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Comparison between Submucous Bipolar Diathermy versus Coblation in Improving Nasal Obstruction and Post Operative Crustations After Turbinoplasty

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Abstract

Background: **Nasal blockage is a very common presentation among patients visiting ENT clinics; inferior turbinates' hypertrophy is a very common cause. The inferior turbinate is composed of three layers: bone, submucosal tissue, and mucosa. Understanding the contributing component of the inferior turbinate hypertrophy is vital for deciding the type of inferior turbinate surgery, hence a CT scan is useful for this purpose.** ***Aim:*** **To compare the effect of submucous bipolar diathermy versus coblation for reduction of hypertrophied inferior turbinate under GA in terms of improvement of nasal obstruction and post operative crustations.** ***Methods:*** **The study was conducted as a randomized controlled prospective study following approval of our institutional research board. The study was carried out at the department of otorhinolaryngology, Suez Canal University hospital (SCUH), Ismailia, Egypt. The participants were recruitted into two groups: Group A: submucous bipolar diathermy group (n= 24) and Group B: coblation group (n= 24).** ***Results:*** **The mean age was 27.9± 9.1 years and 29.3± 7.8 years among groups A and B respectively. Females represented 62.5% and 58.3% among both A and B respectively. The mean BMI was 25.3± 1.3 and 25.8± 0.9 Kg/m^2 among both A and B respectively. In preoperative assessment, all patients showed normal ear and oropharyngeal examination. All participants were G3 in Friedmann grading system. The mean VAS was 9.0 ± 0.8 in both groups. No significant difference was found between the two groups regarding preoperative assessment. After two weeks, there was no difference between the two groups regarding VAS and Friedmann grading system. After two months, a difference was not found between both groups regarding VAS and Friedmann grading system. A significant improvement of VAS score in both groups was found. The VAS 2 weeks postoperative was lower than preoperative with statistical difference in both groups. In addition to that VAS two months postoperative was significantly lower than preoperative in both groups.** ***Conclusion:*** **There was no difference between bipolar diathermy and coblation in terms of postoperative pain or Friedman grading. However, coblation proved to be both safe and effective in comparison to submucosal diathermy.**

Keywords: Diathermy, coblation, nasal obstruction, turpinoplasty

Introduction

Most of patients with nasal blockage in otolaryngology clinics suffer from a condition called inferior turbinate hypertrophy (ITH) [(1)]. Although many factors, such as vasomotor rhinitis, allergic rhinitis, septal deviation, chronic or recurring nasal infections, cigarette smoking, and polluted air, have been linked to turbinate hypertrophy, in most patients, the condition is considered idiopathic because no definite cause can be determined [(2)].

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The inferior turbinates (ITs) consist of bone, submucosal tissue, and mucosa. Understanding the contributing component of the ITH is vital for deciding the type of inferior turbinate surgery, hence a CT scan is useful for this purpose. Whether it is predominantly bone, mucosal hypertrophy, or a mixture of the two should be determined. Concha bullosa of the ITs, a benign tumor called fibrous dysplasia, and other abnormalities of the inferior turbinates can all be evaluated by CT. It is very important to evaluate the inferior turbinate's angle with the lateral bone and its connection on a CT scan. This angle is significant since a simple out fracture will only result in the fracture of the descending part of the inferior turbinate and the symptoms will reoccur a few months later if the angle is 90 degrees, or at the right angle to the lateral nasal wall. The inferior turbinates play a crucial role in controlling nasal airflow and maintaining healthy breathing. In terms of nasal physiology, the anterior portion of the ITs is important [3].

Treatment of enlarged turbinates typically begins with medication, including antihistamines (H1 antagonists), intranasal steroid sprays, and oral and topical nasal decongestants (leukotriene receptor antagonist). When other treatments have failed, surgery is the next option [4].

Several options for surgical treatment of enlarged inferior turbinates have been identified. Coblation, conventional diathermy and radiofrequency tissue reduction are all examples of submucosal electrosurgical methods that can be used for turbinate reduction. Different electrosurgical procedures use different methods for controlling and delivering the radiofrequency electricity used to destroy turbinate tissue. The general physiology of the nose is better protected when submucosal procedures are used [5].

Procedures for inferior turbinate reduction like bipolar diathermy & coblation are easily performed, usually successful & have a high level of patient satisfaction. So, this study was conducted to compare the effect of submucous bipolar diathermy versus coblation for reduction of hypertrophied inferior turbinate under GA in terms of improvement of nasal obstruction and post operative crustations.

Methods:

The study was conducted as a randomized controlled prospective study following approval of our institutional research board. The current study was carried out at the department of otorhinolaryngology, Suez Canal University hospital (SCUH), Ismailia, Egypt.

Adults presenting to the ENT clinic at SCUH complaining from nasal obstruction with bilateral hypertrophied inferior turbinate refractory to medical therapy. Patients aged 18 years or older, both genders, complaining from nasal obstruction with bilateral hypertrophied inferior turbinate and had no improvement after 1 month of medical treatment were included.

Severely deviated nasal septum, who had associated nasal pathology as nasal polyps or adenoid, any patient suffering from medical condition contraindicating general anesthesia or had large bony component of the inferior turbinates in CT scan were excluded.

Sampling Method: Randomized systematic sampling method. Each patient in the turbinoplasty list was assigned a number. Patients with odd numbers were assigned to submucus diathermy group and patients with even numbers were assigned to coblation group.

Randomization: simple randomization method using computer generated random tables.

Sample size [6]**:**

The sample size was determined using the following equation:

$$n = 2\left[\frac{(Z_{\alpha/2}+Z_{\beta})*\sigma}{\mu_1-\mu_2}\right]^2$$

n =The required sample size

$Z_{\alpha/2}$= 1.96 at 95% of the Z distribution from the 5% in the tail

Z_{β} =0.8 at 20% of the Z distribution from the upper 80%.

σ =The estimate of nasal obstruction among patients who underwent submucosal diathermy with inferior turbinate hypertrophy = 0.69 points [1]

$\mu_{1=}$ mean nasal obstruction score among patients who underwent submucosal diathermy with inferior turbinate hypertrophy = 1.77 points [1]

$\mu_{2=}$ mean nasal obstruction score among patients who underwent coblation with inferior turbinate hypertrophy = 1.20 points [1].

Therefore, the calculated sample size was 22 subjects; however, after adding the expected (drop-out) rate (10%), the final sample size was **24 subjects per group.**

Methods for data collection:

- All patients were asked to sign an informed consent form before any procedure.

I. Pre-operative Assessment:

- **Complete history taking that include:** History of previous nasal surgeries, chronic diseases, Allergies to any medications. History of hospitalization or previous operations and associated anesthetic complications. Drug history and any special habits of medical importance.
- **Complete ENT Physical examination that includes** Complete nasal examination by anterior rhinoscopy and endoscopic nasal examination to assess the hypertrophied inferior turbinates.
- **(Friedman grading system of inferior turbinate hypertrophy):**

Grade I: the turbinate was defined as mild enlargement with no obvious obstruction.

Grade II: the turbinate was in between grade I & grade III.

Grade III: the turbinate completely occluded the nasal cavity.

A visual analogue scale (VAS): psychometric measurement instrument widely used in the rhinology field & beyond to subjectively quantify patients' symptoms severity, it represents a horizontal line of 10 cm with word anchors at each end representing the extreme feelings. Patients are instructed to indicate the point on the line that best corresponds to their status for the particular characteristic being evaluated. In addition to its high sensitivity, reliability & reproducibility, VAS is easy & simple to use by patients & health care providers.

0: represents no nasal obstruction.

10: represents complete nasal obstruction.

Investigations:

Routine preoperative investigations (CBC, Coagulation profile).

Preoperative CT scan nose and paranasal sinus.

II. Intraoperative measures

Procedures are done in our operative theater by two senior surgeons from our department. Procedures were done under general anesthesia using a 4mm nasal endoscope. The patient is positioned supine with 30° of head elevation.

In the diathermy group: bipolar Elmed Dennis turbinate probe was used at 20w at 3 entry points in each (IT) each 10 sec [7].

In coblation group using (reflex ultra 45 coblator) at 2 entry point in each (IT) each 10 sec [8].

III. Post-operative care:

The patient was discharged after one hour of the procedure, saline wash is prescribed for one week without any systemic antibiotics.

Ethical consideration:

An informed consent was obtained from all patients or their guardians before taking any data.and ethical clearance was obtained from Medical research committee at faculty of Medicine Suez Canal University.

Statistical analysis

Statistical Package for the Social Sciences known as SPSS version 26 was used to conduct statistical analyses on the acquired data. The Kolmogorov Smirnov test was used to determine if the data followed a normal distribution. Data was provided as tables and graphs when applicable. Frequencies and relative percentages were used to depict the qualitative data. The observed differences between qualitative variables were determined using the Chi square test and the Fisher exact test. The mean and standard deviation were used to represent numerical information. Parametric and non-parametric quantitative variables were compared using the Student t or the Mann Whitney tests, respectively. When comparing quantitative variables within the same group, a Friedmann two-way analysis is performed to determine significance. Statistical significance is indicated when the P value is less than 0.05; else, it is considered to be nonexistent.

Results:

This a prospective cohort study conducted to compare the effect of submucous bipolar diathermy vs. coblation for reduction of hypertrophied inferior turbinate as office-based procedures in terms of post-operative crustations, post-operative improvement of nasal obstruction, intra & post-operative bleeding. Both techniques are mucosal preservation.

The participants were divided into two groups:

Group A: submucous bipolar diathermy group (n= 24).

Group B: coblation group (n= 24).

The mean age was 27.9± 9.1 years and 29.3± 7.8 years among groups A and B respectively. Females represented 62.5% and 58.3% among groups A and B respectively. The mean BMI was 25.3± 1.3 and 25.8± 0.9 Kg/m^2 while the median was 25.7 and 25.8 Kg/m^2 among both A and B respectively. There were 20.8% and 16.7% had chronic illnesses among groups A and B respectively. No significant difference was found between both groups regarding basic characteristics (Table 1).

Table 1. Basic characteristics among the two studied groups.

Variable		Group A n=24	Group B n=24	P value
Age (years)	Mean ± SD	27.9± 9.1	29.3± 7.8	0.568
Gender	Male, n (%)	9 (37.5)	10 (41.7)	>0.999
	Female, n (%)	15 (62.5)	14 (58.3)	
BMI (Kg/m^2)	Mean ± SD	25.3± 1.3	25.8± 0.9	0.292
	Median (range)	25.7 (21.5, 27.9)	25.8 (23.9, 28)	
Chronic illness	No, n (%)	19 (79.2)	20 (83.3)	>0.999
	Yes, n (%)	5 (20.8)	4 (16.7)	

*Student t test, Fisher Exact test, Mann Whitney U test, Chi-square test, *p is significant at <0.05*
BMI; Body Mass Index

SBP was 123.3± 6.9 and 120.6± 2.2 mmHg, DBP was 80.6± 2.2 and 80± 0 mmHg among groups A and B respectively. The mean HR was 84.0± 6.5 and 80.2± 6.3 beats/ minute, while RR was 14.0± 1.2 and 13.9± 1.4 breath/ minute among groups A and B respectively. The temperature was 36.8± 0.2 for both groups. No significant difference was found between the two studied groups (Table 2).

Table 2. Clinical data among the two studied groups.				
Variable		Group A n=24	Group B n=24	P value
SBP (mmHg)	Mean ± SD	123.3± 6.9	120.6± 2.2	0.058
	Median (range)	120 (120, 150)	120 (120, 130)	
DBP (mmHg)	Mean ± SD	80.6± 2.2	80± 0	0.153
	Median (range)	80 (80, 90)	80 (80, 80)	
HR (beat/minute)	Mean ± SD	84.0± 6.5	80.2± 6.3	0.056
	Median (range)	85 (70, 94)	80 (70, 92)	
RR (breath/minute)	Mean ± SD	14.0± 1.2	13.9± 1.4	0.726
	Median (range)	14.0 (12, 16)	14 (12, 16)	
Temperature (°C)	Mean ± SD	36.8± 0.2	36.8± 0.2	0.658
	Median (range)	36.8 (36.5, 37)	36.8 (36.4, 37)	
SBP; Systolic Blood Pressure, DBP; Diastolic Blood Pressure, HR; Heart rate, RR; Respiratory rate *Mann Whitney U test, Student t test, *p is significant at <0.05*				

In preoperative assessment, all patients showed normal ear and oropharyngeal examination. All participants were G3 in Friedmann grading system. The mean VAS was 9.0 ± 0.8 in both groups. No significant difference was found between the two groups regarding preoperative assessment (Table 3).

Table 3. Preoperative assessment among the two studied groups.				
Variable		Group A n=24	Group B n=24	P value
VAS	Mean ± SD	9.0 ± 0.8	9.0 ± 0.8	>0.999
	Median (range)	9 (8, 10)	9 (8, 10)	
Mann Whitney U test , *p is significant at <0.05 VAS; Visual Analogue scale				

After two weeks, there was no difference between A and B regarding VAS and Friedmann grading system (Table 4).

After two months, there was no difference between A and B regarding VAS and Friedmann grading system (Table 5).

There was significant improvement in VAS score in both groups. The VAS 2 weeks postoperative was significantly lower than preoperative in both groups. In addition to that VAS two months postoperative was significantly lower than preoperative in both groups (Table 6).

Table 4. Postoperative assessment (after two weeks) among the two studied groups.				
Variable		Group A n=24	Group B n=24	P value
VAS	Mean ± SD	3.3 ± 2.2	2.6 ± 1.8	>0.999
	Median (range)	2.5 (1, 7)	2 (1, 7)	
Friedmann grading	G1, NO (%)	19 (79.2)	20 (83.3)	>0.999
	G2, NO (%)	5 (20.8)	4 (16.7)	
*Mann Whitney U test , Fisher Exact test, *p is significant at <0.05* VAS; Visual Analogue scale				

Table 5. Postoperative assessment (after two months) among the two studied groups.				
Variable		Group A n=24	Group B n=24	P value
VAS	Mean ± SD	3.7 ± 2.8	2.8 ± 2.1	0.249
	Median (range)	2.5 (1, 8)	2 (1, 7)	
Friedmann grading	G1, NO (%)	17 (70.8)	21 (87.5)	0.345
	G2, NO (%)	1 (4.2)	1 (4.2)	
	G3, NO (%)	6 (25)	2 (8.3)	
*Mann Whitney U test, Fisher Exact test, *p is significant at <0.05* *VAS; Visual Analogue scale*				

Table 6. Comparing preoperative and postoperative VAS among the two studied groups.			
Variable		Group A n=24	Group B n=24
Preoperative VAS	Mean ± SD	9.0 ± 0.8	9.0 ± 0.8
	Median (range)	9 (8, 10)	9 (8, 10)
VAS after two weeks	Mean ± SD	3.3 ± 2.2#	2.6 ± 1.8#
	Median (range)	2.5 (1, 7)	2 (1, 7)
VAS after two months	Mean ± SD	3.7 ± 2.8#	2.8 ± 2.1#
	Median (range)	2.5 (1, 8)	2 (1, 7)
P value		<0.001*	<0.001*
*Friedmann two-way test, *p is significant at <0.05* *Bonferroni test, # significant difference with preoperative VAS*			

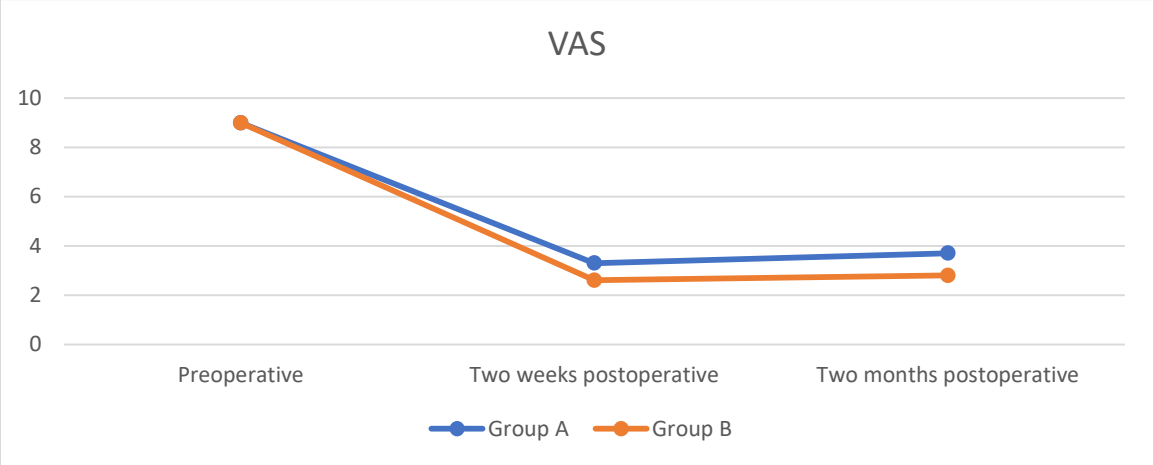

Figure 1. Comparing preoperative and postoperative VAS score between the two studied groups.

Discussion

Despite being overshadowed by nasal septal deviation, ITH is a very common cause of persistent nasal obstruction. As 30 million Americans suffer from chronic allergy or vasomotor rhinitis, a condition often related with ITH [9].

Traditionally, decongestants, topical corticosteroids, immunotherapy and antihistamines have been used to treat

these disorders. However, these methods typically only produce marginal improvements, thus surgery to reduce the ITs may be chosen as the most efficient method of treating this condition [10].

The bone in addition to mucosal components of the turbinate hypertrophy can be addressed during inferior turbinectomy surgery, however only the mucosal component is addressed by medication [9].

In otolaryngology, coblation stands out as a novel approach to treating soft tissue with radio frequency energy. When radio waves are applied in a bipolar configuration to a conductive solution like salt water, the ions in the solution gain energy and produce a miniature plasma field. When tissue is removed, the patient has less pain and heals more quickly due to the reduced thermal effect [11].

By generating a radiofrequency current in plasma field between bipolar electrodes, soft tissue can be removed by the coblation procedure. Some of the tissue after that has been vaporized, the thermal lesion will remain and worsen, resulting in further attenuation and rigidity of the soft tissues. Since this technique only reduces soft tissue volumes, which is not suitable for patients whose turbinate hypertrophy is predominately bony; instead, these patients may be suitable for traditional submucous turbinate excision [12].

Submucosal diathermy (SMD) of the ITs is a common technique that gained popularity in the late 1980s [13], Despite the fact that reports of its use date back to 1907 [14]. Shrinkage of the turbinates' soft tissues is attributed to fibrosis, which in turn is thought to have been triggered by the coagulative current [13, 15]. Healing and normal mucosal function are typically quickly restored after using the SMD method. SMD is preferred by surgeons as the therapy of choice due of the low risk of consequences [11].

High danger of nearby tissue loss due to the high temperature generated by electric diathermy increases the likelihood of postoperative crusting and nasal synechiae [16].

This a prospective cohort study conducted to compare the effect of submucous bipolar diathermy versus coblation for reduction of hypertrophied inferior turbinate as office-based procedures in terms of post-operative crustations, post-operative improvement of nasal obstruction, intra & post-operative bleeding. Both techniques are mucosal preservation.

The mean age of the participants in the current study was 27.9± 9.1 years and 29.3± 7.8 years among diathermy and coblation respectively. Females represented 62.5% and 58.3% among diathermy and coblation respectively. The mean BMI was 25.3± 1.3 and 25.8± 0.9 Kg/m^2 while the median was 25.7 and 25.8 Kg/m^2 among diathermy and coblation respectively. There were 20.8% and 16.7% had chronic illnesses among diathermy and coblation respectively. No difference was found between the participated groups regarding basic characteristics.

In Attia and other colleagues' study, there were a total of 80 patients, split evenly between two groups. In group I, 40 patients had inferior turbinate coblation; there were 12 women and 28 men (mean age, 31.4 5.71SD). Twenty-one (52.5%) males and nineteen females (47.5%) with a mean age of 30.23± (5.64) years were included in Group II, which received submucosal diathermy of the IT [17].

In Gindros study, objectives compared submucosal monopolar inferior turbinate

cauterization to radiofrequency cold coblation for turbinate reduction. Their sample size of 60 patients had a mean age of 32.2 (±11.1) which range from 35 years to 65 years; twenty-eight were females (46.7%) with mean age 31.3 (±12.8) and thirty-two were males (53.3%) with mean age 33.4 (±10.2) years [18].

While The purpose of the Tantawy study was to examine the efficacy of surface bipolar electrocautery against radiofrequency coblation for the treatment of hypertrophy of the inferior turbinates. Thirty-four individuals were analyzed, with a mean age of 28.78.7 years, 70.6% being female, and 29.4% being male [19].

However, 27 individuals were included in the study by Unsal et al., whose mean age was 32.16± 10.48. (range 20-59). There were 21 males and 6 women (77.8 percent) [20].

To determine whether or not submucosal diathermy and coblation are effective for treating hypertrophied inferior turbinates, Salem et al conducted a study. Thirty adults were studied, all of whom had bilateral enlargement of the inferior turbinates and were treated with submucosal diathermy on the right side and coblation on the left. There were a total of 29 people, with a mean age of 29 (ranging from 16 to 41 years old). There were 21 males (70%) and 9 females (30%) [1].

According to Sharmila dhulipalla (2014) [4], the majority of her instances occurred in people between the ages of 20 and 40. The Prinja research [12] found that the highest age incidence occurred in those between the ages of 21 and 30 (42%), followed by 26% in those between the ages of 31 and 40. (63.33 percent) and maximum number of cases were found by Shaib khan et al in age group seventeen to thirty-five years [21].

Prinja's review **(12)** found that men outnumbered women by a margin of 74 to 26, which is in line with the results from the studies conducted by Businco et al. (67% males and 33% females) and Sajad Alhelo (71.88% males and 28.13% females)[22, 23].

Regarding VAS score, in the present study diathermy showed higher VAS than coblation but there was no difference between diathermy and coblation groups as after two weeks, after two months (3.3 ± 2.2 vs. 2.6 ± 1.8; 3.7 ± 2.8 vs. 2.8 ± 2.1).

Consistent with our findings, Gindros found that 1-day postoperative VAS scores for pain were lowest in the coblation group (mean 0.93± 0.73) compared to the diathermy group (mean 1.33± 1.15) but that this difference was not statistically significant ($p = 0.11$) [18].

To add to that, a systematic review and meta-analysis agreed that there was no difference between coblation and SMD [9].

Coblation inferior turbinate reduction for turbinal hypertrophy was found to be a safe and efficient treatment by Bhattacharyya et al. Significant improvement in nasal blockage was noted after 3 months. Six months later, these declines remained statistically significant and were even more pronounced [24].

Two weeks and three months following inferior turbinate coblation, nasal obstruction scores on visual analogue measures considerably decreased, as demonstrated by research from Farmer et al [25].

Roje et al. found that after treating patients' nasal breathing, the patients' VAS scores decreased from a median of 7 to 1 [26].

Radiofrequency coblation, according to the research of Shah et al., was substantially less painful than bipolar cautery both during the surgery and in the immediate postoperative period (P = 0.03) [27].

In disagreement, compared to bipolar cautery, the discomfort experienced during and after coblation was shown to be significantly lower by Salem et al. Based on the Guttman pain scale, they discovered that after coblation, 26 patients (86.7% were pain-free) and only 4 patients (13.3%) reported grade I pain, while after diathermy, 19 patients (63.3% were pain-free) and 11 patients (36.7% were grade I) [1].

Controversy, according to studies by Cavaliere et al. [28], coblation is painless. This might be because the high temperature of cautery, in comparison to coblation, poses a greater risk of collateral injury to the surrounding tissues.

In the current study, there was significant improvement in VAS score in both groups. The VAS 2 weeks postoperative was significantly lower than preoperative in both groups. In addition to that VAS two months postoperative was significantly lower than preoperative in both groups.

Tantawy also found a correlation between the VAS grade before and after radiofrequency coblation for the treatment of inferior turbinate hypertrophy, with 12 cases (35.3% VAS grade 2) and 22 instances (64.7% VAS grade 3) experiencing symptoms. After the intervention, 34 of the cases (94%) were classified as VAS grade 1, while just 2 patients (5.7%) were classified as VAS grade 2, a statistically significant decrease. The VAS grades before and after surface bipolar cauterization of the hypertrophic side of the inferior turbinates showed that 14 patients (41.2% of the total) had VAS grades 2 and 20 patients (58.8% of the total) had VAS grades 3. Post-intervention, 23 patients (73.5% of the total) had a VAS grade of 1 or 2, while 9 patients (26.5% of the total) had a VAS grade of 2 or higher [19].

Unsal et al investigation's corroborated our findings by showing that there were indeed substantial variations between pre- and post-ablation outcomes. Visual analogue scale (VAS) scores decreased after ablation, and this improvement was statistically significant compared to the VAS scores obtained before treatment [20]. The findings were corroborated by research by Uluyol et al., who found that the median VAS score for nasal patency was 7.1± 1.13 before bipolar cauterization and 3.4± 1.0 two months after treatment (p, 0.001). They also concurred that both radiofrequency thermal ablation and bipolar electrocautery led to statistically significant improvements in VAS scores between pre- and post-operative evaluations [29].

Additionally, Shah et al [27] agreed that there was significant improvement in diathermy and coblation groups regarding VAS score. All patients showed considerable improvement in nasal breathing as measured by VAS scale, similar to the findings described by Casale et al [30]. Also, Zhang and others agreed that both cauterization and diathermy showed significant improvement than preoperative [9].

This study had limitation as that we did not evaluate the risk factors that affect the surgical outcomes of hypertrophied inferior turbinates.

Conclusion

It was suggested that both techniques diathermy and cauterization have proven

to be equally effective with no difference between them regarding postoperative pain and Friedman grading. Coblation is considered effective and safe compared to submucosal diathermy.

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