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Endoscopic Medial Flap Inferior Turbinoplasty versus Bipolar Electrocautery in Management of Inferior Turbinate Hypertrophy

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ABSTRACT
Background: Turbinate reduction techniques should consistently minimize nasal obstruction without compromising mucosal function or increasing the risk of problems like crusting or bleeding.
Objective: To evaluate the efficacy of bipolar cauterization against medial flap inferior turbinoplasty in terms of pre- and post-operative outcomes and to assess the outcome of turbinate reduction and the effect on mucociliary clearance.
Patients and methods: This nonrandomized controlled trial was conducted on 24 patients with nasal obstruction, **Group (1):** included 12 patients underwent endoscopic medial flap inferior turbinoplasty. **Group (2):** included 12 patients underwent bipolar cauterization for reduction of the inferior turbinate.
Results: Operation time was significantly longer in group I (53.33±7.48 min) than Group II (32.08±4.50 min). Post-operative crusting and burning sensation were significantly better in group I compared to group II ($p<0.05$).
Conclusions: One safe and effective method to reduce the size of the turbinates is with a medial flap inferior tuboplasty. There was little to no danger of complications after this technically simple operation, and patients reported lasting alleviation from their obstructive problems.
Keywords: Medial Flap Inferior Turbinoplasty, Bipolar Electrocautery, Inferior Turbinate Hypertrophy.

INTRODUCTION

While not necessarily life-threatening, nasal blockage does impair the patient's quality of life and is hence the most common complaint among otolaryngologists' attending physicians. Much nasal obstruction results from expansion of the anterior inferior turbinate, the narrowest portion of the nasal airway. Because of factors like allergen sensitivity, warmth, humidity, and increased airflow pressure, this is the most frequently enlarged area [(1)]. Idiopathic vasomotor changes, hormonal imbalances, inflammatory rhinitis, and unfavorable medication reactions are common causes of nasal obstruction induced by inferior turbinate hypertrophy [(2)].

Medical and antiallergic therapy can be used to address patients with inferior turbinate hypertrophy. Patients who do not improve after treatment may need to have the inferior turbinate surgically reduced [(3)]. Several surgical procedures exist for the purpose of reducing hypertrophy in the inferior turbinates, including microdebrider-assisted inferior turbinoplasty (MAIT), and mucosa sparing techniques [(4)], submucosal electrocautery [(5)], carbon dioxide laser turbinoplasty, as well as cryotherapy [(6)].

Several techniques have been recorded since the initial surgical treatment of hypertrophied inferior turbinates in 1895, and there is still great controversy as to which way is the most beneficial [(7,8)]. Preserving mucosa and physiologic function is ideal for surgical reduction. To avoid the "empty nose syndrome" that can occur, it's best to choose a physiologically preserved method. Turbinate reduction techniques should consistently lessen nasal blockage without compromising mucosal function or increasing the risk of problems like crusting or bleeding [(9,10)].

Our study aimed to evaluate the efficacy of bipolar cauterization against medial flap inferior turbinoplasty in terms of pre- and post-operative outcomes and to assess the outcome of turbinate reduction and the effect on mucociliary clearance.

PATIENTS AND METHODS

From April 2020 to April 2021, 24 patients underwent medical treatment for nasal obstruction caused by hypertrophied inferior turbinate for at least six weeks. They were a part of this non-randomized controlled trial at Zagazig University Hospitals' Otorhinolaryngology Department.

Inclusion criteria:
The study included adult patients who met the criteria for reduction surgery, which include symptoms and evidence of bilateral nasal obstruction due to inferior turbinate hypertrophy, and who had not shown improvement after six weeks of medical treatment. All included subject had no local or general contraindication.

Exclusion criteria:
1- Blood dyscrasia or coagulation disorder.
2- Severe deviation of nasal septum, nasal polyps, and disorders of nasal valve area, paranasal sinus tumors, or maxillofacial trauma.
3- Previous nasal surgery or trauma.
4- Patients with suggestive corona virus disease (COVID 19).

Twenty-four (24) patients were divided into two groups:

Group (1): included 12 patients underwent endoscopic medial flap inferior turbinoplasty.

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Group (2): included 12 patients underwent bipolar cauterization for reduction of the inferior turbinate.
Prior to surgery, every patient underwent a battery of subjective and objective tests. Detailed history about the main symptom (nasal obstruction) of the patient was obtained and clinical examination including complete nasal examination assessed the function and airway resistance. It included looking into the mouth and pharynx (congested throat, hypertrophied tonsils and post nasal discharge).

Visual analogue scale (VAS) evaluation:

Each participant was asked to rate their current level of nasal obstruction on a scale from 0 to 10, where 0 indicates no obstruction and 10 indicates full obstruction, in order to assess nasal obstruction.

Anterior rhinoscopy: Noting any visible congestion, turbinate hypertrophy, discharge, polyps, adhesions, nasal masses or synechiae and assessment of inferior turbinate.

Nasal endoscopy: Specially reporting on:

- Hypertrophied inferior turbinate and discharge.
- Exclude other nasal pathologies as sinusitis, severe deviated septum …etc.

The endoscopic evaluation: Prior to decongesting the nasal mucosa, a straight (4 mm, 0°) endoscope was used. The degree of hypertrophy was classified into 3 endoscopic scores according to the turbinate width/engorgement:

- Grade 1: fully retraction of inferior turbinate
- Grade 2: fill of the half of the nasal fossa by inferior turbinate engorgement
- Grade 3: engorgement of inferior turbinate reach to the nasal septum.

Nasal decongestion: To assess the response of mucosa to decongestion and to rule out bony hypertrophy. Anterior rhinoscopy and nasal endoscopy were used to examine the inferior turbinates; both prior to and six weeks following surgery.

Methylene blue colored saccharine test (MBST):

The objective testing of the mucociliary clearance system was carried out using the following materials: methylene blue (MB) from Egyptian Diagnostic Media in Cairo, Egypt, and sodium saccharine (Sc) from China Pingmei Shenma Group in Kaifenghsien, Henan, China. Saccharine, diluted with methylene blue, was applied to the inferior turbinate tip to conduct the test. The timing of sensation was recorded when the patient could taste sugar and see the blue dye at the oropharynx in order to compare the time objectively with the post-operative test and the mucociliary clearance system [(11)].

Investigation:

1- Laboratory tests that are routinely requested (complete blood count, liver function, renal function, random blood sugar, coagulation profile, viral markers).
2- Every patient had a CT scan of their nasal cavity and paranasal sinuses.
Every CT was examined very carefully aiming at addressing the following points:

1- The condition of inferior turbinate: hypertrophied or not.
2- Presence of septal deviation and its degree with exclusion of cases with severe septal deviation causing nasal obstruction.
3- The condition of the middle turbinate: exclusion of cases with variations and pathologies of middle turbinate causing nasal obstruction.
4- Exclusion of other nasal and paranasal pathologies.

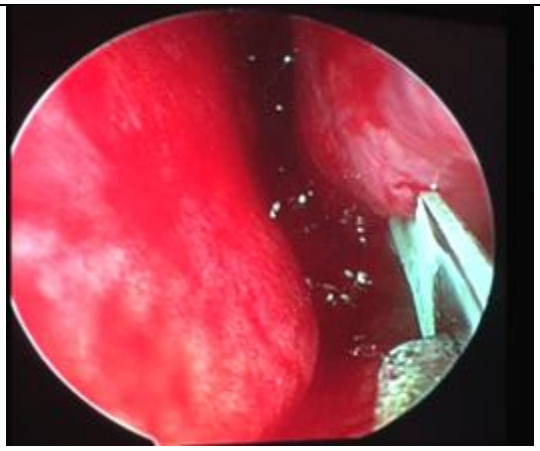
Surgical treatment:

In order to alleviate nasal obstruction, all patients underwent the following surgical procedures. Patients were placed in a supine position with their heads slightly elevated during all procedures, while they were under general hypotensive anesthesia. Preparation of the nasal cavity was accomplished using nasal packs saturated with a solution of saline and epinephrine with a concentration of 1:100,000. A combination of endoscopic sinus surgery and a right-angled endoscope was used throughout the entire procedure.

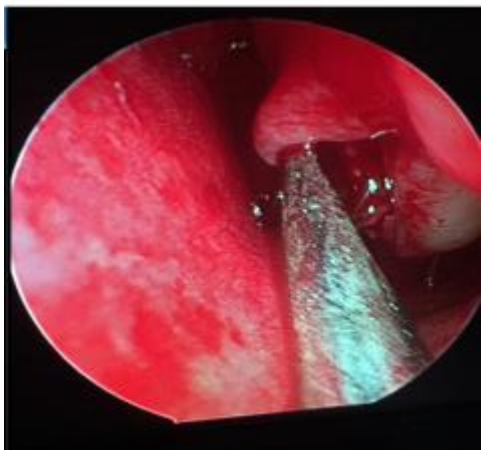
Group I: Endoscopic medial flap inferior turbinoplasty:

Patients in group I were managed by endoscopic medial flap inferior turbinoplasty of inferior turbinate hypertrophy. Endoscopic examination of the inferior nasal turbinate was performed after the nose was prepared with a topical vasoconstrictor solution containing 0.1 percent oxymetazoline hydrochloride. One hundred thousandth epinephrines were mixed with one percent lidocaine and injected locally. The anterior and inferior edges of the inferior turbinate were incised using a scalpel blade number fifteen.

The medial bony surface of the inferior turbinate was extensively dissected to create a medial flap that could be raised both superiorly and posteriorly. The next step was to use scissors and thru-cutting forceps to partially remove the lateral mucosal surface and inferior turbinate bone. After that, the exposed area was covered by repositioning the medial flap. Prior to replacing the flap, any bleeding spots along the excised portion were managed using packing and cauterization. To hold the mucosal flap in place for 48 hours, little pieces of vazelinized gauze were placed throughout the nasal floor (Figure 1).

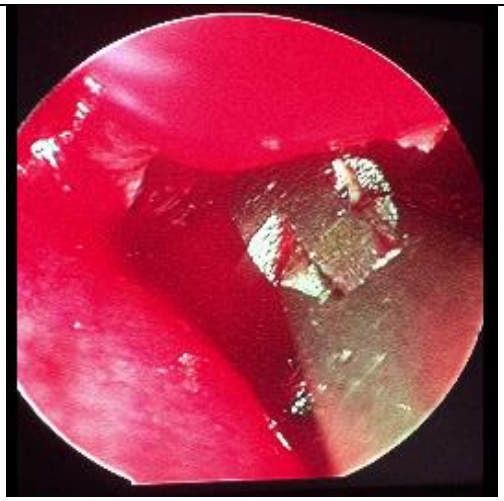


A- Incision with scalpel blade along of the anterior as well as the inferior edge of left inferior turbinate



B- Medial flap is elevated superiorly and posteriorly through dissecting along the medial bony surface of inferior turbinate

C- Partial resection of left inferior turbinate bone and lateral mucosal surface is done using scissors



D- Thru-cutting forceps removes part of the soft tissue and bone

Fig. (1): Steps of endoscopic medical flap inferior turbinoplasty technique.

Group II: Bipolar electrocautery:

Patients in group II were managed by bipolar electrocautery of inferior turbinate hypertrophy. After preparation of the turbinate with oxymetazoline hydrochloride 0.1%, s standard surgical coagulation diathermy generator was connected to the bipolar cautery forceps. The forceps were inserted into the nasal cavity such that their blades touched the top and bottom surfaces of the turbinates in a parallelogram with the nose's floor. Following endoscopic guidance and full turbinate visibility, the diathermy circuit 20w was closed and linear cautery was applied to the mucosa as the forceps was progressively withdrawn. It usually took two or three runs to reduce turbinate size. A foot switch was used to operate the bipolar cautery. There was usually no need for packs (Figure 2).

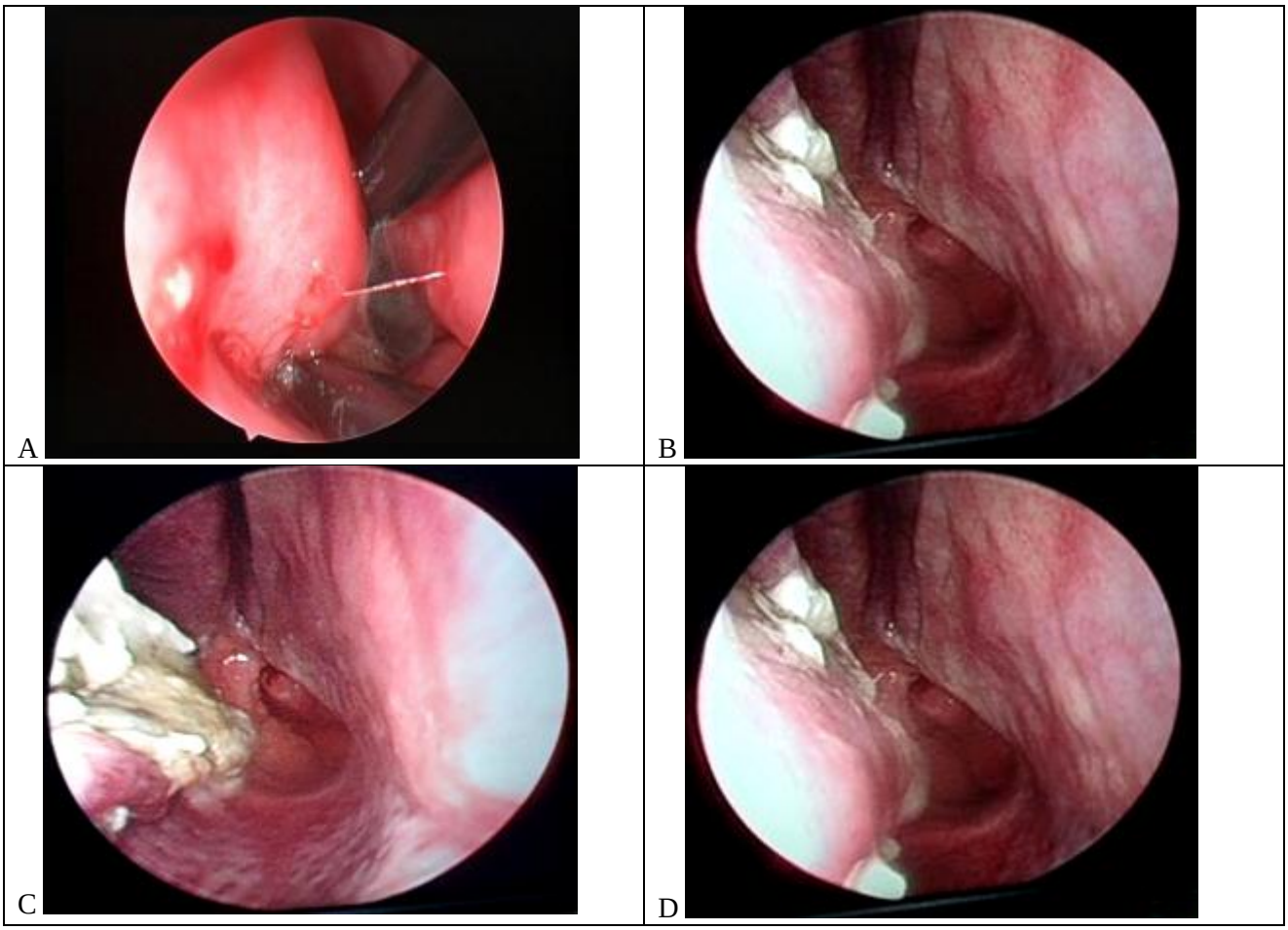


Fig. (2): Intra-operative view of bipolar electrocautery.,

Post-operative medication:

After 48 hours, the nasal packs were removed, and the patients continued with a week of oral antibiotics, analgesics, systemic decongestant, and local nasal decongestant. The next step was a two-month course of nasal saline irrigation following surgery.

Post-operative follow up:

Patients were seen in the Outpatient Department (OPD) once every three weeks following surgery for three months of follow-up. The symptoms (nasal blockage, allergic reactions, and runny nose) were meticulously documented using a visual analogue scale (VAS) during the follow-up appointment. Nostril endoscopy and methylene blue saccharine testing were performed at each appointment. Collecting and tabulating all of the results and findings were done.

Ethical approval:

The Research Ethical Committee of the Zagazig University Faculty of Medicine has given its clearance [reference number: ZU-IRB #6063/5-4-2020]. All patients who participated in the study provided written informed consent. This study complied with the World Medical Association's Declaration of Helsinki, which lays out the standards for research involving human subjects.

Statistical analysis

Data were codified, entered, and analyzed from medical history, basic clinical examination, laboratory tests, and outcome measures using Microsoft Excel. Data analysis was carried out using SPSS (Statistical Package for the Social Sciences) version 20.0. Qualitative data were presented as percentages and numbers and were compared by chi-square test (X^2), combined with either the McNemar. Continuous data were presented as means ± SD and were compared by independent t test and paired t test. A p-value of less than 0.05 was deemed significant.

RESULTS

Age was not significantly different between group I (endoscopic medial flap inferior turbinoplasty group) and group II (bipolar electrocautery group) (1).

Table (1): Demographic data distribution between studied groups

			Group I	Group II	T/ X^2	P
Age			**28.50±6.72**	**31.25±5.81**	**1.185**	**0.198**
Sex	**Female**	**N**	**7**	**5**		
		%	**58.3%**	**41.7%**		
	Male	**N**	**5**	**7**	**0.66**	**0.41**
		%	**41.7%**	**58.3%**		
Smoking	**No**	**N**	**8**	**8**		
		%	**66.7%**	**66.7%**		
	Yes	**N**	**4**	**4**	**0.00**	**1.0**
		%	**33.3%**	**33.3%**		
Total		**N**	**12**	**12**		
		%	**100.0%**	**100.0%**		

There was no significant difference between group I (endoscopic medial flap inferior turbinoplasty group) and group II (bipolar electrocautery group) regarding clinical characters. Operation time was significantly longer in group I than Group II (Table 2).

Table (2): Clinical characters distribution and operation time between studied groups

			Group		X^2	P
			Group I	**Group II**		
Nasal Obstruction	**Mild to Moderate**	**N**	**3**	**4**		
		%	**25.0%**	**33.3%**		
	Severe	**N**	**9**	**8**	**0.20**	**0.65**
		%	**75.0%**	**66.7%**		
Inferior turbinate hypertrophy	**Grade I (Mild)**	**N**	**2**	**1**		
		%	**16.7%**	**8.3%**		
	Grade II (Moderate)	**N**	**3**	**4**	**0.47**	**0.78**
		%	**25.0%**	**33.3%**		
	Grade III (Severe)	**N**	**7**	**7**		
		%	**58.3%**	**58.3%**		
Allergy association	**No**	**N**	**6**	**2**		
		%	**50.0%**	**16.7%**		
	Yes	**N**	**6**	**10**	**3.21**	**0.081**
		%	**50.0%**	**83.3%**		
Total		**N**	**12**	**12**		
		%	**100.0%**	**100.0%**		
			Group I	**Group I**	**t**	
Operation time			**53.33±7.48**	**32.08±4.50**	**8.42**	**<0.001***

*: Significant

There was no significant difference between groups regarding nasal obstruction VAS at pre-operative surgery and majority had severe nasal obstruction symptom but at 3rd month post-operative nasal obstruction VAS mean group I (endoscopic medial flap inferior turbinoplasty group) was significantly lower than group II. Both groups showed significantly decreased VAS mean; the decrease was more in group I (Table 3).

Table (3): VAS for distribution of nasal obstruction between preoperative and 3 months follow-up in studied groups

			Group I	Group II	T/ X^2	P
VAS pre-operative			**6.72±1.87**	**6.68±1.99**	**0.083**	**0.934**
VAS post-operative			**2.08±0.95**	**3.85±0.75**	**2.226**	**0.038***
Pre-operative VAS	**3-7**	**N**	**3**	**4**		
		%	**25.0%**	**33.3%**		
	8-10	**N**	**9**	**8**	**0.21**	**0.651**
		%	**75.0%**	**66.7%**		
Post-operative VAS	**0-2**	**N**	**11**	**9**		
		%	**91.7%**	**75.0%**		
	3-7	**N**	**1**	**3**	**1.52**	**0.23**
		%	**8.3%**	**25.0%**		
P			**0.0009****	**0.04***		

*: Significant

Regarding runny nose, no statistically significant difference was found preoperatively between both groups. However, in group II (the bipolar electrocautery group), the number of cases of runny nose significantly decreased after the operation (Table 4).

Table (4): Runny nose distribution pre and post management distribution between studied groups:

			Group		X^2	P
			Group I	Group II		
Pre-operative Runny nose	**No**	**N**	**4**	**5**		
		%	**33.3%**	**41.7%**		
	Yes	**N**	**8**	**7**	**0.17**	**0.67**
		%	**66.7%**	**58.3%**		
Post-operative Runny nose	**No**	**N**	**6**	**11**		
		%	**50.0%**	**91.7%**		
	Yes	**N**	**6**	**1**	**5.04**	**0.025***
		%	**50.0%**	**8.3%**		
P			**0.44**	**0.009***		

*: Significant

There was no significant difference regarding the post-operative MBST, between group I (endoscopic medial flap inferior turbinoplasty group) and group II (bipolar electrocautery group). Both groups significantly improved 3 months post-operatively, however group I was better than group II (Table 5).

Table (5): Methylene blue-colored saccharine test (MBST) distribution between studied groups:

			Group I	Group II	T/ X^2	P
MBST pre-operative			**21.12±3.85**	**21.69±4.96**	**0.458**	**0.712**
MBST post-operative			**14.08±4.02**	**18.58±3.11**	**2.658**	**0.005***
MBST pre-operative	**<20**	**N**	**2**	**3**		
		%	**27.8%**	**50.0%**		
	>20	**N**	**10**	**9**	**0.25**	**0.61**
		%	**72.2%**	**50.0%**		
MBST post-operative	**<20**	**N**	**11**	**8**		
		%	**91.7%**	**66.7%**		
	>20	**N**	**1**	**4**	**2.24**	**0.13**
		%	**8.3%**	**33.3%**		
P			**0.0002****	**0.04***		

*: Significant

Post-operative crusting and burning sensation were significantly better in group I compared to group II (Table 6).

Table (6): Comparing post-operative synechiae, crusting and burning sensation between the two studied groups:

Post-operative crusting			Group I	Group II	χ^2	p-value
After 1 week			8 (66.7%)	12 (100%)	15.96	0.003*
After 1 month			0.0 (0.00%)	7 (58.3%)		
After 3 months			0.0 (0.00%)	1 (8.3%)		
Burning sensation	No	N	11	7	3.55	0.05
		%	91.7%	58.3%		
	Yes	N	1	5		
		%	8.3%	41.7%		
Total		N	12	12		
		%	100.0%	100.0%		

*: Significant.

DISCUSSION

The ideal turbinate reduction procedure involves removing the non-functional, obstructive parts of the turbinate while keeping the physiological, medial part, which helps to warm and humidify the air that is being inspired and reduces the risk of problems like crusting and bleeding [(12)].

Lower turbinate hypertrophy can be treated surgically using a variety of methods, such as turbinectomy, turbinoplasty, electrocautery (both submucosal and extramucosal), radiofrequency ablation, laser-assisted resection or ablation, cryosurgery, and many more [(13)]. By removing the permanent obstruction and decreasing the impact of edematous mucosa, surgical intervention enhances the nasal airway's dynamic competence and alleviates symptoms [(14)].

The current study showed that age, sex and smoking did not differ significantly between both studied groups, which in agreement with the study of **Aboulwafa *et al.*** [(14)] who reported that, the distribution of ages and sexes did not differ significantly between the groups.

The current study showed that the nasal obstruction preoperatively did not differ significantly between both groups, which in agreement with the study of **Alzobir *et al.*** [(15)] who reported the same findings (Surgical turbinoplasty vs bipolar cauterization) regarding the degree of pre-operative nasal obstruction.

The current study showed that inferior turbinate hypertrophy did not differ significantly between both groups preoperatively and the most patients were in grade 2 and 3. Also, **Abdelhak *et al.*** [(16)] showed that in their study for scoring turbinate hypertrophy all of the patients were in the second or third grade before the operation.

The current study showed that regarding pre-operative associated allergic symptoms in endoscopic medial flap inferior turbinoplasty group there were 6 patients had allergy associated symptoms. In bipolar electrocautery group there were 10 patients had allergy associated symptoms.

The current study showed that operation time was significantly longer in the group I (53.33±7.48 min) than Group II (32.08±4.50 min), which in agreement with the study of **Alzobir *et al.*** [(15)], which found that the duration of the surgery varied significantly between the two groups (Surgical turbinoplasty vs. bipolar cauterization), with the former requiring more time.

Regarding subjective nasal obstruction, each patient included in the study used a ten-point visual analogue scale ranging from 0 to 10 (0-absent, 10-severe) to grade nasal obstruction pre and post-operative follow-up. The current study showed that there was no significant difference between groups as regard nasal obstruction VAS pre-operatively and majority had severe nasal obstruction symptom but after 3 months post-operatively nasal obstruction VAS mean in Group I (endoscopic medial flap inferior turbinoplasty group) was significantly lower than group II and both groups significantly had decreased VAS mean but the decrease was more in Group I, which in agreement with the study of **Alzobir *et al.*** [(15)], **Abdelhak *et al.*** [(16)] and **Cavaliere *et al.*** [(17)]. **Alzobir *et al.*** [(15)] reported that both groups demonstrated a marked improvement in nasal obstruction following surgery, while the turbinoplasty group demonstrated a more pronounced improvement.

El-Gamalah *et al.* [(18)] reported that, satisfaction of patients with hypertrophied inferior turbinate in bipolar electrocautery group was reported by VAS preoperatively, which decreased after 3 months post-operatively.

The current study showed no significant difference between groups as regard runny nose at pre-operative time but at post-operative Group II was significantly lower and there was no significant change at group I, but Group II significantly improved, which in

agreement with the study of **Alzobir *et al.* [15]**, which reported that concerning the comparison of post-operative rhinorrhea between the two groups, it was shown that the bipolar electrocautery group had a statistically significant decrease in rhinorrhea, whereas the turbinoplasty group did not. In contrast **Mori *et al.* [19]** discovered that submucosal excision had a good effect on rhinorrhea symptoms, as well as the ability to breathe more easily via the nose.

The current study showed that methylene blue-colored saccharine test (MBST) results did not differ significantly between both groups, while Group I was better than Group II and both groups significantly improved, which in agreement with the study of **Mohamed *et al.* [11],** which reported that in bipolar diathermy group, MBST test improved in time at the third month (more than the pre-operative time) in 9 patients (42.86%), also in diode laser turbinate reduction surgery MBST test was improved in time at the third month in 90.5% of patients. Also, **Salzano *et al.* [20]** showed that in electrocautery group, the post-operative saccharin transport time (STT) in electrocautery group improved after 3 months.

Group I (endoscopic medial flap inferior turbinoplasty) had better outcomes than group II (no changes in burning sensation after surgery), according to the present study. In contrast**, Alzobir *et al.* [15]** reported that the bipolar cauterization group fared better in terms of post-operative burning sensation compared to the other group.

In this study, we found no statistically significant difference in the number of synechiae experienced by the two groups following surgery. After three months, there were no synechiae in either group. This finding is in line with that of **Alzobir *et al.* [15]** who found no statistically significant difference in post-operative synechiae between the two groups they studied. But in contrast, **Passàli *et al.* [21]** reported that statistically, the electrocautery group had a significantly higher rate of post-operative synechiae development compared to the endoscopic medial flap inferior turbinoplasty group.

El-Gamalah *et al.* [18] reported that post-operative synechiae observed in the first week in 30% of patients and disappeared after management of it.

Statistical analysis revealed that Group I (the endoscopic medial flap inferior turbinoplasty group) had significantly less crusting after surgery compared to Group II (the control group). While crusting persisted for 1 to 3 months in the bipolar electrocautery group, 66.7% of patients in the turbinoplasty group noted it by the end of the first week and 0% by the end of the first month. This is in agreement with the study of **Alzobir *et al.* [15]** who reported the results showed that the turbinoplasty group had much less crusting after surgery compared to the other group. At the conclusion of the first month, no patients in the turbinoplasty group had crusts, whereas those in the surface bipolar cauterization group had crusts that lasted for one to three months. According to their report, the existence of crusting in the early post-operative period explains the slower healing, and the improvement becomes visible after the crusts disappear completely. This was in accordance with **Ragab *et al.* [22]** while comparing results one week after surgery. Following turbinoplasty, crustations showed a marked improvement. Also, keep in mind that there may be a latency time for fibrosis after cauterization reduces the size of the inferior turbinate. Similarly, **Cavaliere et al [17]** reported that, the surgical turbinoplasty group also saw identical outcomes after one week, with crusts fully gone by the end of the first month. Additionally, a same outcome was observed in the post-operative data collected by **Ragab *et al.* [22].** In addition, **Sabaaa *et al.* [23]** found that crusts were less common in the inferior turbinoplasty group compared to the bipolar cautery group after 3 months.

CONCLUSIONS

One effective and relatively risk-free approach to turbinate reduction is the medial flap inferior turbinoplasty. With little to no danger of complications, this technically simple surgery alleviates obstructive problems for good. In contrast to bipolar electrocautery, a procedure that involves removing bone and lateral mucosa while carefully reducing the medial mucosa reduces the likelihood that the turbinate may re-expand over time.

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