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Random nasoseptal flap for revision skull base reconstruction

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Abstract

The nasoseptal flap (NSF) has become the workhorse of endoscopic skull base reconstruction (ESBR). With the increase in endoscopic skull base procedures, there has also been the need for staged and revision procedures where the use of the NSF is no longer an option. These cases have posed new and interesting challenges to skull base surgeons especially with regards to reconstructive options. While free mucosal or turbinate grafts may be too small for certain defects, others such as the pericranial flap require an open procedure with added morbidity. We describe the use of a random nasoseptal flap for the reconstruction of a skull base defect.

Keywords

endoscopic skull base surgery; transsphenoidal surgery; cerebrospinal fluid leak repair; nasoseptal flap

Introduction

The nasoseptal flap (NSF) is the workhorse of endoscopic skull base reconstruction (ESBR).

¹ However, recently there has been an increase in staged or revision endonasal surgeries. In these situations, skull base reconstruction can be a challenge. Zanation et al described the technique of NSF takedown and reuse in these revision cases.² However in practice, there are cases where the original NSF is unsalvageable. A few options for distinct endoscopically harvested flaps exist at this point including both middle and inferior turbinate flaps, but these

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techniques provide a smaller volume for reconstruction that are often not adequate depending on the location of the defect. The use of pericranium and free flaps have been described for these challenging cases but both require external incisions and can increase surgical time. The healing of septal mucosa after a nasoseptal flap has been studied in an animal model that suggests that the mucosal regeneration takes place within 4 weeks.³ Further, in a recent study it was identified that in patients with a prior history of septal surgery NSF is technically feasible and has similar rates flap integrity⁴ However, the possible use of persistent intact mucosal bridge within the healed nasoseptal mucosa as a random flap has not yet been explored.

We describe a case where a random NSF was harvested for endoscopic skull base reconstruction in a revision setting, thus avoiding the morbidity of open procedure.

Case Report

The patient described in the case is a 44-year-old female who presented with a rapidly increasing supra-sellar mass. She was previously treated for a growth hormone secreting pituitary giant adenoma 4 years ago. She underwent an endoscopic transsphenoidal resection with nasoseptal flap reconstruction, followed by craniotomy and post-operative fractionated radiation therapy for residual disease. Over the course of next 4 years, she was well maintained on non-surgical therapy. Despite treatment, there was rapid growth of the tumor to involve the optic chiasma (OC) in the months prior to her presentation to our service. Revision surgery was planned to debulk the tumor and decompress the optic chiasm. Pre-operative MRI demonstrates lesion and prior skull base reconstruction (Figure 1A-B).

On nasal endoscopy, a previously fashioned NSF was identified covering the skull base defect. During the procedure, this flap could not be salvaged and thus a new vascularized flap was designed from the mucosal bridge available over the healed septal mucosa (Figure 2). The skull base defect (1.5×1.5 cm) was closed in layers with an AlloDerm (Allergan, Dublin, Ireland) underlay and the newly fashioned flap placed as an overlay. The technique is explained in detail below. The recovery was uneventful, and the patient was discharged the next day. At the last follow-up of 6 months the patient has healed well and is free of any complications from the procedure. Post-operative MRI demonstrated viable mucosal coverage of skull base defect from the random NSF (Figure 1C-D).

Technique

The nasal cavity was first decongested with cocaine soaked cotton pledgets. Access to the sphenoid corridor was obtained by superior turbinectomy and anterior and posterior ethmoidectomy. The previous NSF was visualised, but it technically could not be salvaged. The previous flap was removed, and the sphenoid corridor was identified to access the sella and the recurrent tumor. There was a bridge of septal mucosa inferiorly in the region of the right sphenopalatine artery distribution coming anterior to the nasal septum. Using a Colorado microdissection needle tip (Stryker, Kalamazoo, MI) electrocautery, the inferior incision was made first. The tissue was incised lateral to medial over the most inferior palpable bone superior to the choana, coming anterior along then nasal floor to the region of a hemitransfixion incision. The superior cut is then made immediately inferior to the

sphenoid corridor opening coming from lateral to medial to the same level as the inferior incision. The inferior and superior cuts were joined and the flap was elevated using the cottle elevator. This mucosal flap was then placed in the nasopharynx for later reconstruction.

The rostrum was removed for expanded endoscopic access and the sphenoid sinus was dissected in plane with the posterior most ethmoid air cell. The skull base was accessed endoscopically and the tumor was debulked. After the maximum amount of tumor was removed a low flow cerebrospinal fluid leak was encountered and the defect was closed with multi-layered reconstruction. AlloDerm was used as an underlay and the random NSF was placed over it. After placing the flap over the defect Surgicel (Ethicon, Somerville, NJ) was placed at the flap periphery, fibrin glue (TISSEEL, Baxter, Deerfield, IL) was applied. Doyle splints were then placed bilaterally and were sutured in place.

Discussion

We describe a novel method of harvesting a random NSF from a mucosal bridge over the healed septal mucosa and nasal floor which helped us to achieve an endoscopic reconstruction and avoid the morbidity of an open approach. The NSF is the one of the most robust local flaps for ESB⁵. However, in revision surgeries, re-use of previously fashioned NSF is technically demanding. This is further complicated by post-operative adhesions or stenosis near the pedicle of the flap thus makes the salvage even more difficult.

The nasal septum is a broad region from which the primary NSF is usually raised. However, it is common to find an intact mucosal bridge is left behind near the inferior septum. This mucosal bridge can be raised as a flap and used as a reconstructive option. However, certain differences do exist between this and the primary NSF.⁴ The mucosal band flap acts like a random flap that receives its blood supply from submucosal network of vessels compared to the primary NSF which is an axial flap based on the posterior septal artery. Further, the mobility of the former flap is not as supple as the primary flap. Thus, the random flap needs to have a large bridge in the posterior region to allow it to survive in the postoperative period. In this case, we were able to successfully use the random NSF to cover the skull base defect without complication. The flap showed enhancement in the postoperative period on subsequent MRI scans suggesting a well healed surface with no evidence of CSF leak or loss of flap integrity. While this flap performed well in this revision skull base reconstruction, further cases will be required to see if this technique has similar promising results.

Conclusion

We have described here the novel use of a random nasoseptal flap for revision endoscopic skull base reconstruction.

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Figure 1. Pre-operative T1-weighted MRI (A,B) demonstrating traditional obliterated nasoseptal flap (coronal, sagittal). Post-operative T1-weighted MRI (C,D) demonstrating mucosal flap surrounding skull base defect (coronal, sagittal).

Figure 2.
Coronal illustration of remnant mucosal bridge and harvest of random nasoseptal flap.