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Comparison between submucosal resection versus combined submucosal diathermy and out-fracture in the treatment of inferior turbinate hypertrophy

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Abstract
Background: Inferior turbinate hypertrophy (ITH) is considered as a common etiology of nasal obstruction. Many techniques had been discussed for reduction of the inferior turbinate size including cryoturbinectomy, submucosal resection (SMR), total and partial turbinectomy, submucosal diathermy (SMD), microdebrider assisted turbinectomy and laser turbinectomy, coblation and Radiofrequency, which have also been used to reduce the size of the turbinate. This research aimed to evaluate the effectiveness of SMR versus mixed SMD with out-fracture method for the therapy of ITH leading to nasal blockage. Forty patients over the age of 17 with chronic nasal obstruction caused by bilateral ITH owing to allergy and non-allergic rhinitis participated in a single-blinded, randomized prospective clinical study. Each participant in the research was randomly assigned to either group A (n = 20) which underwent bilateral SMR or group B (n = 20) which experienced bilateral SMD and out-fracture. Patients underwent nasal obstruction assessment using nasal obstruction symptom evaluation (NOSE) scale, visual analogue scale, stiff nasal endoscopy, computed tomography scanning of the nose and paranasal sinuses, and post-operative assessment (pain, crustation, healing).
Results: Nasal block showed marked improvement in both groups with no statistically significant difference in the 2 groups in 1 week and 1 month after operation. And with a statistically significant difference in favor of SMR group at 3 months after operation. Both groups showed marked improvement in trouble breathing, trouble sleeping and getting air during exercise with no statistically significant difference. Both groups showed a marked improvement 1 week, 1 month and 3 months after operation with a statistically significant difference in the 2 groups at 3 months after operation total NOSE score values in favor of SMR group.
Conclusions: Long-term follow-up demonstrates that submucosal excision is superior to diathermy. When reducing hypertrophy of the inferior turbinates, a SMR method is advised, particularly when a mixed turbinate component is present (bony and mucosal).

Keywords: Submucosal resection, submucosal diathermy, out-fracture, endoscope

Introduction
Many cases of nose blockage are attributed to inferior turbinate hypertrophy (ITH) [1]. This is typically brought on by either chronic allergy rhinitis or chronic rhinosinusitis. Sometimes it happens as a balancing act on the side of the nose where the septum is crooked [2]. It is estimated that between 10 and 20 percent of allergy sufferers experience persistent nose blockage as a result of hypertrophy of the inferior turbinate [3].
If you have an enlarged inferior turbinate, chances are good that you can get relief from medication. People who refuse medical care are the only ones who end up having surgery [4].
Many techniques had been discussed for reduction of the inferior turbinate size which include cryoturbinectomy [5], submucosal resection (SMR) [6], total and partial turbinectomy [7], submucosal diathermy (SMD) [8], microdebrider assisted turbinectomy and laser turbinectomy [9], coblation [10], and radiofrequency [11]. The turbinate has also been shrunk with these.
In addition, problems such as hemorrhage, swelling, and atrophy are not uncommon with any of these methods [12].

Since the mucosal covering of the turbinates plays a vital role in preventing atrophic rhinitis and promoting quick recovery after injury, it is best not to do so [13]. Allergens have an impact on the body, and the inferior turbinate can be surgically reduced or even removed to lessen that influence by reducing the size of the inflammatory tissue or causing scar development. That ought to enhance nose patency by reducing the extent of the inferior turbinates before they serve their purpose of humidifying inspired air and regulating temperature [14].

Surgical procedures for the inferior turbinates included turbine-plasty, bipolar cautery, and out-fracture, despite the fact that there were other options [4]. Despite the prevalence of both endoscopic submucosal resection (ESMR) and endoscopic submucosal diathermy (ESMD), there is ongoing debate over which procedure is more effective for treating inferior turbinate hypertrophy. The turbinal mucosa is preserved in both operations because of the vital part it plays in preserving the turbinate's regular function. Differences in postoperative factors such as hemorrhage, pain, soreness, and perceived and quantitative airway improvement can be used to determine the best option [15].

In order to objectively measure nasal airflow at the time of maximum intake, a simple, quick, and cheap objective technique known as peak nasal inspiratory flow (PNIF) has been developed [16]. When the validated nasal obstruction symptom evaluation (NOSE) instrument has been used, recent research have also shown a correlation between PNIF and patient-reported outcome measures [16].

This research aimed to evaluate the effectiveness of SMR versus mixed SMD with out-fracture method for the therapy of ITH leading to nasal blockage.

Patients and Methods

This was a single blinded, randomized prospective clinical trial of 40 adult patients older than 17 years presented to outpatient clinic of Otorhinolaryngology Department during the period between September 2020 to September 2021 with persistent nasal obstruction due to bilateral ITH as a result of allergic and non-allergic rhinitis.

An informed consent was obtained from all patients and the study was approved by the Local Ethical Committee.

Exclusion criteria included patients aged below 17 years old, revision turbinectomy, sino-nasal polyposis, congenital anomalies and patients with severe symptomatizing septal deviation.

Each participant in the research was randomly assigned to either group A (n = 20) which underwent bilateral SMR or group B (n = 20) which experienced bilateral SMD and out-fracture.

Each patient underwent the following: Full documentation of the past. Name, gender, and age; in-depth ear, nose, and throat background with a focus on nose symptoms (nasal obstruction, sneezing, snoring, nasal discharge), a questionnaire to evaluate and document the characteristics of related symptoms using NOSE and visual analogue scale (VAS) scales, general examination, otorhinolaryngological clinical examination. (anterior rhinoscopy, rigid nasal endoscopy using rigid endoscope), computed tomography (CT) scans of nose and paranasal sinuses and all necessary diagnostic studies, including complete blood count, international normalized ratio, coagulation profile, blood sugar, liver function, and kidney function, were performed before the operation.

Assessment of nasal obstruction

1. Subjective assessment

Using a questionnaire to assess sinus complaints such as stuffiness, obstruction, and difficulty breathing including NOSE and VAS scales which were performed before and after operation

A). NOSE scale

A NOSE grade of 0 indicates that there is no nasal obstruction, while a value of 100% indicates the most severe nasal obstruction. Research results in people with nasal obstruction may benefit from using the NOSE measure because it is a simple, short, reliable, and valid tool [17].

B). Visual analogue scale (VAS)

When filling out the VAS, patients were asked to select the number from 1 to 10 that most accurately reflected how severely their nose blockage affected their daily lives. When the number is higher, the level of blockage is higher.; lower score indicates lower obstruction and discomfort [18].

2. Objective assessment

A. With the help of rigid nasal endoscopy and the Inferior turbinate categorization system [19], the degree to which the turbinates obstruct the airway is determined.

Grade I, (inferior turbinate occupying 0-25% of nares).

Grade II, the inferior turbinates take up between 26% and 50% of nares).

Grade III, inferior turbinates block between 51% and 75% of nares. Grade IV, inferior turbinates block 76-100% of nares.

B. CT scanning of nose and paranasal sinuses was done preoperative and 3 months postoperative.

Follow up to evaluate the subjective and objective measurements of nasal airflow (primary outcome) was done at 1 month and 3 months after operation to be compared with the before-operative data.

Surgical procedure

Techniques of performing submucosal resection (SMR)

After infiltrating both turbinates with a local injection of (1: 100000) epinephrine, making an incision along the infero-medial surface of the turbinate extending from posterior to anterio with a long hand scalpel 15 sized then sickle knife to complete dissection, raising bilateral mucosal flaps, and then resecting the bony turbinate in stages or entirely, and then laterally repositioning the medial mucosa.

Technique of performing combined submucosal diathermy (SMD) and out-fracture

Initially, ESMD was done by inserting diathermy forceps submucosally along the length of the turbinate for a few seconds at two or three distinct paths. After the choncha had been mobilized via in-fracture, an out-fracture method was performed with the aid of a lift. When done, the entire turbinate is shifted horizontally.

Post-operative considerations

Patients were checked on one week, one month, and three months after surgery.

Evaluation of Adverse Events during Surgery *Intraoperative Complications (bleeding)

Intraoperative hemorrhage was assessed using the boezaart surgical Field grading scale [20]:

The absence of any bleeding is indicative of a grade 0 rating; light bleeding requiring no evacuation is indicative of a grade 1 rating; light bleeding requiring some suction on occasion is indicative of a grade 2; grade 3: light to moderate hemorrhage; frequent suction required; surgical area is threatened by bleeding within a few seconds after suction is turned off. Modest hemorrhage, the need for frequent suction, and the imminent danger of bleeding out in the surgery field characterize grade 4. Severe bleeding that cannot be managed by suction poses a serious danger to the surgery field, requiring a "Grade 5" response.

Post-operative complications

Post-operative pain

Patients' perceptions of sublingual pain are assessed using a visual analogue scale (VAS) from 0 to 10 [21]

Post-operative crustations

Using the endoscopy measure developed by (Lund & Kennedy) (21), we ranked the severity of intranasal crustations as follows: Crusts are not present (grade 0), grade 1 crustations are mild and only partly cover the nasal chamber, while grade 2 crustations are severe and completely occupy the nasal cavity.

Post-operative healing

Lund and Kennedy [21] also assessed tissue repair in the following ways:

In cases where there are few or no crustations, rapid mucosal re-epithelialization, subjective reports of improvement in nose complaints, and the absence of nasal synechiae, the prognosis is favorable. Mild to moderate crustations, mucosal re-epithelialization, patient reports improvement in nose complaints, nasal synechiae present. A poor outcome would be the presence of severe crustations and nasal synechiae, a delay in mucosal re-epithelialization, and no subjective improvement in nose complaints as well as ongoing inflammation and infection.

One week, one month, and three months later, we followed up with both groups to assess the aforementioned variables (post-operative complications).

Statistical analysis

The data was analyzed using SPSS 21. The independent t test was used to analyze the quantifiable data, which was presented using the Mean SD, range, and to draw conclusions about the data (in case of 2 independent groups). In contrast, non-parametric numeric data were presented with median and interquartile range (IQR) and analyzed with the Mann Whitney U test (for two-way analysis of variance) and Friedman's test (in case of more than 2 dependent groups). The chi-square test was used to evaluate categorical data presented in the form of numbers and percentages, while the Monte Carlo Exact test and the Fischer Exact test were used in cases where the chi-square test was deemed unsuitable. At the threshold of 0.05, the P value was deemed to be statistically significant.

Results

Demographic characteristics were not statistically significant between both groups. Table (1)

As regard nasal congestion, both groups showed marked improvement after operation. The nasal congestion 1 week after operation markedly improved. At 1 and 3 months after operation there was a persistent improvement in both groups. Figure (1)

Nasal block showed marked improvement in both groups with no statistically significant difference in the 2 groups in 1 week and 1 month after operation. And with a statistically significant difference in favour of SMR group at 3 months after operation. Figure (2)

Both groups showed marked improvement as regard trouble breathing by nose at 1 week, 1 month and 3 months with better results in SMR group at 3 months after operation but there was no statistically significant difference. Figure (3)

As regard trouble sleeping, both groups showed marked improvement after operation on 1 week, 1 month and 3 months after operation with no statistically significant difference. Figure (4)

As regard the ability to get enough air on exercise, both groups showed marked improvement after operation on 1 week, 1 month and 3 months after operation with no statistically significant difference. Figure (5)

Box and Whisker plot for total NOSE score 1 month and 3 months post-operative in both studied groups As regard Total NOSE score, both groups showed marked improvement as SMR Group was 14.5 before operation, then improved to 2.5, 1 week after operation, 1 after 1 month after operation and stayed 1 after 3 months after operation. While SMD group was 11 before operation, then improved to 2, 1 week after operation, 1 after 1 month after operation and became 2 after 3 months after operation. Figure (6), Figure (7)

So, both groups showed a marked improvement 1 week, 1 month and 3 months after operation with a statistically significant difference in the 2 groups at 3 months after operation total NOSE score values in favor of SMR group. Figure (6), Figure (7)

Discussion

Results revealed that the submucosal excision group improved more than the SMD, but the difference was not statistically significant. Findings here are consistent with those of other research. References: Fradis *et al*. [2], Joniau *et al*. [9], Ercan *et al*. [22] and Lukka *et al* [15].

Short-term follow-up revealed no significant difference between the turbinectomy and SMDs, despite Aboulwafa *et al*. [23] showing a substantial improvement from 71.3% before-operation to 25.8% at 3 months after operation in both groups.

In a similar vein, Aboulwafa *et al* [23] discovered that the NOSE score in the turbinectomy group also significantly improved, dropping from 25.8% at 1 month after operation to 8.7% at 6 months after operation. Whereas the diathermy cohort saw a rise from 27.8% to 39.6%. At 6 months after surgery, the SMD group also exhibited deterioration, just like in our research.

On long term follow up (3 months after operation) we noticed a persistent improvement in nasal airway in both groups. However, there is a statistically significant difference as SMR is better than SMD at 3 months after operation as SMD in our study showed some worsening from 5% at 1 month after operation to 10% 3 months after operation.

In our study, NOSE score showed persistent improvement in SMR at 1 and 3 months after operation. There was a significant difference in between both groups (5% vs 10%), SMR is better at long term follow up (at 3 months after operation).

Besides, some cases in the SMD showed even some worsening, as the range of NOSE score at 1 month after operation was (1.25 – 5%) and became (5-13.75%) at 3 months after operation. While in the SMR was (1.25 – 10%) at 1 month and improved to (5- 8.75%) at 3 months after operation.

In Lukka *et al*. [15] study, results were similar to ours as there was a statistically significant improvement in nasal airflow in both techniques compared to before-operative data. While comparing both groups, at 7-10 days after operation, they found that SMR had greater improvement in nasal airway than the SMD.

In our study, we found more improvement in SMR at 1 month after operation than SMD but there was no statistically significant difference in both groups according to (NOSE score) and VAS scale.

However, Lukka *et al*. [15] found no change in their long-term follow-up 3 months after surgery.

Early and late follow-up data from Fradis *et al*. [2] revealed that patients who had SMD fared worse than those in the turbinectomy group.

According to Ercan *et al*. [22], the amount of the turbinates is reduced more by SMR than by RFTVR. Two months after surgery, patients who underwent the SMR method reported greater relief in nasal obstruction complaints and improved surgical results compared to those who underwent the RFTVR technique.

In the present investigation, we were able to precisely place the needle at the area's most rear point and keep it there until its size had shrunk to an acceptable degree. When it was seen that the rear end was still hypertrophied after trying effective needle cautery, SMD was used to help shrink the growth.

While combined bipolar cautery and out-fracture is preferable for moderate bony ITH due to its reduced complication rate, Bozan *et al* [24] suggest using the turbinoplasty technique for large bony turbinate mass because it provides a more volume reduction.

In the present research, we used a subjective technique to assess nasal obstruction, the NOSE scale (score), and VAS scale. At 3 months after operation, there was a statistically significant difference between the NOSE scores of the excision and SMDs, with the former showing a decrease from 72.5% to 5% and the latter from 55% to 10%.

Similar to our findings, Fradis [2], Datta [25], and Aboulwafa [23] found that patients who underwent SMD experienced a return of nasal obstruction on long term follow up, despite a substantial improvement in the short term.

Joniau *et al*. [9] compared powered turbinoplasty (PT) to submucosal cauterization (SMC), and found that PT reduced morbidity of patients on short-term follow up and had superior long-term outcomes than SMC.

Turbinoplasty and out-fracture and bipolar cautery were both found to be successful for reduction of hypertrophied inferior turbinates in research by Bozan *et al* [24]. When comparing before- and post-operative CT scans of the lower turbinates, turbinoplasty was found to be more effective at decreasing inferior turbinate volume than either bipolar cauterization or out-fracture (CT).

Despite this, it was reported by Lukka *et al*. [15] that ESMR and ESMD are equally efficient at reducing nasal blockage. Neither the diathermy nor the excision groups experienced a return of symptoms.

None of the participants in either group experienced significant discomfort after their surgeries. One week and one month after surgery, neither group showed any discernible improvement over the other. On the other hand, Lukka *et al*. [15] found a statistically significant difference between the ESMR and SMDs 7-10 days after surgery.

SMD patients had more crustations than excision patients one week and one month after surgery. However, after 1 month of follow-up, the situation had improved. The findings are consistent with those of previous investigations, including those by salzano *et al*. [26], Imad *et al*. [27], and Gomaa *et al*. [28].

To confirm the efficacy of both groups and to see if the SMD may show more deterioration on long term intervals, bigger sample size trials with follow-up periods of 3 months to 6 months or even 1 year or more may be preferable.\

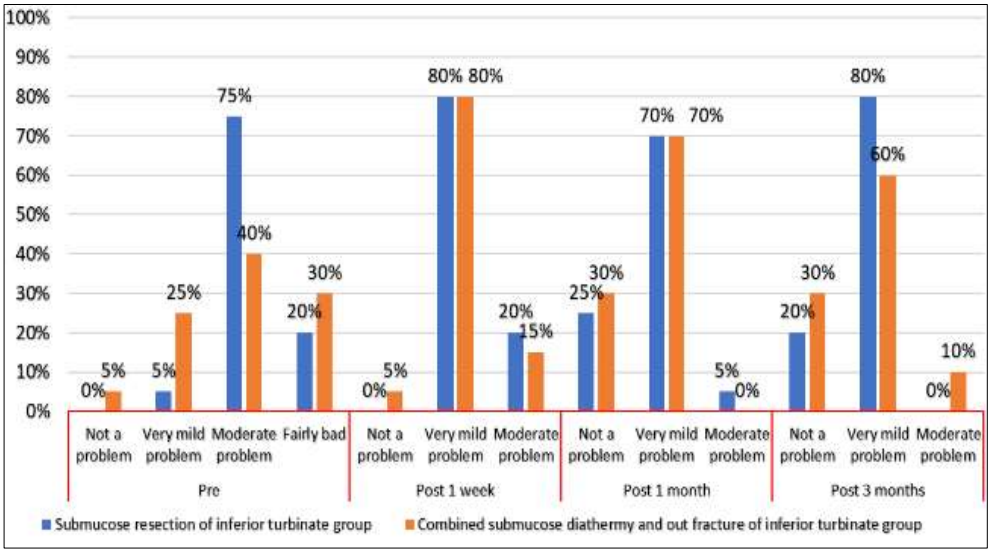

Fig 1: Nasal congestion in both studied groups

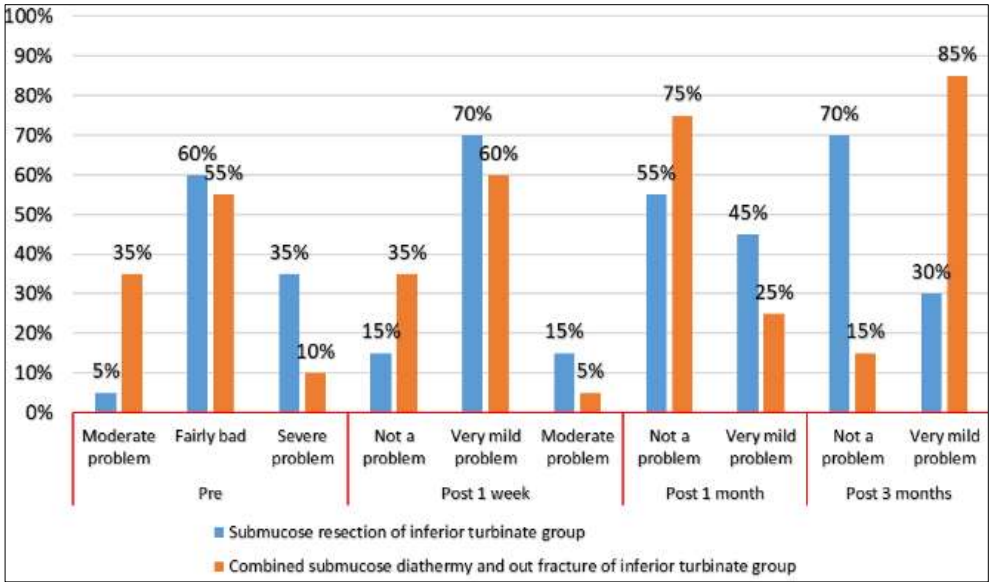

Fig 2: Nasal blockage in both studied groups

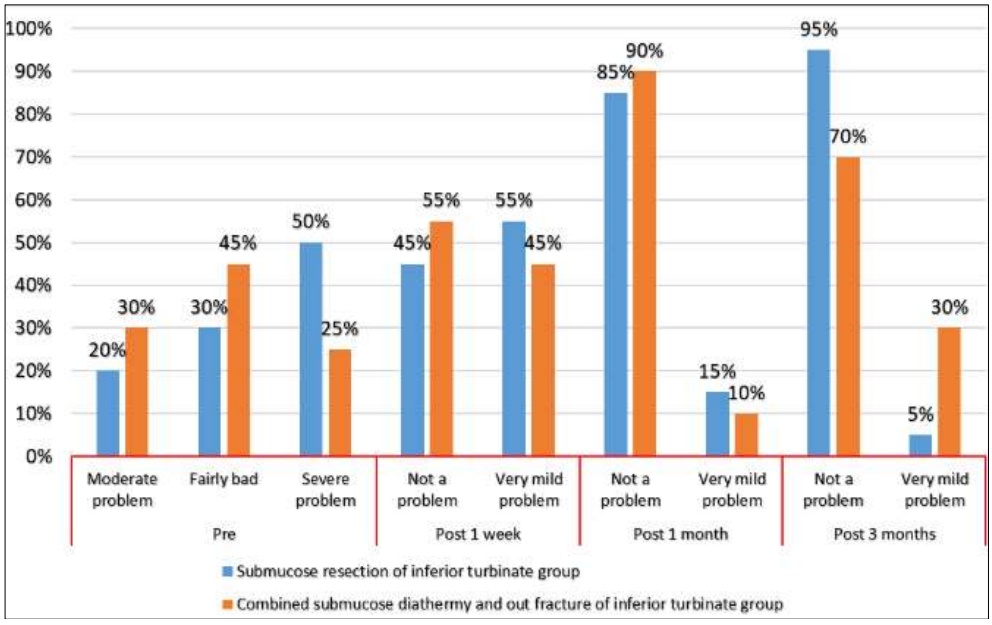

Fig 3: Trouble breathing by nose in both groups

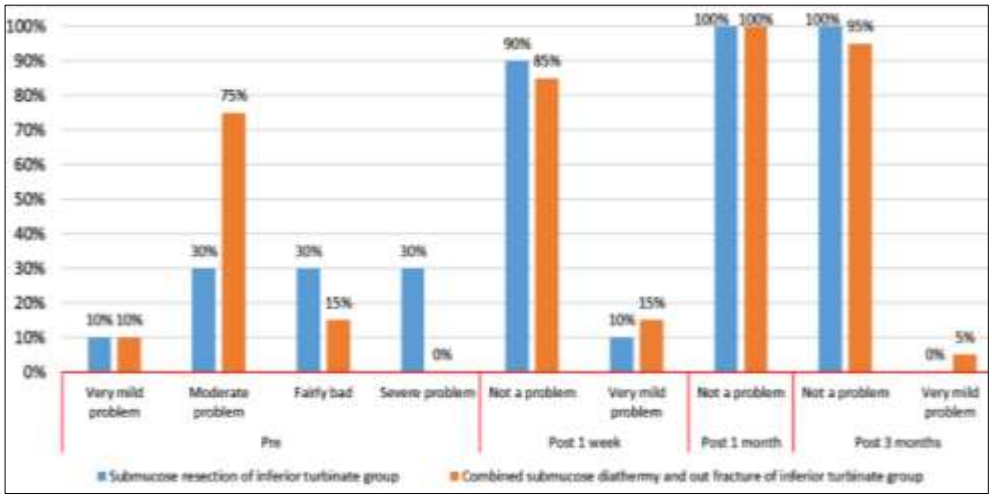

Fig 4: Trouble sleeping in both groups

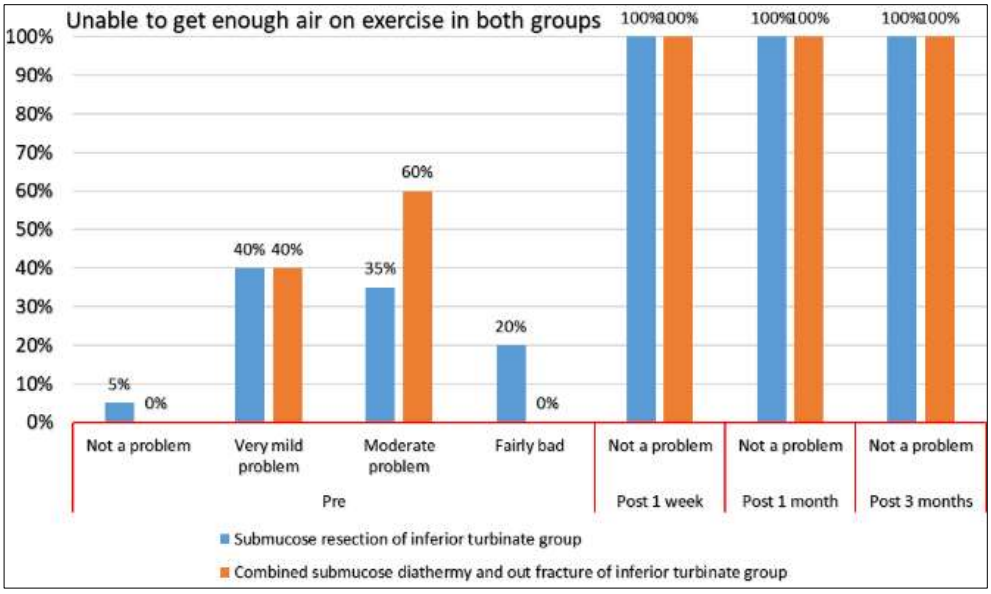

Fig 5: Ability to get enough air on exercise in both groups

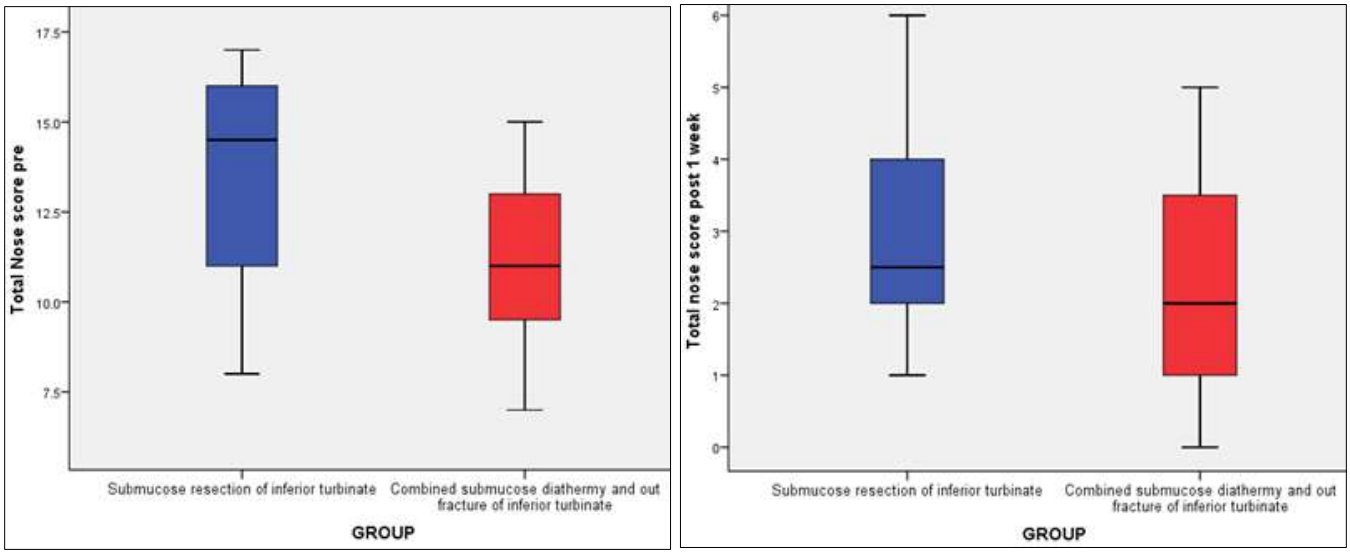

Fig 6: Total NOSE score in both studied groups

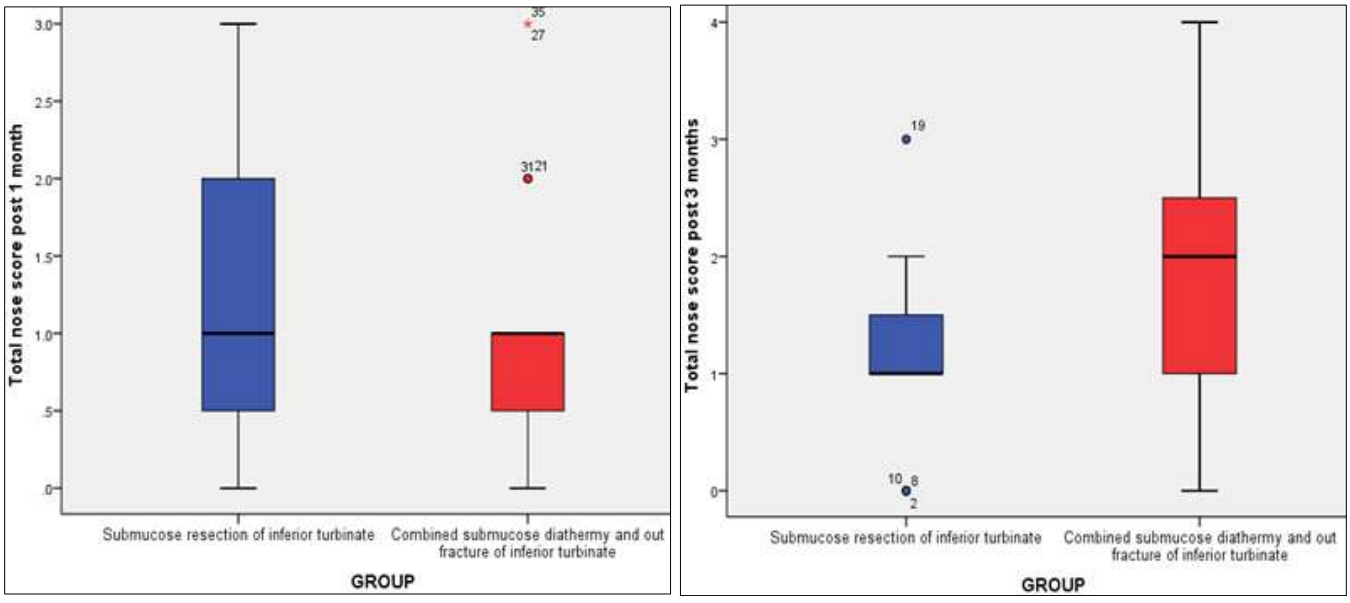

Fig 7: Box and Whisker plot for total NOSE score before-operative and post 1 week in both studied groups

Table 1: Demographic data in both studied groups

Variables	Submucosal resection of inferior turbinate group (n= 20)	Combined submucosal diathermy and out fracture of inferior turbinate group (n= 20)	Test of significance	P
Age (yr.)			t 1.587	0.121
Min. – Max.	17.0 – 43.0	20.0 – 40.0		
Mean ± SD.	25.6 ± 8.05	29.3 ± 6.62		
Sex			χ^2 0.902	0.342
Male	8 (40.0%)	11 (55.0%)		
Female	12 (60.0%)	9 (45.0%)		
Marital status			χ^2 0.902	0.342
Single	12 (60.0%)	9 (45.0%)		
Married	8 (40.0%)	11 (55.0%)		
Smoking			χ^2 1.026	0.311
Non-smoker	15 (75.0%)	12 (60.0%)		
Smoker	5 (25.0%)	8 (40.0%)		

t: independent t test χ^2: Chi square test

Conclusions

Both SMR and combined SMD and out-fracture were found to be successful in reducing nasal blockage caused by hypertrophy of the inferior turbinates. Both one can be used, and no special tools are needed. Nonetheless, submucosal excision outperforms diathermy, particularly in terms of long-term follow-up. When reducing hypertrophy of the inferior turbinates, a SMR method is advised, particularly when a mixed turbinate component is present (bony and mucosal).

List of abbreviation

ITH: Inferior turbinate hypertrophy
SMR: Submucosal resection
SMD: Submucosal diathermy
ESMR: Endoscopic submucosal resection
ESMD: Endoscopic submucosal diathermy
PNIF: Peak nasal inspiratory flow
NOSE: Nasal obstruction symptom evaluation
VAS: Visual analogue scale

Conflict of Interest

Not available

Financial Support

Not available

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