The Magnetic Resonance Imaging Appearance of Endoscopic Endonasal Skull Base Defect Reconstruction Using Free Mucosal Graft

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■ OBJECTIVE: **At our institution, skull base reconstruction using a free mucosal graft from the nasal cavity floor has been the standardized technique after pituitary adenoma resection via transsellar approach. In this study, the expected appearance of the reconstruction on postoperative magnetic resonance imaging (MRI) scans is described and its integrity and impact on the sinonasal cavity are assessed.**

■ METHODS: **Fifty patients were selected, and their electronic medical records were reviewed for postoperative course, Sino-Nasal Outcome Test-22 (SNOT-22) scores, and nasal endoscopy reports. A total of 116 postoperative MRI scans were available to evaluate 1) the appearance and thickness of the graft, 2) the enhancement of the graft, and 3) the T2 signal in sphenoid sinus as a potential indication for inflammatory disease.**

■ RESULTS: **There was no significant change in the thickness of the graft over time. Except for the 7 scans that were obtained without intravenous contrast, all scans showed enhancement of the graft. About half of the patients showed persistent T2 hyperintense signal at 12 and 24 months. However, this finding was not clinically significant, because postoperative SNOT-22 scores showed minimal sinonasal impact.**

■ CONCLUSIONS: **Postoperative MRI surveillance scans showed a stable appearance of the graft that mimics the native mucosa, with enhancement through time, reflecting its robust vascularization and integration to the skull base. Although persistent T2 hyperintense signal was detected in the sphenoid sinus, clinical evidence based on nasal endoscopy reports and SNOT-22 scores indicated minimal sinonasal morbidity.**

INTRODUCTION

Over the last decade, the endoscopic endonasal approach in skull base surgery has progressed remarkably and is increasingly used for resection of multiple skull base diseases of various sizes and locations. This development is, in part, attributable to recent advancement in surgical navigation systems, sophistication of endoscopic instruments, and implementation of multidisciplinary approach.[1] With such expansion of indications, successful reconstruction of the resulting skull base defects has become equally critical.

For small skull base defects (<1 cm) with low-flow cerebrospinal fluid (CSF) leak, reconstruction with synthetic materials or free tissue grafts has been shown to be successful and validated in multiple studies.[2]

For intermediate-sized skull base defects, such as those resulting from transsellar resection of pituitary adenoma, reconstruction is still controversial, with various methods described in the recent literature. Some have advocated graded reconstruction based on intraoperative findings,[3] whereas others have advocated universal reconstruction.[4]

At our institution, we standardized our approach to reconstruction after endoscopic endonasal transsellar resection of pituitary adenoma, using a free mucosal graft harvested from the

Key words
- Endoscopic endonasal pituitary surgery
- Free mucosal graft
- Magnetic resonance imaging
- Skull base reconstruction

Abbreviations and Acronyms
CSF: Cerebrospinal fluid
EMR: Electronic medical records
IV: Intravenous
MRI: Magnetic resonance imaging
POD: Postoperative day
SNOT-22: Sino-Nasal Outcome Test-22

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nasal cavity floor and the inferior meatus. Our previous study showed that this technique kept the advantage of an immediate mucosal coverage of the resultant skull base defect without significant sinonasal morbidity and resulted in a lower rate of postoperative CSF leak compared with other studies in the literature.[5]

As magnetic resonance imaging (MRI) has become the choice of imaging modality for evaluation of potential postoperative complications and surveillance, several investigators[1,6,7] have used this modality to analyze the characteristic appearance of a nasoseptal flap. However, there has been no study describing the appearance of a free mucosal graft on postoperative MRI studies. Therefore, in this study, we aimed to provide a descriptive analysis of a free mucosal graft on postoperative MRI studies and, in so doing, assess the integrity of the reconstruction and its impact on the sinonasal cavity.

METHODS

Patient Selection

This study was approved by our institutional review board (number 4842). A database of consecutive patients who underwent endoscopic endonasal transsellar resection of pituitary adenoma with subsequent multilayer reconstruction using a free mucosal graft from the nasal cavity floor was retrospectively reviewed. The operating surgeons adopted the routine use of this technique in November 2014. Therefore, for the group who underwent reconstruction with a free mucosal graft, we included patients from November 2014 to October 2016.

Among patients who met the inclusion criteria, we excluded those 1) who were followed up at another institution postoperatively and therefore did not have available MRI studies in our electronic medical records (EMR) to review and 2) who had subsequent skull base surgery with a different type of reconstruction method that limited our ability to analyze for the purpose of this study.

For radiographic comparison, a second control group was formed that consisted of consecutive patients who underwent the same operation without subsequent reconstruction with a free mucosal graft. These patients were gathered from the period before November 2014.

Description of Surgery

A thorough description of our surgical technique has been reported elsewhere.[5] The surgery was performed by a dual surgeon team, consisted of an otolaryngologist and a neurological surgeon. All surgery was performed with the use of intraoperative image guidance. The initial step of the surgery was to create bilateral nasal corridors for access to the sella turcica and to allow bimanual instrumentation. After the approach was established, a free mucosal graft was harvested from the nasal cavity floor, including the lateral wall of the inferior meatus up to the attachment of the inferior turbinate and 3–5 mm of the nasal septal mucosa. After the harvesting, the graft was kept in normal saline solution. The pedicle for a potential nasoseptal flap was preserved bilaterally in all cases. Then, the sella turcica was opened and the pituitary adenoma was resected.

The skull base defect was reconstructed immediately after in multiple layers. First, a single layer of synthetic dural substitute was placed as an inlay graft in the extradural space between the dura and the bony skull base defect. Then, the free mucosal graft was placed as an onlay graft over the bony skull base defect, ensuring that the sphenoid sinus mucosa at the edges of the defect was completely elevated and not trapped under the graft. The graft was then supported at the edges by pieces of oxidized regenerated cellulose, and the entire reconstruction was covered with polyethylene glycol hydrogel. Bioresorbable nasal dressing was placed in the sphenoid sinus to support the graft toward the skull base.

For those who did not undergo reconstruction with a free mucosal graft, a single layer of synthetic dural substitute was placed as an inlay graft in the extradural space between the dura and the bony skull base defect. Then, the bony skull base defect was covered with pieces of oxidized regenerated cellulose and polyethylene glycol hydrogel.

Data Analysis

Both inpatient and outpatient EMR were reviewed to obtain baseline characteristics of the included patients. Pathology reports were reviewed to confirm the histologic diagnosis of pituitary adenoma. Operative reports were reviewed to record whether or not other functional surgeries, such as septoplasty and/or inferior turbinoplasty, were performed at the same time.

According to our departmental protocol, all patients are recommended to schedule a routine follow-up visit at 1 week, 1 month, and 3 months postoperatively. They are seen thereafter as needed for any sinonasal problems. During all clinic visits, nasal endoscopy is performed to assess the graft. Patients are also asked to fill out the Sino-Nasal Outcome Test-22 (SNOT-22) questionnaire preoperatively and then 1 month and 3 months postoperatively to assess the degree of sinonasal morbidity.

All patients obtain a routine MRI study at 3 months and 1 year postoperatively. Thereafter, the neurosurgical team determines the frequency for the purpose of surveillance.

At our institution, the MRI studies of the brain with pituitary protocol are performed in either a 1.5-T or a 3-T MRI scanner. Our pituitary protocol entails multiplanar multisequence imaging of the brain centered on the sella turcica. T1-weighted and T2-weighted spin echo are used before and after intravenous (IV) gadolinium administration to obtain images. Repetition time and echo time vary among studies, depending on the magnet field strength used.

For the included patients, the EMR were searched to gather the postoperative MRI studies, obtained either at our institution or at an outside facility. They were reviewed by a neuroradiologist at our institution to assess the appearance of the sellar region, including thickness and enhancement pattern. The thickness of the graft was best measured at the midsagittal plane of T1-weighted postgadolinium images. Postgadolinium images were also used to record enhancement pattern of the graft. Because of the different magnetic field strengths of the MRI scanners and the different amount of gadolinium used, quantitative measurement of enhancement was difficult to obtain. The axial plane of T2-weighted images was used to evaluate the mucosal lining of the sphenoid sinus for any evidence of inflammation.

For those studies that were obtained without gadolinium, the midsagittal plane of T1-weighted images was used to measure the thickness of the graft.

Table 1. Clinical Characteristics of Patients (n = 50)

Characteristic	Value
Age (years)	
Average	55 ± 17
Range	16–87
Gender	
Male	21/50 (42.0)
Female	29/50 (58.0)
History of chronic rhinosinusitis	
Yes	6/50 (12.0)
No	36/50 (72.0)
Unknown	8/50 (16.0)
Pituitary adenoma	
Macroadenoma	45/50 (90.0)
+ suprasellar extension	34/45 (75.6)
+ cavernous extension (unilateral/bilateral)	23/45 (51.1)
Microadenoma	5/50 (10.0)
Concurrent surgery	
Septoplasty	14/50 (28.0)
Inferior turbinoplasty	2/50 (4.0)
Septoplasty + inferior turbinoplasty	10/50 (20.0)
Revision	8/50 (16.0)

Values are number (%) except where indicated otherwise.

The results from data analysis were analyzed using the IBM SPSS Statistics Version 25 software (IBM Corp., Armonk, New York, USA) to determine statistical significance ($P < 0.05$).

RESULTS

From November 2014 to October 2016, 64 patients underwent pituitary adenoma resection via an endoscopic endonasal transsellar approach with immediate reconstruction of the skull base defect. Thirteen patients were excluded because they were followed up at another institution postoperatively and did not have MRI studies available for review. One patient was excluded because she had a CSF leak on postoperative day 2 (POD2) and underwent revision reconstruction with a nasoseptal flap; therefore, this patient's postoperative MRI was not relevant to the purpose of this study. Hence, 50 patients were included. A summary of their clinical characteristics is shown in Table 1.

At the time of initial consultation, 6 patients reported a history of chronic rhinosinusitis, with the most common symptoms including anterior and posterior nasal discharge, nasal obstruction, and facial pain/pressure. Nasal endoscopy in those patients showed evidence of mucosal inflammation. Thirty-six patients denied a history of chronic rhinosinusitis. In 8 patients, there was insufficient documentation to determine.

All 50 patients underwent endoscopic endonasal transsellar resection of the pituitary adenoma as described earlier. During the surgery, 14 patients also underwent septoplasty, 2 patients bilateral inferior turbinoplasty with submucosal microdebridement, and 10 patients both septoplasty and bilateral inferior turbinoplasty. These procedures were performed in addition to improve access to the sella turcica and/or to address the patient's concurrent history of sinonasal symptoms.

Eight patients previously underwent pituitary adenoma resection by outside surgeons and presented to our institution for re-resection because of recurrence or enlarging residual disease. The same surgical approach was taken for these patients.

For the second control group, there were 14 patients who underwent pituitary adenoma resection via an endoscopic endonasal transsellar approach without reconstruction with a free mucosal graft, between August 2012 and September 2014. One patient was excluded because of the postoperative CSF leak on POD2 that was repaired with a nasoseptal flap.

Clinical Data Analysis

By the time of this data analysis, all 50 patients (100%) were followed up at 1 week, 48 patients (96%) were followed up at 1 month, and 30 patients (60%) were followed up at 3 months.

According to nasal endoscopy performed at every visit, the free mucosal graft was well healed in all patients by 1 month postoperatively. The donor site on the nasal cavity floor was also completely or near completely remucosalized by 1 month in all patients. This situation was in contrast to the control group, who did not undergo reconstruction with a free mucosal graft; they did not show complete remucosalization of the sellar defect until the 3 months follow-up.

Preoperatively, 21 patients filled out the SNOT-22 questionnaire. Postoperatively, 25 patients filled out the questionnaire during their 1-month visit and 24 patients during their 3-month visit. Seven patients filled out the questionnaire at all 3 visits. Their SNOT-22 scores are shown in Figure 1. There was 1 outlier (the preoperative score for patient 2), which was included in the statistical analysis but not shown in the figure for simplicity.

A 1-way repeated-measures analysis of variance with post hoc analysis was conducted to determine whether or not there was a statistically significant difference in the mean SNOT-22 scores over time. The mean SNOT-22 scores were 25.14 ± 31.54 at the preoperative visit, 15.57 ± 6.90 at the 1-month postoperative visit, and 11.57 ± 9.57 at the 3-month postoperative visit. The analysis showed that the difference was not statistically significant between the preoperative mean and the 1-month postoperative mean ($P = 1.0$), or between the preoperative mean and the 3-month postoperative mean ($P = 0.61$).

Postoperative MRI Analysis

For the included 50 patients, 116 postoperative MRI studies were available at the time of data analysis. Except for 15 studies, they were all performed at our institution with the standardized pituitary protocol. For the purpose of this study, the quality of these outside images was acceptable. Seven studies were performed without IV gadolinium because decreased renal function was noted at the time of the studies. There were 47 MRI studies obtained around 3 months, 46 MRI studies obtained around 12

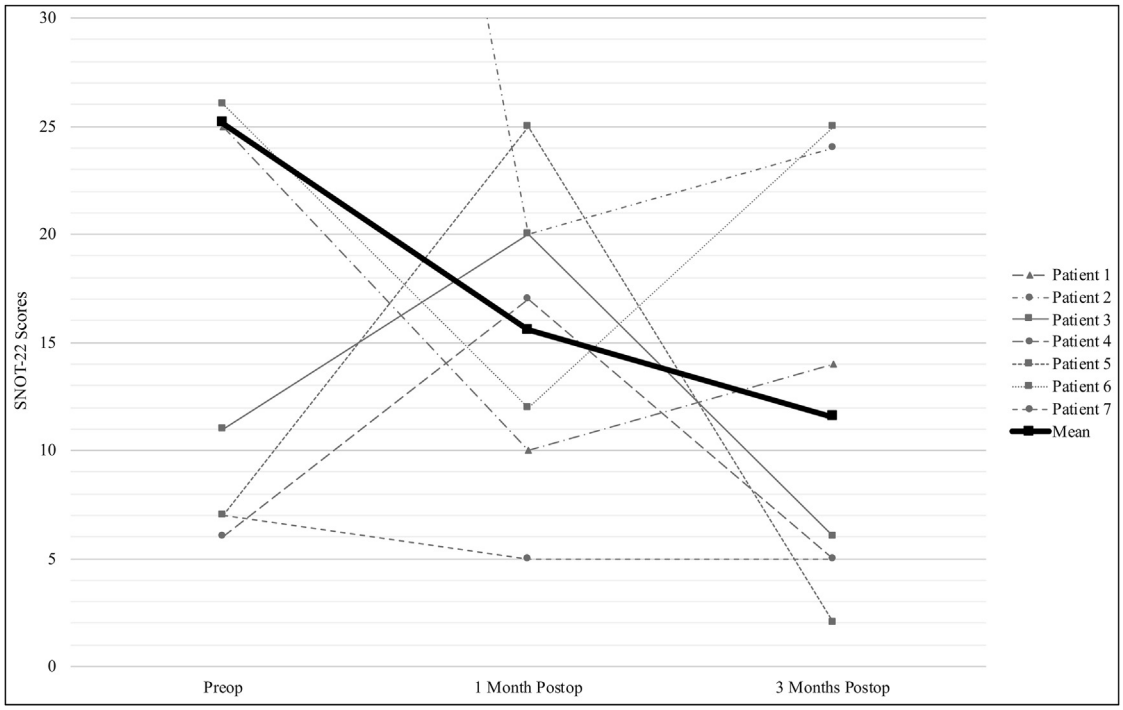

Figure 1. Sinonasal outcome of reconstruction using free mucosal graft. Seven patients who completed the Sino-Nasal Outcome Test-22 (SNOT-22) questionnaire during all 3 clinic visits are included, and their scores are plotted to show the individual trends. The preoperative (Preop) score for patient 2 is an outlier and not shown in the figure but included in the statistical analysis. The mean SNOT-22 score at each visit is also shown with the thicker line. Postop, postoperative.

months, and 23 MRI studies obtained around 24 months postoperatively. **Table 2** summarizes the results of the postoperative MRI analysis.

The thickness of the free mucosal graft was measured in millimeters. No significant difference was seen in thickness over time. The mean thickness was 1.9 ± 1.4 mm at 3 months, 1.5 ± 1.2 mm at 12 months, and 1.6 ± 1.3 mm at 24 months postoperatively.

For the enhancement pattern analysis, the 7 MRI studies that were obtained without IV gadolinium were excluded. All 109 MRI studies showed definite enhancement of the free mucosal graft on postgadolinium images. **Figure 2** shows the midsagittal plane of T1-weighted postgadolinium images of a patient, obtained preoperatively and then 3 months, 12 months, and 24 months postoperatively. These images show the stable appearance of the free mucosal graft with no obvious changes in its thickness or enhancement pattern.

For the second control group, 32 postoperative MRI studies were available: 13 at 3 months, 11 at 12 months, and 8 at 24 months. The appearance of the site of the previous sellar defect was similar to that of the free mucosal graft group, as shown in **Figure 3**. The mean thickness was 2.2 ± 1.6 mm at 3 months, 1.4 ± 0.7 mm at 12 months, and 1.2 ± 0.6 mm at 24 months postoperatively. These values were comparable to those of the free mucosal graft group. Except for 1 MRI study that was performed without IV gadolinium, all studies showed enhancement in this region.

The axial plane of T2-weighted images was used to evaluate the mucosal lining of the sphenoid sinus. The percentage of patients with T2 hyperintense signal in the sphenoid sinus decreased over time. However, almost half of the patients showed persistent T2 hyperintense signal at 24 months postoperatively. **Figure 4** shows the images of a patient who had T2 hyperintense signal in the right lateral recess of sphenoid sinus at 3 months postoperatively, which later disappeared on the 12-month and 24-month postoperative images.

For statistical analysis, 20 patients who had all 3 MRI studies were selected. At 3 months postoperatively, 13 patients showed T2 hyperintense signal in the sphenoid sinus, whereas 7 patients did not. At 12 months postoperatively, 10 patients had T2 hyperintense signal in the sphenoid sinus, whereas 10 patients did not. This change was a consequence of 4 patients who initially had T2 hyperintense signal showing none on the latter study, and 1 patient who initially did not have T2 hyperintense signal showing it on the latter study. At 24 months postoperatively, 9 patients had T2 hyperintense signal in the sphenoid sinus, whereas 11 patients did not. This change was a result of 1 patient who initially had T2 hyperintense signal showing none on the latter study. A McNemar test determined that the difference in the proportions of those with and without T2 hyperintense signal in the sphenoid sinus over time was not statistically significant, from 3 months to 12 months ($P = 0.375$) or from 3 months to 24 months ($P = 0.219$).

Table 2. Radiologic Features of the Free Mucosal Graft

Graft Features	3 Months	12 Months	24 Months
Thickness (mm)	n = 47	n = 46	n = 23
Mean	1.9 ± 1.4	1.5 ± 1.2	1.6 ± 1.3
Range	0.6–6.4	0.6–6.4	0.7–5.1
Enhancement (n = 109)*	n = 46	n = 41	n = 22
Yes	46	41	22
No	0	0	0
Sphenoid sinus T2 signal, n (%)	n = 47	n = 46	n = 23
Yes	37 (79)	25 (54)	11 (48)
No	10 (21)	21 (46)	12 (52)

*Seven magnetic resonance imaging studies were obtained without intravenous contrast and therefore excluded from enhancement analysis.

However, as described earlier, a downward trend in the percentage of patients with T2 hyperintense signal in the sphenoid sinus was detected.

DISCUSSION

With the advancing techniques of endoscopic endonasal approach to skull base surgery, optimizing subsequent skull base reconstruction has been a subject of great interest. Various materials for skull base reconstruction have been described, including synthetic materials (either nonresorbable or resorbable), free tissue grafts, and vascularized flaps.[8]

For the reconstruction to be considered successful, it must recreate the watertight seal between the intracranial compartment and the sinonasal cavity, and it must be able to achieve this with minimal consequent morbidity. Moreover, optimal surgical technique should be safe, easy, and fast. This point is important in preventing delayed CSF leak as well as other well-known complications of skull base surgery, including prolonged

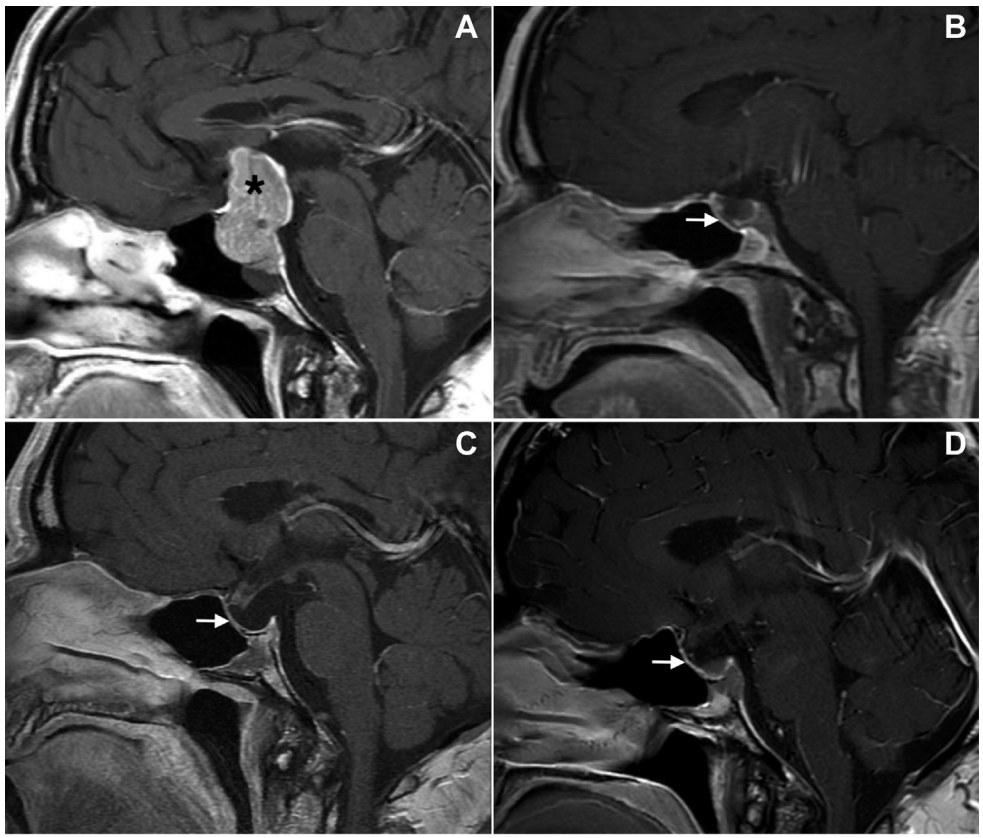

Figure 2. Appearance of free mucosal graft on postoperative magnetic resonance imaging (MRI) studies. T1-weighted postgadolinium image at mid-sagittal plane in the (**A**) preoperative MRI showing the pituitary macroadenoma with suprasellar extension (*asterisk*). T1-weighted postgadolinium image at midsagittal plane in the (**B**) postoperative MRI at 3 months, (**C**) postoperative MRI at 12 months, and (**D**) postoperative MRI at 24 months showing the stable thickness and enhancement of the free mucosal graft (*arrows*).

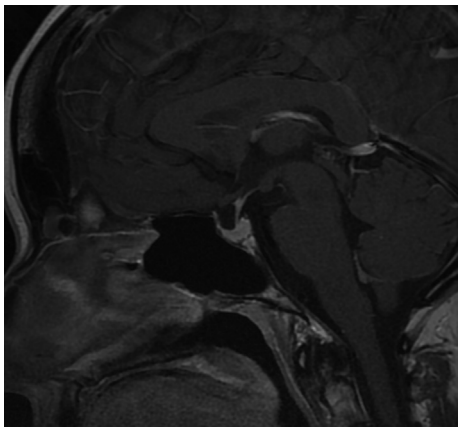

Figure 3. Appearance of the sellar defect on postoperative magnetic resonance imaging study in a patient without free mucosal graft reconstruction. T1-weighted postgadolinium image at midsagittal plane in the postoperative magnetic resonance imaging at 3 months showing a similar appearance both in thickness and enhancement, compared with those who underwent reconstruction with a free mucosal graft.

hospitalization, additional operations, meningitis, and tension pneumocephalus.[9] In particular, the reported incidence of delayed CSF leak after endoscopic endonasal pituitary surgery ranged from 1.8% to 10.0% in recent large case series.[4,10-13]

Many investigators have trialed the graded reconstruction of sellar defect based on intraoperative finding of CSF leak, because intraoperative leak has been correlated with a 6-fold increase in the relative risk of postoperative leak.[14] However, small leaks may not be detected intraoperatively. Moreover, studies still report a nonnegligible rate of postoperative leak in nonreconstructed patients who did not have evident intraoperative leak,[4] which often leads to additional procedures or operations and increased length of stay in the hospital.

As shown in multiple large case series, the adoption of vascularized nasoseptal flap has decreased the incidence of postoperative CSF leak.[11,12] Although the usefulness of vascularized flaps in reconstruction of large skull base defects has been undisputable,[15] they are not without faults. Several complications have been observed,[16-19] including significant postoperative nasal crusting, postnasal drip, and loss of smell. Mucocele formation under the flap has also been reported.[20] Because of the septal cartilage exposure at the donor site, complete healing can take up to 12 weeks, requiring multiple debridements.[17]

Therefore, at our institution, we have standardized our approach to universally reconstruct the sellar defect in multilayer fashion, using a free mucosal graft from the nasal cavity floor, regardless of intraoperative findings, unless the suprasellar cisterns were opened and high-flow intraoperative CSF leak was observed. In those cases, a nasoseptal flap was harvested for reconstruction. In our previous publication,[5] we reported our results in the first 50 consecutive patients. We were able to achieve a gross total resection rate of 78% (39 patients), with intraoperative CSF leak occurring in 40% (20 patients). Every patient underwent reconstruction with a free mucosal graft, and no postoperative CSF leak was observed.

By the time of this manuscript preparation, 145 patients underwent universal reconstruction as described earlier. One patient (0.69%) had postoperative CSF leak occurring on POD2 that required re-exploration and repair with a vascularized nasoseptal flap. This rate compares favorably to the reported incidence in the literature.

There are other notable advantages to using a free mucosal graft as a part of the skull base reconstruction. Unlike abdominal fat graft, which requires a separate surgical incision and causes additional discomfort to the patient, it is immediately available in the surgical field and no additional preparation is required. Harvesting a free mucosal graft from the nasal cavity floor is relatively simple and fast and does not significantly lengthen the operating time. Like vascularized flaps, it provides a mucosal coverage to the skull base defect, but it is less bulky and less disrupting of the normal sinonasal anatomy. This mucosal coverage decreases the likelihood of postoperative CSF leak and leads to faster normalization and recovery of the sphenoid sinus mucosa with less crusting. The healing time for the donor site is also faster, because our nasal endoscopy showed complete or near-complete healing in all patients by 1 month postoperatively. When a free mucosal graft is used, a vascularized flap is still available as a rescue option for potentially more complicated procedures later. As mentioned in the section on "Description of surgery," the rescue flap approach described by Rivera-Serrano et al.[21] was taken in all cases, protecting the pedicle of the nasoseptal flap.

MRI has become the choice of imaging modality for patients who undergo endoscopic endonasal skull base surgery, not only for preoperative planning but also for postoperative evaluation of potential complications and surveillance. Several investigators have used this imaging modality as another method of assessment for skull base reconstruction. Kang et al.[1] described the MRI appearance of nasoseptal flap and showed its viability in a retrospective study of 10 patients who underwent resection of pituitary adenoma. Learned et al.[7] also described the MRI appearance of nasoseptal flap but broadened the assessment by including a wider spectrum of skull base diseases. On the other hand, no study has been published focusing on the appearance of a free mucosal graft on postoperative MRI studies.

Our results showed that both thickness and enhancement pattern of the free mucosal graft remained stable over time. The constant enhancement of the graft in all MRI studies reflects its robust vascularization and integration into its new place. This integration promotes faster healing and more successful watertight closure of the defect. This knowledge of the expected appearance of a free mucosal graft is vital because skull base reconstruction can often affect radiologic interpretations when evaluating for any residual or recurrent disease on surveillance scans.

Compared with the control group who did not have the reconstruction with a free mucosal graft, the radiographic appearance of the previous sellar defect was similar at 3 months, 12 months, and 24 months postoperatively. This finding is consistent with the nasal endoscopy finding at the 3-month postoperative visit, at which time complete mucosalization of

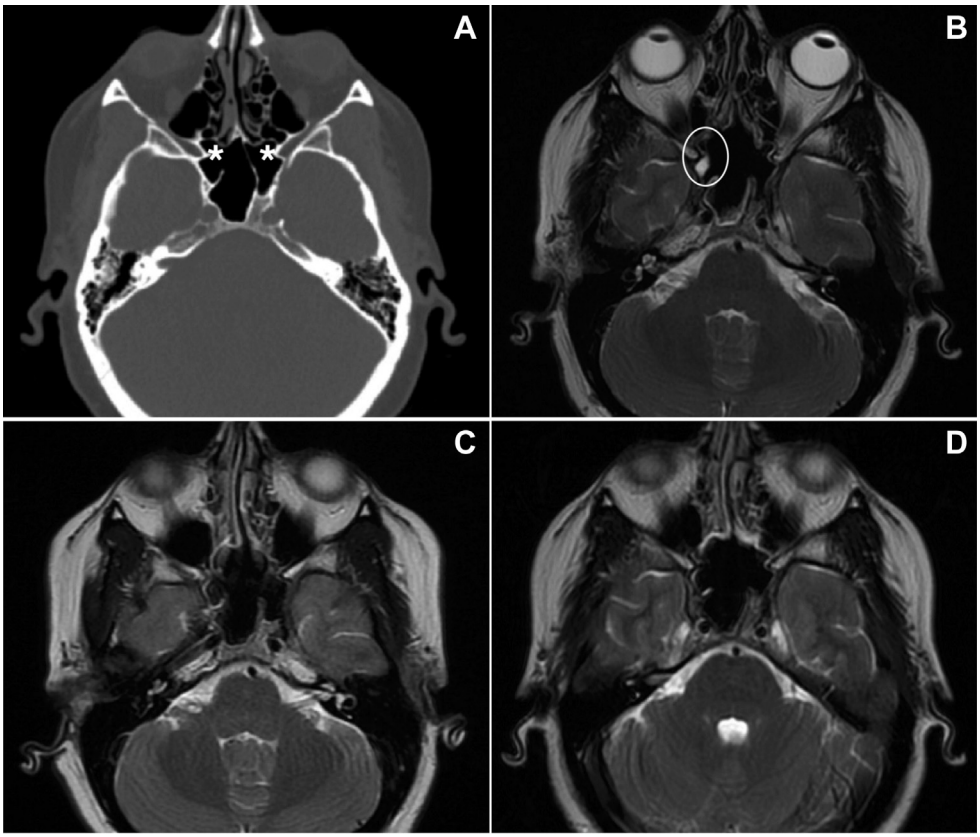

Figure 4. T2 hyperintense signal in sphenoid sinus. (**A**) Preoperative computed tomography of the brain using a neuronavigation noncontrast protocol showing the anatomy of the sphenoid sinus with lateral recess (*asterisks*). T2-weighted postgadolinium axial image at the level of the lateral recess (**B**) at 3 months postoperatively showing T2 hyperintense signal in the right lateral recess (*circled*), (**C**) at 12 months postoperatively showing no T2 signal in the sphenoid sinus, and (**D**) at 24 months postoperatively showing no T2 signal in the sphenoid sinus.

the sellar defect is noted in both groups. However, we suspect that if we were to obtain an MRI study at 1 month postoperatively, there might be a difference in the degree of enhancement between the 2 groups. This theory is based on our nasal endoscopy finding at the 1-month postoperative visit, at which time the free mucosal graft group shows complete mucosalization of the sellar defect with the borders of the graft delineated, whereas the non–free mucosal graft group still shows areas of exposed bone with granulation tissue as it is healing by secondary intention.

By reviewing the signal intensity of the sphenoid sinus mucosa on T2-weighted images, we looked for radiographic evidence of persistent inflammation resulting from the surgery. Many patients had T2 hyperintense signal in the sphenoid sinus mucosa. However, a downward trend was observed in the percentage of patients having T2 hyperintense signal over time, with less than half showing persistent inflammation around 24 months postoperatively. The lack of statistical significance in this downward trend is likely a result of the small number of included patients.

Evidence of persistent T2 hyperintense signal in the sinonasal mucosa was also reported by other investigators. Langdon et al.[18] noted in their study of patients who underwent reconstruction of large skull base defects with vascularized flaps that there were persistent signs of inflammation in the sinonasal mucosa (increased Lund-Mackay scores and evidence of mucosal thickening and fluid retention on T2-weighted images) up to 12 months after surgery. Deconde et al.[22] also reported that the nasoseptal flap was associated with increased radiographic incidence of mucosal thickening in sinuses.

However, the persistent inflammation shown by the T2 hyperintense signal was not translated clinically. Although 79% of postoperative MRI studies at 3 months had T2 hyperintense signal in the sphenoid sinus mucosa, the mean SNOT-22 score at 3 months was lower than the preoperative value. This trend was also noted in our previous studies.[5,23] In patients who have a concurrent history of nasal obstruction and symptoms of chronic rhinosinusitis with attributable anatomic findings, septoplasty and/or bilateral inferior turbinoplasty were performed not only to improve our access to the sella turcica but also to improve their quality of life afterwards. This factor may explain the lower SNOT-22 scores at 3 months postoperatively, compared with preoperative scores.

Because many of those who undergo skull base surgery have native sinonasal mucosa that is noninflammatory, surgeons need to be mindful of the potential sinonasal morbidity resulting from the surgery, which can greatly affect quality of life. In this study, we found that our reconstructive technique using a free mucosal graft from the nasal cavity floor did not significantly affect the sinonasal health of our patients. This result is shown by the fact that there was no statistically significant change in the mean SNOT-22 scores, when comparing the preoperative value with 1-month postoperative and 3-month postoperative values.

There are several limitations to our study, including its retrospective design with its inherent bias and a small sample size. The concomitant history of chronic rhinosinusitis in some patients served as a confounding factor when analyzing the SNOT-22 scores. Also, not every patient was followed up in our clinic postoperatively, filled out the SNOT-22 questionnaire, or had the postoperative MRI study. These factors contributed to several selection biases in the study.

CONCLUSIONS

Postoperative MRI surveillance scans showed a stable appearance of the graft that mimics the native mucosa, with enhancement through time, reflecting its robust vascularization and integration to the skull base. Although persistent T2 hyperintense signal was detected in the sphenoid sinus, clinical evidence based on nasal endoscopy reports and SNOT-22 scores indicated minimal sinonasal morbidity.

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