Comparison and Evaluation Effect between Microdebrider Assisted Turbinoplasty and Submucosal Diathermy of the Inferior Turbinates Techniques

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Abstract

Background: Nasal blockage is one of the common complaints that bring the patient to the otolaryngology clinic, one of its causes is inferior turbinate hypertrophy, and turbinate reduction surgeries aimed to relief this hypertrophy. This study was aimed to compare and evaluate the short-term results and complications of microdebrider-assisted inferior turbinoplasty and submucosal diathermy techniques. Study design and Methods: A prospective randomized comparative clinical study between microdebrider assisted inferior turbinoplasty (MAT) and submucosal electrical diathermy (SMD) of the inferior turbinate. Twenty five patients complaining nasal obstruction due to inferior turbinate hypertrophy not responding to medical therapy, randomly distributed to undergo either SMD or MAT. Comparisons were made between pre-operative and post-operative symptoms scores and endoscopic scores of nasal patency. Results, both techniques were effective in reducing the nasal blockage but the results of MAT were more predictable and controllable during surgery, also MAT resulted showed significant reduction in sneezing at P=0.009 after 3 months of surgery. The most commonly observed post-operative complications were crustation and dryness developed in 8 out of 13 patients after MAT, while there was 12 out of 12 patients after SMD operation got side complications. In conclusion, the MAT operation showed a better substitution of being effective, mucosal preserving, and more controllable during surgery then the classic SMD.

Keywords: Microdebrider, turbinoplasty, submucosal diathermy, inferior turbinates

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Introduction

Nasal blockage is the source of significant patient discomfort; it is one of the daily routines in otolaryngology clinics. A spectrum of diseases can result in a varying degree of nasal stuffiness. Medical management can solve the problem in most of cases but some patients may require turbinate reduction surgery. Inferior turbinate reduction surgery involve many procedures sharing the same principle of reducing the size of the inferior turbinate to alleviate nasal blockage but differ from each other by means of how much of the normal physiology of the inferior turbinate would be preserved. Old procedures such as total or partial resection of the inferior turbinate were short surgical procedures and easy to perform and did not require sophisticated instruments or skills, on the other hand they were associated with significant blood loss and leave the cut surface prone to crustation and synaechiae in addition of being non physiological (Hackman and Ferguson, 2005).

In the mid-1990s, the advent of powered instrumentation of particular microdebrider advanced of surgeon's ability to treat polypoid disease, sinus and nasal disease in a bleeding field, choanal atresia, antral choanal polyps and inferior turbinate hypertrophy (Hackman and Ferguson, 2005; Friedman et al., 1999). This study was aimed to compare and evaluate the short-term results and complications of microdebrider-assisted inferior turbinoplasty and submucosal diathermy techniques

Patients and Methods

Study Design

A prospective randomized comparative surgical study was performed on 25 patients who presented with nasal obstruction and hypertrophied inferior turbinate mucosa refractory to medical treatment using local and/or systemic steroids for several months with or without antihistamines or local decongestants, during the period from January 2013 to December 2013 in Al-Sadr Teaching Hospital, Najaf, Iraq. All of these patients had symptoms and signs of nasal obstruction and stuffiness related to congested turbinate mucosa that did not respond well to medical treatment.

Selection of Patients

Following routine physical ear-nose-throat examination, focusing on detailed nasal examination and endoscopic nasal evaluation. Patients with prominent mucosal hypertrophy were selected by means of a decongestion test and the patients who did not respond well to the decongestant were selected. Patients with history of previous nasal surgery, and those with nasal obstruction due to causes other than turbinate hypertrophy were also excluded. Exclusion criteria was includes acute onset nasal blockage, normal sized inferior turbinates, presence of purulent secretions on nasendoscopy, evidence of chronic sinusitis on CT scan, septal deviation , nasal polyposis, previous nasal surgery, granulomatous and neoplastic diseases of the nose and paranasal sinuses and post nasal space pathology. Thirteen patients involved three females and 10 males were treated with microdebrider (MAT) and 12 patients involved 6 females and 6 males were treated with submucosal diathermy (SMD). Informed consent signed by the patient, the surgeon and the ward’s staff chief were obtained from all patients. Pre-operative evaluation included assessment of hemoglobin level, full blood counts, prothrombin and partial thromboplastin times, fasting blood glucose, and blood urea were obtained.

Follow up

Same precautions of any nasal procedure were followed during the first 24 hours. Patients who did not have any problems were discharged on nasal wash with sodium bicarbonate solution 4 times daily, steroid nasal spray twice daily for the first week and scheduled for control visits. Postoperative work up includes a visit after one week, a second visit was after one month, and a third visited after 3 months, at each visit crusts (if present) are removed, adhesions divided, and when there's suppuration swabs are taken and cultured.

Outcome Parameters

Subjective symptoms, such as nasal obstruction, sneezing, rhinorrhea, hyposmia and facial pain, were evaluated on the seventh day, and in the first and third months after the procedure. The following four points grading system is used for nasal obstruction as grade zero no nasal obstruction, grade 1: mild obstruction, grade 2: moderate obstruction and grade 3: severe obstruction. For sneezing number of sneezes per day was considered to evaluate the results of this complain (grade zero: no sneezing, grade 1: less than 5 attacks per day, grade 2: 5-10 attacks and grade 3: more than 10 attacks. Endoscopic findings were documented and compared in form of the percentage of the width of air space to the total width of the nasal fossa at the anterior end of inferior turbinate by photography. Intra-operative blood loss was measured from the graded container of the suction machine after subtracting the saline used for irrigation, and was divided into 3 grades that included grade 1which less than 50 ml, grade 2: 50-100 ml and grade 3: more than 100 ml.

Statistical Analysis

Symptoms and physical examination findings within groups were compared with interactive chi-square calculator, Yates p-value was considered for small samples, and for large samples paired sample T-test was used. For each statistical analysis, a P value < 0.05 was considered statistically significant.

Results

Age and gender distribution

The results of this study showed that 25 (3.2%) of turbinate reduction surgeries out 780 operation surgeries performed in the otolaryngology operation room at Al-Sadr teaching hospital in Najaf during the period from January 2013 to December 2013. The analysis of this study showed 16 (76%) males and 9 (34%) females with male to female ratio 1.7:1. The age of the patients ranged from 18 years to 42 years, the mean age was 27.5 years for the MAT group and 30.5 years for the SMD group. The patients were chosen randomly, resulted into two groups; microdebrider-assisted turbinoplasty (MAT) group, and sub-mucosal diathermy (SMD) group, the patients' charts were reviewed for nasal blockage, percentage of patency, sneezing, rhinorrhea, facial pain, hyposmia, operative and post-operative complications.

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The Distribution of Symptoms

The results of this study of nasal blockage was the most common presenting symptom in all the 25 (100%) patients (16 male and 9 females) followed by sneezing 19 (76%)

patients (13 males and 6 females), rhinorrhea 12 (48%) patients (8 males and 4 females), and to a lesser extent hyposmia 7 (28%) patients (6 males and 1 female) and facial pain 6(24%) patients equally distributed between males and females (Figure 1)

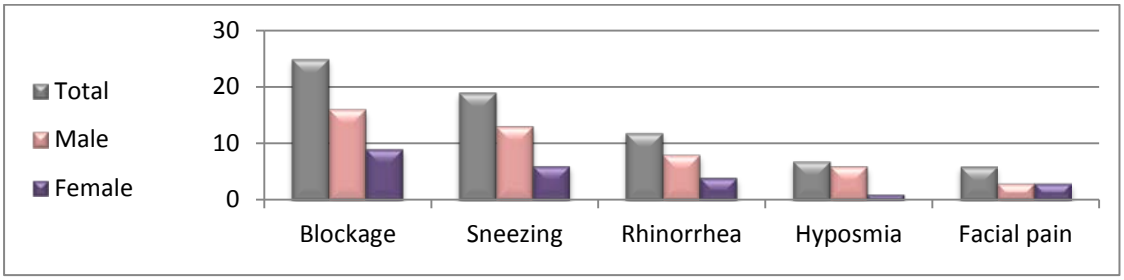

Figure 1: The pre-operative distribution of symptoms among males and females.

According to the grading system followed in this study, the nasal obstruction found as grade 1 was 6 (24%) patients, 2 in the MAT group and 4 in the SMD group, grade 2 showed 12 (48%) patients where 8 in the MAT group and 4 in the SMD group, and in the grade 3 showed 7 (28%) patients where 3 in the MAT group and 4 in the SMD group. These clinical figures were significantly reduced after surgery in the MAT group from 13 patients to 5 patients after one week and to zero after one month at P=0.0002. In the SMD group the number of patients with nasal obstruction was reduced from 12 to 10 after one week and to 2 patients after one month at P=0.005. (Table 1).

Table 1: The distribution of the grades of nasal obstruction before and after surgery

	Pre-operatively		One week		One month		Three months	
	MAT	SMD	MAT	SMD	MAT	SMD	MAT	SMD
Grade 3	3	4	0	0	0	0	0	0
Grade 2	8	4	0	1	0	0	0	0
Grade 1	2	4	5	9	0	2	0	0
Grade 0	0	0	8	2	13	12	13	12
Yates P			0.002	0.18	0.0002	0.005		

This improvement was also observed objectively by means of increment in the mean percentage of nasal patency one week, one month and three months after surgery. In the MAT group , the mean percentage of nasal patency was increased from 6.6 preoperatively to 16.3 after one week, 18.9 after one month, and 19.6 after three months which is statistically significant (P=0.000). In the SMD, the mean percentage of nasal patency was increased from 6.1 preoperatively to 12.4 after one week, 13.8 after one month, and 14.4 after three months of surgery P=0.000. The increment in nasal patency scores was consistent with the clinical improvement in the scores of nasal blockage (Table 2).

Table 2: Comparison of the percentage of nasal patency before and after surgery using the standard deviation (SD)

	Pre-operatively	One week	One month	Three months
MAT	6.6 (SD=1.3)	16.3 (SD=2.6)	18.9 (SD=2.5)	19.6 (SD=2.4)
SMD	6.1 (SD=1.3)	12.4 (SD=1.3)	13.8 (SD=1.4)	14.4 (SD=0.8)
P-value		< 0.000	< 0.000	< 0.000

Sneezing

The MAT group included 10 patients with sneezing pre-operatively ranging from grade 1 grade 3, the number is reduced to eight patients after one week, 5 patients after one month and the remainder of the follow up period at p=0.01. Results in the SMD group included 9 patients with sneezing pre-operatively ranging from grade 1 to grade 3, was reduced to 8 patients after one week, 7 patients after one month and the remainder of the follow up period at P=0.9 (Table 3).

Table 3: Comparison of sneezing before and after surgery

	Pre-operatively		One week		One month		Three months	
	MAT	SMD	MAT	SMD	MAT	SMD	MAT	SMD
Grade 3	1	1	0	0	0	0	0	0
Grade 2	7	3	0	3	0	1	0	1
Grade 1	2	5	8	5	5	6	5	6
Grade 0	3	3	5	4	8	5	8	5
Total	13	12	13	12	13	12	13	12

Rhinorrhea

Rhinorrhea showed in 12 (48%) patients before surgery, eight of them underwent MAT and 4 underwent SMD. In the MAT, rhinorrhea was in 5 patients after three months at P=0.8, while after SMD rhinorrhea was present in two patients on three months after surgery at P=0.9.

Facial pain

Facial pain was present in 6 (24%) patients pre-operatively, three patients underwent MAT and 3 underwent SMD, sinus disease was excluded by means of nasendoscope and CT scan. In MAT group, the 3 patients became pain free after one month at P=0.2, while one of the patients in SMD group continued to have facial pain after 3 months at P=0.6.

Hyposmia

Three patients in MAT group had hyposmia, one patient after one week and none after one month at P=0.3, while in SMD group, four patients had hyposmia pre-operatively, one after one week, one after one month and none after 3 months at P=0.3.

Operation Time and Intraoperative Events

The mean operation time for MAT was 41.5 minutes and SMD was 18.8 minutes. Bleeding during turbinate surgery was unavoidable in both groups. The amount of blood loss varied between the two groups and ranged between few cubic centimeters that could not be measured (lost in the suction circuit tubes) to <300 cubic centimeters. During MAT, two patients had grade 3, six grade 2, and five grade 1 bleeding, while in SMD the blood loss was no more than grade one. Mucosal flap perforation had occurred more commonly during SMD, 3 (25%) patients out of 12 than MAT, 2 (13.38 %) out of 11 patients (Table 4).

Table 4: Operation time and intraoperative events

	Bleeding			Mucosal Perforation		Mean Operative
	Grade1	Grade2	Grade3	+ve	-ve	Time
MAT	5	6	2	2	11	41.5 min.
SMD	12	0	0	3	9	18.8 min.

Post-operative Complications

The crustation in the MAT showed in eight patients that developed and observed after one week, and at second post-operative visit after one month but gradually disappeared at the subsequent visit at third month after surgery at P=0.04. In the SMD, there was 12 patients showed crustation at the first visit on one week after surgery, while at the second visit, there was 9 of them appeared complete resolution, and at the third visit on third months after surgery all of them were free of crustation at P=0.001.

Purulent discharge was shown in two patients in MAT group and one patient in SMD group developed post-operative localized purulent discharge after removal of crustation one week post operatively. The discharge was absent in the subsequent visits.The synaechiae was developed in 1(7.07%) patient in the MAT group and 3 (25%) SMD group, they were treated by division of the adhesion points, no splint was needed, only one patient in SMD group had recurrent synaechiae lasting more than three months at the same site.

Discussion

In general, both techniques were well tolerated by the patients except for mild postoperative headache and mild bleeding after pack removal. The major differences between MAT and SMD were found in terms of nasal patency, sneezing, operative blood loss, operative time, post-operative synaechiae, and crustation. Although, the measuring of the width of air space in the nasal cavity is not a standardized test, in this study found that the results of this technique correlate well with the patients' subjective sensation of nasal blockage. This confirm in the previous study, which showed that the visual identification of turbinate reduction combined with the

elimination of symptoms speaks for effective turbinate reduction (Friedman et al., 1999).

At least 13 surgical techniques have been used over the past 130 years to treat hypertrophy of the inferior turbinate (Myrthe and Huizing, 2000) for only one purpose, which is to relief nasal blockage. Improvement in other symptoms such as sneezing, rhinorrhea, facial pain, and hyposmia were incidental. On the other hand, the nasal mucosa needs to be preserved because of its cardinal role in preparing and filtering the breath of life. So that it would be logical to base our judgment on two points, the first one is the efficacy of the technique in relieving nasal blockage, and the second one is the complications associated with each technique.

The improvement in nasal patency was studied in form of symptomatic relief and improvement in endoscopic scores. Relief of nasal blockage was more pronounced and faster and statistically more significant after MAT than after SMD, because inflammatory oedema is more sever and last longer time after SMD, in addition, SMD involve no volumetric reduction, i.e. the technique depends on post-operative healing and fibrosis (which cannot be predicted with confidence). Joniau et al (2006) performed their study on 19 patients, they did powered turbinoplasty on one side and submucosal cauterization on the other, and they found that powered turbinoplasty was superior to submucosal cauterization in all aspects of the assessment. A significant difference (P<.05) was noted for postoperative crusting, endoscopical scoring of turbinate size, and acoustic rhinometry measurements of nasal cavity volume and mean area at the level of the nasal valve. In addition, the results of powered turbinoplasty were still apparent on long term follow-up, whereas submucosal cauterization was associated with a recurrence of turbinate hypertrophy.

The endoscopic scores increased significantly from 6.6 to 16.5 after one week, to 18.9 after one month and to 19.6 after 3 months, (P=<0.000). The nasal obstruction scale improved significantly after MAT on day 7, and within the periods of first and third months after surgery Cingi et al. (2010). Mahlon et al. (1999) performed MAT for 100 patients in the period from 1994 to 1997 and found that postoperative improvement in nasal patency occurred in 93% of the patients. Different tests of nasal patency yielded different results. The morphological and functional results of MAT might increase of total minimal cross sectional area was 41.5% in 84% of the patients. The mean increase of the total nasal volume was 3.83 cm^3 in 79% of the patients. The mean decrease of the total nasal resistance is 47% in 87% of the cases (Rumen, (2006).

Chieh-Feng and Tai-An (2004) studied MAT on 29 patients, and they found that the overall improvement in nasal obstruction was 91%, this may be explained as five of their patients underwent FESS with turbinoplasty and (14) SMR with turbinoplasty. Friedman et al. (1999) studied 112 patients who underwent bilateral MAT; he had found that symptoms of bilateral nasal obstruction and stuffiness were almost completely resolved after 6 weeks, complete resolution of nasal blockage in 80% of patients and mild nasal obstruction in 20% of the patients two months after MAT, the improvement was statistically highly significant (Hegazy et al., 2007).

After SMD, improvement of nasal patency was observed in all patients after three months and this finding was statistically significant (P= 0.005), while after one month success rate was 83% (P=0.18), after SMD relief of nasal obstruction was 75% after one month, and submucosal diathermy oedema were seen one month after the operation (Ehab, 2010). Fradis et al. (2000) found that diathermy showed good results in 78% of cases two weeks after surgery. The efficacy of the procedure was reduced to 76% two months after surgery. They also noted that the extent of postoperative

improvement does not depend on preoperative conditions; therefore, it is impossible to predict the extent of postoperative improvement on the bases of the results of preoperative assessment.

Milo et al. (2002) in a subsequent study (in which patients were examined two months postoperatively and after 1 year), had found that two months postoperatively 64 of 91 patients (70.3%) experienced subjective improvement in nasal breathing. During the follow-up year, secondary operations were deemed necessary for 16 patients because of unsatisfactory results of the original procedure. They concluded that no means were apparent for predicting preoperatively which patients would benefit most from submucosal diathermy. This may explain why our results regarding improvement in nasal patency differ from the results obtained by other studies, or these differences present because of the variability of sample size, selection criteria, and etiology of turbinate hypertrophy, adding to that diathermy induced oedema may take more than 3 weeks to completely resolve (Ehab, 2010).

Improvement in sneezing was clinically and statistically significant, and was observed in 50% of patients 3 months after MAT, while it was observed in 22% of patients after SMD and was statistically not significant. This may be due to small sample or due to the variable environmental effects between seasons and sometimes within the same day. Chen et al. (2007) performed a comparative study between MAT and submucosal resection of inferior turbinate in children with turbinate hypertrophy and they found that subjective complaints including nasal obstruction, sneezing, rhinorrhea and hyposmia were significantly improved in both groups one month after surgery ($p<0.05$). The MAT typical symptoms related to nasal obstruction as a sneezing, rhinorrhea, snoring which decreased significantly from 6 months to three years after surgery in the microdebrider assisted inferior turbinoplasty group (Liu et al., 2009).

Although improvement in rhinorrhea following both techniques was clinically significant (3 of 8 patients after MAT and 2 of 4 patients after SMD), statistically it was not, probably because of small sample size or the effect of post-operative medications, the patients who sustained rhinorrhea after surgery did not notice any improvement and in one patient in SMD group there was worsening of rhinorrhea for one week following surgery. Chieh-Feng and Tai-An (2004) studied MAT and found that symptoms of rhinorrhea and postnasal discharge were not completely relieved in many patients after the operation, with only 58% (7/12) and 54% (7/13), respectively, of those patients attaining satisfactory outcomes. In this study MAT was superior to SMD in relieving facial pain, while the results were equal regarding hyposmia, however, these results were statistically not significant. Cingi et al. (2010) found that headache and hyposmia grades improved significantly in the first week of the operation both in the microdebrider and radiofrequency group and persisted in the 3rd month of the operation. Chieh-Feng and Tai-An (2004) observed that the overall success rate of relieving frontal headaches was 100% (10/10). Mamdouh et al. (1987) studied the SMD and noted that the post-operative clinical improvement as regards rhinorrhea and sneezing was not as marked as that for nasal obstruction.

The subjective complaints including nasal obstruction, sneezing, rhinorrhea and hyposmia were significantly improved one month after MAT ($p<0.05$). Blood loss during SMD was immeasurable in our method of measuring blood loss (graded container of the suction device), while during MAT blood loss ranged from few milliliters to less than 300 milliliters. Other studies also did not mention significant intra-operative blood loss for both techniques. However, in both groups blood loss was asymptomatic and considered minor in terms of classification of hemorrhage.

The mean operative time for MAT was more than double that for SMD; but it was not more than 41 minutes (Chen et al., 2007). Diaa El Din et al (2011) found that intra-operative blood loss was (37.1 ± 7.4) ml during MAT.

In MAT, the mean operative time was 8 minutes and the mean blood loss was 30 cubic centimeters for each turbinate. Liu et al. (2009) (MAT versus radiofrequency) found that none of the patients developed active bleeding during or after surgery. While mucosal tears were noted in the microdebrider group (11.7%, 7/ 60) there was no loss of mucosa in either group. In our study operative blood loss was more pronounced than in other studies, because we used only cotton pledges impregnated in xylometazoline (Otrivin) to decongest the turbinate before surgery, while in the other studies either cocaine or intraturbinal injection of adrenalin was used. The anesthetic technique (lack of hypotensive anaesthesia) may also correlate to the operative blood loss. Hegazy et al. (2007).

Flap perforation occurred more with SMD probably because of poor visualization of the flap during the procedure, while in MAT the flap was directly visualized and suction power was reduced to avoid mucosal tear, there was no mucosal loss in both techniques and healing was faster with MAT. Hegazy et al. (2007) used a 4 mm debrider for MAT and observed that mucosal tears were common (47%) of the turbinates but there was no loss of mucosa. Crustation was the major post-operative complication in both groups; it developed in 8 of 13 patients treated by MAT and in all of the patients following SMD with gradual improvement over a period of 3 months. Ehab (2010) found that crustation after SMD develops in 50% of patients in the first week, and this was reduced to 5% after 3 months.

Cingi et al. (2010) found no crusting or synechia formation following MAT. Hegazy et al. (2007) observed that 5 of his patients (10%) developed mild crustation after MAT. Friedman et al. (1999) studied MAT on 120 patients; they observed that postoperative complications included synaechiae (5 %) and postoperative bleeding (1.6 %). Liu et al. (2009) observed postoperative crusting and synechia in 7 of 60 patients, and dryness in one of 60 patients after MAT. Filho et al. (2003) studied submucosal diathermy of the inferior turbinate with or without out-fracture. In both groups crusting formation was similar. The analysis of nasal airway patency showed good results in 80% of the patients submitted to submucosal cauterization without-fracture on day 30 postoperatively. In conclusion, endoscopic MAT provided excellent visualization and intraoperative evaluation regarding the amount of turbinate tissue need to be removed to achieve good patency and avoid complications. Both MAT and SMD are effective mucosal preservation techniques, but the results of MAT are more predictable and it is associated with less post-operative morbidity.

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