A Novel Technique for Pedicled Nasoseptal Flap Takedown in Revision Skull Base Surgery

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Abstract

Keywords

- pedicled nasoseptal flap
- anterior skull base surgery
- CO2 laser
- novel
- revision
- takedown

Objective To describe a novel technique of using the CO2 laser for a revision pedicled nasoseptal flap (PNSF) takedown.

Patient Patient with a pituitary adenoma recurrence that had undergone an endoscopic skull base resection with a nasoseptal flap repair 3 years prior.

Procedure Flap edges and bony defect are examined using an image-guidance probe to identify the full extent of the defect. The CO2 laser fiber is used to incise through to the underlying skull base. The flap is then elevated from its most distal portion toward the pedicle, using the laser to cut adhesions away from the underlying dura. The skull base defect is then repaired with an onlay graft of acellular dermis, then the PNSF.

Results The laser was adept at dissecting through mucosa to the underlying bone and at dissecting the underside of the flap from the posterior adhesions and intradural structures safely.

Conclusion The novel use of the of the CO2 laser for the flap takedown was very effective at safely making the mucosal cuts and dissecting the flap from the underlying structures. The nasoseptal flap takedown can be a technically challenging procedure that was made easier by the use of the CO2 laser.

Introduction

Technological advances and understanding of sinonasal anatomy have allowed for the development of endoscopic expanded endonasal approaches (EEAs). The vascularized pedicled nasoseptal flap (PNSF) has become a well-accepted technique for the closure of large skull base defects.^{1–4} The PNSF is a pedicled nasoseptal flap of the mucoperiosteum and mucoperichondrium of the nasal septum based on the sphenopalatine artery. This is the main technique used in our institution for large skull base defects, because of its proven success in achieving the goal of separating the cranial cavity from the sinonasal tract. In the situation of progressive or recurrent disease, repeat procedures need to be performed through the previous surgical site. A repeat procedure

presents the challenge of obtaining intracranial access through the previous skull base defect repair, as well as the need for an additional reconstructive option for prevention of a postoperative CSF leak. The nasoseptal flap takedown technique has been previously described for preserving the PNSF flap and its pedicle during revision surgery and allowing for its reuse in the skull base repair.⁵ This paper describes a novel approach in the nasoseptal flap takedown technique using a CO2 laser.

Technique

At the beginning of the case, the existing flap is examined using a 30-degree scope to identify the pedicle and flap edges (➤**Fig. 1**). The flap edges and bony defect are then examined

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Fig. 1 This beginning view of the pedicled nasoseptal flap (PNSF) shows a flap that is viable with well-healed edges and full coverage of the skull base defect. Yellow highlights are tracing out the course of the pedicle.

with the image guidance probe to identify the full extent of the defect, and to identify if the flap edge is overlying bone. The CO₂ laser (Omniguide; Beampath TM Cambridge, Massachusetts, USA) fiber on an extended handpiece is then used to dissect the flap edges off the underlying skull base (►Fig. 2). The flap is then elevated from its most distal portion toward the pedicle. This portion of the flap elevation is done with two surgeons using a bi-narial four-handed technique. During elevating of the flap, the CO₂ laser is used to cut adhesions away from the underlying dura (►Fig. 3). Once the flap is fully elevated beyond the inferior extent of the defect, careful attention is made to not disrupt the pedicle. It is important to keep the healed pedicle portion of the flap in place. At the completion of the excision, the skull base defect is then covered with an onlay graft of acellular dermis (AlloDerm; LifeCell, Branchburg, New Jersey, USA). The PNSF is then placed over the onlay graft with careful attention

Fig. 2 The CO₂ laser (circled arrow) is being used to dissect the flap edges from the underlying bone (arrow).

Fig. 3 Binarial four-handed technique used to dissect the pedicled nasoseptal flap (PNSF) from the dura with the CO₂ laser (circled arrow).

to placing the septal flap edges over bare bone. The flap edges are then covered with oxidized methylcellulose (Surgicel; Ethicon, Somerville, New Jersey, USA), and then the entire flap is covered with gelatin sponges (Gelfoam; Pfizer, New York, New York, USA). The sponge packing is then trimmed and placed into the nasal cavity coming into contact with the gelatin sponges, without placing any additional pressure on the flap. The sponge packing is then infused with saline under direct visual guidance. The packing stays in place for 6 days, and the patient is started on prophylactic antibiotics.

Results

The patient had a growth hormone-secreting pituitary macroadenoma and had undergone an endoscopic skull base resection with a nasoseptal flap repair 3 years prior. The patient had a recurrence of the pituitary adenoma. Using the CO₂ laser, the nasoseptal flap was successfully taken down without pedicle disruption. The laser was adept at dissecting through the mucosa down to the underlying bone and at dissecting the underside of the flap from the posterior adhesions and intradural structures safely. The patient had an intraoperative cerebrospinal fluid (CSF) leak during tumor removal, and the PNSF achieved complete coverage of the defect and successfully repaired the CSF leak. There was no postoperative leak. The sponge packing was removed in clinic without incident on postoperative day 6. On postoperative week 6, the flap was examined with a 30-degree endoscope and the edges had fully healed without any residual crusting, pulsations, or CSF leak (►Fig. 4).

Discussion

Technological advances have allowed for more complicated and extensive skull base tumors to be performed endoscopically. The pedicled nasoseptal flap is an ideal flap for reconstructing the large skull base lesions,^{6,7} especially when there is an accompanying CSF leak.⁸ In the event of a revision for a skull base procedure that was previously repaired with a PNSF, the flap can be taken down, preserving the pedicle, and used again for the skull base repair.⁵ The PNSF takedown is technically difficult secondary to needing to make mucosal

Fig. 4 Image taken of flap on postoperative week 6 demonstrating full healing of the flap edges with no residual crusting, pulsation, or cerebrospinal fluid (CSF) leak.

cuts through healed scar tissue, contracted and stiff healed flap tissue, and the risk of damaging the underlying structures adhered to the healed flap. This study highlights the novel technique of performing the PNSF takedown with the CO₂ laser. The image-guidance system was used to circumferentially identify where the flap had underlying bone. The laser was especially useful for safely making the mucosal cuts and dissecting the flap from the underlying structures. The laser prevented bleeding during the dissection and allowed for a superb unobstructed view. The laser incision through the mucosa did not prevent the flap from healing normally, as the flap was fully healed at 6 weeks.

Conclusion

The PNSF is a good technique for repairing anterior skull base defects. The nasoseptal flap takedown and reuse is an established technique that has proven itself to be reliable for

revision skull base repairs. The novel use of the CO₂ laser for the flap takedown was very effective at safely making the mucosal cuts and dissecting the flap from the underlying structures. The nasoseptal flap takedown can be a technically challenging procedure, which was made easier by the use of the CO₂ laser.

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