Objective: To report our experience in and our surgical technique of treating vascular anomalies of the buccofacial region using an intraoral buccomucosal flap approach.

Design: Retrospective medical record review and illustration of a specific surgical procedure.

Setting: Academic tertiary care center.

Patients: Thirty-two patients with vascular anomalies of the buccofacial region who have been treated using the intraoral buccomucosal flap approach.

Intervention: Surgical therapy using an intraoral buccomucosal flap approach.

Main Outcome Measures: Surgical outcomes and complications.

Results: Thirty-two patients were treated using the intraoral buccomucosal flap approach. The vascular anomalies treated at this site were venous malformations (17 [53.1%]), lymphatic malformations (13 [40.6%]), and hemangiomas (2 [6.3%]). Surgical removal was accomplished without occurrence of facial nerve dysfunction or other morbidity. The most frequent postoperative problem encountered was scarring with lymphatic malformation treatment.

Conclusion: The intraoral buccomucosal flap procedure is an effective surgical technique for treating vascular anomalies of the buccofacial region.


VASCULAR ANOMALIES ARE represented by several specific disorders. These have been separated into different categories based on their distinct clinical, radiologic, histologic, and molecular biologic features. The International Society for the Study of Vascular Anomalies proposed a classification system by Mulliken and Glowacki and colleagues1-3 and other investigators4-6 and later modified by Waner and Suen.7,8 These classification systems essentially separate vascular anomalies into vascular malformations, vascular tumors, and hemangiomas (Table),9-10 resulting in greater diagnostic accuracy and appropriate multidisciplinary management.

Surgical treatment of vascular anomalies of the head and neck is often challenging, considering the need for hemostasis, preservation of anatomical structures, removal of the lesion, and maintenance of normal facial appearance. Many surgeons have begun to operate at an earlier stage because the degree of ectasia and the flow rate are markedly less.7 Furthermore, the concurrent use of preoperative sclerotherapy or embolization has proved successful in reducing intraoperative blood loss and in helping to more readily define the margins of the lesion from the adjacent normal tissue.

The objectives of this article are to report the pathologic findings and our surgical approach for vascular anomalies that involve the buccofacial region. This surgical approach provides unique access to the entire buccal region without an external skin incision to achieve removal of the lesion. The buccofacial region is bounded by the buccal mucosa medially, the facial skin laterally, the oral commissure area anteriorly, and the anterior border of the masseter muscle posteriorly and extends up to the origin of the buccinator muscle superiorly and its insertion inferiorly.

METHODS

PATIENTS

The medical records of patients undergoing surgery between July 1, 2005, and June 30, 2007, for vascular anomalies involving the buccofacial region at The Vascular Birthmark Insti-
tute of New York, New York City, were reviewed. After a comprehensive clinical examination, all patients underwent magnetic resonance imaging, with contrast enhancement and digital subtraction angiography whenever indicated. Preoperative sclerotherapy and embolization were incorporated into the treatment plan for venous malformations and hemangiomas, respectively. All patients underwent surgical removal using an intraoral buccomucosal flap approach.

**SURGICAL TECHNIQUE**

Initial bimanual palpation of the buccofacial area helps to determine the extent of the lesion (Figure, A). This information is used in association with the magnetic resonance images in planning the extent of the excision and the exact tissue layers involved. A skin marker is used to outline the area of involvement. After facial nerve mapping and monitoring is in place, a Y-shaped intraoral incision based horizontally along the occlusal line is used, with the incision extending along the mucocutaneous junction of the upper and lower hemilips. All incisions are in the mucosa, following injection of lidocaine hydrochloride (1% with epinephrine 1:100 000; Hospira Inc, Lake Forest, Illinois, and sodium metabisulfite, 0.5 mg).

A Denhart oral retractor (Primestar Instruments, Sialkot, Pakistan) is used to open the oral cavity widely, and the tongue is retracted laterally with a Weider retractor (Amaax International, Sialkot, Pakistan). An oral pack is placed into the oropharynx. Sharp dissection and microneedle Bovie electrocautery are then used to cut through the mucosa and to carefully elevate submucosal flaps that are at least 3 to 4 mm in thickness. Flap development exposes the underlying lesion (Figure, B). The area exposed corresponds to the degree of involvement, with additional elevation performed for access when needed. Care is taken during elevation of the mucosal flaps to avoid perforations or injury to the parotid duct orifice and duct.

Once the mucosal flaps are elevated, the lesion is grasped and retracted out of the surgical site. Bimanual palpation assists in the elevation of a cutaneous flap of 4 to 5 mm in thickness or more as the lateral surface of the lesion is dissected (Figure, C). Careful attention is also paid during the dissection to monitor for any untoward disruption in facial nerve conduction and skeletal muscle response. The cutaneous flap is elevated out to the previous skin markings indicating the lateral extent of the lesion. As the lesion is carefully dissected circumferentially, the adjacent normal tissues are preserved until the lesion is removed from the site (Figure, D). Hemostasis is obtained using bipolar cautery, a hemostatic agent, or pressure.

If there is concern about a seroma or if there is a large potential dead space after resection, suction can be placed to drain the cavity. Double-layer wound closure is obtained by interrupted closure of the submucosal layer and the mucosal incision with resorbable sutures (Figure, E).

**RESULTS**

Between July 1, 2005, and June 30, 2007, 32 patients with vascular anomalies of the buccofacial region underwent surgical resection using an intraoral buccomucosal flap. The 3 anomalies treated using this surgical technique were venous malformations (17 [53.1%]), lymphatic malformations (13 [40.6%]), and hemangiomas (2 [6.3%]).

Of 17 patients with venous malformations, 12 (70.6%) were female, and 5 (29.4%) were male. The left facial region was affected in 11 patients (64.7%), and the right facial region was affected in 6 patients (35.3%). The age range of patients with venous malformations was 2 to 44 years, with a mean (SD) age of 17.2 (10.8) years. The median age was 12 years.

Of 13 patients with lymphatic malformations, 9 (69.2%) were female, and 4 (30.8%) were male. The right facial region was affected in 7 patients (53.8%), and the left facial region was affected in 6 patients (46.2%). The age range of patients with lymphatic malformations was 1 to 31 years, with a mean (SD) age of 10.5 (9.2) years. The median age was 5.5 years.

Of 2 patients with hemangiomas, both patients were female, with the left facial region affected in one patient and the right facial region affected in the other patient. The patients were aged 2 and 9 years, respectively.

Digital subtraction angiography was used at the discretion of the interventional radiologist (A.B.) in 17 of 32 patients to further evaluate flow characteristics. Sixteen venous malformations were treated using preoperative percutaneous sclerotherapy 24 hours before surgical therapy. One hemangioma was treated using preoperative transarterial embolization. Intraoral wound dehiscence occurred in 2 patients (1 venous and 1 lymphatic malformation). One patient required a return to the operating room for closure; the other patient was treated conservatively using oral rinses. Two patients with lymphatic malformations required postoperative midfacial fat grafts secondary to tissue loss and scarring. No cases of facial nerve dysfunction or paralysis were noted.

**COMMENT**

Congenital vascular anomalies are often misdiagnosed and in many instances left untreated. This has occurred largely because of physicians in multiple specialties failing to understand the natural history and biologic behavior of this group of lesions. This was particularly true before publication of the 1982 article by Mulliken and Glowacki. The evolution of a meaningful classification system with clinical relevance for diagnostic and treatment strategies has begun to...
improve the management of these patients. Unfortunately, not all physicians are fully cognizant of the current research, controversies, and management considerations for this group of patients.

Unlike hemangiomas, vascular malformations never involute, and the choice of treatment depends on the vascular anatomy of the lesion, its anatomical location, and its involvement with other anatomical structures. The current treatment options are concerned with minimizing blood loss during surgery, limiting the number and appearance of surgical scars, restoring normal bodily contour and symmetry, and preserving normal function such as vision, speech, and mastication.

Adjunctive interventional radiology techniques such as transcatheter embolization or percutaneous sclerotherapy can in some cases effectively treat the lesion. However, for cases that recur or persist, surgical removal is a viable option, and preoperative sclerotherapy can also assist in minimizing bleeding during subsequent surgical procedures. Most cases (30 [93.8%]) in this study were venous malformations or microcystic lymphatic malformations. Based on the experience by one of us (M.W.) before this study, the use of embolization or sclerotherapy techniques for this group of patients when indicated uniformly decreases the degree of bleeding during surgery. This further allows for an easier dissection plane in removing the lesion, and no patient in this study required a blood transfusion.

The extent and proximity of lesions in the head and neck to vital structures often dictate the volume of pathologic tissue that can be removed. Within the buccofacial region, there is a convergence of multiple factors that often prescribe the surgical approach. These considerations include the course of the facial nerve, local invasion of facial muscles, external appearance of the skin, and proximity of disease to the oral commissure, parotid duct, and orifice. By delineating the extent of disease by magnetic resonance imaging and physical examination of the buccal region, preoperative planning can ensure appropriate patient selection for this procedure. Although in most cases a full evacuation of the buccal space can be accomplished, it is not always possible to remove the entire lesion with respect to the degree of tissue involvement, particularly in regard to disease on or near the facial nerve. In these cases, a reasonable goal is to remove as much of the pathologic tissue as is feasible within the constraints of preserving normal structures and function.

Complications of surgery in the buccofacial region may include wound dehiscence, infection, scarring, facial nerve dysfunction, and facial muscle dysfunction. We routinely prescribe postoperative corticosteroids and antibiotics to reduce swelling and to prevent infection. Patients are further instructed to use oral rinses with half-strength peroxide after meals to keep the intraoral incision line clean. Lymphatic malformations frequently require longer periods of wound drainage with bulb suction following surgery, and postoperative corticosteroid injections are often necessary to reduce scarring. Finally, all incisions are placed within the oral mucosa to avoid disruption of the oral commissure, vermilion areas of the lips, or convergence of the facial musculature in the modiolus region.

By using intraoperative facial nerve monitoring, important feedback can be obtained when dissecting lesions that encroach on the facial nerve. Although initially recorded as present or absent, we recently have begun to quantify intraoperative facial nerve action potentials to compare preoperative and postoperative values (data not shown). Although no patient in this study developed facial nerve dysfunction, future goals to quantify minimum facial nerve action potentials may permit further refinement and access to previously inoperative lesions. In conclusion, with appropriate patient selection and the use of preoperative sclerotherapy or embolization, the intraoral buccomucosal flap approach is an

Figure. Surgical technique. A, Preoperative buccal space venous malformation. B, Medial surface mucosal flap dissection. C, Lateral surface skin flap development. D, Surgical area after dissection is completed. E, Closed surgical wound.
effective and safe surgical approach for the treatment of midfacial vascular anomalies.

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REFERENCES