Pedicled Facial Buccinator (FAB) Flap: A New Flap for Reconstruction of Skull Base Defects

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INTRODUCTION

The expansion of endoscopic endonasal skull base surgery has resulted in an increased demand for reconstructive options. Free tissue grafting is a reliable technique to reconstruct small defects that communicate the anatomic space and the nasal cavity. However, their use for the reconstruction of larger defects resulted in an unacceptable incidence of postoperative cerebrospinal fluid (CSF) leaks at our institution. Reconstruction with vascularized tissue has proven indispensable for reliably separating the cranial contents from the paranasal sinuses following extended endoscopic endonasal approaches (EEA). The introduction of the Hadad-Bassagasteguy flap (vascular pedicle nasoseptal flap, HBF) at our institution decreased our postoperative CSF leak rates from >20% to <5%. The HBF is not always available as the nasoseptal area or its vascular supply can be compromised by tumor or prior surgery. In an attempt to keep pace with rapidly expanding reconstructive techniques, our group has focused on developing alternative reconstructive options, several of which have been recently reported.

We present the anatomic and cadaveric foundations for novel modifications of the well-described facial artery musculo (mucosal) (FAM/M) and buccinator flaps, which can be used to reconstruct the skull base.

MATERIALS AND METHODS

Three fresh, and six preserved human specimens were used for anatomic dissections. We investigated the feasibility of transposing superiorly based buccinator myo/mucosal flaps into the nasal cavity and skull base. Both muscular (FAM) and mucosal (FAM/M) flaps were raised, and techniques for transposition into the nasal cavity and base were investigated.

Pedicled facial buccinator flaps (FAB): Incisions used for the harvest of a myocutaneous (FAB) flap are outlined in Figure 1 and are similar to previous reports of the reverse flow FAM/M flap. The facial artery was localized and ligated lateral to the inferior incision, The superior extent of the flap is limited by the orifice of the parotid duct. Tissue was included posteriorly to prevent the likelihood of incorporating the facial vein in the flap. An additional segment of tissue can be included inferior to the parotid duct if necessary (L. or "boot" configuration). The superior and inferior labial arteries were found during the anterior dissection. An anterior vestibular incision was performed to facilitate subperiosteal elevation along the anterior wall of the maxilla, preserving the infraorbital neurovascular bundle which represents the pivot point of the FAB flap (Fig. 1 and 4). The FAB flap was then elevated in the plane of a traditional FAM/M flap with the facial artery remaining intact and the flap pedicled to the facial artery. When mucosa was harvested, a 180° rotation of the flap was required to keep the mucosa in the nasal cavity (Fig. 3D). In dissections that did not include mucosa, a posteriorly based mucosal flap was elevated prior to buccinator elevation.

RESULTS

The facial buccinator flaps was harvested with, and without mucosa and transposed into the nasal cavity using a variety of maxillary osteotomies. It was demonstrated that the FAB flap reliably reached the anterior skull base and planum sphenoidale (Figs. 4-8). The distance from the anterior mid-maxillary wall to the posterior planum, ranged from 6 to 7 cm (Fig. 8). The distance from the anterior mid-maxillary wall to the anterior skull base measured approximately 4.5-5 cm. The distance of the FAB flap from the pedicle to the tip measured 7-8 cm.

DISCUSSION

Reconstruction of the skull base recreates the separation between the sinonasal tract and the cranial cavity, avoiding postoperative CSF leaks, exposure of neurovascular structures and decreases the risk of ascending bacterial meningitis. As experience and technology have increased, EEA’s have expanded and now commonly result in defects comparable in size to those produced by traditional open approaches. As such, there is significant interest in reliably reconstructing these defects without the addition of significant morbidity. Vascularized tissue flaps have the advantage of promoting faster healing and are relatively radiosensitive. Recently described vascular methods of skull base reconstruction include the HBF, the posterior pedicled inferior turbinated flap, the transpydrom temporoantral fascia flap and the Oliver pedicled palatal flap. The “workhorse” HBF flap is able to contribute ~25 cm² of vascularized tissue, but is precluded in patients with a posterior septectomy or extensive sphenoidotomies. The posterior pedicled inferior turbinated flap, based on the posterior lateral nasal artery, has a somewhat limited arch of rotation and contributes a maximum 5 cm² of vascularized tissue. The transpydrom temporoantral fascia flap offers a large volume of reconstructive tissue but contributes significant morbidity in the harvest and transposition. The Oliver pedicled palatal flap can yield up to 10 cm² of vascularized tissue, but is technically challenging and risks a persistent oro-antral fistula.

Variations of a buccinator flap based on the facial artery have been described by multiple authors and will not be elucidated upon. The basis of the FAB flap most closely resembles the buccinator myocutaneous reverse island flap reported in 1999 by Zhao et al. Buccal myocutaneous flaps have historically been used to reconstruct oral cavity defects, but have also been employed to repair defects of the nasal septum, lower lip, conjunctiva and midface. The axial arterial supply of the buccal myo-mucosal flap is the facial/angular artery, although anastomosis/contributions from the infraorbital, dorsal nasal, and lateral nasal arteries can not be ignored. The venous outflow appears to be more dependent on pedicle width than on the inclusion of named veins. Dusperieux et al. reported a variety of maxillary defects, which did not include mucosa, a posteriorly based muscular flap was repositioned into the nasal cavity using a variety of maxillary osteotomies (Fig. 2). The flaps were then delivered into the nasal cavity through a maxillary window outlined below.

Delivery of the flaps

Several techniques for maxillary osteotomy and flap delivery were investigated (Fig. 2). Using standard and high speed instrumentation wide ipsilateral maxillary osteotomies were made and enlarged. The superior limit of the osteotomy was defined by the ICN, the posterior extent is of less consequence as it accommodates only the bulk of the flap rather than representing a critical obstacle, the inferior limit was the level of the hard palate and maxillary floor. The anterior and anterior superior osteotomies were modified to simulate current reconstructive needs. The osteotomy can be carried along the ascending process of the maxilla, including transection of the nasolacrimal duct to allow increased access to the anterior skull base (Fig. 2C). If needed, a transcon tear incision allows for significant extension of the superomedial aspect of the osteotomy. The flaps were introduced into the nasal cavity through a maxillary osteotomy following an aggressive medial maxillectomy to facilitate flap delivery and placement (Fig. 2). The buccal mucosa flap was repositioned and closed primarily.

Measurements were taken by flexible surgical rulers (Kendall, Covidien, Mansfield, MA, USA) and rigid rulers (Wescott, Bankstown, Australia).

RESULTS

Continued dissection along the maxillary face and transposition of the buccal flap into the nasal cavity through a bony defect creates a large (>10cm²) myocutaneous (mucosal) flap that can easily reach the anterior skull base. In contrast to the HBF and the posterior pedicled inferior turbinate flap, the FAB flap can be harvested and transposed following the surgical resection; thus allowing it to be tailored to the specific reconstructive scenario. Additionally, the FAB can be combined with other reconstructive flaps (ie. the HBF) for more extensive skull base reconstruction. Although the FAB flap can be harvested with mucosa we see little utility when used for skull base reconstruction as rapid re-mucosalization occurs in the nasal cavity, and the additional 180° degree rotation needed may hinder venous outflow. The literature supports rapid healing with minimal donor site morbidity at the harvest site. Regardless of the extent of the maxillary osteotomy the risk of flap retraction and post-operative CSF leak should be minimized by aggressive bony/mucosal debridement, allowing intimate approximation of the bone flap interface with surgical packing. Potential complications of the FAB flap include ipsilateral dental paresthesia, facial paresthesia, persistent epiphora, flap loss, injury to the vascular pedicle and introduction of new bacterial subtypes into the operative field. We plan to address the risk of persistent epiphora primarily by installing Crawford silicone tubes. Balbuena et al. reported an 85% decrease in total oral cavity bacterial counts four hours following chlorhexidine garge. We plan to institute a similar protocol to our existing parenteral antibiotic prophylaxis in EEA patients likely to undergo FAB reconstruction.

CONCLUSIONS

Based on previous reports and our findings, we believe that the FAB flap holds significant potential as a reconstructive alternative for a variety of skull base defects, alone or in combination with existing reconstructive options.

REFERENCES


