The Use of Unilateral Pericranial Flaps for the Closure of Difficult Medial Orbital and Upper Lateral Nasal Defects

Jason Newman, M.D.,¹ Peter Costantino, M.D., F.A.C.S.,²
and Jason Moche, M.D.³

ABSTRACT

We present 3 cases in which a unilateral pericranial flap was used to repair defects in the medial orbital and upper lateral nasal areas. All three patients had undergone previous excision of malignant tumors from the upper septum and ethmoid areas. Postoperatively, they all received radiation and then developed wound breakdown with fistula formation, particularly in the area of the incisional site. All 3 patients had undergone previous unsuccessful repair of the fistula. Closure of such fistulas requires well-vascularized nonradiated tissue, which can be provided by a unilateral pericranial flap. This flap is flexible, thin, and well suited to the sinonasal area. Use of this flap avoids the need for a paramedian forehead or other musculocutaneous flap. Cosmetic results were excellent, and there have been no flap breakdowns or complications to date.

KEYWORDS: Pericranial flap, nasocutaneous fistula, sino-nasal cancer

Malignant lesions of the fronto-ethmoid sinuses and the nasal septum are rare.¹ They typically manifest late in their course and can quickly spread to surrounding vital structures. Consequently, curative treatment usually consists of multimodality therapy, incorporating a combination of surgery and radiation.²

One of the documented complications of this modality of treatment is the development of nasocutaneous fistulas in the region of the medial orbital wall and upper lateral nose.³ These fistulas often drain mucopurulent fluid and can cause orbital infections and skin breakdown. Historically, these fistulas have been repaired using local skin flaps, me-

Skull Base, volume 13, number 4, 2003. Address for correspondence and reprint requests: Jason Newman, M.D., Department of Otolaryngology, 1221 Mercantile Lane, Largo, MD 20774. E-mail: jgn2@cornell.edu. ¹New York Presbyterian Medical Center, New York, New York; ²St. Luke's-Roosevelt Medical Center, New York, New York; ³Mount Sinai Medical Center, New York, New York. Copyright © 2003 by Thieme Medical Publishers, Inc., 333 Seventh Avenue, New York, NY 10001, USA. Tel: +1(212) 584-4662. 1531-5010,p;2003, 13,04,205,210,ftx,en;sbs00357x.

dian forehead flaps, or even primary closure. We present an alternative method for closing these fistulas using a pericranial flap.

ANATOMY

The scalp consists of five separate layers: skin, subcutaneous tissue, galea (aponeurosis), loose areolar tissue, and pericranium. The loose areolar tissue which is between the galea and the pericranium, has a blood supply from above and below. In the middle of this layer is a relatively avascular plane, just deep to the galea. This is the plane of dissection that is raised in a pericranial flap.

The main blood supply to the pericranial flap is from the deep branches of the supratrochlear and supraorbital vessels. The main branches of these vessels have an axial length ranging from 15 to 60 mm. Typically, they are at least 40 mm long.⁴ A unilateral flap can be raised because there are few anastomoses across the midline.⁴ The volumes of the pericranial flaps themselves range from 3 to 16 cc.

SURGICAL TECHNIQUE

A bicoronal incision is used for flap exposure. The hair is tied into braids and stapled to avoid the need to shave the patient's head. The bicoronal flap is developed on the surface of the skull, and dissection proceeds to the superior orbital rim in a subperiosteal plane. Care is taken to avoid damage to the supratrochlear and supraorbital neurovascular pedicles. An appropriately long and wide flap, consisting of pericranium and loose areolar tissue, is raised. The blood supply is based on the ipsilateral supratrochlear and supraorbital vessels. The flap is dissected down to the level of the superior orbital rim with care to avoid damage to the feeding vessels (Fig. 1).

Figure 1 Unilateral pericranial flap being raised off skull.

In a subcutaneous plane, the dissection is taken down over the glabella and the dorsum of the nose, allowing adequate exposure of the fistula. The pericranial flap is rotated 180 degrees over the supraorbital rim and tunneled under the subcutaneous tissue. An area of the supraorbital rim and glabella may need to be drilled to accommodate the flap and to avoid pressure ischemia of the flap. The flap is sewn in place to obliterate the nasocutaneous fistula (Fig. 2). The skin defect is closed primarily using a small split-thickness skin graft. The bicoronal incision is closed in standard fashion. A closed-suction drain is placed, and the patient remains in the hospital overnight.

RESULTS

We evaluated 3 patients with nasocutaneous fistulas for whom we used the unilateral pericranial flap. All three patients had been treated by combined surgical and radiation therapy for sinus and nasal septal cancers, and all had undergone some form of attempted local flaps for closure of the fistula.

Figure 2 Pericranial flap rotated 180 degrees and tunneled under glabella to fill a fistulous nasocutaneous defect.

The first patient had adenoid cystic carcinoma treated surgically and then with radiation. He developed a fistula that was initially treated with an advancement cheek flap and then a paramedian forehead flap. However, his fistula persisted. The patient underwent a pericranial flap

and has been free of recurrence of the fistula for 6 months.

The second patient was treated surgically for squamous cell carcinoma of the upper septum and developed a fistula after radiation treatment. She had a failed local advancement flap and subsequently underwent a pericranial flap repair. She has now been free of recurrent fistula for 1 year.

The third patient was treated for adenoid cystic carcinoma and subsequently developed a fistula. After an attempted local skin flap she underwent pericranial flap repair, and has been free of recurrent fistula for 2.5 years (Fig. 3).

DISCUSSION

Use of the pericranial and galeo-pericranial flap for repair of defects in the anterior skull base became popular as techniques in anterior skull base and craniofacial surgery became more routine. It was quickly discovered that a successful outcome after craniofacial and anterior skull base resections required adequate reconstruction of the skull base and separation of the extradural space from the intranasal and paranasal sinus cavities. In the late 1970s and into the early 1980s, many authors described using the

Figure 3 Appearance of patient 3 (A) before and (B) after surgery.

pericranial flap for these purposes.^{5,6} Since then use of these flaps in repair of the skull base has become more routine. Fukuta et al⁷ demonstrated multiple uses for pericranial flaps to repair defects of the anterior skull base. They can be used to create a barrier between the cranial cavity and nasopharynx or to avoid brain herniation. They can also be used to help fill surgically created defects, to cover implants, and to provide vascular flow to free bone grafts.⁸

We used the pericranial flap in a unique setting to repair difficult medial orbital wall and high lateral nasal fistulas. The flap is ideally suited for these difficult repairs. Its predictable and hearty blood supply provide well-vascularized tissue to fill the defect, a feature that is particularly advantageous in a postradiation field. That a significant portion of this flap is derived from a field that is distant from the radiated area increases the probability that the flap will survive. In contrast, most other options for repair of these defects rely upon tissue that has been included in the radiated field.

The pericranial flap is associated with an acceptable morbidity rate at the donor site and does not require a second procedure. These characteristics increase the chances of obtaining cosmetically appealing postoperative outcomes. The flexibility and mobility of the flap are well suited to fill defects in this area, and its use obviates the need for a larger, bulkier myocutaneous flap.

CONCLUSIONS

We used the unilateral pericranial flap to repair defects in the medial orbital and upper lateral nasal areas. The hearty vascular supply of the flap is ideally suited in a postradiation field. Its thin and flexible nature and the cosmetically appealing surgical outcomes make this flap an ideal candidate for use in the sinonasal area. To date, our patients have not experienced recurrences of their fistula or breakdown of the flap, and the cosmetic outcomes have

been excellent. We plan to continue to use this flap to repair defects in the sinonasal areas and will publish the outcomes of a larger series when the data are available.

AUTHORS' NOTE

Portions of this material were presented at the 2000 AAFPRS national meeting. The authors have no grants or affiliations associated with the research or publication of this material.

REFERENCES

1. Lewis JS, Castro EB. Cancer of the nasal cavity and paranasal sinuses. *J Laryngol Otol* 1972;86:255-262
2. Flores AD, Anderson DW, Doyle PJ, et al. Paranasal sinus malignancy: A retrospective analysis of treatment methods. *J Otolaryngol* 1984;13:141-146
3. Van Buren JM, Ommaya AK, Ketcham AS. Ten years experience with radical combined craniofacial resection of malignant tumors of the paranasal sinuses. *J Neurosurg* 1968;28:341-350
4. Potparic Z, Fukuta K, Colen LB, et al. Galeo-pericranial flaps in the forehead: a study of blood supply and volumes. *Br J Plast Surg* 1996;49(8):519-528
5. Johns M, Winn HR, McLean WC, et al. Pericranial flap for the closure of defects of craniofacial resections. *Laryngoscope* 1981;91:952-958
6. Shah JP, Galicich JH. Craniofacial resection for malignant tumors of ethmoid and anterior skull base. *Arch Otolaryngol* 1977;103:514-517
7. Fukuta K, Avery C, Jackson YT. Long term complications of the galeal-frontalis myofascial flap in craniofacial surgery. *Eur J Plast Surg* 1993;16:174-176
8. Argenta LC, Friedman RJ, Dingman RO, et al. The versatility of pericranial flaps. *Plast Reconstr Surg* 1985;76(5):695-702

Commentary

This article describes a useful and elegant method for dealing with what can be a considerable problem. The robustness of this flap can be increased further by incorporating the frontalis muscle in the base of the flap. This maneuver assures a good blood supply. This flap is also valuable because it can be used in the presence of infection, for example,

chronic frontal sinusitis, often much to the amazement of the neurosurgeon. It is interesting how much vascularized bone can be transferred using either a galeofrontalis pedicle or a temporal-galeal pedicle. The former will reconstruct and support a nose; the latter can reconstruct the entire mandible from angle to angle.¹ The galea is one of our true reconstructive friends in the craniofacial region.

REFERENCE

1. Fukuta K, Avery C, Jackson IT. Long-term complications of the galeal-frontalis flap in craniofacial surgery. *Eur J Plast Surg* 1993;16:174-176

Ian T. Jackson, M.D.¹