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A COMPARATIVE ANALYSIS OF SUBMUCOSAL DIATHERMY VERSUS PARTIAL INFERIOR TURBINECTOMY IN THE MANAGEMENT OF NASAL OBSTRUCTION: FOCUS ON POSTOPERATIVE BLEEDING – A RANDOMIZED CONTROLLED TRIAL

Original Research

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ABSTRACT

Background: Nasal obstruction due to inferior turbinate hypertrophy is a frequent complaint in otorhinolaryngology practice and is often associated with chronic rhinitis, significantly affecting quality of life. When medical management fails, surgical reduction of the inferior turbinate becomes necessary. Among the commonly performed procedures, submucosal diathermy and partial inferior turbinectomy are widely practiced; however, their comparative safety, particularly regarding postoperative bleeding, remains a subject of debate, necessitating further evidence from controlled clinical studies.

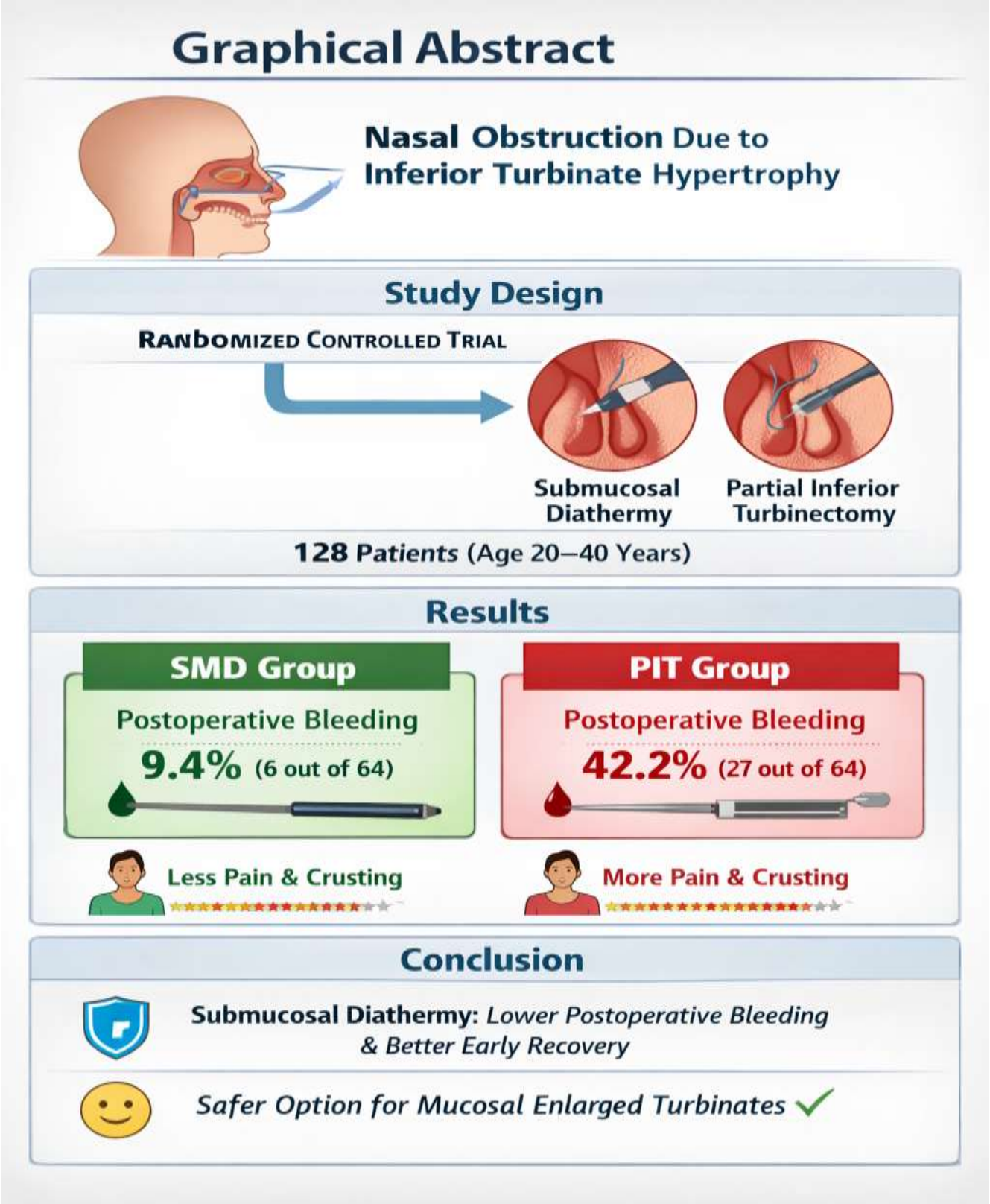
Objective: To compare the incidence of postoperative bleeding between submucosal diathermy and partial inferior turbinectomy in patients with nasal obstruction secondary to inferior turbinate hypertrophy.

Methods: A prospective randomized controlled trial was conducted at Ayub Teaching Hospital, Abbottabad, from July 2021 to January 2023. A total of 128 patients aged 20–40 years with nasal obstruction of at least three months' duration and clinically confirmed inferior turbinate hypertrophy were enrolled and randomized equally into two groups. Patients with significant septal deviation, bleeding disorders, sinonasal pathology, or prior nasal surgery were excluded. Surgical interventions were performed under local anesthesia, and postoperative bleeding was assessed during a one-week follow-up period. Data were analyzed using SPSS version 21, with categorical variables compared using the chi-square test and a significance level set at ≤ 0.05.

Results: The mean age of participants was 30.05 ± 6.00 years, with males comprising 64.1% of the cohort. Postoperative bleeding was observed in 33 patients overall. A significantly higher frequency of bleeding was noted following partial inferior turbinectomy, affecting 27 patients (42.2%), compared with 6 patients (9.4%) in the submucosal diathermy group ($p < 0.001$). No statistically significant association was found between postoperative bleeding and age or gender. Patients undergoing submucosal diathermy also experienced less early postoperative pain and crusting.

Conclusion: Submucosal diathermy demonstrated a substantially lower risk of postoperative bleeding and reduced early morbidity compared with partial inferior turbinectomy, supporting its role as a safer surgical option for patients with mucosal-predominant inferior turbinate hypertrophy.

Keywords: Inferior Turbinate Hypertrophy, Nasal Obstruction, Otorhinolaryngology, Postoperative Hemorrhage, Randomized Controlled Trial, Submucosal Diathermy, Turbinectomy.



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INTRODUCTION

Nasal obstruction is among the most common symptoms encountered in otorhinolaryngology practice and represents a frequent cause of impaired quality of life worldwide (1). Patients often report difficulty in nasal breathing, sleep disturbance, reduced exercise tolerance, and impaired daily functioning, underscoring the clinical relevance of identifying effective and safe management strategies. The underlying causes of nasal obstruction are diverse; however, inferior turbinate hypertrophy has consistently been recognized as a leading anatomical contributor, particularly in individuals with chronic allergic or non-allergic rhinitis (2). Given the central role of the inferior turbinate in normal nasal physiology—facilitating air humidification, filtration, and regulation of airflow—even subtle structural or mucosal changes can result in significant functional compromise (3). Persistent inflammatory stimulation of the inferior turbinate leads to mucosal hyperplasia, stromal edema, vascular engorgement, and, in some cases, bony hypertrophy, all of which contribute to progressive nasal blockage (4). Initial management is predominantly conservative, relying on intranasal corticosteroids, antihistamines, and decongestants to control inflammation and mucosal swelling (5). While many patients respond adequately to medical therapy, a clinically important subset continues to experience refractory symptoms. For these patients, surgical reduction of the inferior turbinate becomes a necessary consideration to restore nasal patency and improve overall well-being. A wide spectrum of surgical techniques has been developed to address inferior turbinate hypertrophy, ranging from minimally invasive mucosa-preserving procedures such as submucosal diathermy to more extensive resections including partial inferior turbinectomy (6-8).

Each technique aims to achieve an optimal balance between effective volume reduction and preservation of turbinate function. However, surgical intervention is not without risk. Among the potential postoperative complications, bleeding remains a major concern due to its association with patient discomfort, delayed recovery, need for additional interventions, and increased healthcare burden (9). Consequently, the perceived risk of postoperative bleeding often influences surgical decision-making. The existing literature presents inconsistent findings regarding bleeding outcomes following different turbinate reduction techniques. Some studies suggest that partial inferior turbinectomy is associated with a higher incidence of postoperative bleeding due to direct mucosal and bony resection, whereas others report comparable bleeding rates between turbinectomy and less invasive approaches such as submucosal diathermy (10,11). This lack of consensus highlights a clear gap in evidence, particularly from well-designed randomized controlled trials that objectively compare these commonly performed procedures within similar clinical settings. Against this background, the present study was undertaken to address this uncertainty by systematically evaluating postoperative bleeding following submucosal diathermy and partial inferior turbinectomy. The objective of this randomized controlled trial was to compare the incidence of postoperative bleeding between these two surgical techniques in patients with nasal obstruction secondary to inferior turbinate hypertrophy, thereby providing evidence-based guidance to support safer and more informed surgical decision-making.

METHODS

This prospective, parallel-group randomized controlled trial was conducted in the Department of Otorhinolaryngology at Ayub Teaching Hospital, Abbottabad, a tertiary-care referral center catering to a large and diverse population. The study was carried out over an 18-month period from 1 July 2021 to 15 January 2023. Adult patients presenting to the otorhinolaryngology outpatient department with symptoms of nasal obstruction were consecutively screened for eligibility. Individuals of either gender aged between 20 and 40 years, with a history of nasal obstruction persisting for at least three months and clinical evidence of significant inferior turbinate hypertrophy on anterior rhinoscopy, were considered for inclusion. Patients with absent or only mild deviation of the nasal septum were included to minimize confounding anatomical factors. Exclusion criteria comprised active nasal or sinus infections, gross septal deviation causing near-total nasal obstruction, septal perforation, known bleeding disorders or current anticoagulant use, sinonasal tumors, concha bullosa, polypoid disease, previous nasal surgery, refusal to participate, or medical unfitness for surgical intervention. The sample size was calculated using the World Health Organization formula for comparative studies. Based on previously reported data suggesting a postoperative bleeding rate of 20% following submucosal diathermy and 4% following partial inferior turbinectomy, with a confidence level of 95% ($\alpha = 0.05$) and a study power of 80% ($\beta = 0.20$), a minimum of 64 participants was required in each group, resulting in a total sample size of 128 patients (12). After enrollment, eligible participants were randomized into two equal groups using a block randomization strategy implemented through a coin-toss method. Allocation concealment was ensured by sequentially numbered, opaque, sealed envelopes opened only at the time of surgery. All surgical procedures were performed under local anesthesia using lidocaine with adrenaline infiltration. In the submucosal diathermy group, a monopolar diathermy probe was introduced beneath the mucosal surface along the length of the inferior turbinate and activated to produce controlled thermal coagulation until visible blanching

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and tissue contraction were achieved. In the partial inferior turbinectomy group, the anteroinferior segment of the inferior turbinate, including mucosal and bony components, was excised under direct visualization using turbinate scissors, followed by electrocautery to secure hemostasis. In both groups, anterior nasal packing with merocel was placed at the end of the procedure and removed after 48 hours.

Postoperatively, all patients received standard care, including oral amoxicillin-clavulanate for five days and isotonic saline nasal sprays. Patients were admitted for in-hospital observation for three days to monitor early complications and were discharged with clear instructions to report any episode of nasal bleeding. Follow-up assessment was conducted one week after surgery, with particular emphasis on the occurrence of postoperative bleeding, defined as any episode of fresh bleeding from the operative site within seven days of the procedure. Data were collected using a structured proforma that recorded demographic characteristics, duration of symptoms, intraoperative details, and postoperative outcomes. Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) version 21. Continuous variables such as age and duration of symptoms were expressed as mean ± standard deviation and compared using independent sample t-tests. Categorical variables, including gender and postoperative bleeding, were presented as frequencies and percentages and analyzed using the chi-square test. Stratified analysis was undertaken to assess the potential effect of age and gender on postoperative bleeding outcomes. A p-value of ≤ 0.05 was considered statistically significant. Ethical approval for the study was obtained from the Institutional Review Board of Ayub Teaching Hospital, Abbottabad. Written informed consent was secured from all participants prior to enrollment, and confidentiality of patient data was maintained throughout the study in accordance with ethical research standards.

RESULTS

A total of 128 patients successfully completed the study, with equal allocation between the submucosal diathermy group and the partial inferior turbinectomy group (n = 64 each). The baseline demographic and clinical characteristics were comparable across both groups. The mean age of the overall cohort was 30.05 ± 6.00 years, with no statistically significant difference between the two surgical groups (30.08 ± 5.81 vs. 30.02 ± 6.24 years; p = 0.956). Male patients constituted 64.1% of the study population in each group, while females accounted for 35.9%, demonstrating complete gender balance between the groups (p = 1.000). The mean duration of nasal obstruction prior to surgery was also similar, measuring 9.19 ± 2.67 months in the submucosal diathermy group and 8.88 ± 2.52 months in the partial inferior turbinectomy group (p = 0.478), indicating baseline comparability before intervention. Postoperative bleeding within the first seven days was observed in 33 patients, corresponding to an overall incidence of 25.8%. A marked difference was noted between the two surgical techniques. In the submucosal diathermy group, postoperative bleeding occurred in 6 patients (9.4%), whereas the partial inferior turbinectomy group demonstrated bleeding in 27 patients (42.2%). This difference was statistically significant, confirming a substantially higher frequency of postoperative bleeding following partial inferior turbinectomy ($p < 0.001$). The majority of patients in the submucosal diathermy group remained free of bleeding events (90.6%), compared with 57.8% in the partial inferior turbinectomy group. Stratified analysis was performed to assess the influence of age and gender on postoperative bleeding. Among patients aged 20–30 years, bleeding occurred in 14.3% of those undergoing submucosal diathermy and 40.0% of those undergoing partial inferior turbinectomy, while in the 31–40 year age group, bleeding rates were 3.4% and 44.8%, respectively. These differences did not reach statistical significance within age strata ($p > 0.05$). Similarly, gender-based stratification showed no statistically significant association between bleeding and gender in either group. Among male patients, bleeding was observed in 7.3% following submucosal diathermy and 51.2% following partial inferior turbinectomy, while among female patients, bleeding rates were 13.0% and 26.1%, respectively ($p > 0.05$). These findings indicated that age and gender did not significantly modify the risk of postoperative bleeding, and that the surgical technique itself was the predominant determinant. Other postoperative outcomes revealed that patients undergoing partial inferior turbinectomy experienced higher levels of postoperative pain within the first 48 hours and exhibited increased nasal crusting at one week when compared with those treated with submucosal diathermy. Nasal packing was well tolerated in both groups, and no patient developed severe hemorrhage necessitating blood transfusion or surgical re-exploration.

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Table 1: Baseline Demographic and Clinical Characteristics

Characteristic	SMD Group (n=64)	PIT Group (n=64)	Total (n=128)	p-value
Mean Age (years)	30.08 ± 5.807	30.02 ± 6.235	30.05 ± 6.001	0.956
Gender: Male (%)	41 (64.1%)	41 (64.1%)	82 (64.1%)	1.000
Duration of Obstruction (months)	9.19 ± 2.67	8.88 ± 2.52	9.03 ± 2.59	0.478

Table 2: Frequency of Postoperative Bleeding by Group

Group	Postoperative Bleeding	No Bleeding	Total
SMD	6 (9.4%)	58 (90.6%)	64
PIT	27 (42.2%)	37 (57.8%)	64
Total	33 (25.8%)	95 (74.2%)	128

Table 3: Bleeding Stratified by Age and Gender

Variable	SMD Group (Bleeding)	PIT Group (Bleeding)	p-value
Age Group			
20–30 years	5/35 (14.3%)	14/35 (40.0%)	0.697
31–40 years	1/29 (3.4%)	13/29 (44.8%)	0.139
Gender			
Male	3/41 (7.3%)	21/41 (51.2%)	0.051
Female	3/23 (13.0%)	6/23 (26.1%)	0.451

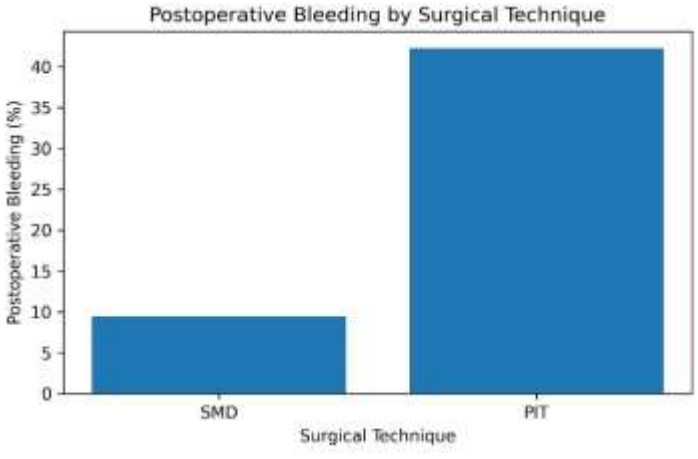

Figure 2 Postoperative Bleeding by Surgical Technique

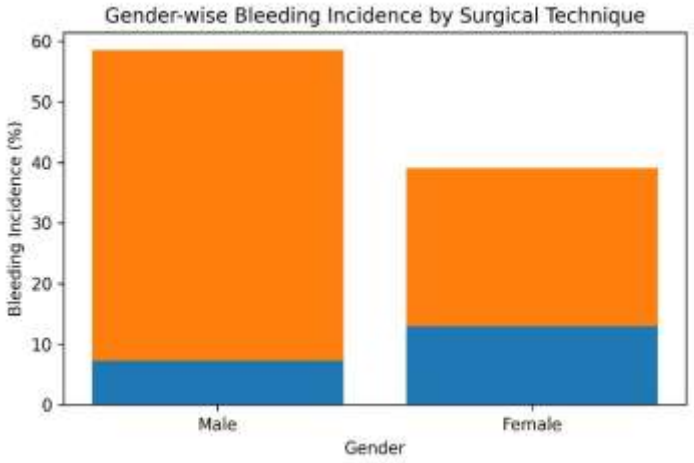

Figure 2 Gender-wise Bleeding Incidence by Surgical Technique

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DISCUSSION

The present study demonstrated a clear and clinically meaningful reduction in postoperative bleeding among patients treated with submucosal diathermy compared with those undergoing partial inferior turbinectomy, with observed rates of 9.4% and 42.2%, respectively. This finding reinforced the primary objective of the trial and provided robust evidence that surgical technique plays a decisive role in early postoperative safety. Similar trends have been reported in previous comparative studies, where excisional turbinate procedures were consistently associated with higher bleeding rates than mucosa-preserving techniques, supporting the external validity of the current results (13,14). The difference in bleeding outcomes observed between the two techniques was anatomically and physiologically plausible. Submucosal diathermy achieved turbinate volume reduction through targeted thermal coagulation of submucosal venous sinusoids while maintaining mucosal integrity. This mechanism promoted fibrosis and shrinkage without generating exposed raw surfaces, thereby minimizing the risk of postoperative hemorrhage (15). In contrast, partial inferior turbinectomy involved resection of mucosa and underlying bone, inevitably exposing a richly vascularized tissue bed. Such exposure increased susceptibility to oozing, reactionary bleeding, and delayed hemostasis, particularly in the early postoperative period (16). These mechanistic differences likely explained the substantial disparity in bleeding frequency between the two groups. Beyond bleeding outcomes, patients treated with submucosal diathermy experienced less postoperative pain and reduced crusting during early follow-up. Although these parameters were not quantified using standardized scoring systems, the consistent clinical pattern suggested improved short-term tolerability and recovery. These findings were in line with the principles of contemporary turbinate surgery, which emphasize functional preservation of the nasal mucosa to maintain humidification, filtration, and airflow regulation while alleviating obstruction (17-19). The results therefore supported the growing preference for conservative, mucosa-sparing approaches when clinically appropriate.

At the same time, the findings required careful contextualization. Submucosal diathermy primarily addressed mucosal hypertrophy and may be less effective in patients with predominant bony enlargement of the inferior turbinate. In such cases, resectional or remodeling procedures remained necessary to achieve adequate airway improvement (20,21). This highlighted the importance of thorough preoperative assessment, including nasal endoscopy and selective imaging, to accurately characterize the nature of turbinate hypertrophy and tailor the surgical approach accordingly. The absence of a significant association between postoperative bleeding and demographic variables such as age and gender further emphasized that technique selection, rather than patient characteristics, represented the principal modifiable determinant of bleeding risk. Several strengths of this study enhanced the reliability of the findings, including its randomized controlled design, adequate sample size, balanced baseline characteristics, and standardized surgical and postoperative protocols. However, certain limitations warranted consideration. The single-center design and relatively homogeneous patient population may have limited generalizability to broader or more diverse clinical settings. Additionally, the study focused exclusively on early postoperative bleeding, without evaluating long-term outcomes such as symptom recurrence, objective airflow improvement, need for revision surgery, or late complications including atrophic rhinitis. The absence of validated pain or quality-of-life scores also restricted the ability to quantitatively compare patient-centered outcomes. Future research should therefore aim to incorporate multicenter designs, longer follow-up periods, and standardized outcome measures encompassing both safety and functional efficacy (22,23). Comparative evaluation of bleeding severity, timing of hemorrhage, and need for additional interventions would further refine risk stratification. Integrating objective nasal airflow measurements and validated symptom scores would also allow a more comprehensive assessment of the balance between effectiveness and safety across different turbinate reduction techniques.

CONCLUSION

Submucosal diathermy emerged as a safer and more patient-friendly surgical approach than partial inferior turbinectomy for the management of nasal obstruction due to inferior turbinate hypertrophy, particularly with respect to postoperative bleeding and early morbidity. By preserving mucosal integrity while effectively reducing turbinate volume, this technique offered a favorable balance between safety and functional recovery. The findings supported the use of submucosal diathermy as a preferred option in patients with mucosal-predominant hypertrophy in the absence of significant bony enlargement, highlighting its practical value in optimizing surgical decision-making and improving postoperative patient comfort.

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AUTHOR CONTRIBUTIONS

Author	Contribution
Ahmed Arif	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Shahnoor Bano Khattak*	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Hafsa Khatoon	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published

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