Prevention of Middle Meatal Synechia Formation after Endoscopic Sinus Surgery with Different Packing Materials

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ABSTRACT

Background*:* One of the primary goals of functional endoscopic sinus surgery for treatment of chronic rhinosinusitis is to create patent paranasal sinus ostia, but formation of synechiae between the middle turbinate and lateral nasal wall can obstruct sinus outflow leading to persistence or recurrence of symptoms. Numerous techniques have been used to prevent postoperative synechiae formation.

Objectives: To evaluate the effect of three different materials (Mitomycin C, Merocel, and Nasopore) on the prevention of synechiae and excessive granulation tissue in the middle meatus with relation of pain and discomfort in patients undergone functional endoscopic sinus surgery.

Methods: An interventional study of (32) selected adult patients with signs and symptoms of chronic rhinosinusitis were seen in otorhinolaryngology department at Al-Imamain Al-kadhimain medical city over a period of 12 months (from May 2017 to April 2018). They were divided into three groups depending on type of middle meatal packing used following functional endoscopic sinus surgery; Group I: (12) patients were packed using Merocel, Group II: (12) patients were using Mitomycin C and Group III: (8) patients were packed using Nasopore. Consent was taken from all patients underwent functional endoscopic sinus surgery for treating their chronic rhinosinusitis and classified into specific group according to type of packing materials. Postoperatively, all patients received I.V. antibiotics for 72 hours then changed to oral for 11 days, given instructions on how to use nasal irrigations using isotonic saline with analgesia as indicated and with systemic or local steroid for all patients. Merocel packing was removed after 48 hr. postoperatively. Patients were seen 7-10 days postoperatively, then every 1 week in the first month, every 2 weeks in the second month, then 1 visit in the third month.

Results: Eighteen patients (56.25%) were males and 14 patients (43.75%) were females. Ages of patients ranged from 20 to 49 years and the mean age ± standard deviation (SD) was 34.3 ± 8.4 years. The most common clinical presentations were nasal obstruction (86.7%) and nasal discharge (76.7%). The stages of rhinosinusitis (Lund and Mackay CT staging system) were ranging from 10 to 20 for both sides, the mean stage ± SD was 14.4 ± 3. Discomfort due to middle meatal packing and pain caused by packing removal were significantly associated with Merocel packing compared to Nasopore as the P values were 0.027 and 0.009 respectively. The rates of development of middle meatal synechia and granulation tissues associated with different packing materials were as follow: Merocel (16.7% and 25%), Mitomycin *C* (25% and 33.3%) and Nasopore (12.5% and 12.5%), respectively. No significant difference has been obtained between different packing materials in preventing the development of middle meatal synechia and granulation tissue following functional endoscopic sinus surgery.

Conclusions: Although each type of middle meatal packing has its specific advantages and disadvantages, no one has been shown to have a superior role than others in preventing the development of middle meatal synchiae following functional endoscopic sinus surgery.

Keywords: Middle meatal packing, Middle meatal synechia, Merocel, Nasopore, Mitomycin C.

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Functional endoscopic sinus surgery (FESS) has become the standard treatment for the management of medically refractory chronic rhinosinusitis and nasal polyps[1]. This is mainly because this approach maintains the sinus mucosa, establishes sinus ventilation and sinus drainage pathway from the natural openings and eliminates the pathology effectively[2].

The formation of synechiae is the most common complication following FESS. Synechiae in the middle meatus can block the normal mucociliary drainage pathway of the sinuses and lead to disease recurrence. The incidence of middle meatal synechiae ranges in literature from 1-36%[3]. Stammberger reported an 8% rate of synechiae following FESS, with 20% of those becoming clinically significant and negatively impacting patient response to surgery[4].

Numerous techniques, including suture medialization, partial resection of the middle turbinate, and nasal packing in the middle meatus, have been used to prevent postoperative synechia formation. Nasal packing remains the most common procedure used to prevent this complication. Conventional packing products, both absorbable and non-absorbable, like Floseal, Merocel, Gelfoam, fibrin glue, Nasopore, hyaluronic acid and mitomycin C have been evaluated for their role in preventing middle meatal adhesions[5]. The type of packing chosen by a surgeon is usually determined by habit, inherited practice, or departmental provision, and the superiority of non-absorbable versus dissolvable nasal packing has been widely debated[6]. Merocel is one of the most common non-absorbable nasal packing materials, is a compressed, dehydrated sponge composed of hydroxylated polyvinyl acetate that can increase in size within the nasal cavity and compress a bleeding vessel through rehydration with normal saline. Because it is a non-absorbable solid, disadvantages may include pain and bleeding upon removal, nasal obstruction, and mucosal edema[6].

Nasopore one of the most commonly used dissolvable materials, is a bioresorbable material produced using a freeze-drying process. It consists of fully synthetic biodegradable, fragmenting foam that absorbs water while supporting the surrounding tissue and providing pressure against bleeding vessels in the nasal cavity. It starts to dissolve within days and can be suctioned from the nasal cavity after several days[6].

Mitomycin C (MMC) is a natural antibiotic derived from *Streptomyces caespitosus*. It has antiproliferative properties at 0.04mg/ml and, in higher dosages, offers cytocidal effects. One single topical application of MMC for 5 minutes offers antiproliferative effects for up to 36 hours. When briefly applied to the human mucosa it reduces the replication of fibroblasts and increases their apoptosis[7].

Methods

An interventional study of (32) selected adult patients with clinical and radiological features of chronic rhinosinusitis with or without polyposis were conducted in otorhinolaryngology department at Al-Imamain Al-kadhimain medical city from May 2017 to April 2018.

All patients underwent functional endoscopic sinus surgery for treatment of chronic rhinosinusitis according to CT finding they were divided into three groups, depending on type of middle meatal packing following FESS: Group I: consisted of (12) patients in whom Merocel packing was used in middle meatus and nasal cavity (kept in situ for 48 hours postoperatively).

Group II: consisted of (12) patients in whom Mitomycin C packing was used (kept in middle meatal cavity for only 5 minutes followed by irrigation with sterile normal saline with no further packing).

Group III: consisted of (8) patients in whom Nasopore packing was used (kept in situ without removal with suctioning of any remnant after 7-10 days).

Inclusion criteria: Age >18, failure of adequate medical treatment indicated by persistence of features of chronic rhinosinusitis.

Exclusion criteria: Revision surgery, sinonasal malignancy, extensive bilateral polyposis, Immune compromised patients, abnormalities of middle turbinate (concha bollosa or paradoxical MT).

VAS scores and Fisher's exact test was used to compare frequencies (proportions). Level of significance (P value) ≤ 0.05 considered as significant.

Results

Ages of patients ranged from 20 to 49 years and the mean age ± standard deviation (SD) was 34.3 ± 8.4 years. Age distribution and mean age ± SD of the studied groups are shown in table 1.

The most common presentation was nasal obstruction (86.7%).

The stages of rhinosinusitis (Lund and Mackay CT staging system) of the patients were ranging from 10 to 20 for both sides, the mean stage ± SD was 14.4 ± 3. The range and mean ± SD among the studied severity of clinical presentation associated with Lund and Mackay CT finding.

There is no significant difference in the rate of development of granulation tissue between various types of packing materials.

No significant difference has been obtained between different packing materials in preventing the development of middle meatal synechia following FESS.

Table 1: Ages distribution.

		Age (years)			Total	Mean ± SD
		20 – 30	31 – 40	41 – 50		
No. of patients	Group I	3	7	2	12	34.8 ± 7.6
	Group II	4	5	3	12	34.3 ± 9.1
	Group III	3	3	2	8	33.6 ± 9.5
Total		10	15	7	32	-

Table 2: Clinical presentations.

Clinical presentations	No. of patients			Total	%
	Group I	Group II	Group III		
Nasal obstruction	11	10	5	26	86.7
Nasal discharge	9	10	4	23	76.7
Headache &Facial pressure	8	6	2	16	53.3
Smell disturbance	5	6	2	13	43.3

Table 3: Rhinosinusitis staging system.

Groups	Rhinosinusitis staging system of both sides	
	Range	Mean ± SD
Group I	10 – 20	14.3 ± 3.4
Groups II	10 – 19	14.2 ± 3
Groups III	11 – 20	14.8 ± 3

Table 4: Discomfort due to middle meatal packing according to VAS.

Middle meatal packing	No. of patients with discomfort (VAS)				Total	P value
	none	mild	moderate	severe		
Merocel	-	3	5	4	12	**0.027**
Nasopore	2	4	2	-	8	

Table 5: Pain due to removal of middle meatal packing according to VAS.

Middle meatal packing	No. of patients with pain (VAS)				Total	P value
	none	mild	moderate	severe		
Merocel	-	2	4	6	12	**0.009**
Nasopore	1	5	1	1	8	

Table 6: Granulation tissue formation in middle meatus obtained at the end of the 3rd month of follow up.

Groups	No. of patients who developed granulation tissue				Percentage of significant granulations	P value
	None	Mild	Moderate	Severe		
I	8	1	2	1	25%	0.6
II	7	1	2	2	33.3%	0.3
III	5	2	1	-	12.5%	0.5

Table 7: **Middle meatal synechia obtained at the end of the 3rd month of follow up.**

Groups	No. of patients who developed middle meatal synechia				% of significant adhesion	% of revision surgery	P value
	None	Type A	Type B	Type C			
I	8	2	1	1	16.7%	8.3%	0.6
II	8	1	2	1	25%	8.3%	0.5
III	6	1	1	-	12.5%	0%	0.8

Discussion

Majority of our patients were males (56.25%). Male predominance was also observed in other studies done by Gupta and Motwani[2], Anand et al[3] and Yamaoka and Gregorio[7] in whom the percentages of males were (67%, 55% and 53%), respectively.

Ages of our patients were ranged between 20 and 49 years and the mean age ± SD was 34.3 ± 8.4 years. The age range / mean age in other studies performed by Mohammed[1], Baradaranfar et al[8] and

Numthavaj et al[9] were (19-49/35), (14-66/38) and (31-49), respectively. The most common clinical presentations were nasal obstruction (86.7%), nasal discharge (76.7%), headache and facial pressure (53.3%). Mohammed[1] obtained the following results: nasal obstruction (74.4%), anterior nasal discharge (35.5%), posterior nasal discharge (30%), headache (70%) and facial pain (17.7%).

The mean Lund and Mackay CT staging system for both sides was 14.4 ± Yamaoka and Gregorio[7] obtained a mean score of 14.5.

Wang et al[5] studied the effects of Vaseline, Merocel and Nasopore on the formation of synechiae and granulation tissues in middle meatus following FESS, in their study the mean Lund and Mackay scores for each group of study were 7.49 ± 2.36, 7.73 ± 2.19 and 7.4 ± 2.17, respectively.

The most common drawback associated with the use of non-absorbable nasal packing compared to absorbable packing is the discomfort that is experienced by the patients while packing is in situ and during removal.

Samad et al[10] and Von Schoenberg et al[11] in their studies found that removal of nasal packing was the most unpleasant experience described by the patients.

In our study, discomfort due to packing and then packing removal were significantly associated with Merocel packing compared to Nasopore as the P values were 0.027 and 0.009, respectively. Wang et al[6] found that in situ pain score in the Nasopore group was significantly lower than in the Merocel group (p = 0.005), and pain on removal showed highly significant difference between the two groups (p = 0.0005). There are 2 important parameters that have been evaluated by some authors[12,13,14] to assess mucosal healing following FESS; these are synechiae in the middle meatus and formation of granulation tissue.

Granulation tissue formation is an essential stage during the mucosal healing process after FESS, and assessment of this process can indicate the healing status.

In our study, the rates of development of significant middle meatal granulation tissues associated with different packing materials were as follow: Merocel (25%), Mitomycin C (33.3%) and Nasopore (12.5%). Extension and rate of granulation tissue and mucosal hypertrophy were graded to three grades based on the criteria described in the study by Hu et al[15] into mild (less than 10%), moderate (10-50%) and severe (more than 50%) into consideration only moderate (10-50%) and severe (more than 50%) granulation tissue formation and we neglected mild ones (less than 10%) as it is not significant. There was no significant difference between the three groups.

Mohammed[1] in his study on 90 patients and follow up duration for 3 months also studied the effects of Merocel, Mitomycin C and Nasopore on the formation of middle meatal granulation tissues following FESS and he obtained the following results: 33.3%, 26.7% and 16.7%, respectively.

Baradaranfar et al[8] in their studies on 37 patients and follow up duration for 3 months studied the role of mitomycin C in preventing significant granulation tissue formation and compared it with saline solution in the control group, they found that 15 (40.5%) patients had granulation tissue postoperatively and only 6 of them (16.2%) had significant granulation, there was no statistical difference between studied and control groups as the P value was 0.083.

Wang et al[6] reviewed 7 randomized control trials published from 2009 to 2013 comparing Merocel to Nasopore packing; they concluded that to date there has not been clarity as to which of the two nasal dressings is superior.

Wang et al[5] compared between Vaseline, Merocel and Nasopore, they obtained results related to synechia at 2 specific times during the course of follow-up, the first one was 3-4 weeks postoperatively in which synechiae were found in 50 (8%) sides in the Vaseline

group, 20 (8.8%) sides in the Merocel group, and 17 (10.5%) sides in the Nasopore group. No significant intergroup differences were observed in the incidence of synechiae in the middle meatus (p = 0.584).

Yamaoka and Gregorio[7] also studied the role of Mitomycin C on 14 patients, 3 cases of adhesion were obtained in the MMC group (21.43%) and 9 in the control group (64.29%). There was no statistically significant difference between the groups (p = 0.054).

Our main objective is to identify the incidence of adhesion associated with each type of middle meatal packing. The rates of adhesions were as follow: Merocel (16.7%), Mitomycin C (25%) and Nasopore (12.5%), no significant intergroup difference has been obtained in preventing the development of middle meatal synechia.

Majority of other studies using different packing materials also showed no significant difference. Yamaoka and Gregorio [7]

In conclusion; although each type of middle meatal packing has its specific advantages and disadvantages, no one has been shown to have a superior role than others in preventing the development of middle meatal synchiae following FESS.

Recommendations: Larger number of patients are need. Longer follow up period. Use of different concentration of mitomycin C. Use each one of these materials with control study. Use other materials (silastic sheet, Gelfoam) in the prevention of formation of middle meatal synechiae following FESS.

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