The Egyptian Journal of Hospital Medicine (July 2019) Vol. 76 (1), Page 3324-3328

Comparative Study between Absorbable Carboxymethyl Cellulose and Non-Absorbable Merocel Nasal Packs after Sinonasal Surgery

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ABSTRACT

Background: Nasal packings can help in control of postoperative bleeding and healing following functional endoscopic sinus surgery (FESS) and nasal surgeries, but traditional non-resorbable packs have several inherent drawbacks. **Objectives:** This study was done to evaluate the effect of carboxy methyl cellulose (CMC) gel and merocel nasal packs after sinonasal surgery regarding postoperative bleeding, pain, pressure headache and formation of synechia. **Patients and Methods:** A total of 40 patients who had undergone sinonasal surgery were studied prospectively. At the end of the operation each patient was packed with dissolvable CMC gel in the right side of the nose and merocel in the left side. The haemostatic effect of the CMC and merocel was assessed during the recovery period. **Results:** six (15%) of the patients packed with CMC had primary postoperative bleeding during the recovery period. Bleeding appeared in four (10%) patients packed with merocel. We observed significant intergroup differences in the level of pain and pressure headache. The CMC group was superior to merocel group and there was a significant low level of pain and pressure headache in the CMC group. Two (5%) of CMC patients and six (15%) of merocel patients developed a synechia at the 4 weeks period. Four (10%) of CMC patients and Ten (25%) of merocel patients developed synechia at the 8 weeks period post operative. **Conclusion:** We found that dissolvable CMC pack is associated with very low levels of localised pain, pressure headache and with low levels of postoperative bleeding and synechia formation.

Keywords: Endoscopic sinus surgery - Carboxymethyl cellulose – Merocel - Resorbable - Nasal synechia -Nasal packing - Nasal complications.

INTRODUCTION

Functional endoscopic sinus surgery (FESS) is one of the most frequently performed operative procedure in the head and neck field. It has become a standard therapy for chronic rhinosinusitis including nasal polyposis that is refractory to conservative measures [(1)]. While the surgical technique of sinonasal surgery are well standardized, there are no common guidelines concerning both the need to perform a nasal packing at the end of the operation and the materials these packings should be made of. While some authors recommend nasal packing other try to avoid its use [(2, 3)]. The purpose of postoperative nasal packing lies in the prevention of adhesions and synechiae, an improved and accelerated wound healing, and most importantly the control of possible postoperative bleedings [(4)]. The most common complications of endoscopic sinonasal surgery are postoperative formation of synechiae in the middle meatus with incidence ranges from 1% to 36%. Synechiae in the middle meatus can block the normal mucociliary drainage pathway of the sinuses and lead to disease recurrence [(5)].

Nasal packing remains the most common procedure to prevent synechiae formation and controlling postoperative bleeding. Conventional packing products such as vaseline gauze strip and expandable polyvinyl acetate (Merocel) are non-absorbable materials. New biodegradable packing materials with various degrees of efficacy have also been developed for example, floseal, merogel/meropak, nasopore and carboxymethyl cellulose [(6)]. The use of conventional nasal packings for the patients is highly uncomfortable and induces local pain and pressure [(7)]. The removal of nasal packings has been described as the most painful part of the whole treatment. Modern nasal packings consist of resorbable materials, which make their removal unnecessary, thus giving the patient more comfort [(8, 9)].

AIM OF THE WORK

This study was done to evaluate the effect of carboxymethyl cellulose (CMC) gel and merocel nasal packs after sinonasal surgery regarding postoperative bleeding, pain, pressure headache and formation of synechia.

PATIENTS AND METHODS

Patients were recruited from the Otolaryngology Clinic of EL-Sahel Teaching Hospital. The total number of enrolled patients was 40 (18 males and 22 females) aged from 19 to 45 years old. Forty patients were randomly selected to be packed with CMC after surgery in the right side of the nose and packed with merocel nasal pack in the left side. Written informed consent was obtained from all patients, and all eligible patients were informed regarding the procedure. **In addition, approval of Al-Azhar Ethical Committee was obtained.** All surgical procedures were performed under general anaesthesia and were performed by the same surgeon. We included patients who were older than 18 years of age and had bilateral chronic rhinosinusitis that was refractory to pharmacological treatment, patients with deviated nasal septum, concha bullosa, hypertrophied inferior turbinate, previous paranasal sinus surgery and fungal sinusitis. **Patient exclusion criteria** included patients with immunodefficient disorders, cystic fibrosis, bronchial asthma, intolerance to aspirin, sinonasal neoplasia, and documented pregnancy

Received:6/4/2019
Accepted:5/5/2019

Preoperative diagnosis was established by means of history, clinical examination, nasal endoscopy and computed tomography (CT) of paranasal sinuses. Nasal endoscopy was done using the endoscopic evaluations for the nasal polyp grading system; 0; no visible polyps, 1; polyps confined to the middle meatus, 2; polyps that had grown beyond the middle meatus but were not completely obstructing the nasal cavity, 3; polyps completely obstructing the nasal cavity. The Lund-Mackay (CT) staging system (0/1/2, per side) was used to assess the findings of the preoperative CT.

The 40 patient were admitted to our department. Demographic information, previous medication, and systemic diseases were entered into the hospital database. 14 patient with bilateral nasal polyposis underwent bilateral functional endoscopic sinus surgery (FESS) and 26 patient with deviated nasal septum underwent septoplasty (8 of them with bilateral inferior turbinate hypertrophy and underwent bilateral partial inferior turbinectomy). Early in the surgery topical vasoconstriction (adrenaline) soaked gauze was impregnated in the nose. At the end of the surgery, the right side was packed with CMC gel, which is vegetable-based polysaccharide foam that actively promotes platelet aggregation upon contact with blood. The dressing that was placed in a syringe is composed of carboxymethyl cellulose (CMC) dry fibres and forms a viscous gel when mixed with sterile ringers lactate solution. The left side was packed with merocel impregnated with antibiotic cream. The merocel packs were removed 1 day after surgery. In contrast, CMC gel was left in place, if remnants were found it was suctioned out during the patient's follow-up visit (5:10 days after discharge). The postoperative regimens for all patients were quite similar, including 10 days oral antibiotic therapy along with the administration of a topical nasal steroid, isotonic saline irrigation and regular follow- up examinations. The first outcome measured was effectiveness of the packing in bleeding control. The haemostatic effect was assessed during the recovery period. Absence of bleeding was marked ''0'' and presence of bleeding or the necessity of using another packing was marked ''1'' .The secondary outcome measured was pain and pressure headache of the nasal and paranasal area 24 h postoperative. Before administration of pain relief medications, pain levels were recorded by patients on a visual analogue scale between 0 and 10, with ''0'' indicating no pain and ''10'' indicating most severe pain. The third outcome measured was the presence of nasal synechia at follow-up visits 4, 8 weeks after surgery. Evaluation was performed bilaterally using 0 and 30 degree endoscopes. The presence of synechia at any follow-up visit was marked ''1'' and absence was marked ''0.''

Statistical analysis

Recorded data were analyzed using the statistical package for social sciences, version 20.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data were expressed as mean ± standard deviation (SD). Qualitative data were expressed as frequency and percentage.

The following tests were done:

- Independent-samples t-test of significance was used when comparing between two means.
- Chi-square (x^2) test of significance was used in order to compare proportions between two qualitative parameters. The confidence interval was set to 95% and the margin of error accepted was set to 5%. The p-value was considered significant as the following:
  - P-value < 0.05 was considered significant.
  - P-value < 0.001 was considered as highly significant.
  - P-value > 0.05 was considered insignificant.

RESULTS

A total of 40 patient were included in this study , they were 22 female (55%) and 18 male (45%) ranging in age from 19 to 45 years old with a mean of 30.85 ±7.79 years (Table 1).

Table (1): Distribution of the studied group.

		Value (40)
Age	(mean ± S D)	30.85 ± 7.79 (19-45)
Sex n (%)	Male	18 (45%)
	Female	22 (55%)

The presenting clinical symptoms in patients of our study are bilateral nasal obstruction which presented in 30 patients (75%), anterior nasal discharge presented in 14 patients (35%), posterior nasal discharge presented in 12 patients (30), headache presented in 28 patients (70%) and facial pain presented in 7 patients (17.5%) (Table 2).

Table (2): Clinical presenting symptoms in patients of our study

Clinical symptoms	No(40)	%
Nasal obstruction	30	75
Anterior nasal discharge	14	35
Posterior nasal discharge	12	30
Headache	28	70
Facial pain	7	17.5

The pre-operative endoscopic findings in this study group were congested nasal mucosa presented in 21 patients (52.5%), polypi presented in 14 patients (35%) nasal discharge presented in 23 patients (57.5%), enlarged IT presented in 8 (20%) and deviated nasal septum presented in 26 patients (65%) (Table 3).

Table (3): Pre-operative endoscopic findings.

Findings	No (40)	%
Congested mucosa	21	52.5
Polypi	14	35
Discharge in middle meatus	23	57.5
Enlarged inferior turbinate	8	20
Deviated septum	26	65

Of forty patients packed with CMC in the right side, 6 patient (15%) had primary postoperative bleeding that required additional classical packing during the recovery period. In the merocel group packed in the left side, 4 patients had postoperative bleeding (10%) that required re-packing. The difference between the two groups was not statistically significant (p = 0.74) (Table 4).

Table (4): Differences between Rt and Lt sides among all cases regarding to bleeding postoperatively

All cases	Rt side (40)		Lt side (40)		FET	P value
	No	%	No	%		
Bleeding						
Yes	6	15.0	4	10.0	0.11	0.74
No	34	85.0	36	90.0		

In the CMC group, pain levels measured 2 hours postoperative ranged from 1 to 6 (mean 2.9), 6 hours ranged from 1-5 (mean 2.65), 12 hours ranged from 1-4 (mean 2.25) and 24 hours ranged from 1-3 (mean 1.7). In the merocel group, pain levels 2 hours postoperative ranged from 1 to 7 (mean 4.4), 6 hours ranged from 2-6 (mean 3.95), 12 hours ranged from 2-6 (mean 3.6) and 24 hours ranged from 1-6 (mean 3.3). This difference was statistically significant ($p < 0.001$) (Table 5).

Table (5): Differences between Rt and Lt sides among all cases regarding to pain score in different times

All cases		Rt side (40)		Lt side (40)		Paired t test	P value
		mean ± SD	Range	mean ±SD	Range		
Pain	VAS 2h	2.9 ± 1.53	1-6	4.4 ±1.58	1-7	Z= 3.7	<0.001**
	VAS 6h	2.65 ± 0.92	1-5	3.95 ± 1.3	2-6	5.59	<0.001**
	VAS 12h	2.25 ± 0.95	1-4	3.6 ± 1.22	2-6	6.07	<0.001**
	VAS 24h	1.7 ± 0.72	1-3	3.3 ± 1.44	1-6	6.68	<0.001**

Pressure headache levels measured in the CMC group, 2 hours postoperative ranged from 1 to 6 (mean 3.05), 6 hours ranged from 1-6 (mean 2.45), 12 hours ranged from 1-4 (mean1.9) and 24 hours ranged from 1-3(mean 1.45). In the merocel group, 2 hours postoperative pressure headache levels ranged from 1 to 7 (mean 3.95), 6h ranged from 2-6 (mean 3.8), 12 h ranged from 1-6 (mean3.65) and 24 h ranged from 1-6 (mean 3.15). This difference was statistically significant ($p < 0.0001$) (Table 6)**.**

Table (6): Differences between Rt and Lt sides among all cases regarding to pressure headache score in different times.

All cases		Rt side (40)		Lt side (40)		Paired t test	P value
		mean ± SD	Range	mean ± SD	Range		
Pressure headache	VAS 2h	3.05 ± 1.58	1-6	3.95 ± 1.34	1-7	3.98	<0.001**
	VAS 6h	2.45 ± 1.38	1-6	3.8 ± 1.09	2-6	5.30	<0.001**
	VAS 12h	1.9 ± 1.01	1-4	3.65 ± 1.51	1-6	Z=4.88	<0.001**
	VAS 24h	1.45 ± 0.68	1-3	3.15 ± 1.44	1-6	7.68	<0.001**

Endoscopic evaluations and follow-up visits in CMC group revealed synechiae in 2 patients (5%) at 4 weeks postoperative and in 4 patients (10%) at 8 weeks postoperative. In the merocel group 6 patients (15%) at 4 weeks postoperative and 10 patients (25%) at 8 weeks postoperative developed synchia. The difference between groups was statistically insignificant ($p = 0.26$) at the 4 weeks period and at the 8 weeks period (Table 7).

Table (7): Differences between Rt and Lt sides among all cases regarding to synechia in different times.

All cases	Rt side (40)		Lt side (40)		FET	P value
	No	%	No	%		
Synechia 4 weeks						
0	38	95.0	34	85.0	1.25	0.26
1	2	5.0	6	15.0		
Synechia 8 weeks						
0	36	90.0	30	75.0	X^2= 3.12	0.077
1	4	10.0	10	25.0		

DISCUSSION

Optimal re-epithelialization of the sinonasal cavities with no persistent or recurrent disease in the long-term, stabilization of the middle turbinate in its natural position and patency of the middle meatus are the main expectations of the rhinologist after sinonasal surgeries [10].

To prevent bleeding complications following surgery, many different types of packing material have been introduced. They have varied from removable to dissolvable, but an ideal, widely used comfortable dressing is still lacking [11]. Removable nasal dressing provides haemostasis through pressure. This has been a very popular packing material because of its low cost and wide availability, but patients consider the procedure of dressing removal as the most uncomfortable aspect of sinus and nasal surgery [12]. Routine packing are still associated with pain during insertion in place and during removal. Furthermore, in place packs can cause nasal obstructions that often continue after removing the packing. Removal of the packing is often accompanied with additional bleeding [6].

New, comfortable absorbable dressings are used for postoperative bleeding control and can minimize pain levels after routine nasal surgery [13]. The results reported by some authors indicate that the relatively new, removable nasal packing covered with CMC fibres are effective, easy to use and are more comfortable than traditional tamponades for patients with anterior epistaxis [14]. In a study comparing two absorbable packings after endoscopic sinus surgery, it reported good bleeding control and low levels of pain overall, but there was some bleeding and pain during packing removal although significantly less pain during removal of CMC fiber packing [15].

Much of the research designed to compare healing and adverse events in nasal cavities packed with biodegradable and nondegradable materials. They concluded that the patients faced less pain, less bleeding and discomfort at the site when biodegradable materials were used [15, 16, 17]. However, in another study analyzing these materials, no significant differences were reported with regard to blockage, swelling, bleeding, and pain [18].

The results of the current study indicated that CMC gel is effective in achieving haemostasis in the early postoperative phase, but is still associated with a slightly higher risk (15%) of postoperative bleeding than the procedure with merocel (10%). The results of a study by **Szczygielski *et al.*** [17] reported more postoperative bleeding in CMC group (13.3%) than the routine nasal pack group (6.7%). In the study of CMC Sinu-Knit dressings, **Karkos *et al.*** [19] reported oozing in 20% of patients that stopped within minutes and did not require intervention. Sinu-Knit is a small dry pack that should be filled with sterile water after placement into the middle meatus.

Our study demonstrated that CMC foam resulted in very low levels of pain during the 24 h after surgery. This confirms results of quoted trials of CMC dressings [13, 17, 20]. In a study of 50 patients, **Al-Shaikh and colleagues** [21] compared a powdered formulation of oxidized cellulose with merocel. Although the degree of adhesions was equivalent for both products, the oxidized cellulose powder performed better with respect to hemostasis and comfort in the first 24 hours after surgery.

The ideal nasal packing should be a part from haemostasis and prevent postoperative synechia formation. In the literature, synechia formations continue to occur in 1–35% of patients. **Miller *et al.*** [22] determined the efficacy of an absorbable hyaluronic acid nasal dressing in reducing synechia formation after FESS relative to non-absorbable packing. They did not find a statistically significant difference between the absorbable and non-absorbable dressings. For reducing synchia, our study demonstrated that the occurrence of synechia formations after use of CMC was relatively lower than the occurrence after classical packing with merocel. Our observations support the results of **Szczygielski *et al.*** [17] but differ from those of **Karkos *et al.*** [19] who noted no postoperative synechia formation with Sinu-Knit packing (CMC derivative).

CONCLUSION

In conclusion, using absorbable nasal pack carboxymethyl cellulose is safe and can be considered a valid alternative to standard nasal dressings. It was well accepted, well-tolerated, seems to decrease synechia formation and better postoperative sinonasal healing. Also associated with very low levels of localised pain and postoperative bleeding. CMC gel can be recommended after nasal and functional sinus surgery.

Conflict of interest statement, the authors declare that they had no conflict of interest.

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