



Original Article

Tailored techniques for Inferior turbinectomy

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Objective: *To determine the effectiveness of tailored techniques of inferior turbinate surgeries in improvement of nasal functions both subjectively and objectively.*

Patients and Methods: *This is a prospective single blinded non randomized study done on 60 patients with inferior turbinate hypertrophy. Patients were grouped into 3 equal groups: group A with only hypertrophy of anterior bony or combined soft and bony part of inferior turbinate and they were operated by anterior end submucosal turbinectomy, group B with isolated posterior bulbous turbinate hypertrophy and they were operated by classic posterior 1/3 surgical turbinectomy and group C including those patient with diffuse turbinate hypertrophy and they were operated by mixture of both techniques. Visual analogue score (VAS) was done preoperatively, 1 month and 2 months postoperatively. Rhinomanometry and saccharine test were done preoperatively and 2 months postoperatively to evaluate the clinical improvement in all groups.*

Results: *The improvement of VAS was highly significant at 2 month compared to preoperative in all groups (p.value was 0.000) with more significant improvement at one month in group A(p.value was 0.000) compared to other groups . The improvement of nasal resistance postoperative was highly significant in all groups (p.value was 0.000). The improvement of nasal mucociliary clearance (NMC) postoperative in group A was significant (p.value was 0.03), while NMC worsened postoperative in group B and group C (p.value was 0.00 in both groups).*

Conclusion: *Inferior turbinectomy must be tailored for every patient according to the site and type of inferior turbinate hypertrophy. All tailored techniques of inferior turbinectomy are very effective in relieving nasal obstruction both subjectively and objectively. Anterior submucosal turbinoplasty leads to better nasal mucociliary clearance than the partial surgical inferior turbinectomy.*

Keywords: *Inferior turbinectomy; nasal resistance; visual analogue score, nasal mucocilliary clearance.*

INTRODUCTION

Chronic nasal obstruction is a common symptom of nasal disease and has many adverse sequelae including mouth breathing, dryness of the oropharynx, nasal speech, disordered sleep, restlessness, malaise, an adverse effect on quality of life and reduced lung volumes.⁽¹⁻³⁾ Inferior turbinate enlargement due to rhinitis is one of the main causes of chronic nasal obstruction.⁽⁴⁾ Rhinitis may be allergic, infective, vasomotor, hormonal or secondary to medication.^(5,6) Long standing swelling may become

irreversible. This may be due to dilated submucosal venous sinuses becoming varicose and unresponsive to sympathetic nervous system stimulation or medical treatment⁽⁷⁾ or because of fibrosis⁽⁸⁻¹⁰⁾ leading to persistent symptoms. Turbinate surgery is common and has been reported as the eighth most common procedure performed by otolaryngologists.⁽¹¹⁾ The central strategy of turbinate surgical procedures is to reduce the volume of the inferior turbinate particularly in its anterior portion, a component of the internal nasal valve, the most resistive segment of the upper airway and the nasal airflow,

without affecting nasal physiology.⁽¹²⁾ Various surgical treatments for enlarged inferior turbinates have been tried over centuries. The selection of an operative procedure to treat the inferior turbinate in chronic rhinitis remains controversial. The large number of surgical techniques in use to reduce turbinate size indicates there is no single technique, which is effective in all patients. Generally, techniques which remove most turbinate tissue have the greatest and longest lasting effect, but are also accompanied by a higher likelihood of morbidity.⁽¹²⁾ The surgical techniques for treatment of enlarged inferior turbinates include total or partial turbinectomy, cryotherapy, submucosal diathermy, laser turbinoplasty, and inferior turbinoplasty.^(13,14) Endoscopes are facilitating more precise surgery, and recent advances permit outpatient procedures to be performed with minimal morbidity. Inappropriate selection of surgery appear to be the major cause of patient dissatisfaction. The aim of this study is to assess the effectiveness of tailored techniques of inferior turbinate surgeries in improvement of nasal functions both subjectively and objectively.

PATIENTS AND METHODS

This study is a prospective single blinded non randomized study done on 60 patients, between October 2010 to October 2012 in Saudi German Hospital (SGH), Jeddah, Saudi Arabia. This study had been done after getting an approval from the local ethical committee and informed consents from the patients. All the patients had inferior turbinate hypertrophy (with no or minimal septal deviation) causing chronic nasal obstruction and did not respond to medical treatment in the form of topical steroids for at least 6 months.

Preoperative assessment of patients in the outpatient clinic included: detailed history taking, full ENT examination including nasal endoscopy, CT paranasal sinuses (PNS) to confirm the diagnosis of turbinate hypertrophy, define its type (bony or soft tissue) and its site (anterior or posterior) and to rule out other causes of nasal obstruction (major septal deviation, nasal polyposis or chronic sinusitis). Other preoperative assessment included rhinomanometry and saccharine test.

The following patients were excluded from the study: patients under 18 years old, patients with any bleeding disorder, or patients who were unable to come for follow up, patients with associated marked septal deviation, nasal polypi, tumors or sinusitis, patients with previous turbinate surgery, patients with poor general medical conditions contraindicating surgery and patients with genetic disorder accompanied by ciliary dysfunction.

Patients were grouped into 3 equal groups and operative techniques were chosen for each group according to the preoperative clinical, endoscopic and radiologic

assessment. Group A, including those with only hypertrophy of anterior bony or combined soft and bony part of inferior turbinate and they were operated by anterior end submucosal turbinoplasty.

Technique of anterior end submucosal turbinoplasty: firstly, submucosal infiltration with saline: adrenaline (200000:1) at the anterior end of the inferior turbinate, then with the use of nasal endoscope 0 degree, the head light or the microscope with the 300 mm focal length lens, the anterior end of the turbinate is incised till the bone. Mucosa and submucosa were raised from anterior 1/3 of the inferior turbinate on both surfaces and the free edge. Then the anterior bony end of the turbinate is removed using osteotomy, turbinate scissors and forward Blakesley forceps. Mucosa is then redressed and sutured with inverted 3/0 vicryl sutures at the site of the first incision.

Group B, including those patients with isolated posterior bulbous turbinate hypertrophy and they were operated by classic posterior 1/3 surgical turbinectomy using turbinate scissor and head light and/or endoscopy followed by bipolar cautery to the cut edge of the turbinate.

Group C, including those patients with diffuse turbinate hypertrophy. In those patients a mixture of both techniques was applied. In all cases anterior nasal packing was applied for 2 days.

Any bleeding, nasolacrimal duct injury, mucosal tears, crustation and synechia were recorded for all groups.

Subjective assessment of nasal obstruction was done using a 10 points visual analogue score (VAS) preoperatively, 1 month and 2 months postoperatively. A score of 0 represented no obstruction and a score of 10 indicated complete as well as constant and unremitting nasal obstruction. Rhinomanometry and saccharine test were done as objective comparison methods preoperatively and 2 months postoperatively to evaluate the clinical improvement for all groups. Rhinomanometry was done for every patient using the active anterior technique as described by Clement.⁽¹⁵⁾ The apparatus used was ATMOS rhinomanometer 300. Total nasal resistance to airflow of 0.3 Pacm³ was set as upper limit of the normal range as described by Eccles.⁽¹⁶⁾

Nasal mucociliary clearance was assessed by using the saccharin transit time (STT) test as a baseline preoperative (patients with STT > 30 min were excluded) and was done after 2 months postoperative. The transit time was recorded from the placement of the saccharin on the inferior turbinate until the patient reported a sweet taste to the nearest minute. Thirty minutes was set as the upper limit of the normal STT range.⁽¹⁷⁾

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Data taken from VAS of nasal obstruction, rhinomanometry and saccharin test were calculated, tabulated and statistically analyzed.

RESULTS

This study is a prospective single blinded non randomized study done on 60 patients (34 males and 26 females) Age of the patients ranged from 18 to 45 with the mean 30.5. All the patients had inferior turbinate hypertrophy (with no or minimal septal deviation) causing chronic nasal obstruction and did not respond to medical treatment for at least 6 months.

There were no postoperative infections, nor adhesions. Crust formation was less in group A (45%, 9/20; in those cases associated with mucosal tears) than in group B (100%) and group C (100%). No major postoperative bleeding was recorded in all groups with only 5 patients had mild postoperative bleeding during pack removal (2 in group B and 3 in group C) and all of them were managed conservatively with temporary packing. Mucosal tear was recorded in 45% of patients in group A (9/ 20), but none of them had postoperative synechia. No nasolacrimal duct injury recorded in all groups of patients.

The mean VAS in group a preoperative, one month and two months post-operative were 8.5, 0.45 and 0.45 respectively. The difference in VAS was highly significant at one month and 2 month compared to preoperative (p.value was 0.000), while this difference was not significant at 2 month compared to one month (p. value was 0.1) (Table 1).

In group B patients, the mean VAS preoperative, one month and two months post-operative were 8.55, 1.55 and 0.65 respectively. The difference in VAS was highly significant at one month and 2 month compared to preoperative (p.value was 0.00), also this difference was significant at 2 month compared to one month (p.value was 0.001) (Table 1).

The mean VAS in group C preoperative, one month and two months post-operative were 9.05, 0.85 and 0.55 respectively. The difference in VAS was highly significant at one month and 2 month compared to preoperative (p.value was 0.00), while this difference was not significant at 2 month compared to one month (p.value was 0.136) (Table 1).

The mean preoperative nasal resistance were 0.83, 0.78 and 0.865 Pacm³ in group A, B and C respectively, while the mean postoperative nasal resistance were 0.185, 0.210 and 0.198 Pacm³ in group A, B and C respectively . The difference between means pre and post-operative nasal resistance were 0.645, 0.570 and 0.668 Pacm³ in group A, B and C respectively. The differences between means of pre and post-operative nasal resistance were highly significant in all groups as p.value was 0.000 (Table 2).

The mean preoperative nasal mucociliary clearance (NMC) were 7.25, 7.2 and 7.3 minutes in group A, B and C respectively, while the mean postoperative nasal mucociliary clearance were 6.95, 8.55 and 8.65 minutes in group A, B and C respectively . So there was significant improvement of NMC in group A (p. value was 0.03), while there was worsening of NMC in group B and group C (p. value was 0.00 in both groups) (Table 3).

Table 1. LSD (least significance test) to detect the mean VAS difference preoperative, one month and 2 month post-operative and its significance.

Group A	Group A	Mean Difference	Significance (P-value)
Preoperative	Postoperative One month	8.400	0.000
	Postoperative Two month	8.400	0.000
Postoperative One month	Postoperative Two month	0	1.00
Group B			
Preoperative	Postoperative One month	7.00	0.002
	Postoperative Two month	7.90	0.000
Postoperative One month	Postoperative Two month	0.90	0.001
Group C			
Preoperative	Postoperative One month	8.20	0.001
	Postoperative Two month	8.50	0.000
Postoperative One month	Postoperative Two month	0.30	0.136

Table 2. Paired Samples Test to detect mean pre and post-operative nasal resistance difference measured in Pacm3 and its significance for all groups.

Nasal resistance	Paired Differences		P-Value
	Mean	Standard Deviation	
Group A	0.645	0.142	0.000
Group B	0.570	0.182	0.000
Group C	0.668	0.145	0.000

Table 3. Paired Samples Test to detect mean pre and post-operative NMC difference measured in minutes and its significance for all groups.

NMC	Paired Differences		P-Value
	Mean	Standard Deviation	
Group A	0.30	0.571	0.030
Group B	-1.350	0.745	0.000
Group C	-1.350	0.875	0.000

Statistical analysis: Data were statistically described in terms of mean, standard deviation (\pm SD), frequencies (number of cases) and relative frequencies (percentages) when appropriate. Comparison of quantitative variables between different groups in the present study was done using T-test and ANOVA test. T-test is a statistic test follows a Student's t distribution and it can be used to determine if two sets of data are significantly different from each other. Analysis of variance (ANOVA) is a collection of statistical models used to analyze the differences between group means and their associated procedures. A probability value (p value) less than 0.05 was considered statistically significant. All statistical calculations were done using computer programs Microsoft Excel version 7 (Microsoft Corporation, NY, and USA) and SPSS (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) statistical program.

DISCUSSION

The physics established with Poiseuille's law demonstrates that as little as a 10% increase in the cross sectional area of the nasal passage produces a 21% increase in flow.⁽¹²⁾

Studies using external nasal dilators have shown 70% of the effects on nasal resistance can be achieved with external dilators in the region of the nasal valve and anterior region of the inferior turbinate.⁽¹⁸⁾ Decongestion of the nose increases the volume of the nasal cavity by 35%.⁽¹⁹⁾ Given the predominant effect of decongestants is vasoconstriction of the inferior turbinate, and given the anterior portion of the inferior turbinate is intimately associated with the region of the nasal valve area, inferior turbinate reduction should produce a significant change in nasal obstruction.⁽¹²⁾

This study is conducted to assess the effectiveness of tailored techniques of inferior turbinate surgeries in improvement of nasal obstruction (subjectively and objectively) and the effect on nasal mucociliary clearance.

In the present study, crust formation was less in group A (45%, 9/20; in those cases associated with mucosal tears) than in group B (100%) and group C (100%), this may be due to that group A patients were operated by submucosal technique with minor tears in mucosa, on the

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other hand in group B and group C patients there is much mucosal loss which results in crustation in all patients.

In our study, mucosal tear was recorded in 45% of patients in group A (9/20) and 40% in group C, but none of them had postoperative synechia because all of these tears were minor tears and silastic splints were routinely applied for the septum in case of associated mucosal injury. This is on line with the review article done by Chang and Ries.⁽²⁰⁾ who reported that maintenance of surface epithelium is necessary to reduce feared complications of crusting, synechiae, and osteitis that may result from bony exposure.

In a study done by Friedman et al,⁽²¹⁾ they recorded 55% of mucosal tears with submucosal resection using microdebrider, this is little higher than our recorded because number of our patients were only 40 (20 in group A, and 20 in group C), in contrast to the Friedman et al study which was done on 120 patients and because we believe that when microdebrider is used submucosally is harder to control than the non-powered instruments.

In this study, the difference in VAS was highly significant at 2 month compared to preoperative in all groups (p. value was 0.000), while this difference was not significant at 2 month compared to one month in group A (p. value was 0.1). This means that much improvement of group A patients compared to other groups occurred at one month postoperative but did not differ much 2 months following surgery due to the use of submucosal technique with little crustation. This is similar to the study done by Elwany and Harrison⁽²²⁾ who reported that postoperative healing was noticeably faster in inferior turbinoplasty compared to partial inferior turbinectomy.

In the present study, the difference between means pre and post-operative nasal resistance were 0.645, 0.570 and 0.668 in group A, B and C respectively. The difference between means pre and post-operative nasal resistance were highly significant in all groups as p. value was 0.000. with improvement in group A and group C more than group B, this is because the anterior end of inferior turbinate is the area of nasal valve and any reduction of the size of inferior turbinate at this area leads to marked improvement of nasal resistance and in case of posterior turbinate hypertrophy in group B cases when it is the main blocking element, relief of this blocking elements improved the airway.

Chen et al⁽²³⁾ made comparison between intratubinal microdebrider turbinoplasty and conventional submucosal in their study on 120 children and they found that both methods are effective in relieving nasal obstruction caused by inferior turbinate hypertrophy. This is similar to our findings in group A patients operated by anterior turbinoplasty. On the other hand if

microdebrider is used on patients with bony swelling, special powered microdebrider blade is needed to remove bony swelling and is more time consuming than our technique.

In our study, there was improvement of NMC in group A (p. value was 0.03), while there was worsening of NMC in group B and group C (p. value was 0.00 in both groups). This may be due to loss of mucosa in group B and group C patients with subsequent affection of NMC. On the other hand, surgery done in group A patients was entirely submucosal and mucosal tears that occurred in 45% of patients were minor tears that healed completely within one month postoperative, so the postoperative NMC was better in group A than others.

This study was conducted on only 60 patients. Further studies are needed on large number of patients with long duration of follow up to assess the effectiveness of tailored techniques of inferior turbinate surgeries in improvement of nasal functions.

CONCLUSION

Inferior turbinectomy must be tailored for every patient according to the site and type of inferior turbinate hypertrophy. This means using anterior submucosal technique for anterior inferior turbinate hypertrophy and combined anterior submucosal and posterior classic technique in diffuse hypertrophy and posterior classic technique in isolated bulbous posterior end hypertrophy of inferior turbinate. All tailored techniques of inferior turbinectomy are very effective in relieving nasal obstruction subjectively and objectively with early subjective improvement of nasal obstruction in anterior submucosal turbinoplasty compared to partial inferior turbinectomy. Anterior submucosal turbinoplasty leads to better nasal mucociliary clearance than the partial surgical inferior turbinectomy and less crusting especially if no mucosal injury occurs.

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1. Mahmoud Attia, None.
2. Ahmed Hussein, None.

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