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To Compare the Outcome of Inferior Turbinate Reduction Using Submucosal Diathermy and Surgical Turbinectomy with Respect to Nasal Valve Adequacy and Crusting/Synechiae Formation

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Abstract

Introduction: Inferior turbinate hypertrophy is a common cause of chronic nasal obstruction and significantly affects quality of life by impairing nasal breathing, sleep, and daily activities. Surgical reduction is indicated in patients who remain symptomatic despite medical therapy. Various techniques have been described, including partial inferior turbinectomy and submucosal diathermy, with differences in efficacy, mucosal preservation, and postoperative complications. However, the optimal surgical approach remains debated.

Aims: To compare the outcomes of inferior turbinate reduction using partial inferior turbinectomy and submucosal diathermy with respect to nasal valve adequacy, symptomatic relief, postoperative crusting, synechiae formation, and postoperative morbidity.

Materials and methods: The present study was a prospective comparative study conducted from July 2024 to December 2025 in the Department of Otorhinolaryngology (ENT), Vydehi Institute of Medical Sciences and Research Centre, Bengaluru. The study included a total of 60 patients diagnosed with inferior turbinate hypertrophy requiring surgical intervention. Patients were divided into two groups of 30 each: Group A – partial inferior turbinectomy and Group B – submucosal diathermy.

Result: Both groups were comparable regarding age and gender distribution ($p>0.05$). Symptomatic relief was significantly higher in the partial inferior turbinectomy group compared with submucosal diathermy (66.7% vs 40.0%, $p=0.038$). Nasal patency scores improved significantly in both groups; however, no significant difference was observed between groups at 3 months (8.23±0.69 vs 8.20±0.70, $p=0.839$). Postoperative bleeding, crusting, and synechiae formation showed no statistically significant differences. Submucosal diathermy demonstrated significantly lower postoperative pain scores on Day 7 (3.49±0.83 vs 4.15±1.31, $p=0.023$).

Conclusion: Partial inferior turbinectomy provides better symptomatic improvement, whereas submucosal diathermy offers superior early postoperative comfort. Both techniques provide comparable improvement in nasal valve adequacy with similar complication profiles.

Keywords: *Inferior turbinate hypertrophy; Partial inferior turbinectomy; Submucosal diathermy; Nasal obstruction; Nasal valve; Crusting; Synechiae.*

INTRODUCTION

Nasal obstruction is one of the most common symptoms encountered in otorhinolaryngology practice and has a considerable impact on patients' quality of life by affecting normal breathing, sleep, physical activity, and general well-being. Persistent nasal blockage may result in mouth breathing, snoring, sleep-disordered breathing, impaired olfaction, and reduced exercise capacity. Among the various structural and inflammatory causes, hypertrophy of the inferior turbinates is considered one of the most important contributors to increased nasal airway resistance. Inferior turbinate enlargement may occur due to allergic rhinitis, chronic rhinosinusitis, environmental irritants, or compensatory hypertrophy associated with deviated nasal septum.[1] Studies have demonstrated that inferior turbinate hypertrophy, particularly when combined with septal deviation, significantly contributes to nasal obstruction severity, as assessed by validated symptom-based scoring systems such as the Nasal Obstruction Symptom Evaluation (NOSE) scale.[2]

The inferior turbinates are essential components of the nasal airway, performing important physiological functions including humidification, filtration, warming of inspired air, and regulation of airflow. However, excessive enlargement of turbinate tissue can compromise nasal patency, especially at the internal nasal valve region, which represents the narrowest and functionally most significant portion of the nasal airway.[3] Even minor changes in this region may result in considerable alterations in airflow dynamics. Histological evaluation of hypertrophied inferior turbinates has revealed mucosal and submucosal changes, including chronic inflammatory infiltration, vascular alterations, glandular hypertrophy, and basement membrane thickening, emphasizing the importance of preserving mucosal function during surgical reduction procedures.[4]

Medical management remains the initial treatment modality for inferior turbinate hypertrophy and includes intranasal corticosteroids, antihistamines, saline irrigation, and avoidance of triggering factors. However, many patients continue to experience persistent symptoms despite adequate medical therapy and require surgical intervention.[5] The main objective of turbinate surgery is to achieve effective reduction in turbinate volume, improve nasal airflow, and maintain normal mucociliary function while minimizing postoperative complications. Various surgical techniques have been described, including submucosal diathermy, radiofrequency ablation, laser reduction, powered turbinoplasty, and surgical turbinectomy.[6]

Submucosal diathermy (SMD) is a minimally invasive technique that reduces inferior turbinate volume by applying thermal energy within the submucosal tissue, resulting in fibrosis and shrinkage while preserving the overlying mucosa. The preservation of mucosal integrity may help maintain normal nasal physiology and reduce postoperative morbidity. In contrast, surgical turbinectomy involves partial or complete excision of turbinate tissue, producing immediate enlargement of the nasal airway but carrying a potential risk of excessive tissue removal, mucosal damage, crusting, and synechiae formation.[7] Previous comparative studies have reported differences in postoperative outcomes between conservative mucosa-preserving techniques and more aggressive tissue reduction procedures; however, the optimal surgical approach remains controversial.[8]

Postoperative functional outcomes following turbinate surgery depend not only on the degree of airway enlargement but also on preservation of nasal valve function and prevention of healing-related complications. The internal nasal valve contributes significantly to nasal airflow resistance, and alteration of this region can influence postoperative breathing efficiency. Furthermore, complications such as crusting and intranasal synechiae formation may interfere with mucociliary clearance, delay healing, and result in persistent nasal symptoms despite adequate turbinate reduction. Synechiae formation, even when limited, can modify airflow patterns and negatively affect surgical outcomes.[9] Therefore, evaluation of both functional improvement and postoperative complications is essential when comparing different turbinate reduction techniques.

With advancements in rhinological surgery, current emphasis has shifted toward procedures that provide effective airway improvement while preserving nasal structure and function. Although both submucosal diathermy and surgical turbinectomy are widely practiced methods for managing inferior turbinate hypertrophy, comparative evidence regarding their effects on nasal valve adequacy and postoperative complications remains limited. A better understanding of these outcomes may assist clinicians in selecting an appropriate surgical technique that balances symptomatic relief with preservation of nasal physiology.

The present study aims to compare the outcomes of inferior turbinate reduction using submucosal diathermy and surgical turbinectomy with respect to nasal valve adequacy and postoperative crusting/synechiae formation.

MATERIALS AND METHODS

Study design: Prospective Study

Place of study: ENT inpatient department, Vydehi Institute Of Medical Sciences and Research Centre, Bengaluru

Period of study: July 2024 to December 2025 (one and half year)

Study Population: Study will be conducted among patients with clinically diagnosed Inferior turbinate hypertrophy with or without Nose and Paranasal sinus diseases, admitted in ENT inpatient department Vydehi Institute Of Medical Sciences and Research Centre, Bengaluru, after getting the informed consent for the Inferior turbinate reduction under general anesthesia and briefly explaining the patient in the language that he/she understands

Sample size: 60 patients

Inclusion Criteria:

- Patients between 17-50 years of age, of both male and female sex.
- Cases of clinically diagnosed Inferior turbinate hypertrophy withor without Nose and paranasal sinus diseases undergoing inferior turbinate reduction under general anesthesia
- Patients who have given Written Informed Consent

Exclusion criteria:

- Bleeding or coagulation defects, cranial abnormalities.
- Acute upper respiratory tract infections

Statistical Analysis: For statistical analysis, data were initially entered into a Microsoft Excel spreadsheet and then analyzed using SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and GraphPad Prism (version 5). Numerical variables were summarized using means and standard deviations, while Data were entered into Excel and analyzed using SPSS and GraphPad Prism. Numerical variables were summarized using means and standard deviations, while categorical variables were described with counts and percentages. Two-sample t-tests were used to compare independent groups, while paired t-tests accounted for correlations in paired data. Chi-square tests (including Fisher's exact test for small sample sizes) were used for categorical data comparisons. P-values ≤ 0.05 were considered statistically significant.

RESULT AND INTERPRETATION

Table 1. Comparison of Demographic Characteristics Between Partial Inferior Turbinectomy and Submucosal Diathermy Groups

Variable	Category	Partial Inferior Turbinectomy (n=30) n (%)	Submucosal Diathermy (n=30) n (%)	Total (n=60) n (%)	p-value
Age group (years)	≤20	5 (16.7)	7 (23.3)	12 (20.0)	**0.619**
	21–30	5 (16.7)	8 (26.7)	13 (21.7)	
	31–40	6 (20.0)	5 (16.7)	11 (18.3)	
	41–50	14 (46.7)	10 (33.3)	24 (40.0)	
Gender	Female	21 (70.0)	19 (63.3)	40 (66.7)	**0.584**
	Male	9 (30.0)	11 (36.7)	20 (33.3)	

Table 2. Comparison of Symptomatic Relief Between Treatment Groups

Symptomatic Relief	Partial Inferior Turbinectomy (n=30) n (%)	Submucosal Diathermy (n=30) n (%)	Total (n=60) n (%)	p-value
No relief	10 (33.3)	18 (60.0)	28 (46.7)	**0.038**
Relief present	20 (66.7)	12 (40.0)	32 (53.3)	

Table 3. Comparison of Nasal Patency Scores Between Partial Inferior Turbinectomy and Submucosal Diathermy Groups

Nasal Patency Assessment	Treatment Group	Mean ± SD	p-value
Preoperative	Partial Inferior Turbinectomy	3.22 ± 0.47	0.812
	Submucosal Diathermy	3.19 ± 0.39	
Day 7	Partial Inferior Turbinectomy	5.81 ± 0.40	0.766
	Submucosal Diathermy	5.85 ± 0.46	
Day 21	Partial Inferior Turbinectomy	6.66 ± 1.06	0.888
	Submucosal Diathermy	6.62 ± 0.94	
3 Months	Partial Inferior Turbinectomy	8.23 ± 0.69	0.839
	Submucosal Diathermy	8.20 ± 0.70	

Table 4. Comparison of Postoperative Complications Between Treatment Groups

	Postoperative Outcome	Partial Inferior Turbinectomy (n=30) n (%)	Submucosal Diathermy (n=30) n (%)	Total (n=60) n (%)	p-value
Postoperative bleeding	Present	4 (13.3)	9 (30.0)	13 (21.7)	**0.117**
	Absent	26 (86.7)	21 (70.0)	47 (78.3)	
Crusting Day 7	Present	15 (50.0)	10 (33.3)	25 (41.7)	**0.19**
	Absent	15 (50.0)	20 (66.7)	35 (58.3)	
Crusting Day 21	Present	18 (60.0)	15 (50.0)	33 (55.0)	**0.436**
	Absent	12 (40.0)	15 (50.0)	27 (45.0)	

Table 5. Comparison of Synechiae Formation Between Treatment Groups

Synechiae Formation	Partial Inferior Turbinectomy (n=30) n (%)	Submucosal Diathermy (n=30) n (%)	Total (n=60) n (%)	p-value
Present	15 (50.0)	19 (63.3)	34 (56.7)	**0.297**
Absent	15 (50.0)	11 (36.7)	26 (43.3)	

Table 6. Comparison of Operative and Postoperative Pain Outcomes Between Treatment Groups

Parameter	Treatment Group	Mean ± SD	p-value
Duration of Surgery (minutes)	Partial Inferior Turbinectomy	39.50 ± 9.49	0.2
	Submucosal Diathermy	43.17 ± 12.24	
Pain VAS Day 7	Partial Inferior Turbinectomy	4.15 ± 1.31	0.023
	Submucosal Diathermy	3.49 ± 0.83	
Pain VAS Day 21	Partial Inferior Turbinectomy	2.20 ± 1.28	0.064
	Submucosal Diathermy	2.88 ± 1.50	

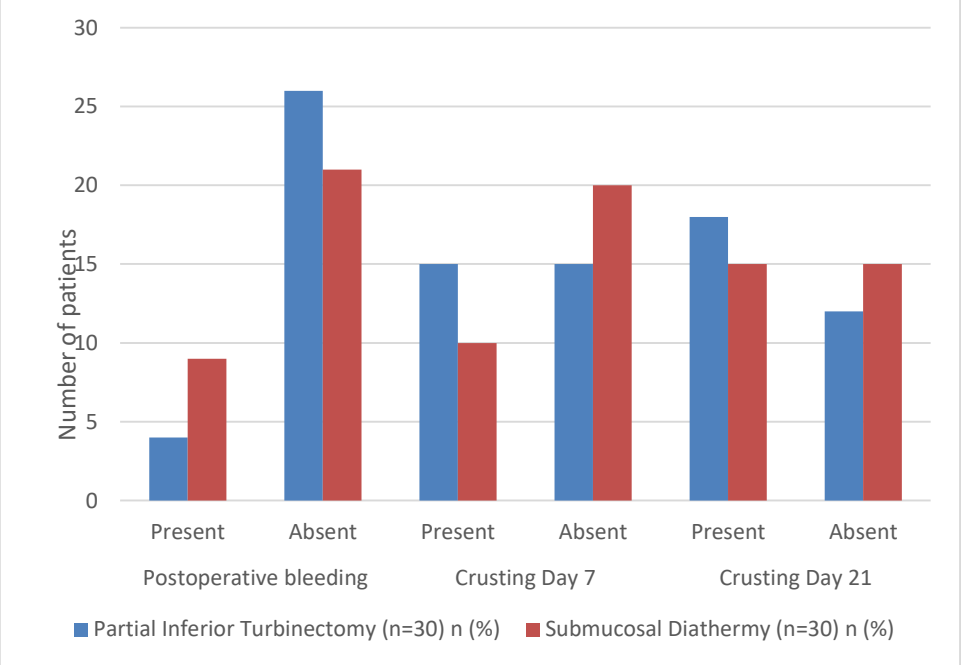

Figure 1. Comparison of Postoperative Complications Between Treatment Groups

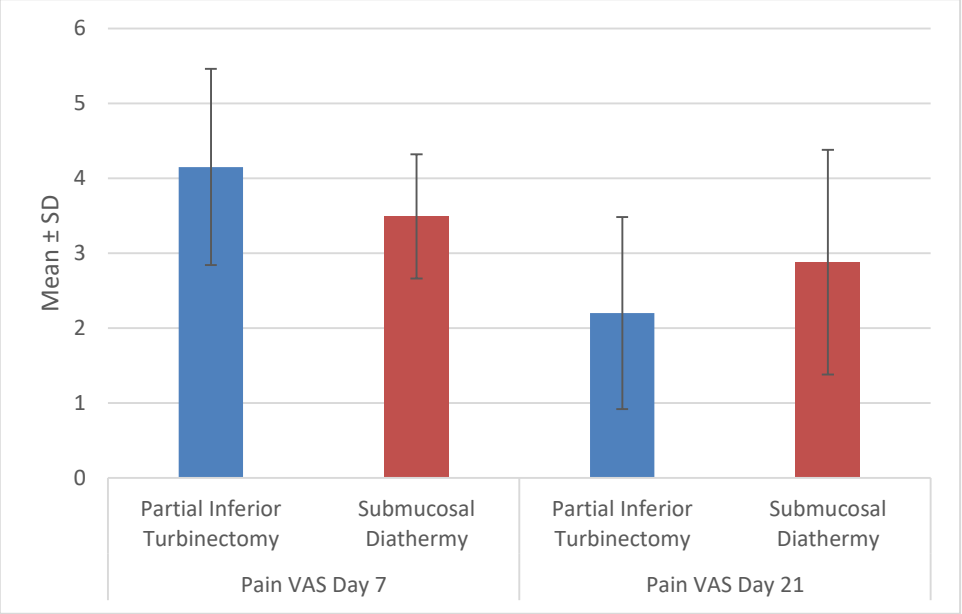

Figure 2. Comparison of Postoperative Pain Outcomes Between Treatment Groups

Table 1 demonstrates the baseline demographic characteristics of patients undergoing partial inferior turbinectomy and submucosal diathermy. The distribution of patients across different age groups was comparable between both treatment groups. The majority of patients belonged to the 41–50 years age group, accounting for 46.7% of patients in the partial inferior turbinectomy group and 33.3% in the submucosal diathermy group. The difference in age distribution between the two groups was not statistically significant (p=0.619). Regarding gender distribution, females constituted the majority in both groups, with 70.0% in the partial inferior turbinectomy group and 63.3% in the submucosal diathermy group. The difference in gender distribution was statistically non-significant (p=0.584),

Table 2 compares symptomatic improvement following inferior turbinate reduction procedures. Symptomatic relief was observed in 66.7% of patients undergoing partial inferior turbinectomy compared with 40.0% of patients treated with submucosal diathermy. Conversely, absence of symptomatic relief was higher in the submucosal diathermy group (60.0%) compared with the partial inferior turbinectomy group (33.3%). The difference between the two treatment groups was statistically significant (p=0.038)

Table 3 presents the comparison of nasal patency scores at different postoperative follow-up periods. The preoperative nasal patency scores were similar between the partial inferior turbinectomy and submucosal diathermy groups (3.22 ± 0.47 vs 3.19 ± 0.39; p=0.812), confirming comparable baseline nasal obstruction severity. At postoperative Day 7, both groups showed marked improvement in nasal patency, with mean scores of 5.81 ± 0.40 and 5.85 ± 0.46, respectively, without significant difference (p=0.766). Similar findings were observed at Day 21, where nasal patency improvement remained comparable between both groups (p=0.888). At 3 months, the mean nasal patency score was 8.23 ± 0.69 in the partial inferior turbinectomy group and 8.20 ± 0.70 in the submucosal diathermy group, with no statistically significant difference (p=0.839).

Table 4 evaluates postoperative complications including bleeding and crusting following inferior turbinate reduction. Postoperative bleeding was observed in 13.3% of patients undergoing partial inferior turbinectomy compared with 30.0% of patients undergoing submucosal diathermy. Although bleeding was more frequent in the submucosal diathermy group, the difference was not statistically significant (p=0.117). Regarding crusting on postoperative Day 7, crusting was present in 50.0% of patients in the partial inferior turbinectomy group and 33.3% in the submucosal diathermy group; however, this difference did not reach statistical significance (p=0.190). At Day 21, crusting persisted in 60.0% of partial inferior turbinectomy patients and 50.0% of submucosal diathermy patients, with no significant difference between groups (p=0.436).

Table 5 compares the incidence of postoperative synechiae formation between the two surgical techniques. Synechiae formation was observed in 50.0% of patients following partial inferior turbinectomy and in 63.3% of patients following submucosal diathermy. Although a higher proportion of synechiae formation was noted in the submucosal diathermy group, the difference was not statistically significant (p=0.297).

Table 6 compares surgical duration and postoperative pain scores between the two treatment groups. The mean duration of surgery was slightly lower in the partial inferior turbinectomy group (39.50 ± 9.49 minutes) compared with the

submucosal diathermy group (43.17 ± 12.24 minutes), although the difference was statistically non-significant (p=0.200). Postoperative pain assessment using VAS on Day 7 showed significantly lower pain scores among patients undergoing submucosal diathermy compared with partial inferior turbinectomy (3.49 ± 0.83 vs 4.15 ± 1.31; p=0.023). By Day 21, pain scores decreased in both groups, with no statistically significant difference (p=0.064).

DISCUSSION

Inferior turbinate hypertrophy is one of the most frequent anatomical causes of chronic nasal obstruction and contributes significantly to increased nasal airway resistance. Surgical reduction of enlarged inferior turbinates aims to improve nasal airflow while preserving mucosal function and minimizing postoperative complications. In the present study, a comparative evaluation was performed between partial inferior turbinectomy (PIT) and submucosal diathermy (SMD) with respect to symptomatic relief, nasal valve adequacy, postoperative crusting, synechiae formation, pain, and other surgical outcomes.

In the present study, both treatment groups were comparable regarding demographic characteristics. The majority of patients belonged to the 41–50 years age group, accounting for 46.7% (14/30) of patients in the partial inferior turbinectomy group and 33.3% (10/30) in the submucosal diathermy group. The difference in age distribution was statistically insignificant (p=0.619). Similarly, females constituted the majority of patients in both groups, with 70.0% (21/30) in the PIT group and 63.3% (19/30) in the SMD group, while males constituted 30.0% and 36.7%, respectively (p=0.584). Comparable baseline demographic characteristics were also reported by Jawaid A et al., who found no significant differences in age and gender distribution between patients undergoing inferior turbinectomy and submucosal diathermy.[10] Gangaraj et al. also reported similar demographic profiles between comparative turbinate reduction groups, supporting the comparability of treatment groups in evaluating surgical outcomes.[11]

The present study demonstrated a significant difference in symptomatic improvement between the two surgical techniques. Symptomatic relief was achieved in 66.7% (20/30) of patients undergoing partial inferior turbinectomy compared with 40.0% (12/30) of patients undergoing submucosal diathermy, whereas absence of relief was observed in 33.3% (10/30) and 60.0% (18/30) patients, respectively. This difference was statistically significant (p=0.038). The higher symptomatic improvement following partial inferior turbinectomy may be attributed to direct removal of hypertrophied turbinate tissue, resulting in greater immediate enlargement of the nasal airway. Similar findings were reported by Nawaz et al., who demonstrated superior subjective improvement after turbinectomy compared with SMD.10 However, Datta et al. reported that although turbinectomy provided effective airway enlargement, submucosal techniques also produced significant improvement with fewer postoperative complaints.[12] Differences between studies may be explained by variations in surgical technique, patient selection, severity of turbinate hypertrophy, and duration of follow-up.

Assessment of nasal valve adequacy through nasal patency scoring showed significant improvement following both procedures. Preoperatively, the mean nasal patency score was comparable between the two groups (PIT: 3.22 ± 0.47; SMD: 3.19 ± 0.39; p=0.812). At postoperative Day 7, improvement was observed in both groups, with mean scores of 5.81 ± 0.40 in the PIT group and 5.85 ± 0.46 in the SMD group (p=0.766). At Day 21, the mean nasal patency score further improved to 6.66 ± 1.06 and 6.62 ± 0.94, respectively (p=0.888). At 3 months follow-up, the mean score was 8.23 ± 0.69 in the PIT group and 8.20 ± 0.70 in the SMD group (p=0.839). These findings indicate that both techniques were equally effective in improving long-term nasal airflow and maintaining nasal valve adequacy. Similar results were reported by Gangaraj et al., who observed significant improvement in nasal obstruction following both PIT and SMD without a statistically significant difference in long-term outcomes.[11] Fradis et al. also reported comparable functional improvement between turbinectomy and submucosal diathermy, although turbinectomy produced greater anatomical reduction.[13]

Preservation of nasal mucosa is an important consideration in inferior turbinate surgery. Submucosal diathermy reduces turbinate volume through controlled thermal injury and fibrosis while maintaining the mucosal surface, whereas turbinectomy involves direct excision of turbinate tissue. Sapci et al. demonstrated that mucosa-preserving techniques resulted in better preservation of mucociliary function compared with partial turbinectomy.[5] Passali et al. emphasized that an ideal turbinate reduction procedure should provide adequate airway improvement without compromising the physiological functions of the nasal mucosa.[14]

Regarding postoperative bleeding, the present study showed bleeding in 13.3% (4/30) of patients after partial inferior turbinectomy and 30.0% (9/30) after submucosal diathermy. Although bleeding was numerically higher in the SMD group, the difference was statistically insignificant (p=0.117). Previous studies have reported variable postoperative bleeding rates depending on surgical technique and postoperative care. Fradis et al. observed increased bleeding risk with more extensive tissue removal; however, careful surgical technique and adequate haemostasis may influence complication rates.[13]

Postoperative crusting was evaluated at Day 7 and Day 21 in the present study. At Day 7, crusting was present in 50.0% (15/30) of PIT patients and 33.3% (10/30) of SMD patients, with no statistically significant difference (p=0.190). At Day 21, crusting persisted in 60.0% (18/30) of the PIT group and 50.0% (15/30) of the SMD group (p=0.436). Although partial turbinectomy showed a higher numerical frequency of crusting, the difference was not significant. Joniau et al. reported that conservative turbinate reduction techniques were associated with reduced postoperative morbidity and acceptable long-term outcomes compared with more aggressive procedures.[15]

Synechiae formation is an important postoperative concern as intranasal adhesions may compromise airflow despite adequate turbinate reduction. In the present study, synechiae formation occurred in 50.0% (15/30) of patients after partial inferior turbinectomy and 63.3% (19/30) after submucosal diathermy. Although synechiae were more frequent in the SMD group, the difference was statistically insignificant (p=0.297). The absence of significant difference in the present study suggests that both procedures carry comparable risks of adhesion formation.

Postoperative pain assessment revealed that patients undergoing submucosal diathermy experienced significantly lower pain levels during the early postoperative period. The mean VAS pain score on Day 7 was 4.15 ± 1.31 in the PIT group compared with 3.49 ± 0.83 in the SMD group (p=0.023). At Day 21, pain scores decreased in both groups, with values of 2.20 ± 1.28 for PIT and 2.88 ± 1.50 for SMD, showing no statistically significant difference (p=0.064). These findings indicate that SMD provides better early postoperative comfort due to reduced tissue trauma. Similar observations were reported by Datta et al. and Sapci et al., who demonstrated lower postoperative morbidity with minimally invasive turbinate reduction procedures.[12],[5]

The mean duration of surgery was slightly shorter in the partial inferior turbinectomy group (39.50 ± 9.49 minutes) compared with the submucosal diathermy group (43.17 ± 12.24 minutes), although the difference was statistically insignificant (p=0.200). Previous studies have shown that operative time depends largely on surgical expertise, instrumentation, and procedural complexity rather than the technique alone.[16]

CONCLUSION

The present study demonstrated that both partial inferior turbinectomy and submucosal diathermy are effective surgical procedures for the management of inferior turbinate hypertrophy, producing significant improvement in nasal airflow and nasal valve adequacy. Partial inferior turbinectomy showed superior symptomatic relief, indicating better subjective improvement in nasal obstruction. However, submucosal diathermy was associated with reduced early postoperative pain, supporting its minimally invasive nature and mucosa-preserving advantage. No significant differences were observed between the two techniques regarding postoperative bleeding, crusting, or synechiae formation. Both procedures provided comparable long-term functional outcomes. Therefore, the choice of surgical technique should be individualized based on the extent of turbinate hypertrophy, desired functional improvement, and the need to minimize postoperative morbidity.

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