Triple-Layer Reconstruction Technique for Large Cribriform Defects After Endoscopic Endonasal Resection of Anterior Skull Base Tumors

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Introduction

Endoscopic endonasal transcribriform resection of anterior skull base(ASB) tumors results in large skull base defects that may extend the entirety of the cribriform plate, from the posterior wall of the frontal sinuses to the tuberculum sellae sagitally, and from one medial orbital wall to the other coronally. Endoscopic repair of these large cribriform defects can often be challenging. We describe our reconstruction technique for large ASB defects after endoscopic endonasal transcribriform resection of ASB tumors. This triple-layer technique is comprised of autologous fascia lata, acellular dermal allograft (ADA), and a vascularized pedicled nasoseptal flap (PNSF). The technique is described and postoperative cerebrospinal fluid (CSF) leak rate is evaluated.

Methods

Retrospective review of a prospective database over a two-year period identified 10 patients who underwent a purely endoscopic endonasal transcribriform approach for resection of ASB tumors. Lesions included 2 olfactory groove meningiomas, 2 esthesioneuroblastomas, 1 olfactory schwannoma, 1 sinonasal small cell neuroendocrine carcinoma, 1 sinonasal melanoma, 1 adenoid cystic carcinoma, 1 sinonasal/anterior skull base inflammatory pseudotumor, and 1 recurrent osteoblastoma. After tumor resection, all patients underwent triple-layer reconstruction using autologous fascia lata inlay, acellular dermal allograft inlay/overlay, followed by a vascularized PNSF to reconstruct a large cribriform ASB defect.

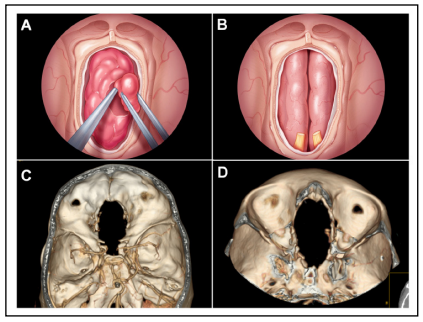

Figure 1. A: Illustration of endoscopic view of ventral skull base with a 30-degree endoscope during endoscopic transcribriform resection of a midline skull base tumor. B: Endoscopic view of the transcribriform skull base dural defect. C and D: 3D reconstructed CT angiogram (C: view from above,D: view from below) of a patient who underwent endoscopic transcribriform resection of an olfactory groove meningioma demonstrating the size of the anterior skull base defect.

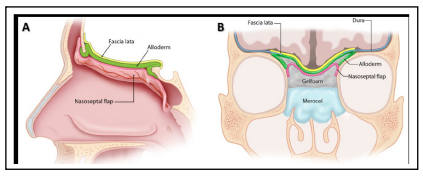

Figure 2. Illustration (A: sagittal, B: coronal views) demonstrating the triple-layer reconstruction technique for repair of large anterior skull base defects using an autologous fascia lata inlay, alloderm inlay/outerlay graft, and a vascularized pedicled nasoseptal flap. The repair is bolstered with gentamicin-soaked gelfoam pledgets followed by an expandable Merocel nasal tampon (Reprinted with permission from © 2012 Chris Gralapp).

Results

The average cribriform defect size was 9.1 cm2 (range, 5.0 – 13.8 cm2). All 10 patients underwent successful reconstruction with a postoperative CSF leak rate of 0% without the use of postoperative lumbar drainage. The mean follow-up period was 7.4 months (range, 2 to 17 months). The mean age was 45.8 years (range, 15-81 years) with 30 percent of the patients being females.

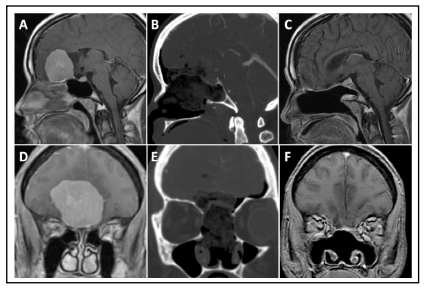

Figure 3. A and D: Preoperative sagittal (A) and coronal (D) T1-weighted Gd-enhanced MRI demonstrating a large olfactory groove meningioma that was resected using an endoscopic endonasal transcribriform approach with subsequent repair using the triple-layer reconstruction technique. B and E: Postoperative sagittal (B) and coronal (E) CT scans demonstrate a large anterior skull base defect extending from the frontal bone to the sella turcica in the sagittal view and from the medial orbit to the medial orbit in the coronal view. C and F: Postoperative MRI at 1 year demonstrates excellent reconstruction of the anterior cranial base without recurrent tumor.

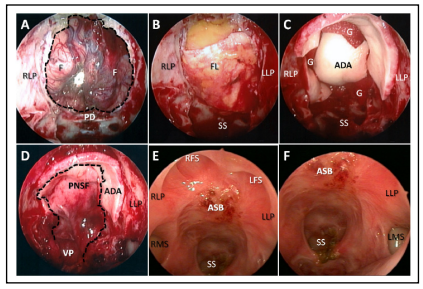

Figure 4. Intraoperative photographs of triple-layer reconstruction of patient in Figure 3. A: Endoscopic view of the ASB dural defect (outlined by dashed lines). Bilateral frontal lobes (F) are visualized through the dural defect. B: An initial layer of autologous fascia lata (FL) is tucked underneath the edges of the dura as inlay graft to convert a "high-flow" defect to a "low-flow" defect. C: A piece of thick ADA is placed as a combined inlay/outerlay graft by wedging the graft underneath the edges of the bony defect with gelfoam (G) pledgets, as the redundant outer margins of the graft act as an overlay to cover the margins of the bony defect. D: The PNSF is rotated to cover the skull base repair. E and F: Photographs of nasal endoscopy at 1 year after surgery demonstrates excellent mucosalization of the ventral skull base repair. RLP=right lamina papyracea, PD=planum dura, LLP=left lamina papyracea, SS=sphenoid sinus, VP=vascular pedicle, RFS=right frontal sinus, LFS=left frontal sinus, ASB=anterior skull base, RMS=right maxillary sinus, LMS=left maxillary sinus.

Conclusions

The triple-layer reconstruction technique using autologous fascia lata, acellular dermal allograft and a vascularized PNSF is effective in reconstructing large anterior skull base defects after endoscopic resection of the cribriform plate.

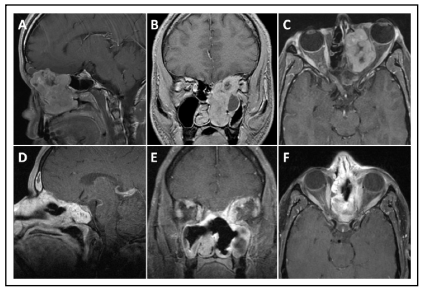

Figure 5. A-C: Preoperative sagittal (A), coronal (B), and axial (C) T1-weighted Gd-enhanced MRI demonstrating an adenoid cystic carcinoma invading the cribriform plate and left lamina papyracea that was resected using an endoscopic endonasal transcribriform approach with subsequent repair using the triplelayer reconstruction technique. D-F: Postoperative sagittal (D), coronal (E), and axial (F) T1-weighted Gd-enhanced MRI at 3 months after surgery demonstrating vivid enhancement of the nasoseptal flap at the ventral skull base with restoration of previous proptosis.

References

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