Original Article

Efficacy of Powered Submucous Resection in Inferior Turbinate Hypertrophy: A Longitudinal Observational Study

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Abstract

Background: The program is hyperplasia of the inferior turbinate, a frequent cause of chronic nasal obstruction that is often unresponsive to medical treatment. Powered sub-mucous resection (PSMR) is a type of surgery that is intended to decrease the size of the turbinates without damaging the mucosal lining. Longitudinal prospective data about clinical and functional outcomes are scarce. The objective is to compare the clinical and functional outcomes of PSMR in the treatment of inferior turbinate hypertrophy in the course of one year of follow-up. **Material and Methods:** The study is a longitudinal observational study of 95 patients (mean age 38.7 ± 12.1 years, 60% male) who underwent bilateral endoscopic PSMR between January 2023 and January 2024. Nasal obstruction was evaluated using the Visual Analog Scale (VAS) and acoustic rhinometry to assess the dimensions of the total minimal cross-sectional area (TMCA), total volume (TV), and total nasal resistance (TNR). **Results:** The mean VAS scores were significantly reduced from 3.72 preoperatively to 1.63 at 12 months ($p < 0.001$), with a higher percentage of mild/normal to moderate/severe obstruction. Acoustic rhinometry demonstrated significant improvements in TMCA (1.02 → 1.58 cm^2), TV (8.41 → 12.18 cm^3), and TNR (0.83 → 0.37 $Pa/cm^3/s$) (all $p < 0.001$). Symptomatic improvement was evident by 1 month and sustained throughout the 12-month follow-up. **Conclusion:** PSMR is associated with both subjective nasal obstruction and objective nasal airway function, with significant improvement and a considerable long-lasting effect. This method has the benefit of minimising turbinate volume while retaining mucosal integrity. Thus, it is a good surgical option for patients with refractory inferior turbinate hypertrophy.

Keywords: Hypertrophy of the inferior turbinate; Powered sub-mucous resection; nasal obstruction; Visual Analog Scale; acoustic rhinometry; long-term study.

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Introduction

Obstruction of the nose is a common symptom encountered in otolaryngological practice, significantly affecting an individual's quality of life, sleep quality, and functional performance.[1] Inferior turbinate hypertrophy (ITH) constitutes one of the most frequent anatomical contributors to chronic nasal airway obstruction, especially when refractory to comprehensive medical management, including intranasal corticosteroids, antihistamines, and saline irrigation.[2-4] The inferior turbinates are dynamic erectile tissues that regulate nasal airflow, humidity, and filtration; hypertrophic changes within this structure result in increased airway resistance and consequential breathing difficulty.[2,5] Chronic ITH may arise from allergic rhinitis, non-allergic rhinitis, environmental irritants, or compensatory response to septal deviation, thus representing a multifactorial pathophysiological entity.[6-8] Surgical intervention is indicated when clinical symptoms are recalcitrant to optimised medical therapy, with the primary surgical objective being a sustained reduction of turbinate volume while preserving mucosal function and minimising postoperative morbidity.[9-11]

Historically, surgical management of ITH has evolved from aggressive volume reduction techniques, such as total or partial inferior turbinectomy, to increasingly conservative approaches aimed at mucosal preservation.[12,13] Conventional submucosal resection (SMR) has been established as a reliable means of removing submucosal tissue while preserving the overlying mucosa, thereby optimising nasal patency and reducing symptom recurrence.[14,15] This technique involves elevation of the mucosal flap, excision of submucosal tissue, and, in some instances, outfracture of the turbinate bone, depending on the anatomic composition of hypertrophy.[16] There is evidence that SMR is useful in both subjective and objective outcomes of nasal airway obstruction, but some postoperative effects like crusting, bleeding, and mucosal trauma are still of concern among a small group of patients.[15,17]

The introduction of powered instrumentation has proposed microdebrider-aided procedures and powered turbinoplasty as alternatives to focus on decreasing operative time and working on reducing the loss of blood, typically the outcomes of a surgery, without losing safety and effectiveness.[18] at the same time,

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Powered sub-mucous resection (PSMR) facilitated by an endoscopic microdebrider allows controlled resection of hypertrophic submucosal tissue in direct view without sacrificing the effectiveness and safety, which is theoretically more efficient.[19,20] Nevertheless, although comparative studies identify procedural attributes, longitudinal data about the long-term clinical outcomes of PSMR are scarce, with a specific focus on heterogeneous patients and long-term follow-ups.

Several systematic analyses of the modalities of turbinate and mucosal reduction have shed light on the range of available interventions, such as laser ablation, cryotherapy, radiofrequency ablation, and microdebrider-assisted turbinoplasty.[21] In that regard, mucosal minimalism has been identified as a key determinant of both the long-term luminal functional outcomes of the nasal cavity, in the form of humidification, filtration, and sensory feedback.[22]

Nares obstruction and surgery responsiveness assessment involves both objective and subjective values. Patient-reported measures of symptom severity and quality-of-life improvement, including the Visual Analog Scale (VAS) and Nasal Obstruction Symptom Evaluation (NOSE) scales, are subjective tools that improve the validity of surgical outcomes studies and guide evidence-based clinical decision-making.[23,24] Objective measurements of nasal airway patency and resistance, such as acoustic rhinometry and rhinomanometry, augment patient-centered clinical evaluation with strong anatomical and physiological data.

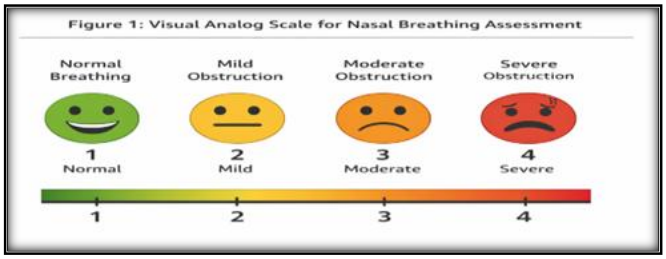
Despite improvements in technology and surgical technique, there remains a perceived gap in longitudinal surgical data, specifically in the area of powered submucosal resection during ITH interventions. Numerous comparative studies have looked at short-term post-operative outcomes or mixed designs; few of them have systematically followed clinical outcomes that extend beyond a six-month time frame, which is powered in comparison with traditional SMR or novel methods.[19,20] And further, a few randomised selection studies tracked clinical outcomes that were natural to standard clinical care beyond the six-month time horizon. This heterogeneity in study designs, the temporalities of follow-up, and the results further make it difficult to amalgamate the existing literature and attest to the importance of narrow longitudinal studies.

The current longitudinal observational survey aims to clarify the clinical outcomes of powered submucosal resection for inferior turbinate hypertrophy over the long term, including subjective symptom reduction and objective functional improvement. This study aims to measure alterations in nasal obstruction in the postoperative period, the longevity of therapeutic outcomes, and the safety of the procedure in a clinical environment through monitoring a group of patients with bilateral PSMR using microdebriders. The study design allows for enhanced learning about PSMR as a modern operational method, with possible outcomes including the optimisation of clinical guidelines and improvements in patient selection. By doing so, it promotes the current debate on the best practice in the surgical treatment of refractory ITH. It empirically proves the effectiveness of powered methods or refutes the current assumptions of the efficacy of similar strategies in the long run. Finally, the work would aim to educate clinicians, researchers, and policymakers on the relative virtues of PSMR and to promote better-quality care for patients with chronic nasal obstruction. This limitation may be associated with hypertrophy of the inferior turbinate.

Materials and Methods

Study design and setting: The study was a longitudinal observational study over 2 years, i.e., January 2023 to January 2025, and included 95 patients with a diagnosis of inferior turbinate hypertrophy. All the subjects underwent bilateral endoscopic and power resection of the inferior turbinates. Follow-up of the operation was conducted over 12 months. Both preoperative and postoperative assessments were performed before and after nasal decongestion to ensure comprehensive clinical and functional evaluation.

Clinical assessment included the anterior rhinoscopy and diagnostic nasal endoscopy. Nares aeration was subjectively evaluated with the four-point visual analog scale (VAS), the levels of which include normal (score 1), mild obstruction (score 2), moderate obstruction (score 3), and severe obstruction (score 4). Also, the Cottle test was used to rule out external nasal valve collapse as a cause of nasal obstruction [(Figure 1]. Acoustic rhinometry was used to evaluate nasal patency. In patients who showed evidence of hyperplasia of the inferior turbinate that was resistant to sufficient medical treatment, surgical intervention was suggested.



These are inclusion and exclusion criteria.

Patients with chronic nasal obstruction, which could be explained by the hypertrophy of the inferior turbinate, and who had a negative Cottle's test and were nonresponsive to the usual medical treatment, were taken as eligible in the study. Acoustic rhinometry was used as objective confirmation of the congestion in tubarins. Recruitment involved eligible patients recruited from outpatient departments and private clinical practice, who were then booked for surgery. Patients with other causes of nasal obstruction or who did not undergo a full evaluation were not included in the study.

Outcome measures: The most effective position for surgical intervention was to relieve nasal blockage by reducing the size of the inferior turbinate without damaging the mucosa covering it or interfering with its physiological secretion of nasal fluid. This was achieved by selecting hypertrophic erectile tissue and submucosal glands. Subjective and objective outcome measures were used to define clinical success.

Surgical intervention: powered sub-mucous resection.

All operations were performed using a powered microdebrider system linked to a suction device. Surgery was performed, in

most instances, under local anesthesia administration of 2% lidocaine with epinephrine (1:100,000). The endoscope was a 4-mm, 0-degree rigid nasal endoscope used for visualisation.

The procedure was medicalisation of the inferior turbinate, followed by a longitudinal incision in its anterior part. A Freer elevator was then used to slice the submucosal layer to form an intratubular pocket. A microdebrider with a 3.5-mm serrated blade was inserted into the submucosal plane, and the operator directed it onto the hypertrophic tissue. Guided back-and-forth movements enabled the removal of excess tissues of erectile significance while leaving the mucosa intact. When the tissue reduction was complete, the turbinate was gently lateralised, and light nasal packing with Merocel was placed [Figure 2].

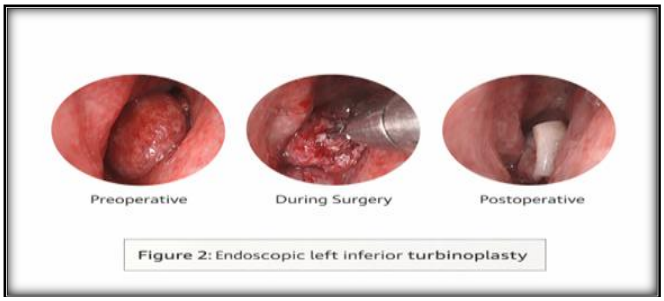


Figure 2: Endoscopic left inferior turbinoplasty

Outcome assessment and criteria for success.

The effectiveness of surgery was measured by comparing preoperative results with postoperative results obtained in the absence of nasal decongestion. This method was used to achieve physiological nasal states, as pharmacological decongestion is not the physiological state of the nasal mucosa. Preoperative decongestion was used solely to assess the dynamic and static aspects of nasal obstruction. The criterion for treatment success was a 50% or greater reduction in VAS scores and a statistically significant difference in the four acoustic rhinometry parameters between preoperative and postoperative measurements ($p < 0.05$).

Statistical analysis: Statistical Package for the Social Sciences (SPSS) version 22 was used for data analysis. To summarise the sociodemographic and clinical characteristics, descriptive statistics were used to present them as frequencies and percentages. Paired t-tests have been used to compare preoperative and postoperative clinical parameters. Acoustic rhinometry results served as functional outcome measures and were evaluated using the Wilcoxon matched-pairs signed-rank test. The p-value should be below 0.05, which is the threshold for statistical significance.

Results

[Table 1] explains the Visual Analog Scale (VAS), which was used to measure the severity of nasal obstruction in patients. The scale will have four categories, ranging from no obstruction to severe obstruction. It normalises subjective patient-reported symptoms and enables comparison of preoperative and postoperative outcomes.

Table 1: Categorization of Visual Analog Scale (VAS) Scores for Nasal Obstruction

Score Category	Severity Description	VAS Range
1	No obstruction	0
2	Mild obstruction	1–3
3	Moderate obstruction	4–7
4	Severe obstruction	8–10

Table 2: Distribution of VAS Scores Preoperatively and Postoperatively (N = 95)

VAS Category	Preoperative n (%)	Postoperative n (%)
Normal	0 (0%)	48 (51%)
Mild	6 (6%)	32 (34%)
Moderate	38 (40%)	15 (16%)
Severe	51 (54%)	0 (0%)
Total	95 (100%)	95 (100%)
Mean VAS score	3.72	1.63
Mean difference	—	2.09
p-value	—	< 0.001

[Table 2] shows how the patients were distributed in VAS categories before and after surgery. The postoperative change in severity of obstruction, which is severe to moderate, then mild and normal, shows a major improvement in symptoms. Powtered submucous resection proved to be clinically effective, and its mean VAS score decreased by 2.09 points.

Table 3. Functional Assessment by Acoustic Rhinometry Before and After Surgery (N = 95)

Parameter	Preoperative Mean (SD)	Postoperative Mean (SD)	Mean Difference	p-value
TMCA (cm^2)	1.02 (0.05)	1.58 (0.07)	0.56	< 0.001
TV (cm^3)	8.41 (0.52)	12.18 (0.68)	3.77	< 0.001
TNR ($Pa/cm^3/s$)	0.83 (0.06)	0.37 (0.05)	0.46	< 0.001

[Table 3] presents objective data on nasal airway function obtained by acoustic rhinometry. The TMCA (Total Minimal Cross-sectional Area) and TV (Total Volume) improved, and the TNR (Total Nasal Resistance) decreased compared to the preoperative condition, demonstrating enhanced airflow and functional outcomes. These changes were found to be

statistically important as shown by the p-values.

Table 4: Demographic and Clinical Characteristics of the Study Population (N = 95)

Variable	Category	n (%)
Age (years)	18–30	24 (25%)
	31–45	39 (41%)
	46–60	26 (27%)
	>60	6 (6%)
Sex	Male	57 (60%)
	Female	38 (40%)
Laterality of turbinate hypertrophy	Bilateral	95 (100%)
Associated allergic rhinitis	Yes	62 (65%)
	No	33 (35%)
Duration of symptoms	<2 years	21 (22%)
	2–5 years	46 (48%)
	>5 years	28 (30%)

The baseline demographic and clinical profile of the study cohort have been provided in [Table 4]. It comprises age, sex distribution, allergic rhinitis laterality, and symptom duration. Such information places the study population in context, allowing readers to assess generalisability and baseline comparability.

Table 5: Longitudinal Change in Mean VAS Scores During Follow-up (N = 95)

Time Point	Mean VAS Score (SD)	Mean Reduction from Baseline	p-value*
Preoperative	3.72 (0.61)	—	—
1 month postoperative	1.98 (0.54)	1.74	< 0.001
6 months postoperative	1.66 (0.48)	2.06	< 0.001
12months postoperative	1.63 (0.46)	2.09	< 0.001

*Compared with preoperative baseline using paired analysis.

[Table 5] shows the course of symptom improvement over a year. The VAS scores significantly decreased at both follow-up points, with the greatest effect at the 12-month follow-up. This exhibits the short-term and long-term efficacy of superior turbinate sub-mucous resection.

Discussion

The current longitudinal observational research indicates that powered sub-mucous resection (PSMR) of the inferior turbinates can be performed to provide statistically and clinically significant improvement in both subjective symptoms and objective measures of nasal airway function. Patients mainly reported moderate to severe nasal obstruction preoperatively, with a similar change to mild or no obstruction during postoperative PSMR, with significant differences in the mean Visual Analog Scale (VAS) of 3.72 to 1.63 at 12 postoperative months ($p < 0.001$). This observation is in line with previous studies that reported that when conservative treatment of inferior turbinate hypertrophy fails, surgical intervention is a better method for reducing patient-reported nasal obstruction scores.[15,20]

Notably, this research adds to the current literature by demonstrating long-term symptomatic relief at 1-year follow-up, with stable decreases in VAS scores at 1, 6, and 12 months [Table 5]. This long-term clinical activity is consistent with results from longitudinal cohorts of patients undergoing turbinate reduction surgery: long-term clinical improvement was associated with mucosa-preservation methods.[26] The extent of improvement in VAS scores in the cohort is much greater than even the smallest difference between clinical outcomes of nasal obstruction, indicating the applicability of such results to clinical practice.

The symptomatic benefits are further supported by objective functional improvement, as measured by acoustic rhinometry. The postoperative results on total minimal cross-sectional area (TMCA) and total nasal volume (TV), and the decrease in total nasal resistance (TNR), are consistent with the finding that PSMR results in significant anatomical and physiological changes in the nasal airway. This finding is in line with the literature, which reports increased nasal patency after microdebrider-aided turbinate resection compared with baseline measurements.[15,28] The substantial reduction in nasal resistance, the outcome, is also associated with the improved airflow dynamics desired in the surgical treatment of nasal obstruction.[25,29]

The demographic profile of the research participants, consisting mainly of middle-aged individuals and a high prevalence of concomitant allergic rhinitis (65%), is a normal clinical manifestation in the practice of otolaryngology. The presence of allergic inflammation has been established as a contributing factor in the pathogenesis of chronic turbinate hypertrophy.[4,30] The sample size of patients with different times of symptom onset improves the generalisability of the findings and reflects the heterogeneity in the pathology of the turbinates in clinical practice.

Comparative results of turbo-nose surgeries indicate that procedures using microdebriders, such as PSMR, have potentially beneficial effects compared with non-powered measures, including radiofrequency ablation and laser treatment.[22,31] Compared with non-powered procedures, microdebrider techniques may offer advantages in producing lasting functional improvement, as evidenced by reduced operative time and intraoperative blood loss.[20] This, combined with the long-term functional results achieved in this study, may

justifiably be considered as a compelling argument in favour of considering

The observation of early postoperative enhancement at 1 month and the maintenance of effectiveness up to 12 months imply that PSMR has both short-term and long-term beneficial effects. This trend of initial response and subsequent stabilisation is in line with the principles of mucosa preservation, which aim to sustain physiologic nasal storage and filtration while minimising atrophic tissue and crusting in the immediate postoperative period, compared with more aggressive resections.[33]

However, the observational nature of the present study limits the ability to draw direct cause-and-effect conclusions and prevents the organisation of alternative turbinate reduction modalities head-to-head. RCTs have remained the most appropriate method for determining conclusive comparative efficacy. The existing RCTs comparing submucosal resection with microdebrider-assisted or other energy-based techniques suggest that all modalities offer improvements, though differences in individual outcomes (e.g., health care, bleeding, healing period) could be used to select a technique, considering patients and surgeons.

The other consideration is the 1-year follow-up period. Even though this is enough time to show that the benefits are sustained, with reduced symptoms and functional improvement, a longer-term follow-up would help establish their sustainability even after 1 year. Late rehypertrophy or mucosal acclimatisation has been reported in some studies of turbinate reduction, which can counteract short-term outcomes of surgery, and so long-term outcomes can be considered.[36] Long-term outcomes would be a valuable addition to the body of knowledge on the persistence of surgical outcomes and possible predictive factors of long-term success.

Overall, it is possible to conclude that the results of this article demonstrate that powered sub-mucous resection of the inferior turbinates can be considered a remedy to chronic nasal congestion that could not be cured with a medical treatment. These levels of subjective obstruction reductions and associated objective rhinometric measurements were maintained over one year. These results are in line with and extend prior research on microdebrider-aided turbinate surgery, which supports the use of PSMR as a long-term, physiologically sound, and effective modality for treating patients with inferior turbinate hypertrophy.

Conclusion

Powered sub-mucous resection (PSMR) of the inferior turbinates is a safe and effective surgical procedure in patients with intractable nasal obstruction to medical treatment. The method yields significant and lasting changes in subjective nasal airflow, as reflected by decreases in Visual Analog Scale scores, and in objective nasal function, as shown by increases in total minimal cross-sectional area and nasal volume, and decreases in nasal resistance using acoustic rhinometry. These gains were noted as early as 1 month after surgery and persisted for 1 year, demonstrating that it is highly effective in the early stages and long-lasting.

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Conflicts of interest

There are no conflicts of interest.

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