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Comparative Study Between Different Techniques for Middle Turbinate Stabilization During Endoscopic Sinus Surgery

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Background:The nasal turbinates play important role in nasal functions contribute to inspiratory resistance, which is necessary for normal breathing.Chronicrhinosinusitis is a frequent condition that is treated by functional endoscopic sinus surgery when fail medical therapy. Objective:The aim of the current study is to evaluate the middle turbinate stabilization during endoscopic sinus surgery by using different techniques aiming to maintain the patency of osteomeatal Complex(OMC).Patients and methods: A prospective randomized clinical studyincluded 36 patients had chronic rhinosinusitis with or without nasal polyps refractory to medical treatment were surgically treated with functional endoscopic sinus surgery with a follow-up for a minimum of 3 months.Preoperativeandpostoperative evaluation of the associated nasal symptoms olfaction, facial pain and nasal obstruction, was done by using the visual analogue scale (VAS). Postoperative endoscopic assessments to the presence of synechiae and crustations of middle meatus.Results: Regarding comparison between the pre and post-operative olfaction there was statistically significant improvement on the three groups with the best improvement on suture stabilization of middle turbinate group than middle turbinate bolgarization than FESS without MT stabilization (56.9%> 25.3%>18.6%) respectively. There was highly statistically significant improvement on the three groups in nasal with the best improvement on suture stabilization of middle turbinate group than middle turbinate bolgarization than FESS without MT stabilization (76.2%> 52.7%>37.3%) respectively.There was statistically significant difference in post-operative crusting between the three studied groups after 1 month, two and three months with the least percent on FESS without MT stabilization (control group) followed by undergoing middle turbinate bolgarization group then suture stabilization of middle turbinate group (8.4%,12.5%, 29.2%).There was statistically significant difference in post-operative synechiae between the three studied groups at 1st, 2nd and 3rd month with better results on suture stabilization of middle turbinate group.Conclusion:The middle turbinate suture technique and bolgerization technique are a simple, reliable, and cost-saving methods.Thetranseptal middle turbinate suturing provides the highly effective, efficient and most patient friendly technique of preventing adhesions after endoscopic sinus surgery.

Keywords: Middle turbinate suturing,bolgerization technique, rhinosinusitis and Endoscopic Sinus Surgery

INTRODUCTION

The turbinates are the most prominent feature of the lateral nasal wall(Sava et al.,2018). The developing lateral nasal wall shows series of

elevations at the beginning of 8th fetal week, which will ultimately develop into the turbinates. The maxillo-turbinal forms the inferior turbinate, while the ethmo-turbinal forms the middle and superior turbinate(Som and Naidich,2013). These turbinates are usually three or four in number. They appear as scrolls of bone, covered by ciliated columnar epithelium. The superior, middle and inferior turbinates are present in all individuals. A small supreme turbinate may be present in some individuals (Mendiratta et al., 2016). The shape of the middle turbinate is highly variable, as it can be paradoxically curved or pneumatized. Any pneumatization of the middle turbinate is technically referred to as a concha bullosa. If the vertical portion or lamella of the middle turbinate is pneumatized, the cell that is formed is referred to as the interlamellar cell (Rusu et al., 2020).

Prior to adaptation of endoscopic approaches for sinonasal pathology, patients regularly endured significant morbidity from open approaches to the sinonasal cavity that were often fraught with failure. With improvements in transnasal endoscopy, functional endoscopic sinus surgery (FESS) subsequently emerged from the work of Messerklinger and other pioneers in the field (Tajudeen and Kennedy, 2017).Chronic rhinosinusitis is a frequent condition that is treated by functional endoscopic sinus surgery when fail medical therapy, and has been reported to provide both immediate and long-term symptom reductionand improvement in quality of life in 85% of patients (Krings et al., 2014). Several factors contribute to lateralization of the middle turbinate with or without synechia formation: trauma to the lateral mucosal surface of the middle turbinate, resection of the horizontal portion of the basal lamella, improper manipulation of the middle turbinate resulting in a floppy turbinate, severe polyposis surrounding the middle turbinate, postoperative swelling, inadequate postoperative debridement, and improper packing of the nasal airway after surgery(Rebeiz and Smith, 2018).The most frequently reported complication is adhesion of the lateral aspect of the middle turbinate to the lateral nasal wall.The potential sequela of turbinate lateralization and scarring is the obstruction of the middle meatus and the maxillary, ethmoid, or frontal sinus ostia. The prevention of middle turbinate lateralization, and middle meatalsynechiae formation, is the key to maintaining a patent OMC and providing good post-operative results(Bansal and Singh, 2019).

Therefore, this study is conducted to evaluate a suture stabilization technique of the middle turbinate in an attempt to solve this problem and preserve the middle turbinate. As well, to compare between different methods of medialization of the middle turbinate as regard:crustations, olfaction, nasal obstruction, nasal secretion and inflammatory edema.

MATERIALS AND METHODS

A prospective randomized controlled clinical study included 36 patients selected from the Outpatients Clinic of the Otorhinolaryngology Head and Neck Departments, Faculty of Medicine, Zagazig University Hospital along the period from June 2019 to February 2020. Patient had chronic rhinosinusitis with or without nasal polyps refractory to medical treatment were surgically treated with functional endoscopic sinus surgery with a follow-up for a minimum of 3 months, were enrolled after obtaining informed consent. The study had been approved by the local ethics committee on research involving human subjects of Faculty of Medicine, Zagazig University Hospital.

Inclusion and exclusion Criteria:

Patients have age from 18 - 60 years of both males and females were enrolled for FESS for chronic sinusitis with or without nasal polyps. While, patients with systemic diseases involving nasal structures, pregnantpatients and patients who were not fit for surgerywere excluded from the study.

Technical design:

A total of 36 patients (72 nasal sides) were operated, FESS was done for nasal cavities of each patient, all patients were divided into three equal groups: Group (A): patients treated with suture stabilization of middle turbinate. Group (B): patients treated with MT bolgarization.Group(C): patients undergoing FESS without MT stabilization became as control group.

All patients were subjected to the following: (a)Preoperative evaluation (history, routine nasalexamination, investigation). (b) Surgical management by FESS was completed by middle turbinate suture or bolgarization as the final step.

Preoperative assessments:

Preoperative evaluation of the associated nasal symptoms olfaction and facial pain, was done by using the visual analogue scale (VAS), the patient rates his symptoms from a score of 0 to 10 with score 0: being asymptomatic and 10:

being the most severe symptom, as mild: 0-3, moderate: 4-7, and severe: 8 -10. Nasal obstruction, was done by using the visual analogue scale (VAS) the patient rates his symptoms from a score of 0 to 10 with score 0: being breathing freely and 10: being the most severe symptom, as (mild intermittent blockage:0-3),(moderate continuous blockage: 4-7), and (severe, no nasal breathing: 8 -10).

The operative technique:

All procedures done under general hypotensive anesthesia with patients in supine position with slight elevation of patient head. At the beginning of the surgery, the mucosa and nasal cavities had been decongested by using nasal packs with 1: 100 000 of saline adrenaline.All Patients undergoing functional endoscopic sinus surgery involving at least middle meatalantrostomy, anterior and posterior ethmoidectomy. At the end of FESS the stabilization techniques done.

Middle turbinate suturing:

After endoscopic sinus surgery in **group(A)** we take a 4/0polyglactin 910 (vicryl) suture on a 13mm straight needle. Under endoscopic guidance the needle is passed through the middle turbinate in left nostril from lateral to medial side crossing the nasal septum to the contralateral side,the needle is continued through the middle turbinate from the medial to lateral on the opposite side and then brought out through the right nostril,the needle is picked up and it is then reinserted in the opposite direction from right to lift nostril anterior to the anterior end of the middle turbinate through the septumand knots are tied thereby securing the middle turbinate tightly against the septumThe tightness of the knots is checked with an endoscope. The suture usually dissolves in around 4-6 weeks' time.

Bolgarization:

After endoscopic sinus surgery in **group (B)** we take a sickle knife under endoscopic guidance it is passed through the nostril to medial surface of middle turbinate, the mucosa just posterior to the turbinate caudal end, and the opposing septal mucosa are abraded by the sickle knife. This lead to creating of tow denuded area measuring about (4 × 4) mm on both surfaces. Merocel packs are inserted in the middle meatus and allowed to expand via irrigation by saline, thus maintaining the middle turbinate in a mediatized position and allowing it to come into contact with the nasal septum.

Postoperative follow up:

The nasal pack was removed after 24 hours in the control group and MT suturing group but in group of bolgarization the pack removed after 48h or 72h, the patients discharged on oral antibiotics, nasal decongestant, and analgesic for 7 days and pressure saline irrigation three to four times daily for 2 to 3 weeks after surgery.All patients postoperative were underwent to an assessment protocol similar to the preoperative in additional to postoperative endoscopic assessments to the presence of synechiae and crustations of middle meatus were quantified on 0-2 point basis (0 = not present, 1 = present, 2 = markedly present).

Statistical Analysis:

Data were checked, entered and analyzed using SPSS version 23 for data processing. The following statistical methods were used for analysis of results of the present study. Data were expressed as number and percentage for qualitative variables and mean + standard deviation (SD) for quantitative one. F-test was used to calculate difference between quanitative variables in more than two groups. ANOVA test for repeated measures was used to calculate difference between pre and post-operative quanitative variables in one group.Chi-square test (X2) used to find the association between row and column variables. For all above-mentioned statistical tests done, the threshold of significance was fixed at 5% level (P-value).

RESULTS

Regarding comparison between the pre and post-operative facial pain, there was statistically significant improvement on the three groups with the best improvement on suture stabilization of middle turbinate group(Table 1).Regarding comparison between the pre and post-operative olfaction, there was statistically significant improvement on the three groups with the best improvement on suture stabilization of middle turbinate group than middle turbinate bolgarization than FESS without MT stabilization (56.9%> 25.3%>18.6%) respectively (Table 2).

Table 1: Pre-operative and post- operative facial pain between studied groups

Facial pain	Group (A) (24)	Group (B) (24)	Group (C) (24)	F test	p
Preoperative mean ± SD Range	6.7± 2.25(5-10)	6.9± 1.5(4-9)	6.8± 2. (5-9)	0.04	0.9
Postoperative 2 weeks mean ± SD Range	4.1± 0.9(2-6)	5.8± 1.3(3-7)	5.2±1.2 (3-7)	6.8	0.003*
Postoperative 1 month mean ± SD Range	2.3±1.2(0.0-4)	3.6± 1.3(2-6)	3.8± 1.1(3-6)	5.5	0.008*
Postoperative 2 months mean ± SD Range	1.3± 0.6(0.0-3)	2.1± 0.9(0.0-3)	2.6 ±0. (0.0-4)	7.8	<0.001**
Postoperative 3 months mean ± SD Range	0.8 ± 0.2(0.0-2)	1.4 ± 0.2(0.0-3)	1.9 ± 0.4(1-4)	19.2	<0.001**
Percent of improvement	73.7%	39.3%	25.7%		
p-value^	<0.001**	<0.001**	0.001**		

^p-value for comparing pre and post-operative, * Statistically significant difference (P ≤ 0.05) and ** Statistically highly significant difference (P ≤ 0.001).

Table 2: Comparing pre-operative and post-operative olfaction between studied groups

Olfaction (smell disturbance)	Group (A) (24)	Group (B) (24)	Group (C) (24)	F test	p
Preoperative mean ± SD Range	7.1±1.6(6-10)	6.7±1.9(5-10)	6.9±1.8(5-9)	0.1	0.8
Postoperative 2 weeks mean ± SD Range	4.4± 0.4(1-5)	4.9± 0.6(2-6)	5.1±0.8 (1-6)	4.1	0.02*
Postoperative 1 month mean ± SD Range	1.3±1.2(0.0-4)	3.8± 1.3(2-6)	4.6± 1.3(3-6)	22.1	<0.001**
Postoperative 2 months mean ± SD Range	1.1± 0.6(0.0-2)	2.1± 0.9(0.0-3)	4.2 ±0.7(0.0-4)	23.9	<0.001**
Postoperative 3 months mean ± SD Range	1.06 ± 0.8(0.0-2)	1.9 ± 0.9(0.0-3)	3.8 ± 0.6(0.0-3)	9.1	<0.001**
Percent of improvement	56.9%	25.3%	18.6%		
p-value	<0.001**	<0.001**	0.001**		

^p-value for comparing pre and post-operative,* Statistically significant difference (P ≤ 0.05) and ** Statistically highly significant difference (P ≤ 0.001).

Table 3: Comparing post-operative synechiae between the three studied groups:

Post-operative synechiae	Group (A)		Group (B)		Group (C)		X^2	p
	NO. (24)	%	NO. (24)	%	NO. (24)	%		
After 2 weeks								
No	13	54.2%	14	58.3%	12	50.0%		
Present	11	45.8%	10	41.7%	12	50.0%	1.8	0.4
Markedly present	0.0	0.0%	0.0	0.0%	0.0	0.0%		
After 1 month								
No	15	62.5%	16	66.7%	7	29.2%		
Present	9	37.5%	8	33.3%	17	70.8%	8.1	0.01*
Markedly present	0.0	0.0%	0.0	0.0%	0.0	0.0%		
After 2 months								
No	21	87.5%	18	75.0%	9	37.5%		
Present	3	12.5%	6	25.0%	13	54.1%	16.1	0.002*
Markedly present	0.0	0.0%	0.0	0.0%	2	8.4%		
After 3 months								
No	23	95.8%	21	87.5%	16	66.6%		
Present	1	4.2%	3	12.5%	6	25.0%	10.1	0.003*
Markedly present	0.0	0.0%	0.0	0.0%	2	8.4%		
p-value^	0.001**		0.001**		0.008*			

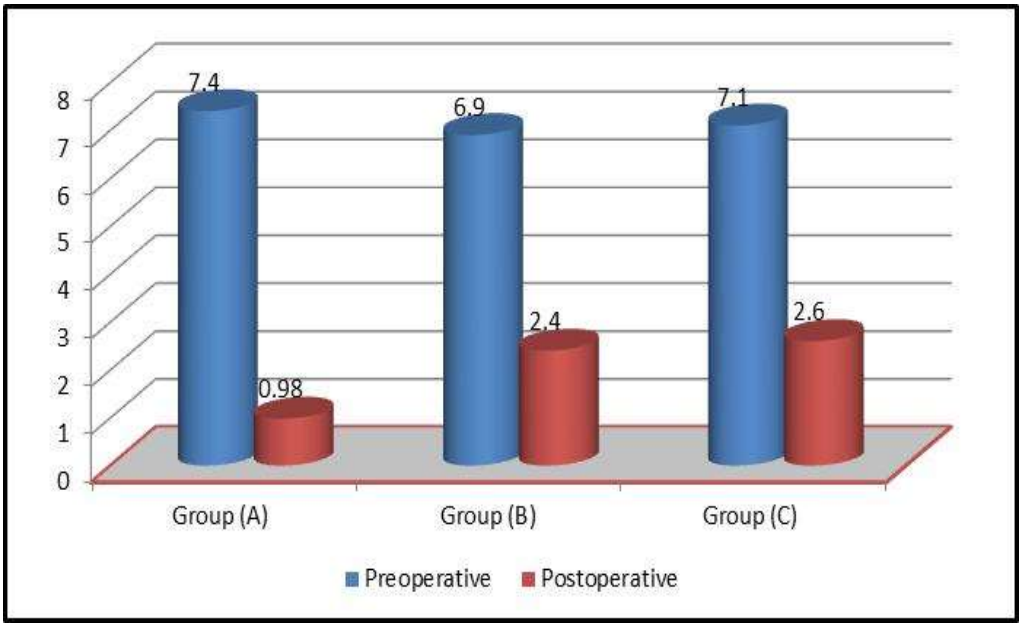

Figure 1: Bar chart for pre and post-operative nasal obstruction among the studied groups.

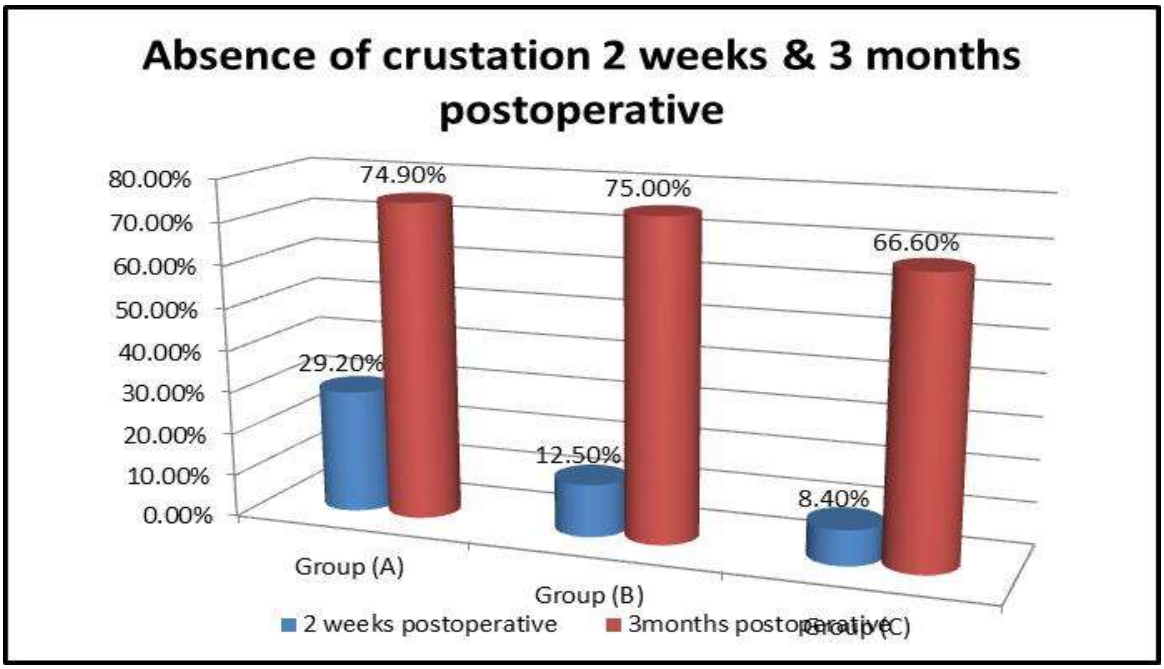

Figure 2: Bar chart for pre and post-operative crustation among the studied groups.

Concerning comparison between the pre and post-operative nasal obstruction, there was highlystatistically significant improvement on the three groups with the best improvement on suture stabilization of middle turbinate group than middle turbinate bolgarization than FESS without MT stabilization (76.2%> 52.7%>37.3%) respectively(Figure 1).

Concerning comparison between the 2 weeks and 3 months post-operative crusting, there was highly statistically significant improvement on FESS without MT stabilization group than middle turbinate bolgarization group than suture stabilization of middle turbinate group (Figure 2).

Regarding comparison between thethe three studied groups at 1st, 2nd and 3rd month, there was statistically significant difference in post-operative synechiae with better results on suture stabilization of middle turbinate group than undergoing middle turbinate bolgarization group than FESS without MT stabilization (control group) where (45.8%, 41.7% and 50.0%) of suture stabilization of middle turbinate group, undergoing middle turbinate bolgarization group and FESS without MT stabilization had synechiae 2 weeks post-operatively improved to (4.2%, 12.5% and 33.4%) of the three groups respectively three months post-operatively (Table3).

DISCUSSION

The current study is complementary to a previous work. In this study, we compared different techniques of MT medialization and their effect on symptoms and postoperative endoscopy findings. We studied three groups: group A underwent ESS with suturing medialization of the MT, group B underwent ESS with bolgarization of MT, and finally, group C underwent conventional ESS (the control group).

In our study, the pre and post-operative facial pain showed a statistically significant improvement on the three groups with the best improvement on suture stabilization of middle turbinate group and this is consistent with the finding of Hegazy et al. (2015)who found that patients in group A (ESS with suture medialization of the MT) showed a highly statistically significant improvement in facial pain, whereas the patients in both groups B (ESS with bolgarization of the MT) and C (normal ESS) Showed a statistically significant improvement. Also, there was statistically significant improvement on the three groups in olfaction with the best improvement on suture stabilization of middle turbinate group than middle turbinate bolgarization than FESS without MT stabilization (56.9%> 25.3%>18.6%) respectively. This results were in agree with Alzubiadi et al.(2020) who reported that Smell was improved in both Bolgarization and suturing groups by an improvement rate of 23.7% and 50%, respectively, compared to significant worsening in control group.

Dutton and Hinton (2011)who studied the

effect of conchopexy on olfaction on a large number of patients and they reported that application of an MT suture does not exert any effect on olfactory functions Smell loss occurs in 15% to 30% of CRS patients, particularly in the case of old age, smokers, and asthmatics (Hummel et al. 2017). Among the patients undergoing ESS, the proportion of smell loss reaches approximately 80%. The olfactory function reportedly improves in approximately 70% of patients having smell loss after ESS, but its improvement rate and preoperative prognostic factors vary among studies(Jiang et al. 2008 Aand Kim et al. 2019).

There was statistically significant difference in post-operative synechiae between the three studied groups with better results on suture stabilization of middle turbinate group than undergoing middle turbinate bolgarization group than FESS without MT stabilization (control group) where (4.2%, 12.5% and 33.4%).Suture medialization of the MT suggested by several as the most definitive method for preventing lateralization.(Hewitt and Orlandi, 2008)showed suture medialization of the MT to be effective in preventing lateral synechia in up to 90% of cases.(Dutton and Hinton, 2011) showed 92% success rate with the same technique is highly consistent with these findings.

Our results showed highly statistically significant improvement on the three groups in nasal obstruction with the best improvement on suture stabilization of middle turbinate group than middle turbinate bolgarization than FESS without MT stabilization (76.2%> 52.7%>37.3%) respectively.This results are in agreement with the findings of Alzubiadi et al., (2020)who found that there was a statistically significant change (improvement) in nasal obstruction reported by patients in all the three groups, however, the change was significantly larger in suturing group (75.5%), in bolgarization group(41.1%) and (40.5%) in controls.

Clearly, successful MT medialization by itself was not an absolute guarantee for the prevention of symptoms because there are many more variables in ESS that can affect the final outcome. Similarly, MT lateralization was not necessarily associated with symptoms because the MT was often attached to the lateral nasal wall anteriorly without any visible interference with the middle meatus patency.Although we managed to lyse most of the symptomatic lateral synechiae in the office.

CONCLUSION

The middle turbinate suture technique and bolgerizationtechnigue are a simple, reliable, and cost-saving methods for preventing middle turbinate synachiae and have no detectable adverse effects on olfaction following ESS. Suture stabilization of middle turbinate technique was also clinically and statistically better than the technique of bolgarization.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

AUTHOR CONTRIBUTIONS

All author contributed in all parts of the paper.

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