

Comparison of the post-operative outcomes between different surgical techniques for inferior turbinate reduction surgery

A cross sectional study

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ABSTRACT

الأهداف: مقارنة وقياس نتائج ما بعد الجراحة بين مختلف التقنيات الجراحية لتقليل تضخم القرنية الأنفية السفلية، وتحديد العوامل المرتبطة بها.

المنهجية: شملت هذه الدراسة المقطعية خلال الفترة من يناير 2021م وديسمبر 2022م بقسم الأنف والأذن والحنجرة بمدينة الملك عبد العزيز الطبية بالرياض، المملكة العربية السعودية على 301 مريضاً بالغاً يعاني من تضخم القرنية السفلية للأنف. تم تقسيم المرضى بشكل عشوائي إلى عدة مجموعات مختلفة. بعد ذلك تمت مراجعة المرضى بعد أسبوع واحد من الجراحة، وشهر واحد، ثم 6 أشهر لتقييم النتائج والمضاعفات المرتبطة بكل تقنية جراحية؛ واستخدم كل من تحليل البيانات الوصفي والجداول المتقاطعة والانحدار اللوجستي كإساليب لتحليل البيانات.

النتائج: شعر معظم المرضى في كل المجموعات بتحسّن جزئي أو كامل بعد الجراحة، حيث بلغت نسبة النتائج الإيجابية 92%. شملت العلامات الشائعة عند المرضى انحراف الحاجز الأنفي وتشوه شكل الأنف الخارجي، في حين أن انسداد الأنف كان العرض الأساسي المبلغ عنه من قبل المرضى. حدث نزيف ما بعد الجراحة في 3.7% من الحالات؛ لم يتم ملاحظة أي التصاقات بعد الجراحة. أظهرت تقنيات المايكروديبريدر والرقعة الوسطية وكسر الجدران وتصويب الغشاء الأنفي الداخلي جميعها معدلات تحسّن أعلى بشكل ملحوظ من التقنيات الأخرى.

الخلاصة: تقدم هذه الدراسة رؤى حول نتائج ما بعد الجراحة لمختلف تقنيات الجراحة لتصغير قرنيات الأنف السفلية في المملكة العربية السعودية. تظهر التقنيات المعترف بها معدلات تحسّن أعلى، وتعطي دليلاً بتوجيه قائم على الأدلة لاختيار النهج الجراحي الأمثل. وبالرغم من ذلك، تشير قيود الدراسة إلى ضرورة إجراء أبحاث مستقبلية للتحقق من هذه النتائج وتوسيع فهمنا لهذا الموضوع. ختاماً، تسهم هذه الدراسة بشكل كبير في تقديم معرفة قيمة في مجال جراحة الأذن والأنف والحنجرة، مما يهدف إلى تعزيز النتائج المرجوة من العملية للمرضى وتحسين طرق معالجة تضخم قرنيات الأنف السفلية جراحياً على الصعيد الوطني والعالمي.

Objectives: To compare and measure post-operative outcomes among various surgical techniques for reducing inferior turbinate hypertrophy (ITH), and to identify the factors associated with the clinical outcomes of turbinoplasty in patients with this condition.

Methods: A cross-sectional study was carried out from January 2021 to December 2022 at the Otorhinolaryngology Department of King Abdulaziz Medical City in Riyadh, Saudi Arabia. A total of 301 adult patients with ITH were included and were divided into different groups. Postoperative follow-up assessments were completed after one week, one month,

and 6 months to evaluate outcomes and complications associated with each surgical technique; descriptive analysis, cross-tabulation, and exact logistic regression were utilized as data analysis methods.

Results: Most patients in both groups experienced partial or complete improvement after surgery, with 92% showing positive outcomes. Common clinical signs included deviated nasal septum deviation and external nasal deformity, while nasal obstruction was most frequently reported as the primary symptom. Post-surgery bleeding occurred in 3.7% of cases; no adhesions were noted. Microdebrider, medial flap, out-fracture, and submucosal diathermy techniques all demonstrated significantly higher improvement rates than others.

Conclusion: The identified techniques with higher improvement rates offer evidence-based guidance for selecting optimal surgical approaches, while the study's limitations warrant further prospective research to validate these findings. Ultimately, it contributes valuable knowledge to the field of otorhinolaryngology, aiming to enhance patient outcomes and improve the management of ITH worldwide.

Keywords: inferior turbinate surgery, cross sectional study, surgical techniques

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The inferior turbinate, a composite protrusion situated on the internal aspect of the lateral nasal sidewall, plays a critical role in regulating nasal airflow. It forms the inferior boundary of the nasal valve, a pivotal segment of the nasal airway responsible for restricting airflow. Additionally, the inferior turbinate functions to warm and humidify inspired air, making it essential for proper nasal breathing. The laminar airflow directed towards the surface of the inferior turbinate generates resistance, leading to the production of mucus and effective maintenance of humidity in the nasal cavity.^{1,2}

Inferior turbinate hypertrophy (ITH) is a common cause of chronic nasal obstruction, often affecting patients with conditions such as allergic rhinitis, idiopathic rhinitis, and septal deviation.^{1,2} The prevalence of ITH was not fully explored, however, Clarck et al³ carried out a study in the United States which revealed that the prevalence of ITH was 72% among their studied population. Locally, Fageeh et al⁴ found that the prevalence of ITH was estimated to be 10.8% among different causes of nasal obstruction. Initial treatment typically includes medications like antihistamines, topical decongestants, and topical corticosteroids to alleviate congestion and restore comfortable nasal breathing.^{1,5,6} Unfortunately, not all patients respond effectively to medical intervention; some may only experience modest improvements, while others experience no change, leading to persistent nasal obstruction.¹ Therefore, surgical intervention is necessary to alleviate symptoms and improve patient's quality of life.^{1,5,6}

Different surgical techniques have been utilized to treat ITH, including submucosal diathermy, partial inferior turbinectomy, powered turbinectomy, and radiofrequency ablation.^{1,5-12} As a result, numerous studies have been published comparing the outcomes of various surgical techniques for inferior turbinate reduction. In a comprehensive study by Levy et al¹² in 2022, they thoroughly examined 1035 patients who had undergone different surgical techniques for treating ITH. They carried out a detailed analysis of post-operative bleeding to make comparisons. The study revealed that endoscopic turbinoplasty exhibited the lowest rates of post-operative bleeding.¹² while Omranifard's findings show that both outfracture of the inferior turbinate and submucosal partial inferior turbinectomy are effective strategies for improving respiratory function.¹³

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While research on surgical techniques to reduce ITH has grown, there is still a lack of comprehensive data comparing their results. Therefore, our main objective was to investigate postoperative outcomes, including complications and subjective improvements, related to different surgical approaches for inferior turbinate reduction in an epidemiological cross-sectional study. This research aims to assess and compare postoperative outcomes among patients who have undergone various surgical techniques for inferior turbinate reduction, with a specific focus on factors like: bleeding, crusting, dry throat, voice changes, postnasal drip, nasal obstruction, repeat medication, and the need for further nasal surgery.

The significance of this research lies in its focus on the high prevalence and substantial impact of ITH on patients' daily lives. Chronic nasal obstruction caused by this condition can lead to difficulties in breathing, disrupted sleep patterns, decreased cognitive functioning, and an overall reduction in the quality of life.^{4,5} By understanding the various outcomes associated with different surgical techniques, we can make evidence-based recommendations regarding which procedure will provide maximum benefit and suitability to each patient.

Our findings from this study will contribute to the existing knowledge on surgical management options for ITH. They will assist otorhinolaryngologists and healthcare providers when making recommendations to patients experiencing persistent nasal obstruction due to ITH. Ultimately, our research aims to enhance patient outcomes, enhance post-operative satisfaction rates, and optimize treatment of this common nasal condition.

This cross-sectional study compared outcomes achieved using various surgical techniques for inferior turbinate reduction surgeries. In particular, this study sought to measure the efficacy of turbinoplasty and turbinectomy in reducing ITH when utilizing various surgical techniques such as microdebrider, medial flap excision, out-fracture, turbinectomy with scissors, submucosal diathermy and submucosal resection. By assessing postoperative outcomes associated with each technique, this study attempted to determine their efficacies for relieving the nasal obstruction, reducing complications, and providing subjective improvement among those suffering from ITH. Furthermore, this investigation attempted to highlight any differences among surgical approaches to assist physicians and patients in selecting an ideal method that will lead to optimal patient outcomes and an enhanced quality of life.

Methods. This investigation utilized an observational cross-sectional design and was carried out at the Otorhinolaryngology Department of King Abdulaziz Medical City in Riyadh, Saudi Arabia, from January 2021 to December 2022. This study included adult patients aged 16 years or older who underwent either turbinoplasty alone or combined with septoplasty (septoturbinoplasty).

Patients younger than 16 years, pregnant patients, and those who underwent septoplasty without turbinoplasty were excluded from the study. Furthermore, patients who underwent other ENT surgeries, such as endoscopic sinus surgery or functional endoscopic sinus surgery, were not considered for inclusion. Patients who did not undergo imaging (Sinus CT) before surgery were also excluded from the study.

To fulfill our objectives, we carried out a cross-sectional study with 301 patients diagnosed with ITH and divided them into 6 groups based on the surgical technique that was carried out: Group A (underwent turbinoplasty with medial flap), Group B (underwent microdebrider), Group C (received out-fracture), Group D (underwent turbinectomy with scissors), Group E (treated with submucosal diathermy), and Group F (underwent submucosal resection). Postoperative follow-up occurred one week, one month, and 6 months post-surgery to assess outcomes and potential complications associated with each surgical technique.

The study was carried out ethically, with all study procedures being carried out in accordance with the requirements of the World Medical Association's Declaration of Helsinki. Ethical clearance was obtained from the institutional review board of King Abdullah International Medical Research Centre, Riyadh, Saudi Arabia, before data collection (KAIMRC, no.: NRC23R/544/08). Patient privacy and confidentiality were strictly maintained throughout the study, all participants provided informed consent before their inclusion in the study, and their identifiers were removed to ensure anonymity.

Statistical analysis. The patients' electronic records were reviewed using the hospital's health care information system solely by research team members, which were then carefully revised, coded, and entered into the Statistical Package for the Social Sciences statistical software, version 22.0 (IBM Corp., Armonk, NY, USA) for analysis. All statistical analyses were carried out using 2-tailed tests, and a *p*-value less than 0.05 was considered significant.

Descriptive analysis was carried out based on frequency and percent distribution for all variables, including patient demographic data, the presence of any

comorbidities (namely, diabetes mellitus, hypertension, or asthma), and details related to the turbinoplasty surgery. Clinical signs, symptoms, and outcomes among the study patients were graphed for better visualization and understanding.

Crosstabulation was employed to assess factors associated with the clinical outcome of turbinoplasty. The significance of relations in cross-tabulation was tested using the Pearson Chi-square test and Exact probability test for small frequency distributions.

Additionally, an exact logistic regression model was used to assess the distribution of improvement rate based on the surgery procedure, utilizing odds ratios (ORs) with 95% confidence interval (CI) estimates.

Results. A total of 301 patients with ITH underwent turbinoplasty and were included in the study. The mean age of the patients was 31.1 ± 10.6 years. Out of the total, 195 (64.8%) patients were males. Concerning body mass index (BMI), 115 (38.2%) had a normal weight, 78 (25.9%) were overweight, and 108 (35.9%) were classified as obese. Regarding co-morbidities, 217 (72.1%) patients reported having other chronic health problems (Table 1).

Figure 1 illustrates the distribution of clinical signs and symptoms among the study patients with ITH. The most commonly reported sign was deviated nasal septum, observed in 93% of the cases followed by external nasal deformity (15.9%), nasal polyps (11%), pale mucosa (9.6%), and concha bullosa (7%). Among the symptoms, nasal obstruction was the most frequently reported, accounting for 96.3% of the cases,

Table 1 - Demographics data of patients undergone turbinoplasty for hypertrophied inferior turbinate.

Personal data	n (%)
<i>Age in years</i>	
<20	39 (13.0)
20-29	107 (35.5)
30-39	98 (32.6)
40+	57 (18.9)
<i>Gender</i>	
Male	195 (64.8)
Female	106 (35.2)
<i>Body mass index</i>	
Normal weight	115 (38.2)
Overweight	78 (25.9)
Obese	108 (35.9)
<i>Co-morbidities</i>	
Yes	217 (72.1)
No	84 (27.9)

Values are presented as numbers and percentages (%).

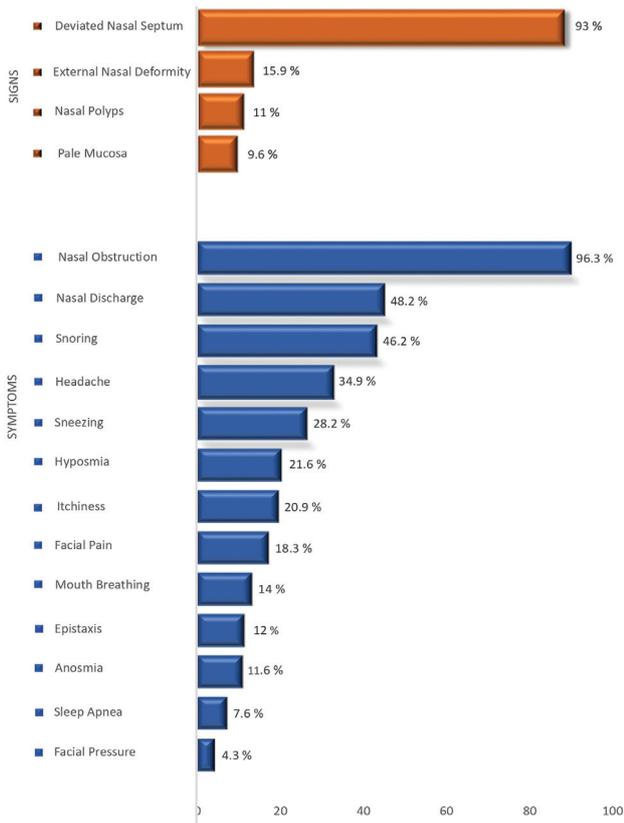


Figure 1 - Clinical signs and symptoms among study patients with hypertrophied inferior turbinate.

followed by nasal discharge (48.2%), snoring (46.2%), headache (34.9%), sneezing (28.2%), and hyposmia (21.6%). Clinical symptoms with the lowest reporting frequency included disturbed sleep patterns (7.6%) and facial pressure (4.3%).

Table 2 presents the distribution of different turbinoplasty procedures among patients with ITH. Submucous diathermy (SMD) was the most commonly used technique, accounting for 39.9% of cases, followed closely by the microdebrider approach at 38.2%. Outfracture was used in 10.3% of cases, while the medial flap technique was utilized in 5.6%. Partial turbinectomy with scissors represented 4.7%, while submucosal reduction represented the least favored approach with only a 1.3% utilization rate. Furthermore, 15 (5%) cases underwent revision procedures.

Of those patients that received turbinoplasty for ITH, 92% showed either partial or complete improvement, with only 24 (8%) not experiencing change. No adhesions formed, and only 3.7% experienced post-surgical bleeding issues. **Table 3** offers insight into the factors associated with the clinical outcome of turbinoplasty among patients with ITH. Male patients

Table 2 - Turbinoplasty data among patients with hypertrophied inferior turbinate.

Turbinoplasty data	n (%)
<i>Turbinoplasty surgery</i>	
SMD	120 (39.9)
Microdebrider	115 (38.2)
Outfracture	31 (10.3)
Medial flap	17 (5.6)
Partial turbinectomy with scissors	14 (4.7)
SMR	4 (1.3)
<i>Revision</i>	
Yes	15 (5.0)
No	286 (95.0)
<i>Tear</i>	
Bilateral	4 (1.3)
Unilateral	44 (14.6)
No	253 (84.1)
<i>Saliastic use</i>	
Yes	250 (83.1)
No	51 (16.9)

Values are presented as numbers and percentages (%).
SMD: submucous diathermy, SMR: submucosal reduction

demonstrated greater improvement, with 93.8% showing positive outcomes versus 88% of females; this difference was statistically significant ($p=0.049$). Furthermore, 94% of those with other comorbidities experienced post-surgical improvement versus 86.9% without ($p=0.041$). Other factors, including age and intraoperative procedures, had no significant correlation to improvement rates.

Table 4 details the relationship between clinical outcomes of turbinoplasty among patients with ITH and the specific techniques utilized during their procedure. Medial flap (OR=5.7), microdebrider (OR=6.5), outfracture (OR=3.2), and SMD (OR=5.2) techniques demonstrated significantly higher improvement rates and were statistically significant.

Discussion. The present cross-sectional study aimed to compare the postoperative outcomes of different surgical techniques for inferior turbinate reduction surgery in patients with ITH. Our study population consisted of 301 patients who underwent turbinoplasty, and the mean age of the patients was 31.1 ± 10.6 years. Most patients were male (64.8%), and concerning BMI, 38.2% had a normal weight, 25.9% were overweight, and 35.9% were classified as obese. Our study population also exhibited various co-morbidities, with 72.1% of patients reporting other chronic health problems.

Consistent with the literature, our study found nasal obstruction to be the most commonly reported

Table 3 - Factors associated with the clinical outcome of turbinoplasty among patients with hypertrophied inferior turbinate.

Factors	Improvements		P-values
	Yes	No	
<i>Age in years</i>			
<20	34 (87.2)	5 (12.8)	0.602 [†]
20-29	99 (92.5)	8 (7.5)	
30-39	90 (91.8)	8 (8.2)	
40+	54 (94.7)	3 (5.3)	
<i>Gender</i>			
Male	183 (93.8)	12 (6.2)	0.049*
Female	94 (88.7)	12 (11.3)	
<i>Body mass index</i>			
Normal weight	103 (89.6)	12 (10.4)	0.464 [†]
Overweight	73 (93.6)	5 (6.4)	
Obese	101 (93.5)	7 (6.5)	
<i>Co-morbidities</i>			
Yes	204 (94.0)	13 (6.0)	0.041*
No	73 (86.9)	11 (13.1)	
<i>Revision</i>			
Yes	15 (100)	0 (0.0)	0.242 [†]
No	262 (91.6)	24 (8.4)	
<i>Tear</i>			
Bilateral	4 (100)	0 (0.0)	0.809 [†]
Unilateral	40 (90.9)	4 (9.1)	
No	233 (92.1)	20 (7.9)	
<i>Saliastic use</i>			
Yes	231 (92.4)	19 (7.6)	0.596
No	46 (90.2)	5 (9.8)	

Values are presented as numbers and percentages (%). *P-value of <0.05 (significant).
[†]Exact probability test.

Table 4 - Relationship between clinical outcomes of turbinoplasty among patients with hypertrophied inferior turbinate and used technique.

Turbinoplasty procedures	Improvements		OR (95% CI)
	Yes	No	
Medial flap	16 (94.1)	1 (5.9)	5.7 (1.6-20.9)*
Microdebrider	110 (95.7)	5 (4.3)	6.5 (2.1-12.9)*
Out-fracture	25 (80.6)	6 (19.4)	3.2 (1.1-11.8)*
Scissors	12 (85.7)	2 (14.3)	3.6 (0.8-15.6)
SMD	110 (91.7)	10 (8.3)	5.2 (1.9-10.6)*
SMR	4 (100)	0 (0.0)	3.4 (0.74-25.6)

Values are presented as numbers and percentages (%), odds ratios (OR) and confidence interval (CI). *P-value of <0.05 (significant). SMD: submucous diathermy, SMR: submucosal reduction

symptom, with 96.3% of the patients experiencing this condition. The most common finding among the patients in the study was DNS, which was observed in 93% of cases. Additionally, there were less frequent occurrences of other clinical signs, including external nasal deformities, nasal polyps, pale mucosa, and concha bullosa. Among the symptoms, nasal discharge, snoring, headache, sneezing, and hyposmia were

commonly reported, while disturbed sleep patterns and facial pressure had the lowest frequency of reporting.

The main focus of our study was to determine the extent of clinical improvement following turbinoplasty, as evaluated through postoperative assessments carried out within one week. Our findings indicate that approximately 92% of the cases demonstrated either partial or complete improvement, while only 8% did

not experience any improvement. Importantly, there were no instances of adhesions developing, and only a small percentage (3.7%) of patients reported post-surgical bleeding. These results from our study suggest that various surgical methods used for reducing ITH are associated with positive outcomes, characterized by a high rate of improvement and a low occurrence of complications.

When comparing our results with the existing literature on surgical treatment for ITH, we find alignment with certain studies while observing variations in outcomes based on specific surgical techniques.^{9,12,14-18} Iqbal et al¹⁴ for example, reported a similar trend to our findings in 2017, with most patients experiencing improvement in the first weeks postoperatively and a further increase in the number of patients showing improvement after three months. This similarity underscores the importance of carrying out multiple fixed clinical encounters to accurately assess patient clinical improvement, as we recommended in our study. The consistency between the 2 studies adds credibility to the notion that postoperative improvement after turbinoplasty is a gradual process, with patients experiencing a progressive reduction in symptoms over time.

Consistent with the investigations carried out by Levy et al¹² and Iqbal et al,¹⁴ our paper likewise revealed a low incidence of bleeding following turbinoplasty. Levy et al's study¹² attributes this reduced bleeding rate to advancements in endoscopic surgical techniques and increased surgical expertise, factors that may also contribute to the low bleeding rate observed in our study. Improved surgical precision and post-operative complication reduction could provide a plausible explanation for the minimal bleeding observed in our research.

The study of Karamatzanis et al⁹ confirms our conclusion that microdebrider-assisted turbinoplasty provides lower complications than other surgical techniques. This indicates that using a microdebrider may increase safety and better patient outcomes in inferior turbinate reduction surgery. Its precise yet gentle tissue removal may decrease trauma while decreasing complications risk. This also aligns with other literatures reported such as Singh et al¹⁶ and Chen et al.¹⁷

Furthermore, the study of Harju et al¹⁸ highlighted the importance of assessing contractility in surgical intervention, an aspect not directly addressed in our study. The relevance of contractility assessment may provide insights into the functional changes of the inferior turbinate post-surgery. Including contractility assessment in future studies could enhance

understanding of the mechanical effects of different surgical techniques on the inferior turbinate.

Similarly, Abdullah et al¹⁹ emphasized the significance of understanding the contributing components of ITH to decide the appropriate surgical technique. Our study's alignment with this notion further validates the importance of individualizing treatment based on the underlying causes of hypertrophy. Tailoring surgical approaches to the specific etiology of ITH could lead to more targeted and effective interventions.²⁰

Study's strengths & limitations. The current study comparing post-operative outcomes of different surgical techniques for inferior turbinate reduction surgery in Saudi Arabia presents several strengths and limitations. The study's inclusion of a substantial sample size of 301 patients enhances the reliability and generalizability of the findings, providing valuable insights for healthcare practitioners.

Despite the strengths of this study, several limitations should be considered. The retrospective design may introduce biases and impact the internal validity of the results. The predominance of combined surgical encounters with septoplasty limits assessing individual outcomes for turbinoplasty techniques. Additionally, the influence of surgical experience on the results is challenging to assess without division into multiple surgical operation teams.

This study adds valuable regional data to the field of surgical treatment for ITH in Saudi Arabia. It highlights effective surgical techniques and emphasizes the importance of follow-up assessments. The low post-operative bleeding rate suggests advancements in surgical techniques and expertise. Future research can build on these findings, and they have global implications for improving surgical outcomes and patient care.

In conclusion, this cross-sectional study offers valuable insights into the outcomes of various surgical techniques for inferior turbinate reduction in patients with ITH. Results demonstrate that various approaches, including SMD, microdebrider, out-fracture, and medial flap techniques, yield high improvement rates and low complication rates. These findings align with prior research emphasizing multiple fixed clinical encounters to track patient clinical improvement over time accurately. We recommend carrying out prospective studies and to utilize tools of nasal functional testing such as nasal turbinate contractility test as well as augmenting the validated scores such as nasal obstruction symptom evaluation, visual analog scale, Glasgow benefit inventory to accurately measure long term improvement and the effect on patients' quality of life.

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