Endoscopic score: a new method for evaluating different inferior turbinate reduction techniques

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Background
Nasal airway obstruction is a common complaint faced in otorhinolaryngology, which may significantly impair the patients' quality of life. Inferior turbinate hypertrophy is one of the main causes of chronic nasal obstruction, and different surgical techniques have been described for its reduction.

Aim
This study compared three different inferior turbinate reduction techniques using a new objective method in addition to a subjective one.

Materials and methods
A randomized controlled trial was carried out on 45 patients with hypertrophied inferior turbinates, who were randomly divided into three equal groups: group A underwent partial inferior turbinectomy, group B was subjected to inferior turbinate bipolar surface cautery, and group C underwent inferior turbinoplasty. Assessment was done preoperatively and postoperatively at 2 weeks, 1 month, and 3 months using total nasal symptom score (TNSS) and endoscopic score.

Results
All groups had significant improvements in the TNSS and endoscopic score when compared with baseline data. TNSS mean for all groups declined from 5 to 3 at 3 months after surgery, with *P* values less than 0.001. Most of the cases of group A (87%), group B (60%), and group C (93%) had an endoscopic score of 0, with nasal airways greater than 6 mm at 3 months after surgery.

Conclusion
Partial turbinectomy, bipolar cauterization, and turbinoplasty techniques for the inferior turbinate reduction are comparable and effective regarding improvement of the obstructive as well as the nonobstructive nasal symptoms. Endoscopic score is a helpful tool for easy, rapid, and objective assessment of the nasal airway.

Keywords:
endoscopic score, nasal airway, partial turbinectomy, quality of life after turbinectomy, turbinate reduction, turbinate cauterization, turbinoplasty

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Introduction

Nasal airway obstruction is a common complaint faced in otolaryngology, which can affect significantly the individual's quality of life. Its prevalence is 26.7% in urban centers [1]. An estimate $5 billion is spent annually on medications to treat nasal obstruction. Moreover, surgical remedies account for at least $60 million [2].

Inferior turbinate hypertrophy is one of the main causes of chronic nasal obstruction [3–5]. Initially, medical treatment can be used such as nasal decongestant drops with antihistamines, as well as topical and systemic steroids. However, the prolonged use of nasal decongestants is discouraged as it usually leads to damage of the nasal mucosa. Ultimately, surgical intervention is incited in cases of medical treatment failure [6].

Different surgical techniques have been described for inferior turbinate reduction. At the beginning of the 20th century, many surgeons advocated total turbinectomy. Nevertheless, rhinologists soon shifted away from total and near-total turbinate resections because of the excessive bleeding, postoperative crusting, and the dreads of developing atrophic rhinitis. Partial turbinate reduction techniques gradually gained popularity among surgeons over the following years driven by the availability of newer technologies [7].

Most of the techniques have satisfactory results, yet no technique is perfect, and each is associated with short- and long-term effects [8].

This study is a supplement to the already existing literature. Furthermore, it compared three different techniques using a new objective method in addition to a subjective one.

Materials and methods

This study was a double-blinded randomized controlled trial carried out from January 2018 till August 2018 in a Tertiary Care Hospital, after approval of the Ethical Committee. All patients were consented. All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study

A total of 45 patients were randomly divided using sealed envelopes into three groups: A, B, and C (1: 1: 1 allocation). Group A included 15 patients who underwent partial inferior turbinectomy, group B included 15 patients who were subjected to inferior turbinate bipolar surface cautery, and group C included 15 patients who underwent inferior turbinoplasty.

All patients recruited were diagnosed with bilateral hypertrophied inferior turbinates, were above the age of 15 years, had persistent nasal obstruction not improving with previous attempt of medical therapy including mometasone furoate 50 μg nasal spray two puffs per nostril, twice daily for 1 month, and desloratadine 5 mg once daily for 14 days. Patients with unilateral inferior turbinate hypertrophy, marked septal deviations, sinonasal polyps, tumors, or a history of previous nasal surgery were excluded.

All patients were subjected to subjective and objective preoperative assessment protocol by a surgeon who was blinded to the patient groups.

Subjective symptoms score (total nasal symptom score)

A subjective disease-severity rating method was used to evaluate the clinical severity of the disease. Patients' symptoms were evaluated based on a questionnaire assessing nasal congestion, runny nose, sneezing, and nasal itching.

The severity of each individual symptom was assessed with the following score: 0 = no symptoms, 1 = mild symptoms (steady symptoms but easily tolerated), 2 = moderate symptoms (awareness of symptoms, bothersome but tolerable), and 3 = severe symptoms (symptoms are hard to tolerate and interfere with the daily activities). The sum of the nasal symptom scores provides the total nasal symptom score (TNSS) (maximum of 12).

Objective score (endoscopic score)

The following scoring system was proposed by the authors to evaluate the nasal airway as an indirect reflection of the turbinate hypertrophy. Each side of the nose was evaluated separately, and the average of the two sides was taken. Patients were assessed without using topical/systemic decongestants (to reflect its common-daytime size). Assessment of the distance between the lower end of the nasal septum and the anteroinferior end of the inferior turbinate was done using 0° rigid nasal endoscopes (4 and/or 6 mm) and/or a premeasured 1 mm cotton-tipped probe (Fig. 1).

Grade 0 = nasal airway greater than 6 mm (easy passage of the 6-mm-sized endoscope).

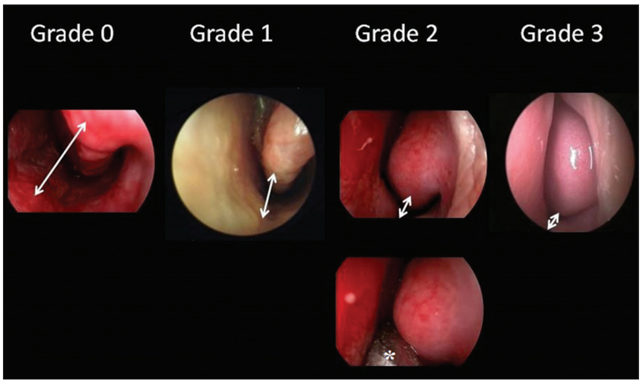
Grade 1 = nasal airway 4–6 mm (easy passage of the 4-mm-sized endoscope but limited for the 6-mm-sized endoscope).

Grade 2 = nasal airway 1–3 mm (limited passage of the 4-mm-sized endoscope).

Grade 3 = nasal airway less than 1 mm (smaller than a premeasured 1-mm cotton-tipped probe).

Postoperatively, no medications were prescribed apart from amoxicillin-clavulanic acid 1 g every 12 h for one week and paracetamol 500 mg when necessary. All patients were followed in the outpatient clinic at 2 weeks, 1 month, and 3 months by the same surgeon responsible for the preoperative assessment, who was kept blinded to the performed operation. Subjective and objective assessments were done using the TNSS and the endoscopic score, respectively.

Figure 1



Endoscopic scoring of the left nasal airway. Asterisk: 4-mm 0° rigid nasal endoscope inserted and photographed for demonstration, in grade 2 scored left nasal airway.

Surgical procedures

All procedures were done by one surgeon, not the assessor, under general anesthesia with the patients in supine position and with a slight head elevation. Nasal cavity was packed with nasal packs soaked with mixture of saline epinephrine solution (1: 50 000 concentration). Turbinates were infiltrated with mixture of saline epinephrine solution (1: 200 000 concentration). All surgical steps were done using a 4 mm (0°) rigid nasal endoscope.

In group A, partial inferior turbinectomy was done using Haymann nasal scissors for partial resection of the inferior portion of the inferior turbinate (Fig. 2).

In group B, bipolar surface cautery was done by applying surface coagulation (15 W) to the inferior turbinate from posterior to anterior direction. Single or multiple passes were used according to the amount of reduction needed (Fig. 2).

In group C, inferior turbinoplasty was done by making an incision at the inferior margin of the inferior turbinate with partial extension to its head, using a scalpel blade (size 15). Mucosal flaps were elevated using a dissector, and a part of the turbinate (bone and parenchyma) was resected. Finally, the mucosal flaps were redropped (Fig. 2).

At the end of the surgery, nasal airways were easily admitting the 4 mm rigid nasal endoscope. Hemostasis was done with nasal packs inserted into nasal passages for 48 h.

Statistical analysis

Data management and statistical analysis were performed using Statistics/Data Analysis (Stata) version 14.2.

Numerical data were summarized using mean and SD (StataCorp - Texas - USA). Categorical data were summarized as count and percentages. Comparison among the three groups was done using one-way analysis of variance. Pairwise differences were detected by paired *t*-test. For categorical variables, differences were analyzed with χ^2 test; Fisher's exact test was used when appropriate. All *P* values were two sided. *P* values ≤ 0.05 were considered statistically significant.

Results

There was no statistically significant difference regarding the mean age values ($P = 0.07$) and the sex distribution ($P = 0.6$) within the three groups (Table 1).

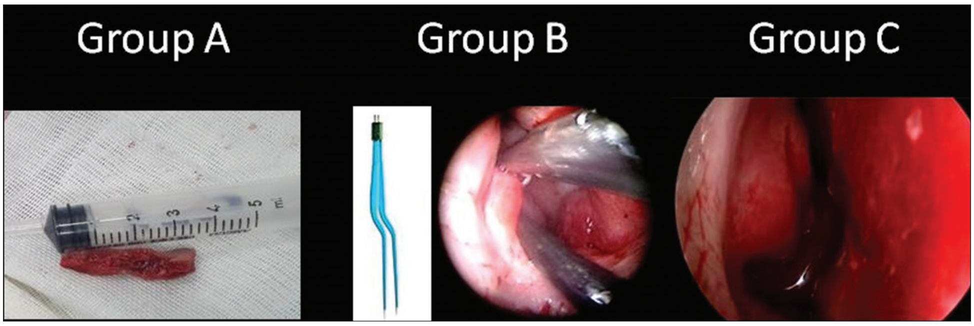
Regarding TNSS, the baseline mean (SD) was 5 (2), 5 (2), and 5 (1) for groups A, B, and C, respectively, with no statistically significant difference among the 3 groups ($P = 0.8$). Three months after surgery, the mean (SD) declined to 3 (2), 3 (2), and 3 (1) for groups A, B, and C, respectively. Yet, no statistical significance was detected among the groups ($P = 0.8$) (Table 2). Pairwise comparison of baseline with 3-month follow-up data of each group showed a statistical significance, with a *P* value less than 0.001 (Table 3 and Fig. 3).

Analysis of baseline endoscopic score data showed that most of group A (60%) and B (60%) cases were of score 2, whereas most of group C cases (53%) were of score 3, with no statistical significance among the groups ($P = 0.7$). At 3-month follow-up, most of the cases in groups A (87%), B (60%) and C (93%) had 0 endoscopic

Table 1 Demographic data of the tested groups

Groups	Variables			
	Group A	Group B	Group C	*P*
Mean (SD) age (years)	22 (6)	28 (11)	28 (9)	0.07
Sex [*n* (%)]				
Male	5 (33.3)	7 (46.7)	5 (33.3)	0.6
Female	10 (66.7)	8 (53.3)	10 (66.7)	

Figure 2



Different procedures performed in the study: group A (partial inferior turbinectomy specimen), group B (bipolar surface cauterization), and group C (inferior turbinoplasty after reposition of mucosal flaps).

Table 2 Comparison between the groups regarding total nasal symptom score

	Count	Mean (SD)	Range	*P*
Baseline				
Partial turbinectomy (A)	15	5 (2)	2-8	0.8
Bipolar surface cautery (B)	15	5 (2)	3-10	
Turbinoplasty (C)	15	5 (1)	3-7	
2 weeks				
Partial turbinectomy (A)	15	4 (2)	1-7	0.9
Bipolar surface cautery (B)	15	4 (2)	1-9	
Turbinoplasty (C)	15	4 (1)	2-6	
1 month				
Partial turbinectomy (A)	15	3 (1)	1-7	0.8
Bipolar surface cautery (B)	15	4 (2)	2-9	
Turbinoplasty (C)	15	3 (1)	2-5	
3 months				
Partial turbinectomy (A)	15	3 (2)	1-8	0.8
Bipolar surface cautery (B)	15	3 (2)	1-7	
Turbinoplasty (C)	15	3 (1)	1-5	

Table 3 Total nasal symptom score's comparison of baseline with 3-month postoperative data

	Mean (SD)	Range	*P*
Partial turbinectomy (A)			
Baseline	5 (2)	2-8	<0.001
2 weeks	4 (2)	1-7	
1 month	3 (1)	1-7	
3 months	3 (2)	1-8	
Bipolar surface cautery (B)			
Baseline	5 (2)	3-10	<0.001
2 weeks	4 (2)	1-9	
1 month	4 (2)	2-9	
3 months	3 (2)	1-7	
Turbinoplasty (C)			
Baseline	5 (1)	3-7	<0.001
2 weeks	4 (1)	2-6	
1 month	3 (1)	2-5	
3 months	3 (1)	1-5	

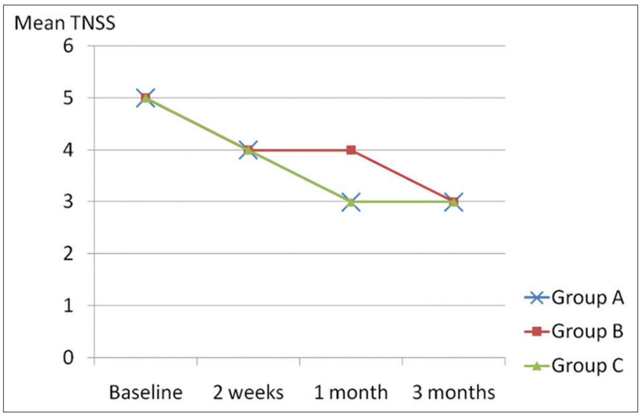
score, with no statistically significant difference among the groups ($P = 0.09$) (Table 4). Nevertheless, pairwise comparison between baseline endoscopic score and 3-month follow-up intervals for each group showed a statistically significant improvement ($P < 0.001$) for groups A, B, and C (Table 5).

There were no troublesome complications encountered during or 2 weeks after surgery apart from extensive crusting, which was noted mostly in group B cases but to a less extent in groups A and C. After 3 months, most of the cases of group A (60%) and group B (87%) had little crusts, whereas most of the group C cases (80%) had no crusts.

Discussion

Although nasal obstruction owing to inferior turbinate hypertrophy is not a life-threatening condition, it may significantly impair patients' quality of life [9,10].

Figure 3



Change in the mean total nasal symptom score with time.

Different techniques for inferior turbinate reduction are available; yet, controversy is still present over the merits of these various techniques. Complete resection of the inferior turbinate was abandoned to avoid developing atrophic rhinitis. Thus, many surgeons advocated the partial resection. There was a debate concerning the site of resection within the inferior turbinate. Resection of the posterior part of the inferior turbinate was performed by Proetz in 1953, where he assumed that it was responsible for the obstruction. Unlike Proetz, others considered the turbinate head to be the alleged cause for the obstruction. Horizontal inferior margin resection was carried out by many surgeons, which was claimed to reduce the risk of bleeding from the sphenopalatine artery [11]. The drawback of this method is the presence of raw area which may incite pain, crust formation, and the 'disaster' of atrophic rhinitis development in cases with extensive resection.

Electrocautery is one of the common methods used for inferior turbinate reduction. The heat coagulates the tissues leading to necrosis, which is followed by fibrosis and ultimately shrinkage of the turbinate [12]. Disadvantages of such procedure include mucosal atrophy, loss of cilia, crusting, synechiae, and difficulty to control the amount of tissue reduction [13,14].

The term 'turbinoplasty' was introduced in the 1980s. Its principle is to reduce the inferior turbinate with preservation of the mucosa [15]. Several methods have been described by many authors for submucosal reduction of the inferior turbinate [16]; for example, the partial inferior turbinoplasty technique entails removal of a wedge-shaped piece of the inferior edge of the turbinate and the margins are brought together [17]. This method is claimed to have less adverse effects owing to mucosal preservation.

Table 4 Comparison between the groups regarding endoscopic score's baseline, 2-week, 1-month, and 3-month data

Endoscopic score	Groups						P
	Group A		Group B		Group C		
	Count	%	Count	%	Count	%	
Baseline							
(0) Nasal airway >6 mm	0	0	0	0	0	0	0.7
(1) Nasal airway 4-6 mm	0	0	0	0	0	0	
(2) Nasal airway 1-3 mm	9	60.0	9	60.0	7	46.7	
(3) Nasal airway <1 mm	6	40.0	6	40.0	8	53.3	
2 weeks							
(0) Nasal airway >6 mm	11	73.3	8	53.3	10	66.7	0.6
(1) Nasal airway 4-6 mm	2	13.3	6	40.0	4	26.7	
(2) Nasal airway 1-3 mm	2	13.3	1	6.7	1	6.7	
(3) Nasal airway <1 mm	0	0.0	0	0.0	0	0.0	
1 month							
(0) Nasal airway >6 mm	13	86.7	9	60.0	13	86.7	0.08
(1) Nasal airway 4-6 mm	0	0.0	5	33.3	1	6.7	
(2) Nasal airway 1-3 mm	2	13.3	1	6.7	1	6.7	
(3) Nasal airway <1 mm	0	0.0	0	0.0	0	0.0	
3 months							
(0) Nasal airway >6 mm	13	86.7	9	60.0	14	93.3	0.09
(1) Nasal airway 4-6 mm	1	6.7	5	33.3	0	0.0	
(2) Nasal airway 1-3 mm	1	6.7	1	6.7	1	6.7	
(3) Nasal airway <1 mm	0	0.0	0	0.0	0	0.0	

Table 5 Endoscopic scoring's comparison of baseline with 3-month postoperative data

Endoscopic score	Time								P
	Baseline		2 weeks		1 month		3 months		
	Count	%	Count	%	Count	%	Count	%	
Group A									
(0) Nasal airway >6 mm	0	0	11	73.3	13	86.7	13	86.7	<0.001
(1) Nasal airway 4-6 mm	0	0	2	13.3	0	0.0	1	6.7	
(2) Nasal airway 1-3 mm	9	60.0	2	13.3	2	13.3	1	6.7	
(3) Nasal airway<1 mm	6	40.0	0	0.0	0	0.0	0	0.0	
Group B									
(0) Nasal airway >6 mm	0	0.0	8	53.3	9	60.0	9	60.0	<0.001
(1) Nasal airway 4-6 mm	0	0.0	6	40.0	5	33.3	5	33.3	
(2) Nasal airway 1-3 mm	9	60.0	1	6.7	1	6.7	1	6.7	
(3) Nasal airway<1 mm	6	40.0	0	0	0	0	0	0	
Group C									
(0) Nasal airway >6 mm	0	0.0	10	66.7	13	86.7	14	93.	<0.001
(1) Nasal airway 4-6 mm	0	0.0	4	26.7	1	6.7	0	0	
(2) Nasal airway 1-3 mm	7	46.7	1	6.7	1	6.7	1	6.7	
(3) Nasal airway <1 mm	8	53.3	0	0.0	0	0.0	0	0.0	

Most of the inferior turbinate reduction techniques provide satisfactory results for a more or less long period [18]. Similarly, in this study, all groups had significant improvements in the TNSS and endoscopic score when compared with baseline data. TNSS mean for all groups declined from 5 to 3 at three months after surgery, with *P* values less than 0.001 (Table 3 and Fig. 3). Most of the cases of group A (87%), group B (60%), and group C (93%) had an endoscopic Score 0 with nasal airways greater than 6 mm at 3 months after surgery (Table 4). These results were consistent with several studies including the study conducted by Dewidar [19] in 1999 for comparing reduction of hypertrophied inferior turbinate using surgical scissors and microdebrider. He showed that partial turbinectomy was associated with postoperative improvement of nasal obstruction.

In 2017, Rao *et al.* [20] compared between the bipolar surface cautery, monopolar cautery, complete turbinectomy, and injection sodium tetradecyl sulfate. They reported better reduction of the inferior turbinate with the bipolar cautery.

Fortunately, the nonobstructive symptoms within the TNSS showed some improvement. By reviewing the literature, Datta *et al.* [21] in 2018 reported that two techniques, partial inferior turbinectomy and submucosal diathermy, are 'not only effective in reducing the nasal obstruction in allergic rhinitis due to hypertrophied inferior turbinates but also other symptoms like rhinorrhea, sneezing, itching and headache.' Moreover, Hamerschmidt *et al.* [22] in 2016 compared turbinoplasty efficacy in patients with and without allergic rhinitis. Their study demonstrated the efficacy of inferior turbinoplasty, 3 months after the surgery, regarding the nonobstructive symptoms (snoring, anosmia, facial pressure, itching, sneezing, and rhinorrhea) in addition to improving the obstructive symptoms.

In this study, there was no statistically significant difference among the three groups regarding improvements of TNSS and endoscopic Score at 3 months after surgery (P = 0.8 and 0.09, respectively) (Tables 2 and 4). Similar results were seen in the study conducted by Rodrigues *et al.* [23] which showed that turbinoplasty and endoscopic turbinectomy were equally effective in the improvement of the complaint of nasal obstruction.

On the contrary, Bozan *et al.* [24] compared among three methods for turbinate reduction: turbinoplasty, outfracture, and bipolar cauterization. Their results showed superiority of turbinoplasty method in reduction of the lower turbinate volume than the other methods. However, their study evaluated the turbinate volume with computed tomography scans and without clinical correlation.

In this study, crusting was the only undesired sequela met. Extensive crusting was observed after 2 weeks in patients of group B. However, by the third month, most of the crusts markedly decreased in groups A and B and mostly vanished in group C. In accordance with this study, Dhulipalla [25] studied symptoms of nasal obstruction on 90 patients divided into three groups (unipolar surface cautery, cryotherapy, and radiofrequency). Surface cautery was found to cause extensive crusting at 2 weeks after surgery which waned with time. Similarly, Passàli *et al.* [4] reported more crusting with electrocautery but less was encountered with patients who underwent submucosal resection. In addition, Vijayakumar and Divakaran [26] conducted a prospective study on 30 adult patients with symptomatic hypertrophy of inferior turbinate. The studied patients, who underwent surgical turbinoplasty, had minimal crusting after surgery.

It is worth mentioning that the proposed 'endoscopic score' was used in this study to depict the nasal airway objectively. It was helpful in the preoperative assessment, during the operation to quantify the amount of turbinate's reduction, and in the postoperative follow-up of cases. In addition, it was economic, could be easily learned, and the authors did not face difficulties with its application. However, cases with septal deviations, which are excluded in this study, might hinder its application.

Ideally, some limitations could be attributed to this study such as absence of patient's stratification into allergic and non-allergic categories. Intraoperatively, the amount of the inferior turbinate tissue reduction by different techniques could not be exactly standardized. Other objective methods of assessment could be added as acoustic rhinometry, rhinomanometry, and/or computed tomography scans. Finally, longer follow-up period, amount of blood loss, and duration of the anesthesia could add more information.

The definite mechanism of improvement of the nonobstructive symptoms with the different turbinate reduction techniques remains unclear and could be an interesting point for future researches.

Conclusion

Partial turbinectomy, bipolar cauterization, and turbinoplasty techniques for the inferior turbinate reduction are comparable and effective regarding improvement of the obstructive as well as the nonobstructive nasal symptoms. Endoscopic score is a helpful tool for easy, rapid, and objective assessment of the nasal airway.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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