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Original Article

Bipolar Electrocautery Technique Versus Mini Inferior Turbinoplasty in Persistent Inferior Turbinate Hypertrophy

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Abstract

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Background: Nasal obstruction is one of the most prevalent complaints in otolaryngological practice, significantly impairing patients' quality of life. Inferior turbinate hypertrophy [ITH] is a common cause, often managed surgically when refractory to medical therapy.

Aim of The Study: This study aimed to compare the efficacy, operative parameters, and postoperative outcomes of mini-inferior turbinoplasty [tunneling technique] versus bipolar electrocautery for ITH reduction.

Patients and Methods: This prospective randomized clinical trial included 60 patients with chronic nasal obstruction due to bilateral ITH unresponsive to medical therapy for over three months. Patients were randomly assigned to two equal groups: Group A [mini-inferior turbinoplasty] and Group B [bipolar electrocautery]. All procedures were conducted at Al-Azhar University Hospitals. Patients were evaluated intraoperatively for bleeding and operative time, and postoperatively for nasal packing, crustation, synechia, nasal obstruction, and recurrence over a 3-month follow-up.

Results: Group A had a significantly longer operative time [27.77 ± 3.80 min vs. 13.07 ± 2.72 min, $P=0.001$] and higher intraoperative bleeding [22.37 ± 3.32 ml vs. 7.83 ± 1.46 ml, $P=0.001$] than Group B. Postoperative bleeding and need for nasal packing were observed only in Group A [16.7%, $P=0.02$]. Crustation was significantly more frequent in Group B [96.7% vs. 6.7%, $P=0.001$], while nasal obstruction at one month was higher in Group B [66.7% vs. 16.7%, $P=0.001$]. No significant differences were observed in synechia or recurrence.

Conclusion: Both mini-inferior turbinoplasty and bipolar electrocautery are effective in ITH reduction. Bipolar electrocautery offers advantages in operative time, minimal bleeding, and no need for nasal packing. However, mini-inferior turbinoplasty yields lower rates of crustation and better early postoperative relief from nasal obstruction.

Keywords: Inferior Turbinate Hypertrophy; Nasal Obstruction; Bipolar Electrocautery; Mini-Inferior Turbinoplasty; Tunneling Technique.



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INTRODUCTION

Chronic nasal obstruction is a common complaint encountered in otolaryngology and can significantly affect a patient's well-being. It contributes to a wide spectrum of symptoms such as mouth breathing, nasal speech, and dryness of the oral and pharyngeal mucosa [1]. In many cases, these disturbances extend beyond physical discomfort to include impaired sleep quality, fatigue, headaches, and diminished mental clarity, all of which cumulatively lead to reduced productivity and a poorer quality of life. Furthermore, the burden of chronic nasal obstruction can have socioeconomic consequences due to increased healthcare utilization and lost workdays [2].

Among the anatomical causes of nasal obstruction, inferior turbinate hypertrophy remains one of the most frequently identified structural contributors. The inferior turbinates are critical for regulating airflow, humidifying inspired air, and filtering particulate matter. However, in certain individuals, these structures can become chronically enlarged due to inflammation, allergies, or environmental irritants, leading to persistent airflow resistance [3]. This hypertrophy is primarily mucosal or submucosal in origin and is often localized to the anterior aspect of the turbinate, which contains venous sinusoids that behave like erectile tissue and become engorged, further compromising nasal patency [4].

Initial management typically involves pharmacological therapies. Intranasal corticosteroids remain the cornerstone of treatment for allergic and non-allergic rhinitis and are particularly effective in reducing turbinate size by limiting mucosal inflammation and vascular congestion. However, a significant proportion of patients do not achieve satisfactory relief with medical therapy alone. In such cases, surgical intervention is considered to mechanically reduce turbinate volume and restore nasal airflow [5].

The primary goal of turbinate reduction surgery is to decrease the bulk of the inferior turbinate while preserving its physiological functions, including humidification and air filtration. An ideal technique would achieve this balance while minimizing intraoperative and postoperative complications such as bleeding, crusting, or mucosal atrophy. Therefore, the surgical approach must be tailored to both the anatomy of the turbinate and the severity of the obstruction, taking into account the patient's overall health and response to prior therapies [6].

One of the most commonly employed techniques is bipolar electrocautery, a method that involves the application of thermal energy to coagulate submucosal tissues, resulting in volume reduction through controlled fibrosis. This procedure is favored by many surgeons due to its simplicity, low cost, and feasibility under local anesthesia. It avoids the need for complex instrumentation and can be performed as an outpatient procedure, making it highly accessible, especially in resource-limited settings. Nevertheless, it is not without limitations. Bipolar cautery may lead to surface tissue damage, crusting, and, in some cases, delayed mucosal healing [7].

In recent years, more advanced surgical methods have been developed to offer a more refined reduction with fewer complications. Among these, the mini-inferior turbinoplasty technique using a powered microdebrider has gained increasing popularity. This approach involves submucosal tunneling, allowing

for the selective removal of hypertrophic tissue and turbinate bone while preserving the overlying mucosa [8].

The microdebrider offers excellent precision and visualization, aided by continuous suction and irrigation that help maintain a clear surgical field. This facilitates accurate resection with minimal collateral tissue trauma. Additionally, the instrument's cooling system and interchangeable cutting tips further enhance safety and adaptability during surgery [9].

Although both bipolar electrocautery and microdebrider-assisted turbinoplasty are effective in relieving nasal obstruction, there remains a lack of consensus regarding their comparative outcomes in terms of symptom relief, patient satisfaction, complication rates, and long-term efficacy. Some studies suggest that microdebrider turbinoplasty may result in greater and more sustained improvements in nasal airflow, with fewer postoperative symptoms. However, others highlight that bipolar electrocautery, despite being a more straightforward procedure, offers similar benefits in selected patients, particularly those with milder degrees of hypertrophy and no bony involvement [10] [11].

Despite growing clinical experience with both techniques, there is limited head-to-head data specifically comparing the mini-inferior turbinoplasty [tunneling technique] and bipolar electrocautery in cases of persistent inferior turbinate hypertrophy refractory to medical treatment. Most existing studies either focus on one modality or present retrospective findings with small sample sizes, limiting the generalizability of conclusions. Moreover, variations in surgical technique, patient selection, and follow-up duration further complicate efforts to standardize treatment protocols or define best practices.

Given this gap in comparative evidence, particularly in the context of refractory turbinate hypertrophy, it is necessary to conduct studies that directly assess the relative advantages and limitations of these two approaches using standardized outcome measures. The present study aims to compare the clinical efficacy, safety profile, and patient-reported outcomes of bipolar electrocautery versus mini-inferior tuboplasty specifically the tunneling technique—for the surgical management of persistent inferior turbinate hypertrophy unresponsive to medical therapy.

PATIENTS AND METHODS

This prospective randomized interventional clinical study was conducted over a period of 18 months, from April 2023 to October 2024, at Al-Azhar University Hospitals. The research targeted patients attending the outpatient ENT clinics with chronic nasal obstruction attributable to inferior turbinate hypertrophy. The study received ethical approval from the Faculty of Medicine, Al-Azhar University, and written informed consent was obtained from all participants or their legal guardians. Participant confidentiality was strictly preserved using anonymized codes and secure documentation. Individuals retained the right to decline participation, and any unforeseen risks encountered during the study were promptly addressed and reported to the ethics committee.

Inclusion and Exclusion criteria: Eligible participants included male and female patients aged between 16 and 50 years who had experienced persistent nasal obstruction due to hypertrophied inferior turbinates lasting more than six months, unresponsive to at least three months of medical therapy. Patients were excluded if they had a history of chronic rhinosinusitis, prior nasal or turbinate surgery, nasal polyps, sinonasal tumors, or significantly deviated nasal septum. Those with systemic comorbidities such as diabetes mellitus, uncontrolled hypertension, or bleeding disorders were also excluded to avoid perioperative complications and confounding outcomes

Data collection

Preoperative assessment: Each participant underwent a comprehensive clinical assessment beginning with a detailed medical history focusing on the onset, duration, and nature of nasal obstruction, associated symptoms, and any prior treatments. General physical examination included assessment of vital signs and general health status to ensure surgical fitness. Diagnostic investigations were performed preoperatively, including computed tomography [CT] scanning of the nose and paranasal sinuses to rule out underlying sinus disease and define turbinate anatomy. Laboratory evaluations encompassed complete blood count, coagulation profile [PT, PTT, INR], random blood sugar, renal and liver function tests, and viral serologies including hepatitis markers to identify any contraindications for surgery or anesthesia.

Anterior rhinoscopy and nasal endoscopic examination were carried out preoperatively and during scheduled follow-up visits using a 0-degree rigid endoscope. These examinations were repeated at postoperative intervals: one week, two weeks, one month, and three months to assess mucosal healing, detect complications, and evaluate symptom resolution. Otoscopic or endoscopic ear examinations were also conducted to ensure the absence of concurrent middle ear pathology.

Randomization was performed using opaque sealed envelopes to allocate patients equally into two treatment groups. Group A consisted of 30 patients who underwent mini-inferior turbinoplasty using the tunneling technique. Group B included 30 patients who underwent bipolar electrocautery turbinate reduction.

Surgical techniques: All procedures were carried out under general anesthesia and endoscopic visualization using a 0-degree scope for precision and safety

Group A: Mini inferior turbinoplasty was initiated by infiltrating the inferior turbinate with normal saline to create a submucosal plane. After lateralizing the turbinate using a Freer elevator, a small submucosal pocket was created at the anteroinferior aspect using a number 15 blade. A microdebrider set at a speed of 5000–7000 cycles per second in oscillating mode was then introduced. Resection was confined to the submucosal tissue, primarily targeting the anterior turbinate head, while preserving the overlying mucosa. Hemostasis was secured with anterior nasal packing for 48 hours when needed.

Group B: Patients underwent bipolar electrocautery where, after turbinate lateralization with a Freer elevator, bipolar cautery was applied in a linear fashion along the free edge of the turbinate from posterior to anterior. The arms of the bipolar forceps were maintained at a 2-mm distance, and coagulation was activated via a foot switch. This technique produced submucosal fibrosis and volume reduction. As with the first group, anterior nasal packing was applied for 48 hours postoperatively when required for hemostasis.

Both groups were assessed intraoperatively for estimated blood loss, recorded in milliliters, and for the need for nasal packing at the end of surgery. The total operative time was measured using a stopwatch from the first surgical incision to the completion of the procedure.

Postoperative Assessment: Post operative evaluation included the presence or absence of active bleeding, blood clots, synechiae formation, crusting, and recurrence of nasal symptoms at each follow-up visit. Recurrence of turbinate hypertrophy was assessed during the final visit at three months postoperatively.

Statistical analysis: Collected data were analyzed using the Statistical Package for Social Sciences [SPSS], version 20. Categorical variables were presented as frequencies and percentages, while continuous variables were expressed as means, standard deviations, and ranges, assuming normal distribution. Chi-square and Fisher's exact tests were employed for comparisons of qualitative variables, while independent t-tests were used for comparisons between quantitative variables with parametric distribution. A confidence level of 95% was adopted, and results were considered statistically significant when the p-value was less than 0.05.

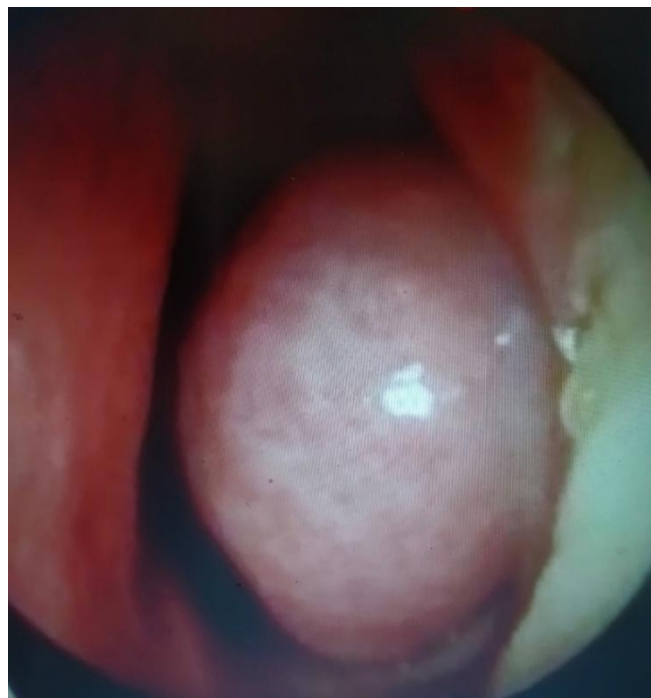


Figure [1]: pre-operative endoscopic view of hypertrophied inferior turbinate.

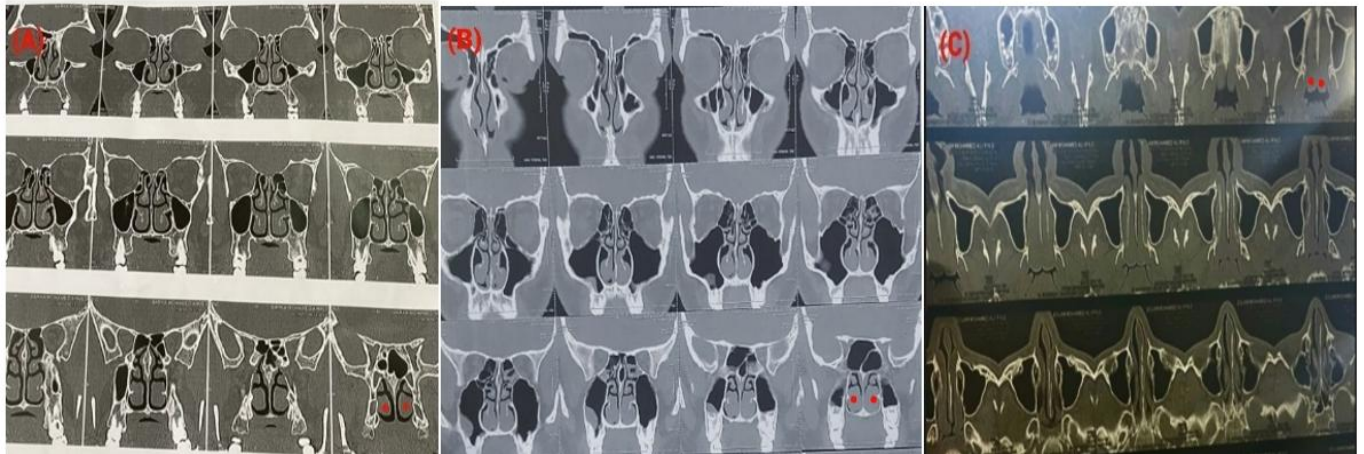


Figure [2]: Pre-operative CT scan on the nose and paranasal sinuses [A, B: coronal views and C: axial views] showing hypertrophied inferior turbinates [red dots]

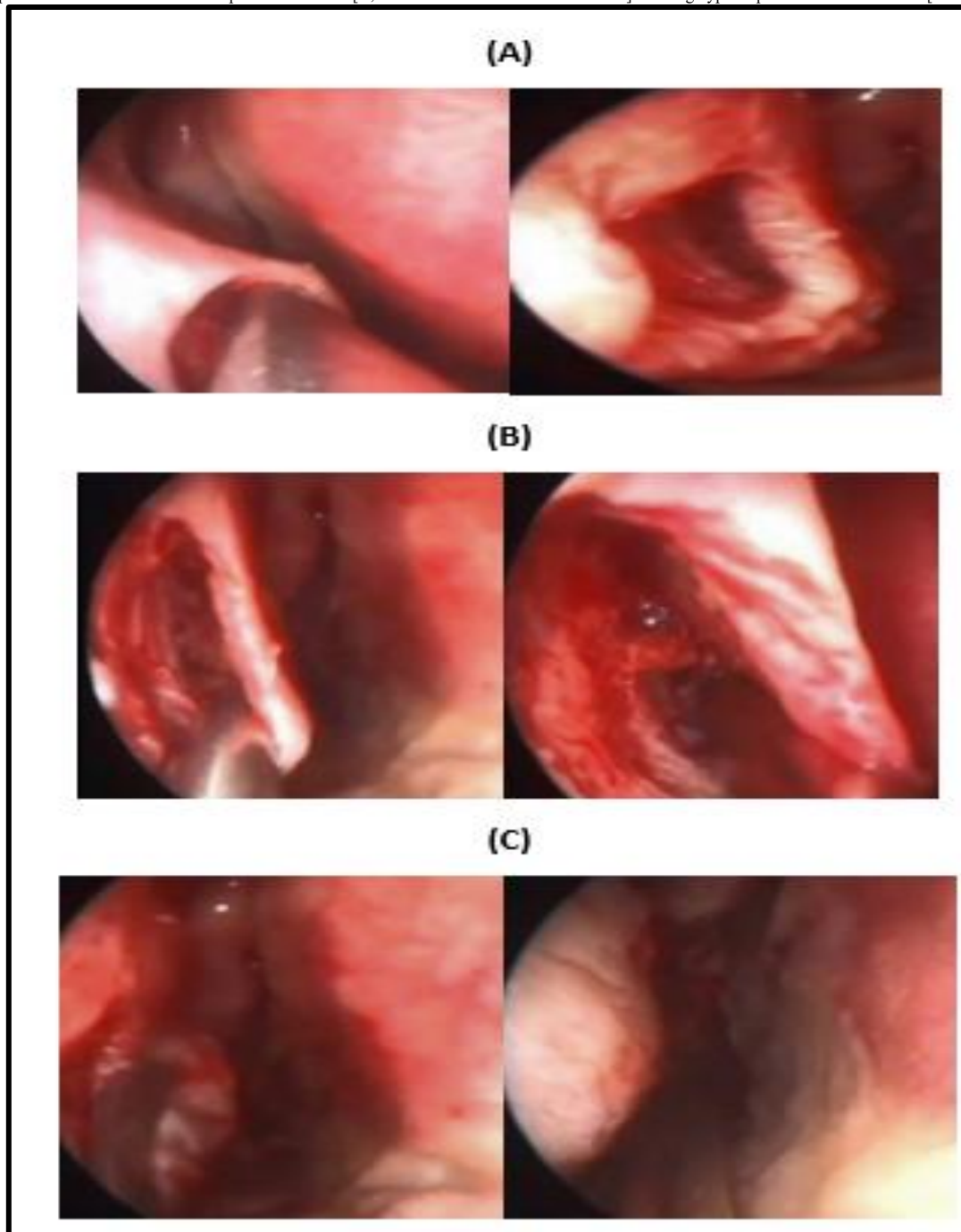


Figure [3]: Group A: Mini Inferior Turbinoplasty-Tunneling Technique, [A] Anteroinferior submucosal incision and pocket, [B] Microdebrider blade insertion [C] The inferior turbinate size was reduced.

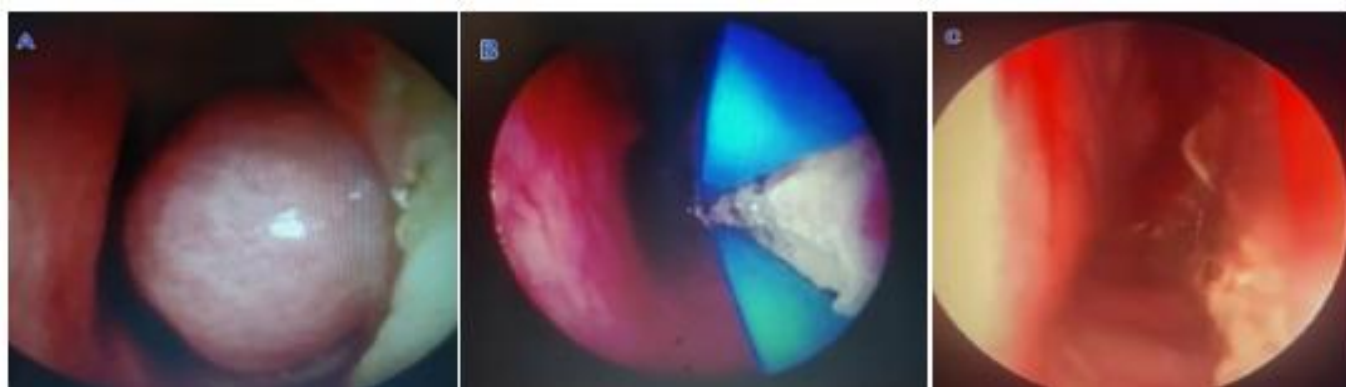


Figure [4]: Group B: bipolar electrocautery technique, [A] Inferior turbinate hypertrophy, [B] Linear cauterization between the two arms of bipolar cautery [C] The inferior turbinate size was reduced.

RESULTS

In this study, 75 patients were assessed for eligibility; 10 patients did not meet the criteria, and 5 patients refused to participate in the study. The remaining 60 patients were randomly allocated into two groups [30 patients in each one]. All of them were followed up and statistically analyzed. According to the patients' demographics, 34 cases were female and 26 were male and their ages ranged from 16 to 50 years [mean = 31.13 years]. The two groups were comparable in terms of their demographics [$P > 0.05$ for all] [Table 1].

The mean of intra-operative time [Mint] for patients of group A was 27.77 ± 3.80 and it was 13.07 ± 2.72 for patients of group B [$P = 0.001$]. The mean of intra-operative bleeding [ml] for patients of group A was 22.37 ± 3.32 and it was 7.83 ± 1.46 for patients of group B [$P = 0.001$] [Table 2].

As regards nasal packing, in group A there were 5 [16.7%] cases that had nasal packing, while there were 0 [0%] cases in group B [$P = 0.02$].

As regards the postoperative outcomes, In group A, there were 5 [16.7%] cases had postoperative bleeding, 2 [6.7%] cases had first week crustation, 2 [6.7%] cases had second week synechia, 5 [16.7%] cases had first month nasal obstruction and 3 [10%] cases had third month recurrence, while there were no cases had postoperative bleeding, 29 [96.7%] cases had first week crustation, 4 [13.3%] cases had second week synechia, 20 [66.7%] cases had first month nasal obstruction and 1 [3.3%] case had third month recurrence. There were significant differences regarding first week crustation and first month nasal obstruction, postoperative bleeding, while there were statistically non-significant differences regarding second week synechia and 3rd month recurrence.

Table [1]: Demographic data of the studied patients.

		Group A	Group B	P-value
		No. = 30	No. = 30	
Age	Mean $\pm$ SD	30.33 ± 7.89	31.93 ± 10.15	0.498
	Range	16 – 50	16 – 50	
Sex	Male	14 [46.7%]	12 [40.0%]	0.602
	Female	16 [53.3%]	18 [60.0%]	

P-value > 0.05 : Non-significant [NS]; P-value < 0.05 : Significant [S]; P-value < 0.01 : highly significant [HS]. *: Chi-square test, *: Independent t-test

Table [2]: Comparison between the studied groups according to Intra-operative time [Mint] and Intra-operative bleeding [ml].

		Group A	Group B	P-value
		No. = 30	No. = 30	
Intra-operative time [Mint]	Mean $\pm$ SD	27.77 ± 3.80	13.07 ± 2.72	0.000
	Range	18 – 34	10 – 20	
Intra-operative bleeding [ml]	Mean $\pm$ SD	22.37 ± 3.32	7.83 ± 1.46	0.000
	Range	18 – 29	6 – 10	

P-value > 0.05 : Non-significant [NS]; P-value < 0.05 : Significant [S]; P-value < 0.01 : highly significant [HS].

Table [3]: Comparison between the studied groups according to postoperative bleeding, 1st week crustation, 2nd week synechia, 1st month nasal obstruction and 3rd month recurrence.

		Group A		Group B		P-value
		No.	%	No.	%	
Postoperative bleeding	Absence	25	83.3%	30	100%	0.020
	Presence	5	16.7%	0	0%	
1st w crustation	Absence	28	93.3%	1	3.3%	0.000
	Presence	2	6.7%	29	96.7%	
2nd w synechia	Absence	28	93.3%	26	86.7%	0.389
	Presence	2	6.7%	4	13.3%	
1st m nasal obstruction	Absence	25	83.3%	10	33.3%	0.000
	Presence	5	16.7%	20	66.7%	
3rd m recurrence	Absence	27	90 %	29	96.7%	0.301
	Presence	3	10%	1	3.3%	

P-value > 0.05: Non-significant [NS]; P-value < 0.05: Significant [S]; P-value < 0.01: highly significant [HS].

DISCUSSION

Nasal obstruction is among the most encountered complaints in otolaryngology practice, affecting up to one-third of the population. It may be presented as unilateral or bilateral, acute or chronic, and can be intermittent or persistent. This symptom often leads to a significant decrease in quality of life due to impaired nasal airflow, resulting in disrupted sleep, daytime somnolence, and impaired concentration [12].

Anatomically, the most frequent causes of nasal obstruction are deviated nasal septum and inferior turbinate hypertrophy [ITH]. ITH may result from compensatory mechanisms secondary to septal deviation or may be associated with chronic rhinitis, whether allergic, vasomotor, or hypertrophic [13].

Due to the high prevalence of ITH and its impact on quality of life, numerous surgical interventions have been developed. Modern techniques prioritize minimal invasiveness and faster recovery while maintaining effective relief of obstruction. Techniques such as microdebrider-assisted turbinoplasty [MAT], radiofrequency ablation [RFA], and electrocautery have shown favorable outcomes in terms of symptom relief, operative efficiency, and postoperative recovery [14].

The current study aimed to compare the efficacy and safety of two commonly used surgical interventions for ITH—mini-inferior turbinoplasty using the tunneling technique versus bipolar electrocautery—in a prospective randomized clinical setting. This study enrolled 60 patients with nasal obstruction secondary to hypertrophied inferior turbinates refractory to medical management for at least three months. All patients were recruited from Al-Azhar University Hospitals and randomized into two equal groups. Group A underwent mini-inferior turbinoplasty via the tunneling technique, while Group B received bipolar electrocautery.

Demographically, the study included 34 females and 26 males with an age range of 16 to 50 years [mean 31.13 years]. No

statistically significant difference was observed between the two groups regarding age or sex distribution. These results align with the findings of **Aboulwafa et al.** [15], who reported no demographic differences between comparative treatment groups. However, the current demographics slightly differ from those in other studies, such as **Karamatzanis et al.** [12] and **Al Jabr et al.** [16], who reported varying distributions in terms of age and gender.

Intraoperative parameters showed significant differences between the groups. Group A had a mean operative time of 27.77 ± 3.80 minutes, significantly longer than Group B's mean of 13.07 ± 2.72 minutes [$p < 0.001$]. Similarly, Group A experienced greater intraoperative bleeding [22.37 ± 3.32 mL vs. 7.83 ± 1.46 mL, $p < 0.001$]. These findings are consistent with **Abo Elmagd et al.** [17], who observed prolonged surgical duration and higher blood loss in mini turbinoplasty procedures.

White and Rebeiz [18] also documented an average duration of 16 minutes for bipolar electrocautery, supporting the present findings. However, discrepancies exist with studies like **Nagalingeswaran and Dinesh** [19] who reported a shorter duration for turbinoplasty procedures.

The need for postoperative nasal packing was significantly higher in Group A [16.7%] compared to none in Group B, correlating with the higher intraoperative bleeding seen in turbinoplasty cases. This observation echoes findings from **Abo Elmagd et al.** [17], emphasizing the relationship between blood loss and packing requirements.

Conversely, **Nagalingeswaran and Dinesh** [19] reported no need for packing post-turbinoplasty, indicating variability based on technique and surgeon experience.

Regarding postoperative complications, crust formation in the first week was significantly more prevalent in Group B [96.7%] compared to Group A [6.7%] [$p < 0.001$]. This is consistent with

Askar *et al.*^[20], who found bipolar electrocautery associated with a higher rate of crusting.

Similarly, Abo Elmagd *et al.*^[17] reported lower rates of crusting in microdebrider-assisted turbinoplasty. Synechia were noted in 6.7% and 13.3% of patients in Groups A and B, respectively, without significant difference.

These findings agree with El Henawi *et al.*^[21], who reported a synechia rate of 9.6% for turbinoplasty, and contrast with Alzobir *et al.*^[22], who found a higher synechia rate with bipolar electrocautery [20%].

At one-month follow-up, nasal obstruction was significantly more prevalent in Group B [66.7%] compared to Group A [16.7%] [$p < 0.001$], indicating superior early functional outcomes in the mini turbinoplasty group.

Similar observations were reported by El Henawi *et al.*^[21], who found marked symptom relief as early as one-month post-turbinoplasty.

In addition, this aligns with the outcomes reported by Benchev^[23] and Lee and Chen^[24], both documenting symptom improvement rates exceeding 79% within the first two months postoperatively.

In terms of recurrence at three months, 10% of Group A and 3.3% of Group B exhibited symptom relapses, though the difference was not statistically significant. Improvement trajectories documented by Askar *et al.*^[20] in patients undergoing bipolar electrocautery showed a steady rise in symptom relief over time, with 23.8% experiencing improvement at one month and 81% at three months. However, these results suggest that turbinoplasty may offer more immediate and sustained relief, particularly in the early postoperative phase.

Postoperative bleeding complications were significantly higher in Group A [16.7%] compared to none in Group B. This aligns with El Henawi *et al.*^[21], who reported a 7% bleeding rate following turbinoplasty.

Other studies, such as those by Lee and Chen^[24], reported bleeding in 10% of cases, typically managed conservatively with vasoconstrictive agents.

Interestingly, Rao *et al.*^[25] documented a much higher bleeding rate [30%] in patients undergoing bipolar electrocautery, contradicting the findings of the current study and highlighting variability based on patient selection and technique.

In summary, this study demonstrates that mini-inferior turbinoplasty via the tunneling technique, while associated with longer operative times and higher intraoperative bleeding, offers superior early symptom relief, less crust formation, and better overall patient outcomes compared to bipolar electrocautery. These results are supported by various published studies emphasizing the efficacy of MAT in achieving sustained symptom control and reducing postoperative morbidity. Despite these findings, individual patient characteristics, surgeon expertise, and resource availability should guide the choice of surgical technique. Further large-scale, multicentric randomized trials with longer follow-up periods are warranted to validate the long-term superiority of mini turbinoplasty over other less invasive options.

Conclusion:

Both bipolar electrocautery and mini-inferior turbinoplasty [tunneling technique] are effective and equally successful surgical options. Bipolar electrocautery has advantages in shorter surgery time and no postoperative bleeding, eliminating the need for nasal packing. Meanwhile, mini-inferior turbinoplasty offers less postoperative crusting and better early improvement of nasal obstruction, resulting in lower patient morbidity.

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