

# Considerations of different sellar reconstruction techniques based on presence of intraoperative CSF leak during endonasal transsphenoidal surgery

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## Abstract

Cerebrospinal fluid (CSF) leak is a well-recognized complication of endoscopic transsphenoidal surgeries.<sup>1</sup> Various reconstruction techniques such as the nasoseptal flap (NSF) and free mucosal graft (FMG) have been described to seal off postoperative CSF leak.<sup>2,3</sup> We seek to explore the benefits and problems with each by looking at our case series.

All endonasal skull base surgeries in a single tertiary academic center between 1 January 2019 and 31 December 2023 were retrospectively reviewed. 61 of 282 (21.6%) endonasal skull base surgeries had intraoperative CSF leaks. For grade 1 leaks, abdominal fat and FMG harvested from the anterior nasal space (Figure 1) (17, 89.5%) or sphenoid sinus (2, 10.5%) were applied in 19 (46.3%), and NSF was used in 22 (53.7%). For grade 2 (16 patients) and grade 3 (2 patients) leaks, reconstruction with pedicled NSF technique was performed.

With these techniques, rates of postoperative CSF leaks were 1 in 217 (0.46%) cases with no reconstruction done, and 0% with FMG or NSF reconstruction. Nasoendoscopic follow-up in clinic showed that FMG afforded better sinonasal outcomes in terms of the duration of crusting (2.26 versus 5.49 months, mean difference 3.22, 95% CI 1.55 – 4.90, p = 0.003), and smell disruption (1.31 versus 3.07 months, mean difference 1.75, 95% CI 0.73 – 2.78, p = 0.007).

For grade 1 CSF leaks, reconstruction with FMG was sufficient at sealing leaks, and afforded better outcomes than NSF. NSF might only be required for higher-grade leaks.

## Introduction

Postoperative CSF leak rates of endoscopic pituitary surgery ranges from 1.9 to 10% in existing literature.<sup>1,4</sup> Repair of intraoperative CSF leakage with a nasoseptal flap (NSF) have demonstrated reduction in leak rates to 0-2.9%.<sup>2</sup> This reconstruction technique carries the drawback of nasal discomfort, excessive crusting, and anosmia.<sup>3</sup> The exposed cartilage of the nasal septum needs time to mucosalize, and during this time, multiple debridements and saline rinses are necessary.<sup>5</sup>

Peris-Celda et al. described their technique of using FMGs to reconstruct the primary defect in skull base surgeries, showing that it successfully sealed off intraoperative CSF leaks in selected cases.<sup>3,6</sup> FMGs can be harvested from a variety of different donor sites, including the anterior nasal floor, the middle turbinate, and the sphenoid sinus.<sup>7</sup> Use of FMGs also helps to minimize sinonasal morbidity.<sup>7</sup> We seek to report our institution’s 5-year experience of using FMG in selected intraoperative CSF leaks.

## Methods and Materials

All endonasal transsphenoidal surgeries in a single tertiary academic center between 1 January 2019 and 31 December 2023 were included for analysis. Craniofacial resections through a transcribiform approach were not included.

Data on patient demographics, presence of intraoperative CSF leak (graded according to Esposito and Kelly’s description), reconstruction technique, and postoperative nasoendoscopic follow-up were collected. The presence of postoperative CSF leak, crusting, adhesions, purulent sinusitis and smell disruption were analyzed.

	No. of Cases	Grade 0	Grade 1	Grade 2	Grade 3
Transsellar	270	223	37	10	0
TS + TT	5	0	1	4	0
TS + TP	3	0	1	1	1
Transpterygoid	2	0	1	1	0
Transclival	2	0	0	1	1
Total	282	223	41	16	2

Table 1. Distribution of CSF leaks based on approach. TS = transsellar, TP = transplanum, TT = transtuberulum.

## Results

A total of 282 endonasal skull base surgeries were performed, of which 270 were standard transsellar approaches, and 12 were extended approaches. 61 (21.6%) had intraoperative CSF leaks. Table 1 shows the distribution of leaks categorized by approach.

In grade 0 cases, sellar floor reconstruction was not done: the dural leaflets were flapped back and covered with oxidized cellulose. 4 grade 0 cases had NSF replaced because they were tumour recurrences and NSF was already used in prior surgery. For grade 1 leaks, abdominal fat and FMG harvested from the anterior nasal space (Figure 1) (17, 89.5%) or sphenoid sinus (2, 10.5%) were applied in 19 (46.3%), and NSF was used in 22 (53.7%). Both FMG and NSF required good circumferential bone contact (Figure 2), and edges were enforced with oxidized cellulose and sealant glue. For grade 2 (16 patients) and grade 3 (2 patients) leaks, reconstruction with pedicled NSF technique was performed. (All extended approaches had reconstruction with NSF).

Rates of postoperative CSF leaks were 1 in 217 (0.46%) cases with no reconstruction done, and 0 in the 65 cases with FMG or NSF reconstruction. Nasoendoscopic follow-up showed significant differences in average duration of crusting (2.26 versus 5.49 months, mean difference 3.22, 95% CI 1.55 – 4.90, p = 0.003), and smell disruption (1.31 versus 3.07 months, mean difference 1.75, 95% CI 0.73 – 2.78, p = 0.007) between FMG and NSF groups.

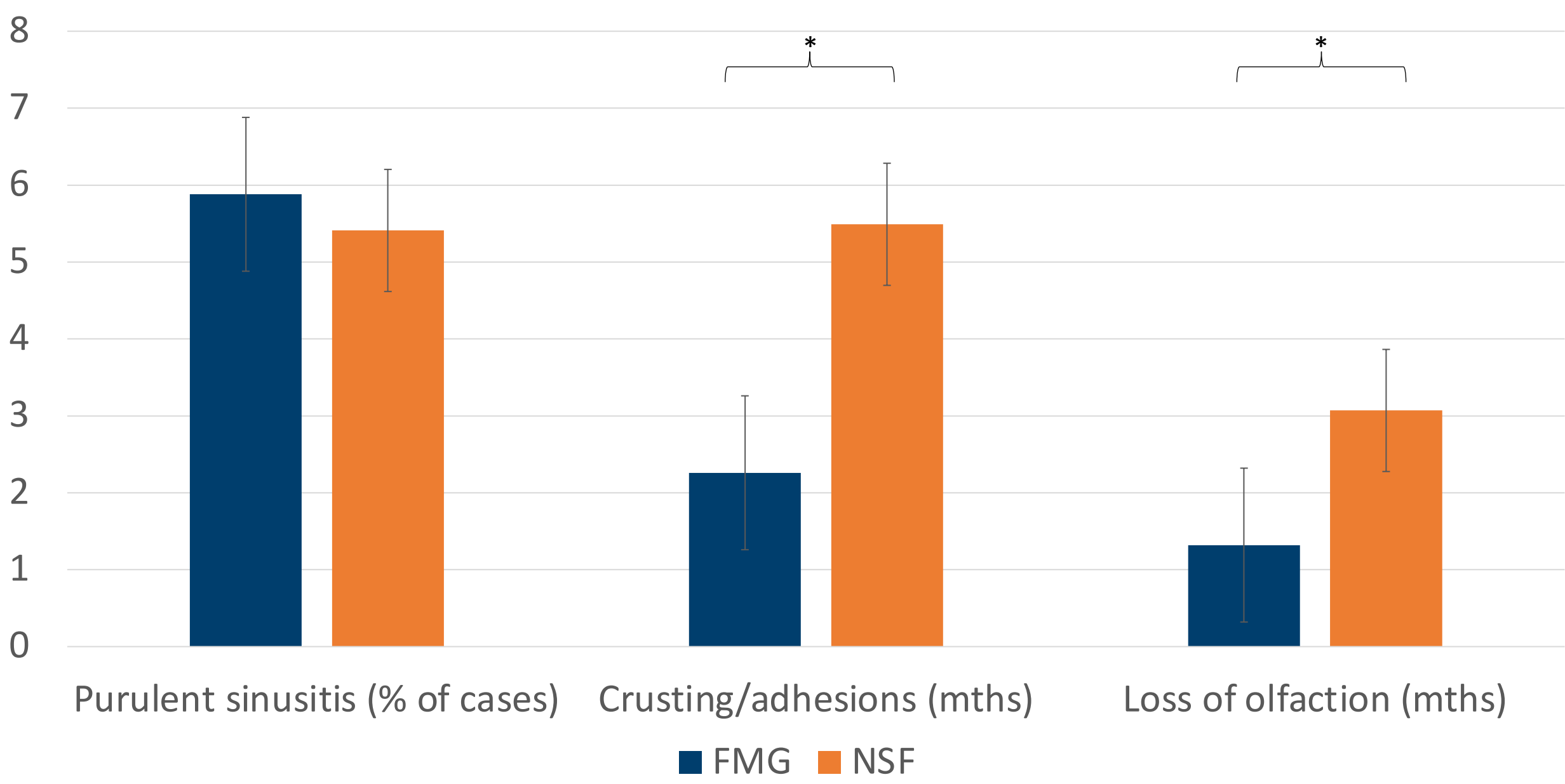


Chart 1. Comparison of sinonasal outcomes between FMG and NSF cases. Significance marked with (\*).

## Discussion

Our findings corroborated with those of Peris-Celda et al. in terms of greatly minimizing postoperative CSF leaks and achieving better sinonasal outcomes.<sup>6</sup> Similarly, this technique is not used in extended endonasal approaches as the transdiaphragmatic dissection usually results in high-flow leaks.<sup>8</sup>

In our experience, harvesting of FMG from the anterior nasal floor was quick, healed rapidly, and preserves both middle turbinates allowing for normal physiologic airflow. Sphenoid sinus mucosa varies depending on septations, and occasionally tears, so using it for sellar reconstruction was not always feasible.

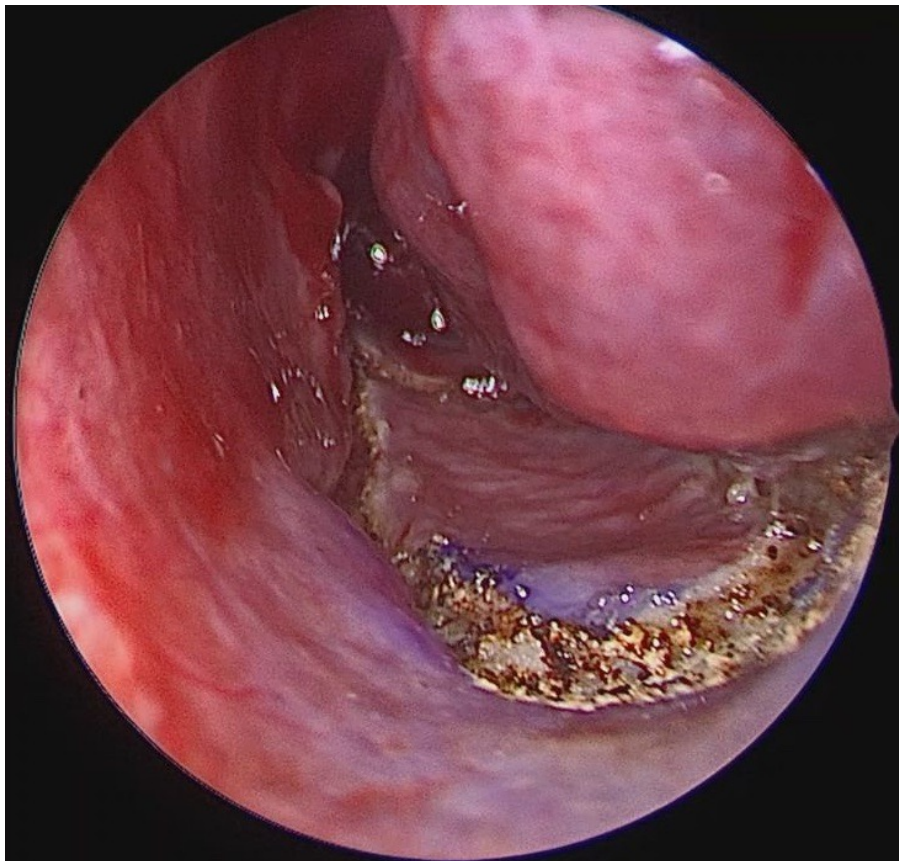


Figure 1. Harvesting of FMG from anterior nasal floor.

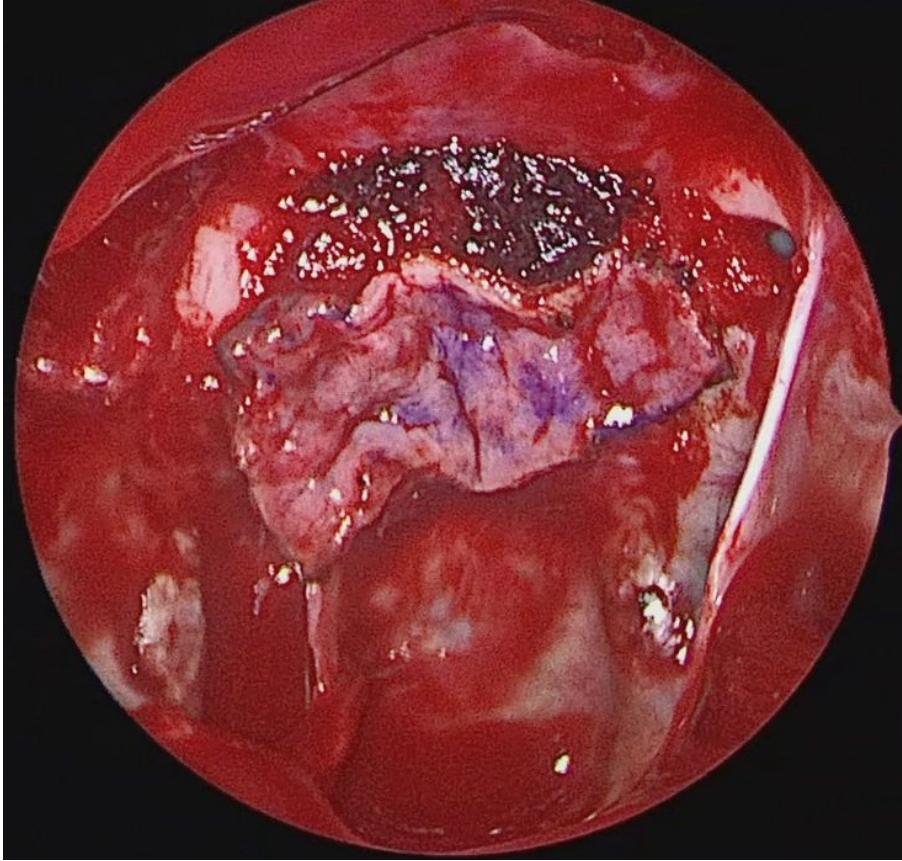


Figure 2. FMG laid over sellar defect with good circumferential bony contact.

## Conclusions

Intraoperatively observed absence of CSF leak was highly reliable, and no sellar reconstruction was necessary. For grade 1 transsellar CSF leaks, reconstruction with FMG was sufficient in sealing the leak, and afforded better sinonasal outcomes than NSF. NSF might only be required for grades 2–3 leaks.

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