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# Nasal Packing after Functional Endoscopic Sinus Surgery

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## Abstract

This chapter was to have a systematic review and meta-analysis on the available literature in order to compare the efficacy and postoperative outcomes of nasal packing (absorbable vs. nonabsorbable) after treatment of chronic rhinosinusitis with functional endoscopic sinus surgery (FESS). The systematic review included five studies with 241 nasal cavities in each treatment group. The prevalence of synechia in the absorbable groups ranged from 4.6 to 8.0% while nonabsorbable groups ranged from 8.0 to 35.7%. The absorbable group had a lower postoperative bleeding; however, there were no clear findings on postoperative pain. Postoperative edema was in general similar among groups, and no consistent findings were found on bleeding and pain while removing packing. The meta-analysis included two studies using the same type of packing material. The combined OR (0.33, 95% CI=0.04–2.78) for postoperative synechia did not significantly favor ( $P=0.016308$ ) absorbable packing over nonabsorbable packing. The available literature showed that there is some evidence that absorbable nasal packing may provide superior outcomes to nonabsorbable packing after FESS. However, lack of homogeneity between these studies makes it impossible to have a definitive conclusion.

**Keywords:** absorbable, bleeding, efficacy, epistaxis, FESS, functional endoscopic sinus surgery, meta-analysis, nasal, nonabsorbable, packing, synechia

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## 1. Introduction

Chronic rhinosinusitis is an extremely common condition affecting millions of individuals worldwide. Up to approximately 16% of the adult population in the United States were reported to have suffered from it [1, 2]. Chronic rhinosinusitis can have a significant negative impact on quality of life [3], and therefore, treatment is usually required. Although chronic

rhinosinusitis can usually be managed pharmacologically, some patients do not respond well and require surgery [2].

The most commonly used surgical approach for the management of chronic rhinosinusitis perhaps is functional endoscopic sinus surgery (FESS) [4, 5]. It aims to improve or restore drainage and airflow on affected sinuses [2]. FESS is effective in more than 90% of patients [6] and significantly improves quality of life [7]; nonetheless, postoperative complications such as bleeding and adhesions (synechia) are quite common [8]. Due to this reason, after FESS, the nasal cavity is often packed with material designed to stop bleeding, reduce clot formation, lower the risk of synechia, and promote healing [8, 9]. Nonabsorbable nasal packing was applied after FESS traditionally [7]; nonetheless, patients seem not be able to tolerate the packing and its removal [10]. Absorbable nasal packing was introduced more recently and appears to be well tolerated by patients [11, 12].

There were a number of studies comparing the efficacy of nonabsorbable and absorbable nasal packing after FESS [8–14]; however, the results on if a method is better than another or if the methods used had a comparable efficacy were conflicting among the studies. In an effort to gain a better understanding of the efficacy and other outcomes on nonabsorbable vs. absorbable nasal packing after FESS for the treatment of chronic rhinosinusitis, we have conducted a systematic review and a meta-analysis of the available literature. Among the literature, we only include randomized trials and examined postoperative synechia as the key indicator of nasal packing efficacy in our meta-analysis.

## **2. Material and methods**

### **2.1. Searching strategy**

Combinations of the following search terms, FESS, rhinosinusitis, bleeding, gelatin, hyaluronic acid, carboxymethylated cellulose, CMC, and packing, were used on Medline, Current Contents, and the Cochrane databases on January 31, 2013.

### **2.2. Studies selection**

Studies meet following criteria were considered for inclusion in this systematic review and meta-analysis—Studies published in English, randomized clinical trials, reported on postoperative pain, edema, synechia/adhesion and/or bleeding/hemostasis. Studies were excluded if they did not meet those criteria.

### **2.3. Extraction of data**

Two independent reviewers were employed to extract data. If there were any disagreements, a third reviewer would be consulted. The following data were extracted for each eligible study: authors, year of publication, number of nasal cavities packed per treatment group, age of participants, sex distribution of participants, the type of nasal packing used, postoperative treatment, the time to removal of packing, the incidence of postoperative synechia, the

incidence of postoperative bleeding, postoperative pain, postoperative edema, and bleeding and pain on removal of packing.

The incidence of postoperative synechia for absorbable nasal packing vs. nonabsorbable nasal packing was the primary outcome for our meta-analysis.

## 2.4. Analysis of data

Binary outcomes and comparisons made for absorbable nasal packing vs. nonabsorbable nasal packing were calculated from odds ratios (ORs) with 95% confidence intervals (CIs). A  $\chi^2$ -based test of homogeneity was implemented, and the inconsistency index (I<sup>2</sup>) statistic was determined. If I<sup>2</sup> was >50%, the studies were considered to be heterogeneous; if I<sup>2</sup> was >75%, the studies were considered to be highly heterogeneous; and if I<sup>2</sup> was <25%, the studies were considered to be homogeneous. If the I<sup>2</sup> statistic (>50%) indicated heterogeneity existed between studies, a random-effects model was calculated; otherwise, a fixed-effects model was calculated. Pooled summary statistics for ORs of the individual studies are reported, a P value < 0.05 was taken to indicate statistical significance. All analyses were performed using Comprehensive Meta-Analysis statistical software, version 2.0 (Biostat, Englewood, NJ).

## 3. Results

### 3.1. Search of literature

Of total of 124 records that were retrieved from the database search, 106 were excluded after title/abstract review, 13 were excluded after full-text review, and five were included in the systematic review with two of these five studies also included in the meta-analysis of postoperative synechia.

### 3.2. Characteristics of study

**Table 1** summarized the systematic review, which included the studies characteristics [8, 11–13, 15]. A total of 241 nasal cavities were treated in each group for all studies combined and the number of nasal cavities treated in each study ranged from 30 to 100. Four of the five studies [8, 11, 13, 15] reported the age of study participants which ranging from 35.7 to 43.2 years among three studies [8, 13, 15] and 54.0 years in one study [11]. The same four studies [8, 11, 13, 15] also reported the sex distribution of the participants, with the ratio of males ranging from 54 to 67%. For the absorbable nasal packing materials, MeroGel<sup>®</sup> was used in two studies [8, 12], while Cutanplast [15], carboxymethylated cellulose (CMC) foam [13], and NasoPore [11] were used in the other three studies, respectively. For nonabsorbable nasal packing material, Merocel was used in three studies [8, 11, 15], polyvinyl alcohol sponges [12], and routine nasal packing (cotton gauze placed in a latex glove finger) [13] were used in the remaining two studies respectively. Among the five studies, four [8, 12, 13, 15] of which reported on postoperative treatments with the administration of various antibiotics, three [8, 11, 13] of which reported on the time to packing removal which ranging from 1 to 7 days.

First author (year)	Nasal cavities packed Abs vs. Nonabs	Age (years)	Sex (male %)	Absorbable packing	Nonabsorbable packing	Postoperative treatment	Time to packing removal
Cho (2012)	100 vs. 100	35.7	64	Cutanplast	Merocel	2nd generation cephalosporin or clarithromycin, analgesics as needed, prednisone	NA
Miller (2003)	37 vs. 37	39.1	54%	MeroGel®	Merocel	Cefuroxime, saline nasal spray and nasal irrigation	Postoperative day 5–7
Berlucchi (2009)	44 vs. 44	NA	NA	MeroGel®	PVA sponge	Amoxicillin + clavulanic acid, non-aspirin analgesics as needed, saline nasal spray	NA
Szczygielski (2010)	30 vs. 30	43.2	62%	CMC foam	Routine packing <sup>a</sup>	Cefazolin sodium, decongestants	Postoperative day 1
Shoman (2009)	30 vs. 30	54	67	NasoPore	Merocel	NA	Postoperative day 7

<sup>a</sup>Cotton gauze placed in a latex glove finger.

Abs, absorbable nasal packing material; CMC, carboxymethylated cellulose; NA, data not available; Nonabs, nonabsorbable nasal packing material; PVA, polyvinyl alcohol.

**Table 1.** Characteristics of studies included in the systematic review.

### 3.3. Outcomes of study

Three studies [8, 12, 13] reported the prevalence of synechia and were ranged from 4.6 to 8.0% in the absorbable packing groups and from 8.0 to 35.7% in the nonabsorbable packing groups. The follow-up duration for monitoring of postoperative synechia was 12 weeks in one study [12] and 8 weeks in two studies [8, 13]. Two studies [11, 13] reported postoperative bleeding data and both found decreased bleeding in the absorbable group compared to the nonabsorbable group. The same two studies also reported postoperative pain data with one found that pain was less in the nonabsorbable group [11], while the other found the pain was considerable less in the absorbable group [13]. Postoperative edema results were reported on three studies [8, 11, 12]; one [12] of which found that edema was less pronounced in the absorbable group compared with the nonabsorbable group, while the other two [8, 11] found no clear differences in edema between groups. Two studies [11, 15] reported on bleeding and pain on packing removal, respectively. One study [11] found that pain and bleeding were similar among groups, while the other study [15] found that pain and bleeding were both markedly reduced in the absorbable group compared with the nonabsorbable group. See **Table 2** for the aforementioned assessments which the timing varied between studies.

Abs vs. Nonabs						
First author (year)	Synechia	Postoperative bleeding	Postoperative pain	Postoperative edema	Bleeding on packing removal	Pain on packing removal
Cho (2012)	NA	NA	NA	NA	59 vs. 91%	1.01 ± 0.16 vs. 2.37 ± 0.19
Miller (2003)	8.0 vs. 8.0% (8 weeks)	NA	NA	0.70 ± 0.45 vs. 0.71 ± 0.45 (8 weeks)	NA	NA
Berlucchi (2009)	4.6 vs. 29.7% (12 weeks)	NA	NA	43.2 vs. 58.4%	NA	NA
Szczygielski (2010)	6.7 vs. 35.7% (8 weeks)	13.3 vs. 6.7%	5.5 (3-9) vs. 0.962 (0-4) (24 h)	NA	NA	NA
Shoman (2009)	NA	3.67 ± 2.45 vs. 3.44 ± 2.01 (1st week)	3.33 ± 2.50 vs. 3.70 ± 2.98 (1st week)	2.78 ± 2.52 vs. 2.78 ± 2.36 (1st week)	0.90 ± 0.55 vs. 0.83 ± 0.53	4.03 ± 2.80 vs. 3.97 ± 2.72

Abs, absorbable nasal packing material; Nonabs, nonabsorbable nasal packing material; NA, data not available; VAS, visual analogue scale.

**Table 2.** Summary of outcomes for studies included in the systematic review.

### 3.4. Assessment quality

**Table 3** highlighted the quality of the studies included in the systematic review. Not all studies [8, 13] had comprehensive information, and several studies [8, 11, 12] did not have outcome assessor, care provider, and/or patient blinding. However, the studies generally had

First author (year)	Method of randomization used	Groups similar at baseline regarding the most important prognostic indicators	Eligibility criteria specified	Outcome assessor blinded	Care provider blinded	Patient blinded	Point estimates and measures of variability presented for the primary outcome measures	Analysis included an intention-to-treat analysis
Cho (2012)	Y	Y	Y	Y	Y	Y	Y	N
Miller (2003)	Y	NA	Y	Y	N	N	Y	Y
Berlucchi (2009)	Y	Y	Y	Y	N	N	Y	Y
Szczygielski (2010)	Y	NA	Y	NA	NA	NA	Y	Y
Shoman (2009)	Y	Y	Y	Y	N	Y	Y	Y

N, no; NA, information not available or not applicable; Y, yes.

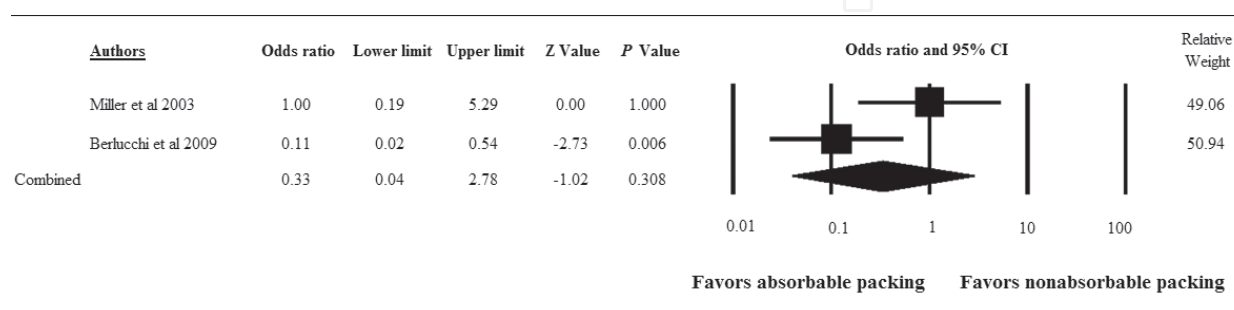
**Table 3.** Quality assessment of studies included in the systematic review.



characteristics consistent with being high quality trials. The study reported by Cho et al. [15] met all of the quality criteria aside from not including an intention-to-treat analysis.

### 3.5. Postoperative synechia meta-analysis

**Figure 1** summarized the results of the two studies [8, 12], which were included in the meta-analysis of postoperative synechia. A random-effects model of analysis was used because there was a significant heterogeneity between the two studies for this outcome ( $Q = 3.492$ ,  $I^2 = 71.37\%$ ,  $P = 0.062$ ). The combined OR for postoperative synechia did not significantly favor absorbable nasal packing over nonabsorbable nasal packing or vice-versa ( $P = 0.308$ ).



**Figure 1.** The odds ratios (OR) of postoperative synechia after FESS with absorbable vs. nonabsorbable nasal packing. Data are presented as OR with 95% confidence interval (CI). Heterogeneity test results:  $Q = 3.492$ ,  $df = 1$ ,  $P = 0.062$ ,  $I^2 = 71.37\%$ .

Note that due to a significant between study heterogeneity, meta-analysis of the other postoperative outcomes was not possible.

## 4. Discussion

This is the first (to our knowledge) systematic review/meta-analysis to compare postoperative synechia efficacy and other outcomes of absorbable vs. nonabsorbable nasal packing after FESS for the treatment of chronic rhinosinusitis. A total of 241 nasal cavities in each treatment group within five randomized clinical trials met the inclusion criteria for this systematic review. The type of nasal packing material used among studies was considerably varied among other characteristics. Postoperative bleeding was less with absorbable packing, while postoperative pain and edema, pain and bleeding on packing removal found no between group differences or consistent findings. Our meta-analysis from the findings of two studies also revealed that when compared with nonabsorbable nasal packing, the incidence of postoperative synechia was not significantly reduced by absorbable nasal packing.

As noted earlier in our meta-analysis findings, the incidence of postoperative synechia for absorbable nasal packing was not significantly lower than nonabsorbable nasal packing. Among the studies in our systematic review, a markedly lower rate of synechia within

8 weeks of surgery among patients who received absorbable packing was reported by Szczygielski et al. [13]. Similarly, a non-eligible study (for the inclusion in our systematic review/meta-analysis), Hu et al. [16], reported that there was a reduced rate of postoperative synechia among patients who received absorbable nasal packing (Meropack) compared with those without packing. In contrary, little difference in the rate of postoperative synechia between patients who received absorbable (FloSeal) and nonabsorbable (Merocel) nasal packing was found in a prospective, non-randomized study by Baumann and Caversaccio [9]. Several other studies have also demonstrated no significant difference among packing with CMC, no packing, or nonabsorbable packing for reducing postoperative synechia [17, 18]. The lack of homogeneity was clearly shown by the disparate findings among studies, most notably in the type of absorbable packing material used. Due to this lack of homogeneity, we were restricted in our ability to make any definitive conclusions. However, the variability in synechia outcomes between studies does suggest that when it comes to reducing postoperative synechia, different types of absorbable packing materials are not created equal. Thus, in order to directly compare the efficacy of different absorbable packing materials for reducing synechia after FESS for the treatment of chronic rhinosinusitis, additional randomized trials are needed.

Although only two studies provided data on postoperative bleeding were included in our systematic review, both of these studies found decreased bleeding with absorbable packing. Several previous studies also suggest that packing with absorbable material (Meropack, Gelfoam) reduces postoperative bleeding compared with no packing [16, 19]. Jameson et al. [20] have also reported packing with absorbable material (FloSeal) decreased postoperative bleeding compared with nonabsorbable packing. In contrary, several other studies have found no difference in postoperative bleeding with absorbable (NasoPore, CMC) vs. nonabsorbable or no nasal packing [11, 21]. As with postoperative synechia, the disparate findings may be explained by the lack of homogeneity between studies. In order to further investigate the efficacy of absorbable vs. nonabsorbable nasal packing for preventing bleeding after FESS for treatment of chronic rhinosinusitis, additional randomized trials are needed.

We also examined other outcomes after FESS beside postoperative synechia and bleeding. These include postoperative edema and pain, and bleeding and pain on removal of packing. As expected, lack of consistency was again found in these results between studies. However, it should be mentioned that the study reported by Cho et al. [15], which had the most number of patients and according to our assessment, was the highest quality randomized controlled trial included, did reveal markedly less bleeding and pain on removal of absorbable nasal packing compared with nonabsorbable nasal packing.

A number of limitations must be mentioned in our study. One, both the type of packing material used and the duration of follow-up were different among the studies, which markedly restricted our ability to perform meta-analyses of the results. Two, our analyses did not take into account other important factors that may have biased the study findings, which consequently our meta-analysis, factors including indicators of packing efficacy, such as edema granulation and postoperative infection, associated pathologies, such as perioperative treatment, nasal polyps, postoperative debridement, aspirin sensitivity, smoking history, etc.



Three, we have decided not to include patient satisfaction as an outcome measure. Although when evaluating the effectiveness of any treatment, this is a very important consideration; we believe that it is more important to conclusively determine which means of nasal packing is most clinically effective. We do have to mention that the results from a previous randomized controlled trial, which was not eligible for inclusion in our systematic review/meta-analysis, suggested that the majority of patients prefer absorbable nasal packing material (specifically MeroGel) over nonabsorbable material [10]. Finally four, we only included a relatively small number of studies for our meta-analysis which limited the power of analysis. Lastly, due to the lack of data/sufficiently detailed methodological descriptions on the different types of FESS, we were not able to perform any analyses on them.

## 5. Conclusions

We were not able to make any definitive conclusions on the outcomes for the comparison of absorbable vs. nonabsorbable nasal packing material after FESS from the results of our systematic review and meta-analysis. Although there is some evidence to suggest that absorbable packing may be superior to nonabsorbable packing; lack of homogeneity between studies reported in the current literature, especially regarding the type of absorbable nasal packing material used, has become a major limiting factor for further analysis. Aside from the limiting factor, our systematic review also highlighted the fact that there is a limited amount of information available from high quality randomized trials on the efficacy of absorbable packing vs. nonabsorbable packing after FESS. In order to provide more definitive information on the absorbable packing vs. nonabsorbable packing and to compare the efficacy of different types of absorbable packing materials, additional randomized controlled trials are required. We hope such trials can be spurred by this study.

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