealed that following pack removal, no patient in the microdebrider group experienced any postoperative hemorrhage. One week following surgery, two patients in the surgical group (6.7%) experienced subsequent bleeding, which was managed with nasal packings and antibiotics.

In terms of nasal blockage improvement time, the current study showed a statistically significant benefit for microdebrider turbinoplasty (P = 0.009). Compared to just 15.4% of patients treated with alternative methods, half of the microdebrider patients (50%) saw an improvement in their symptoms within two weeks. On the other hand, compared to 0% in the microdebrider group, 42.3% of patients in the other approaches group needed two months to see an improvement in nasal blockage. Because the microdebrider's volumetric tissue reduction maintained nasal airway patency without compromising mucosal integrity, this quicker functional recovery is a crucial patient-centered outcome.

Badran et al., (19) found that after three months, 26 patients (86.6%) in the microdebrider group and 27 patients (90%) in the surgical group reported a significant improvement in nasal obstruction, 2 patients (6.7%) in both groups reported a mild improvement, 2 patients (6.7%) and 1 patient (3.3%) reported no change, and no patient reported a worsening of nasal obstruction. The difference was not statistically significant (p>0.05).

Kizilkaya et al., (20) 30 patients had RF and microdebrider-assisted turbinoplasty, using one technique for one nasal tube and the other for the other. They contrasted gains in nasal mucociliary function and nasal obstruction. When compared to their pre-operative levels, the MD group's nasal blockage, rhinorrhea, sneezing, and snoring dramatically improved six months to three years after surgery (p<0.05). While there was a substantial improvement in all of the RF group's symptom scores from 6 months to 1 year after surgery (p<0.05), there was no further improvement at 2 and 3 years after surgery (p>0.05).

Cingi et al., (18) found that both the MD and RF groups' nasal discharge, headache, and hyposmia grades dramatically improved after the first week of the procedure and continued to do so in the first and third months. After surgery, intergroup comparisons did not show any significant differences between the two approaches (p<0.05). They came to the conclusion that microdebrider-assisted partial turbinoplasty is more successful and satisfactory in treating nasal obstruction because MD can efficiently enlarge the nasal airway.

While, **Rao and Sreerama, (15)** found that their nasal airway improved the most after whole turbinectomy (85%), followed by partial turbinectomy (80%) and microdebrider turbinoplasty (75%).

Abou Zaid et al. (11) found that both groups showed a significant improvement in nasal obstruction as measured by the Visual Analog Scale (VAS), with group B experiencing a greater improvement than group A. which were, on average, 2.63 in MAIT and 3.54 in SMD one month after surgery.

Furthermore, **Maniaci et al. (21)** showed that all assessed parameters showed statistically significant improvement (P < 0.001 in all cases), indicating that microdebrider-assisted turbinoplasty is very successful in managing clinical symptoms.

One of the most notable results of the current study was the olfactory outcome. While 65.4% of patients in the other procedures group reported an unpleasant odor after surgery, all microdebrider patients (100%) had no postoperative olfactory complaints (P < 0.001). Bad odor was completely missing in the microdebrider group (0%), present in 83.3% of radiofrequency patients, 20% of SMR patients, and 100% of surface cauterization patients (P < 0.001) in the four-technique study. This symptom most likely results from a combination of functional impairment of the olfactory epithelium in the context of extensive mucosal disruption and postoperative crustation creating a malodorous milieu.

In comparison to the other procedures group, the microdebrider group had a considerably decreased risk of postoperative synechiae (0% vs. 34.6%, P = 0.016). Synechiae were seen in 33.3% of radiofrequency patients, 70% of surface cauterization patients, and completely absent in both the microdebrider and SMR groups in the four-technique study (P < 0.001). One of the most clinically significant side effects of turbinate surgery is synechiae development, which is an adhesion between opposing mucosal surfaces after postoperative inflammation and fibrosis and can continue nasal blockage even after surgery.

This finding is in agreement with the results of **Rao and Sreerama, (15**), who found that the Microdebrider group had the lowest rate of synechiae production (5%), whereas the Partial Turbinectomy group had the highest rate (15%).

Similarly, **Annamalai et al. (22**) 14 patients in the conventional group produced synechiae (p=0.016), indicating a much reduced incidence of synechiae with the microdebrider approach, while reported synechiae generation was absolutely absent in the microdebrider group.

Setliff and Parsons (23) in 345 patients showed and decreased middle turbinate trauma reduced synechiae with the microdebrider method. **Bernstein et al. (24**) shown a low percentage of synechiae formation and quick mucosal healing in 40 patients who had endoscopic sinus surgery using the microdebrider.

According to the current study, the microdebrider group experienced inferior turbinate atrophy considerably less frequently than the other techniques group (14.3% vs. 50.0%, P = 0.04). Interestingly, atrophy was found in 100% of SMR patients in the four-technique analysis, which is the most damaging result in the series. This is in contrast to 14.3% for microdebrider, 0% for radiofrequency, and 30% for surface cauterization patients (P < 0.001). Because it puts patients at risk for empty nose syndrome, which is characterized by paradoxical nasal obstruction, pharyngeal dryness, and crustation due to loss of the turbinate's humidification and mucociliary function, inferior turbinate atrophy is a serious long-term consequence.

The current study's four-technique comparative analysis offers a thorough summary of the advantages and disadvantages of each strategy for treating chronic inferior turbinate hypertrophy. With early healing, mostly within a month, no crustation, no synechiae, no foul odor, and the lowest atrophy rate, the microdebrider inferior turbinoplasty technique showed the best overall postoperative profile. Low rates of bleeding and atrophy were two benefits of radiofrequency tissue reduction; nonetheless, it was consistently linked to protracted healing, ubiquitous crustation, and frequent foul odor. Although SMR had low synechiae rates and an adequate healing duration, its consistently high atrophy rate eliminated it as the best method. With the highest rates of infection, crustation, foul odor, and synechiae along with delayed healing, surface cauterization showed the least favorable profile.

Yoo et al. (25) found that both radiofrequency-ablation turbinoplasty and microdebrider-assisted turbinoplasty were similarly effective in improving medication ratings and lowering nasal symptoms in individuals with AR throughout a 5-year postoperative period.

The current study further supported the microdebrider's usefulness in advanced disease by showing that, in the particular context of severe nasal obstruction, neither SMR nor microdebrider produced any crustation or delayed healing, whereas RF and surface cauterization were linked to 100% crustation and 100% delayed healing in severe cases.

In the 2010s, RFA and MAIT have grown in popularity as treatments for turbinate hypertrophy. The results of each method were compared in a seminal systematic review and meta-analysis conducted in 2015 by Acevedo et al. The inclusion/exclusion criteria were satisfied by 26 research in total. According to the meta-analysis, there is no significant difference between RFA and MAIT for any outcome, however both show notable improvements in VAS and rhinomanometry-measured outcomes. This study pointed out significant gaps in the body of current literature. to the 26 trials, only 12 had randomization, just three had researcher blinding to the technique used, and the median follow-up period was six months (26).

Liu et al.'s 2009 comparison of RFA and MAIT is one RCT that was part of Acevedo et al.'s meta-analysis and has received a lot of attention (27). The reviewers of the aforementioned 2010 Cochrane review expressly remarked that Liu's study was the closest to being included, even though this publication (and all others) did not match the inclusion criteria. The reviewers were unable to get information about the randomization technique, which eventually led to its exclusion. Nonetheless, Liu et al.'s methodology has certain advantages over many other studies that were part of Acevedo et al.'s meta-analysis, and the findings are noteworthy. A total of 120 patients were divided into equal-sized RFA and MAIT groups at random. VAS (nasal obstruction, sneezing, rhinorrhea, and snoring), anterior rhinomanometry, and the saccharin test for nasal mucociliary clearance were used to assess the results throughout a three-year follow-up period. Three years after surgery, only seven patients in the MAIT group and twelve in the RFA cohort were lost to follow-up. For every outcome metric at six months, one, two, and three years following surgery, the MAIT cohort showed notable improvement. Only after six months and a year were RFA results noteworthy. They came to the conclusion that because MAIT removes submucosal tissue more thoroughly than RFA, it is more effective over the long run (28).

Even though it was smaller and had only a year of follow-up, another study that was part of Acevedo et al.'s paper similarly revealed that MAIT produced better results than RFA. At three months, six months, one year, and two years after surgery, the MAIT cohort had higher VAS scores, according to another meta-analysis comparing RFA and MAIT. Additionally, at one and two years after surgery, the MAIT cohort demonstrated superior anterior rhinomanometry scores (29).

The Glasgow Health Status Inventory was recently used by Kankaanpää et al. to assess patient-reported quality of life in 98 patients who had undergone turbinate therapy with MAIT, RFA, diode laser, or a sham operation at random. All methods, including the placebo, improved quality of life; however, at three months, only MAIT outperformed the placebo procedure in a statistically meaningful way. Nonetheless, the researchers came to the conclusion that there weren't many patients in the placebo group, and a bigger study population might have led to the other methods also reaching statistical significance (30).

LeConte et al. used cadaveric models to compare the aerosolization of five popular endonasal surgical techniques: electrocautery, MAIT, powered drilling, RFA, and cryotherapy. Aerosols above the backdrop were produced by electrocautery, powered drilling, RFA, and cryotherapy; the majority of these aerosols were smaller than 1 µm. In comparison to electrocautery and powered drilling, MAIT and cryotherapy generated substantially fewer aerosols overall. The innovative placement of an aerosol evacuator in the contralateral nasopharynx, which absorbed more than 99% of all aerosols, was examined in this study. Due to its exclusive use of cadavers and its inability to determine whether aerosolized particles may harbor the COVID-19 virus, this investigation was limited (31).

Conclusion

The results of this study show that microdebrider inferior turbinoplasty is a very safe and successful surgical method for treating chronic inferior turbinate hypertrophy. The microdebrider technique was linked to significantly earlier postoperative healing, superior improvement in nasal obstruction, complete absence of postoperative crustation and synechiae, preservation of olfactory function, and the lowest rate of inferior turbinate atrophy among the submucosal approaches when compared to radiofrequency tissue reduction, submucosal resection, and surface cauterization.

The microdebrider's mucosal-sparing mechanism, which preserves the pseudostratified columnar epithelium and its associated mucociliary and olfactory functions while selectively reducing the hypertrophied submucosal stroma, is responsible for these benefits.

Submucosal excision had similar healing results, but its long-term usefulness is limited by its consistently high rate of turbinate atrophy. For mild-to-moderate cases, radiofrequency ablation is a low-morbidity alternative; nevertheless, it should not be used alone for severe hypertrophy. Surface cauterization should only be used in situations where no other method is available because it showed the least favorable overall complication profile.

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