The Nasoseptal "Mirror" Flap for Expanded Endoscopic Skull Base Reconstruction

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Introduction

The nasoseptal flap, first described in 2006,[1] revolutionized skull base reconstruction after endoscopic endonasal surgery, reducing postoperative cerebrospinal fluid leak rates from over 20%[2] to approximately 3–5%.[3,4] Based on the posterior septal branch of the sphenopalatine artery, the flap has been modified to include additional nasal mucosa to expand its reach while maintaining reliable vascularity.[5-8] In expanded approaches such as the transpterygoid approach, however, the ipsilateral vascular supply may be sacrificed, limiting reconstructive options to a contralateral flap. We present two cases of patients with extensive skull base tumors. In the first, only a left-sided nasoseptal flap was available. To achieve adequate coverage of an extensive skull base defect, we developed a novel bilobed modification incorporating contralateral septal and nasal floor mucosa as a random-pattern extension, enabling complete reconstruction.

Clinical Case Presentations

Case 1

- 47-year-old male with incidentally discovered large right trans-spatial skull base mass during endocrine workup; imaging showed involvement of the pterygopalatine and infratemporal fossae, maxillary and sphenoid sinuses, orbital apex, optic canal, and middle cranial fossa.
- Multicorridor resection (endonasal transpterygoid, Caldwell-Luc, lateral orbitocraniotomy) created an extensive defect; right sphenopalatine artery not salvageable.
- Novel left-sided nasoseptal flap with right septal/nasal floor random-pattern extension designed for expanded coverage.
- Extradural resection without CSF leak; bilobed flap achieved complete reconstruction with confirmed perfusion.
- Final pathology: schwannoma; flap fully viable at 1 month.

Case 2

- 68-year-old female with recurrent left spheno-orbital meningioma involving the infratemporal and pterygopalatine fossae, parasellar region, orbit, and maxillary sinus.
- Multicorridor resection (endonasal transsphenoidal/transpterygoid, Denker's, lateral orbitotomy) with sacrifice of left sphenopalatine artery and high-flow CSF leak.
- Modified nasoseptal flap pedicled on the right posterior septal branch with contralateral septal extension used for reconstruction.
- Dural inlay and fat graft placed; bilobed flap provided complete coverage with preserved vascularity.
- Final pathology: meningioma; no postoperative CSF leak at 2 months

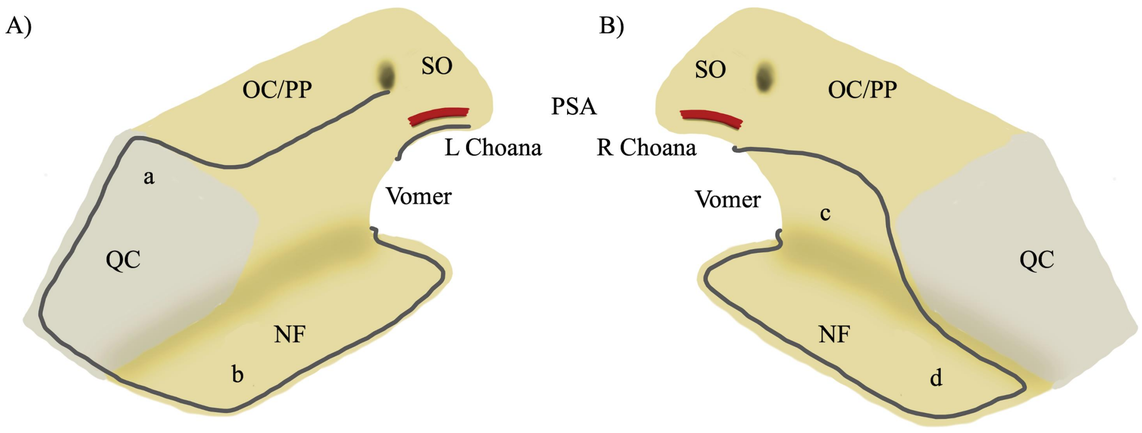

Figure 1: Schematic of incisions for the proposed modification; example of a left-pedicled flap. A) View of incisions from the left. B) View of incisions from the right. *SO – sphenoid ostium; OC/PP – olfactory cleft/perpendicular plate; QC – quadrangular cartilage; NF – nasal floor; PSA – posterior septal branch of the sphenopalatine artery.*

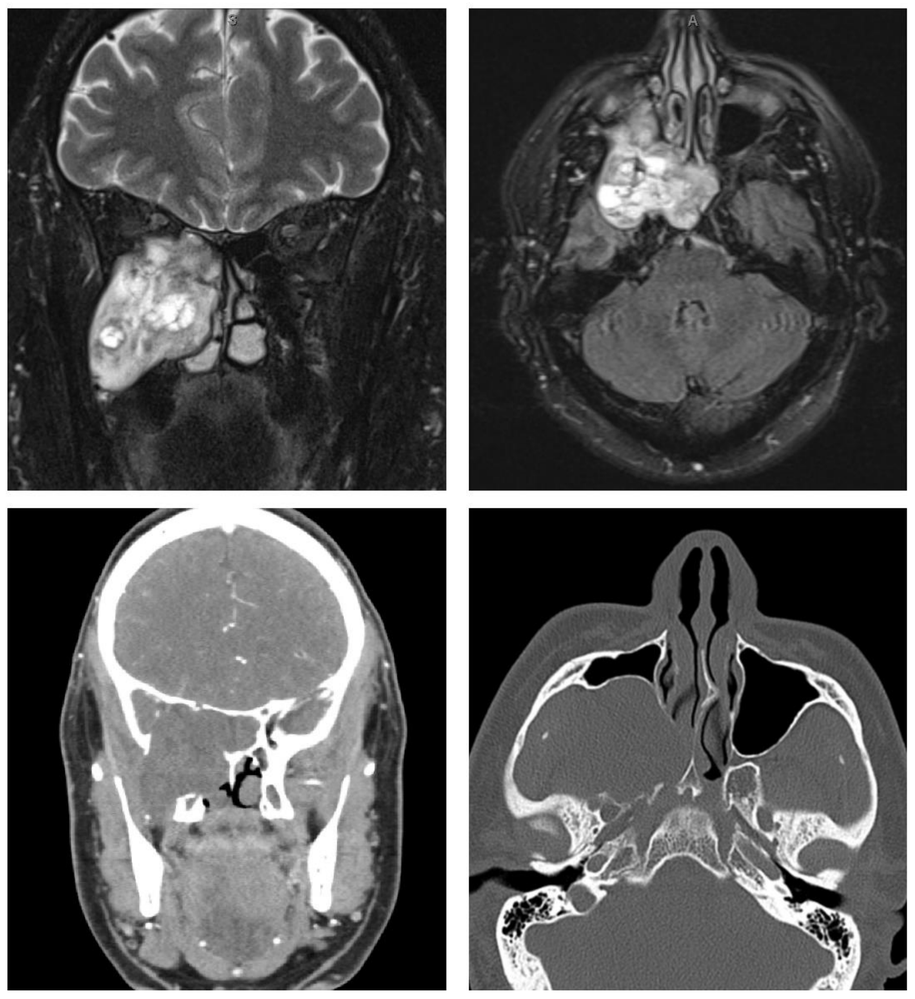

Figure 2: Magnetic resonance imaging and computed tomography scans from Case 1 demonstrating a large, expansile T2-bright, partially cystic tumor centered in the pterygopalatine fossa with extension into the infratemporal fossa, middle cranial fossa, maxillary sinus, and sphenoid sinus

Discussion

- Numerous nasoseptal flap modifications have expanded reconstructive reach, including lateral nasal wall extensions,[6-8] pedicle dissection into the pterygopalatine fossa,[11-13] and bilateral flap harvest.[14] However, when one sphenopalatine/internal maxillary artery is sacrificed (e.g., transpterygoid or revision surgery), reconstructive surface area may be limited to a single vascular pedicle.
- We describe a novel bilobed nasoseptal flap incorporating contralateral septal mucosa as a random-pattern extension across the posterior free edge of the vomer, creating two mirror-image mucosal paddles.
- The contralateral extension relies on posterior septal mucosal continuity (no axial vessel), with vascularity confirmed intraoperatively using ICG fluorescence. The superior limit is the olfactory cleft; anterior extension was limited to avoid septal perforation or nasal deformity.
- Compared with previously described bilateral-septal techniques in revision cases, our modification utilizes the free edge of the vomer as the confluent mucosal bridge rather than a prior septectomy surface.
- The bilobed geometry is particularly suited for wide coronal or tall craniocaudal skull base defects. In CSF leaks, the inter-paddle cleft must be positioned away from the dural defect.
- Limitations include loss of the option for a reverse flap and potential donor-site morbidity. The perfusion limits of the posterior vomeral bridge and performance in high-flow CSF leaks require further study.

Conclusions

This novel modification of the nasoseptal flap allows bilateral septal mucosa to be harvested on a unilateral pedicle using the mucosal bridge along the posterior edge of the vomer. The bilobed mirror flap may be particularly helpful in cases where the typical vascular pedicle of the nasoseptal flap is not present on one side of the nasal cavity. Additionally, the orientation of the two mucosal paddles allows for extensive coronal or sagittal plane coverage.

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References