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Turbinoplasty Using Submucosal Microdebrider, Radiofrequency And Conventional Surgical, What Is The Best?

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Abstract

Background: Nasal inferior turbinate hypertrophy is one of the most common causes of nasal obstruction. Many different surgical methods are currently available**. Study Design and Objectives:** This retrospective observational study was conducted for 3.5 years (between 2009 - 2012) to determine the best objective result technique of powered submucosal inferior turbinoplasty using special microdebrider blade for turbinoplasty comparing it with Radiofrequency turbinoplasty and conventional surgical turbinoplasty and follow up of the patients to detect any possible complications and an objective result. This operation was done in Al-Azhar University Hospitals in Egypt. The mean follow-up time was 2 years. **Results:** The study showed significant difference in bleeding between the three groups postoperatively (P <0.05), but there was no significant difference in nasal crustation between the three groups (P > 0.05). Acoustic rhinometry showing significant improvement in width of minimal cross sectional area in all groups after 6 months, 1 and 2 years (P <0.05) .The least width was in the radiofrequency group about 0.15 ± 0.06cm which represent 38.6 ± 24% after 2 years. Mucociliary clearance time, assisted by saccharin test, significantly decreased (P <0.05) in all groups all over the study. There was no significant difference (P >0.05) between the three groups after 6 months postoperatively but after 1 and 2 years there was a significant difference between the three groups (P <0.05). **Conclusion:** Radiofrequency turbinoplasty is the procedure, which can be done under local anesthesia. The microdebrider submucosal turbinoplasty is the procedure of highest efficacy and least complication so it must be the procedure of choice if the device is available.

1. Background

Nasal obstruction as a consequent of enlarged inferior turbinates is a common presentation in Otorhinolaryngology. [1]The hypertrophy of the inferior turbinates may be due to various causes including allergic reaction, vasomotor rhinitis or drug-induced rhinitis. [2]Mucosal swelling of the inferior turbinates is part of the physiologic vascular changes that take place during the nasal cycle. Hyper-reactivity, infection and allergy may enhance these changes. Enlargement of the inferior turbinates can be due to either an enlargement of the osseous or mucosal component of the turbinate. [3]

Inferior turbinate hypertrophy can be confirmed objectively by rhinomanometry. This investigation is performed with and without decongestion and total resistance is calculated. Resistance above 0.3 Pa/ml/s is usually symptomatic.Acoustic rhinometry is another objective method of nasal airway assessment. However, it still has poor correlation with the patients' subjective symptom ratings. [4]The surgical techniques for treatment of enlarged inferior turbinates include total or partial turbinectomy, cryotherapy, submucosal diathermy, laser turbinoplasty, and submucosal turbinoplasty. [5&6]

Recently, the advent of microdebrider and radiofrequency for the surgical treatment of hypertrophic inferior turbinates appear to offer some advantages over traditional techniques with regard to postoperative complications and mucosal preservation. (7)

2. Patient and Methods

This study conducted on 60 patients, attending Otorhinolaryngology department, Al-Azhar university hospital, with nasal obstruction and diagnosed as hypertrophied inferior turbinate refractory to medical treatment from 2009 till 2012 were identified as possible candidates. Patients were divided into 3 groups. Group I: Include 20 patients subjected to microdebrider submucosal turbinoplasty.Group II: Include 20 patients subjected to Radiofrequency turbinoplasty.Group III: Include 20 patients subjected to conventional surgical turbinoplasty.

2.1.Patient epidemiology

From January 2009 to July 2010, inclusively, 60 patients (33men and 27 women) with chronic nasal obstruction and rhinitis were enrolled. Their ages ranged from 18 to 53years (mean: 32.5 years).

Table (1): Mean± standard deviation (SD), frequency, percentage values and results of one-way ANOVA test and Chi-square test for comparison between ages and gender distributions in the three groups

Demographic data	Submucosal Microdebrider (n = 20)	Radiofrequency (n = 20)	Conventional surgical (n = 20)	P-value
Age (Mean ± SD)	31.4 ± 7.4	34.4 ± 10.2	31.8 ± 8.8	0.507
Gender (Frequency,%)				
Male	12 (60)	11 (55)	10 (50)	0.817
Female	8 (40)	9 (45)	10 (50)	

There was no statistically significant difference between mean age values in the three groups; also, there was no statistically significant difference between gender distributions in the three groups, as shown in table (1)

2.2. Surgical techniques

The microdebrider submucosal turbinoplasty procedure was performed under general anesthesia and under endoscopic guidance. A submucosal pocket was dissected by tunneling with microdebrider blade with dissecting tip in an anterior to posterior and superior to inferior sweeping motion. A 2.9 mm diameter microdebrider tip (Medtronic Xomed®), rotating continuously in a circular fashion and set at 3,000 rpm while using suction irrigation, was applied to remove all the stromal tissue possible from inside of the turbinate. Particular attention was paid to preserve the mucosal flap during this removal process. For patients with hypertrophied turbinate posterior end(tails), the same procedure was performed from a second entry point made at the mid-portion of the inferior turbinate to gain better access to treat the ‘‘mulberry-tip’’ of the inferior turbinate. The nasal passages were packed with a piece of Merocel® (Medtronic Xomed®) for a one day.

Radiofrequency turbinoplasty was performed under local anesthesia. We used the ENT ecCoblator Plasma Surgery System® (Arthrocare Corp®) with a voltage range of 96 to 312 voltage root-mean-squares (Vrms) at 100 kHz. The wand was damped with 0.9% normal saline to permit the plasma field to form during insertion. All surgical procedures were performed under endoscopic guidance. After packing each nostril parallel to the inferior turbinate with piece of cotton soaked with 2 % xylocaine and 1:100,000 epinephrine, the tip of the probe was inserted submucosally at the anterior head of inferior turbinate and extended to the posterior portion of the inferior turbinate (three entries per turbinate, one at the medial surface of inferior turbinate, one at the turbinate surface facing the inferior meatus and one parallel to the nasal floor).

Then, the inferior turbinate was ablated with an output power level of four (168–182 Vrms) in the posterior to anterior direction. The wand was kept in position for 15 seconds unlessthe whitening of the overlying mucosa of the applied region was noted. The withdrawal was performed at coagulation mode. Great care was taken not to injure the mucosa of inferior turbinates. No nasal packing was needed after the procedure.

Conventional surgical turbinoplasty was performed under general anesthesia. All surgical procedures were performed under endoscopic guidance. After infiltration of the inferior turbinate with 2% xylocaine with 1:100,000 epinephrine, a 3-4 mm mucosal incision was done on the head of the inferior turbinate.

The submucosal tissue was dissected from the medial surface and inferior edge of the bone via the mucosal incision assisted by the use of an elevator. The excess cavernous tissue was then resected using Hartmann forceps. After surgery, nasal packing with Merocel® was continued for 2 or 3 days depending on bleeding which ranged from mild to moderate bleeding.

2.3. Outcome measure&Postoperative follow up

The surgical outcomes for all procedures were evaluated with respect to distinct parameters: acoustic rhinometry and saccharin testing. All patients were evaluated prior to surgery, at 6 months after surgery, and at 1 and 2years after surgery. Patients were requested to not use oral or topical steroids, antihistamines and vasoconstrictors during the 1-month post-operative period.

3. Results

The study show significant difference in bleeding between the three groups postoperatively (P <0.05), both microdebrider and radiofrequency groups no bleeding in all patients while 5 patients after conventional surgical turbinoplasty represent 25% of this group show bleeding which stop after 2 days of nasal packing. No significant difference in nasal crustation between the three groups (P > .05). The percentages of crustation are 0 %, 13 % and 25%for each group respectively, as shown in table (2) and figure (1).

Table (2): Frequency, percentage values and results of Chi-square test for comparison between complications in the 3 groups.

Complications	**Submucosal Microdebrider (n = 20)**	**Radiofrequency (n = 20)**	**Conventional surgical (n = 20)**	***P*-value**
Bleeding (Frequency, %)	0 (0)	0 (0)	5 (25)	0.004*
Crustation (Frequency, %)	0 (0)	3 (15)	5 (25)	0.065

**: Significant at P ≤ 0.05*

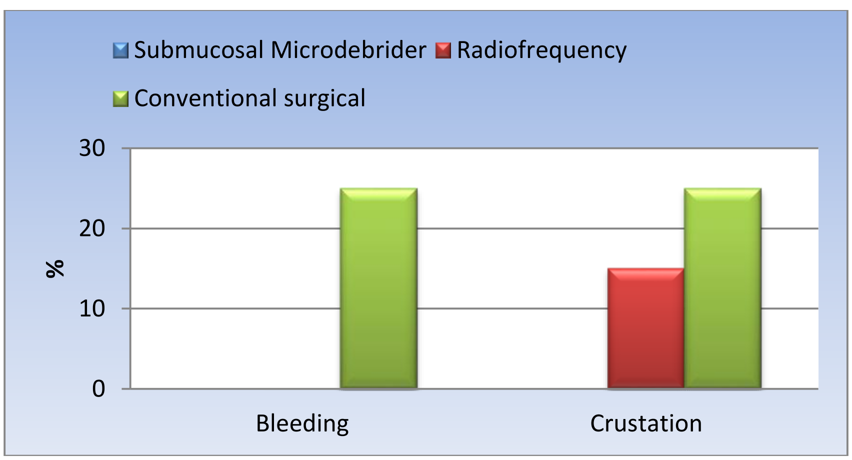

Figure (1): Prevalence of complications in the three groups

Acoustic rhinometry showing significant improvement in width of minimal cross sectional area in all groups after 6 months, 1 and 2 years (P <0.05).The least width was in the radiofrequency group about 0.15 ± 0.06cm that represent 38.6 ± 24% after 2 years and the best width was in the microdebrider group after 6 month 0.40 ± 0.04cm which represent 99.8 ± 26.7 % .This means that acoustic rhinometry may give an idea about nasal obstruction, as shown in table (3) and figure (2).

Table (3): Mean± standard deviation (SD) values and results of one-way ANOVA test and Tukey's test for comparison betweenminimal cross sectional areas(MCA) in the three groups at each observation period.

Turbinoplasty / Period	Submucosal Microdebrider (n = 20)	Radiofrequency (n = 20)	Conventional surgical (n = 20)	*P*-value
Pre-operative (Mean ± SD)	0.41 ± 0.07	0.42 ± 0.07	0.41 ± 0.07	0.886
6 months (Mean ± SD)	0.81 ± 0.06	0.77 ± 0.07	0.78 ± 0.07	0.134
1 year (Mean ± SD)	0.80 ± 0.06	0.66 ± 0.03	0.77 ± 0.07	<0.001*
2 years (Mean ± SD)	0.79 ± 0.06	0.57 ± 0.04	0.76 ± 0.07	<0.001*

**: Significant at P ≤ 0.05, Different letters are statistically significantly different according to Tukey's test*

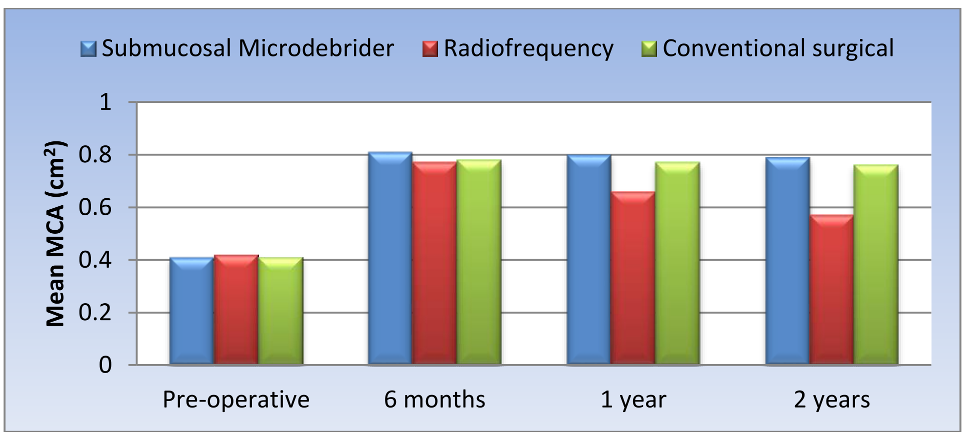

Figure (2): Mean MCA in the three groups

Changes by time in each group

In each group, there was a statistically significant increase in mean minimal cross sectional area (MCA) after 6 months, 1 year and 2 years, as shown in table (4) and figure (3).

Table (4): Mean± standard deviation (SD) values and results of paired t-test for the changes by time in mean MCA of each group.

Turbinoplasty	Period	Mean difference ± SD	*P*-value
Submucosal Microdebrider	Post-operative - 6 months	0.40 ± 0.04	<0.001*
	Post-operative - 1 year	0.39 ± 0.04	<0.001*
	Post-operative - 2 years	0.38 ± 0.04	<0.001*
Radiofrequency	Post-operative - 6 months	0.35 ± 0.05	<0.001*
	Post -operative - 1 year	0.24 ± 0.06	<0.001*
	Post -operative - 2 years	0.15 ± 0.06	<0.001*
Conventional surgical	Post -operative - 6 months	0.37 ± 0.04	<0.001*
	Post -operative - 1 year	0.36 ± 0.04	<0.001*
	Post -operative - 2 years	0.34 ± 0.04	<0.001*

**: Significant at P ≤ 0.05*

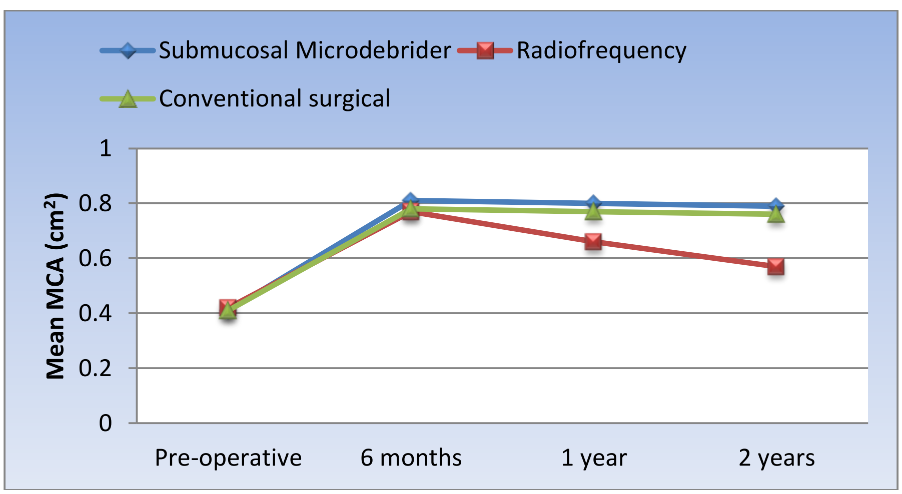

Figure (3): Changes by time in mean MCA of each group

Comparison between percentage increases in MCA of the three groups

The percentage increase was calculated as:

$$\frac{\text{MCA (post-operative)} - \text{MCA (pre-operative)}}{\text{MCA (pre-operative)}} \times 100$$

Through all periods; there was no statistically significant difference between Submucosal Microdebrider and conventional surgery groups; both showed the statistically significantly highest mean % increase in MCA. Radiofrequency group showed the statistically significantly lowest mean percentage increase in MCA, as shown in table (5).

Table (5): Mean± standard deviation (SD) values and results of Kruskal-Wallis test and Mann-Whitney U test for comparison between percentage increases in MCA in the three groups.

Turbinoplasty / Period	Submucosal Microdebrider (n = 20)	Radiofrequency (n = 20)	Conventional surgical (n = 20)	*P*-value
Post-operative - 6 months	99.8 ± 26.7	86 ± 27.2	92.2 ± 25.7	0.041*
Post-operative - 1 year	96.9 ± 25.8	60.3 ± 29	89.9 ± 25.7	<0.001*
Post-operative - 2 years	94.5 ± 25.9	38.6 ± 24	87.1 ± 25.3	<0.001*

** Significant at P ≤ 0.05, Different letters are statistically significantly different according to Mann-Whitney U test.*

Mucociliary clearance time, assisted by saccharin test, significantly decreased (P <0.05) in all groups all over the study. There was no significant difference (P >0.05) between the three groups after 6 months postoperatively but after 1 and 2 years there was a significant difference between the three groups (P <0.05). The best improvement, marked decrease in mucociliary clearance time, was in the microdebrider group which about 7.3 ± 1.5 minutes with percentage of decrease 31.1 ± 4% after 1year and 6.9 ± 1.5minutes with percentage of decrease 29.6 ± 4.3% after 2 years. While the least improvement, least decrease in mucociliary clearance time, was in the radiofrequency group which was 5.6 ± 1.8 minutes and by percentage 22.7 ± 5.9% after 1 year and 3 ± 1.1 minutes and by percentage 12.4 ± 4.2 % after 2 years. The decrease in surgical group after 1 year was 7.2 ± 1 minutes which about 30.7 ± 2.6 % and after 2 years was 6.4 ± 1.3 minutes, which about 27.1 ± 3.5 %, as shown in table (6), and figure (4).

Table (6): Mean± standard deviation (SD) values and results of one-way ANOVA test and Tukey's test for comparison between mucociliary clearances in the three groups at each observation period.

Turbinoplasty / Period	Submucosal Microdebrider (n = 20)	Radiofrequency (n = 20)	Conventional surgical (n = 20)	*P*-value
Pre-operative (Mean ± SD)	23.2 ± 2.3	24 ± 2.3	23.3 ± 2.5	0.490
6 months (Mean ± SD)	15.1 ± 1.4	15.9 ± 1.1	15.1 ± 1.8	0.118
1 year (Mean ± SD)	15.9 ± 1.3	18.5 ± 1.1	16.2 ± 1.8	<0.001*
2 years (Mean ± SD)	16.3 ± 1.4	21 ± 1.9	17 ± 1.7	<0.001*

**: Significant at P ≤ 0.05, Different letters are statistically significantly different according to Tukey's test*

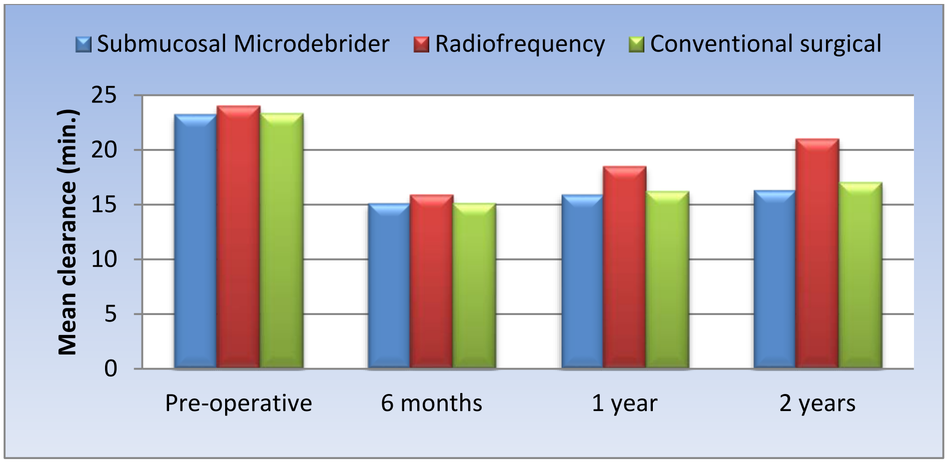

Figure (4): Mean mucociliary clearance in the three groups

Changes by time in each group

In each group, there was a statistically significant decrease in mean mucociliary clearance after 6 months, 1 year and 2 years.

Comparison between percentage decreases in mucociliary clearance of the three groups, as shown in table (7) and figure (5).

The percentage decrease was calculated as:

$$\frac{\text{Clearance (post-operative)} - \text{Clearance (pre-operative)} \quad x \quad 100}{\text{Clearance (pre-operative)}}$$

Table (7): Mean± standard deviation (SD) values and results of paired t-test for the changes by time in mean mucociliary clearance of each group.

Turbinoplasty	**Period**	**Mean difference ± SD**	***P*-value**
Submucosal Microdebrider	Post-operative - 6 months	-8.1 ± 1.4	<0.001*
	Post -operative - 1 year	-7.3 ± 1.5	<0.001*
	Post -operative - 2 years	-6.9 ± 1.5	<0.001*
Radiofrequency	Post -operative - 6 months	-8.1 ± 1.7	<0.001*
	Post -operative - 1 year	-5.6 ± 1.8	<0.001*
	Post -operative - 2 years	-3 ± 1.1	<0.001*
Conventional surgical	Post -operative - 6 months	-8.3 ± 1.2	<0.001*
	Post -operative - 1 year	-7.2 ± 1	<0.001*
	Post -operative - 2 years	-6.4 ± 1.3	<0.001*

**: Significant at P ≤ 0.05*

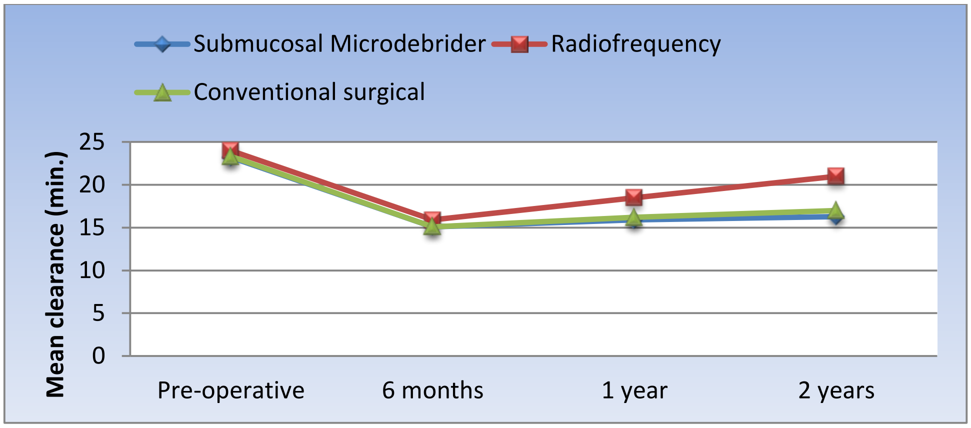

Figure (5): Changes by time in mean mucociliary clearance of each group

After 6 months; there was no statistically significant difference between the three groups, also after 1 year and 2 years; there was no statistically significant difference between Submucosal Microdebrider and conventional surgery groups; both showed the statistically significantly highest mean percentage decrease in mucociliary clearance. Radiofrequency group showed the statistically significantly lowest mean percentage decrease in mucociliary clearance, as shown in table (8).

Table (8): Mean± standard deviation (SD) values and results of one-way ANOVA test and Tukey's test for comparison between % decrease in mucociliary clearance in the three groups

Turbinoplasty / **Period**	**Submucosal Microdebrider (n = 20)**	**Radiofrequency (n = 20)**	**Conventional surgical (n = 20)**	***P*-value**
Post-**operative - 6 months**	34.8 ± 3.7	33.5 ± 4.5	35.4 ± 3.5	0.279
Post-**operative - 1 year**	31.1 ± 4	22.7 ± 5.9	30.7 ± 2.6	<0.001*
Post-**operative - 2 years**	29.6 ± 4.3	12.4 ± 4.2	27.1 ± 3.5	<0.001*

** Significant at P ≤ 0.05, Different letters are statistically significantly different according to Tukey's test*

Discussion

The principal goal of turbinate surgery is to obtain an improvement in nasal-breathing ability for recipients while at the same time preserving the physiological function of the nasal passages and mucosa, and eliciting minimal discomfort or adverse effects.

Pasaali and his colleagues[8]have reported that submucosal resection provided the greatest relief of nasal obstruction due to hypertrophy of the inferior turbinates of all available surgical procedures with. It should be noted, however, that this technique produces some mucosal damage to the inferior turbinate and requires great surgical skills. Gindros and his colleagues [9] has reported that for each increase in nasal valve width (MCA) as measured by acoustic rhinometry there is corresponding decrease in nasal resistance and increase in nasal flow as measured by anterior rhinomanometry.

This study show significant difference in bleeding between the three groups postoperatively, as in both microdebrider and radiofrequency groups no bleeding inall patients while five patients after conventional surgical turbinoplasty represent 25% of this group show bleeding which stop after 2 days of nasal packing. No significant difference innasal crustation between the three groups (P > .05). The percentages of crustation are 0 %, 13 % and 25%for each group respectively.

Chen YL and his colleague [10] reported significant increase in crusts (P <0.05) present over the inferior turbinate from 0% to 2.50±0.51 conventional surgical group which is much lower than in our study. This difference may be due to better hand skills leading to less mucosal trauma and tear while both of the studies are identical in microdebrider result.

Yañez and Mora[11] agree with this study in significant difference (decrease) of bleeding and crustation after use of microdebrider. Only 4/338 patients has crustation and 1/338 patients has bleeding and Saki and his colleagues [12]reported very low incidence of crustation after radiofrequency 1±0.6 but in this study they use regular nasal packing for 1 to 3 days to avoid bleeding.

In this study the incidence of complications (bleeding and crustation) in the radiofrequency group are lower than surgical group but still higher than the incidence occurs in the other studies. This incidence may explained by mucosal tear which may occur in our study.

Kizilkaya and her colleagues[13] conducted a prospective trial with 30symptomatic patients who underwent simultaneous radiofrequency and microdebrider turbinoplasty on consecutive sides. They use acoustic rhinometry to assess outcomes to a follow-up of 6 months. Both procedures resulted in improvement in minimal cross sectional area with no statistically significant differences.

By using the Acoustic rhinometry in this study, it shows significant improvement in width of minimal cross sectional area in all groups after 6 months, 1 and 2 years (P <0.05) . No significant difference between the three groups after 6 months (P > .05). After 1 and 2 years there is significant difference between the three groups (P <0.05) with least improvement (narrowest nasal valve) in the radiofrequency group while the best improvement (widest nasal valve) in the microdebrider group. The least width was in the radiofrequency group about 0.15 ± 0.06cm that represent 38.6 ± 24% after 2 years and the best width was in the microdebrider group after 6 month 0.40 ± 0.04cm which represent 99.8 ± 26.7%.

Gindros and his colleagues [14] agree with this study as they show significant increase in minimal cross sectional area by acoustic rhinometry (P <0.05) after radiofrequency. Also this study show corresponding decrease in nasal resistance

Liu CM and his colleague[15] reported no significant difference (P >0.05)between microdebrider and radiofrequency 6 months postoperatively while significant difference was reported between both groups (P <0.05)from 1 year up to 3 years, which in line with this study.

Back and his colleague[16]agree with this study as regard radiofrequency as they reported significant improve in mean saccharin transit time 6 months and 1 year postoperatively.

Chen YL and his colleague[17] reported significant decrease in mean saccharin transit time(P <0.05) 1 and 3 months after conventional surgical turbinoplasty and microdebrider turbinoplasty which in line with this study. However, they notice increase in mean saccharin transit time in surgical group during the first week thatmay be explained by presence of crusts during this period. This explanation is confirmed by absence of this increase in microdebrider group.

Passaliand his colleague[8] published results of a randomized clinicaltrial with 382 patients comparing six treatment groups, turbinectomy, laser cautery, electrocautery, cryotherapy, submucosal resection, and submucosal resection without fracture. After 6 years of follow-up, they found that submucosal resection resulted in the highest degree of nasal patency and restoration of mucociliary clearance.

Chen and his colleague [18] evaluated long-term outcomes of endoscopic microdebrider without fracture compared with endoscopic submucous tissue resection alone and without microdebrider for hypertrophic turbinates in patients with perennial allergic rhinitis. A total of 145 patients were followed to 3 years using saccharin transit time as outcome measures. Both groups had similar improvement in saccharin transit time at 1 year sustained to 3 years postoperatively.

With the use of Mucociliary clearance time, assisted by saccharin test, significantly decreased (P <0.05) in all groups all over the study ,but that didn't appear inthe first 6 months postoperatively (P > .05) between the three groups, furthermore after 1 and 2 years there was a significant difference between the three groups (P <0.05). The best improvement, marked decrease in mucociliary clearance time, was in the microdebrider group which about 7.3 ± 1.5minutes with percentage of decrease 31.1 ± 4% after 1year and 6.9 ± 1.5minutes with percentage of decrease 29.6 ± 4.3% after 2 years. While the least improvement, least decrease in mucociliary clearance time, was in the radiofrequency group which was 5.6 ± 1.8minutes and by percentage 22.7 ± 5.9% after 1 year and 3 ± 1.1 minutes and by percentage 12.4 ± 4.2 % after 2 years. The decrease in surgical group after 1 year was 7.2 ± 1 minutes which about 30.7 ± 2.6 % and after 2 years was 6.4 ± 1.3 minutes which about 27.1 ± 3.5 %.

Conclusion

Submucosal microdebrider turbinoplasty: is the technique of highest efficacy and least complication. Availability of the microdebrider in the operating room is the main problem in this technique but Radiofrequency turbinoplasty: is the simplest technique, easily done under local anesthesia. The efficacy is high (significant improvement) in the first year. During the second year, the efficacy is significantly decreased but still effective. Conventional surgical turbinoplasty: is as effective as microdebrider but the complication namely crustation and bleeding in this method is higher. In addition, this method need much more fine skillful hand. This method is time consuming than the other two methods.

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