CASE REPORT

Lateral Orbital/Anterior Midfacial Degloving Approach for Nasopharyngeal Angiofibromas with Cavernous Sinus Extension

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Abstract—A case of nasopharyngeal angiofibroma removed through a modified lateral approach for an infratemporal fossa resection is reported. This modification involved removing the bone of the lateral orbital apex and posterior middle fossa to expose the dura and periorbita and, when combined with a midfacial degloving approach, provided full access to the tumor abutting the cavernous sinus extradurally while preserving middle ear function. (*Skull Base Surgery*, 4(4):232–238, 1994)

Juvenile nasopharyngeal angiofibromas (JNAs) are uncommon, histologically benign tumors found principally in adolescent boys. These tumors are highly vascular and commonly cause bony destruction from local invasion. They arise most frequently in the area of the sphenopalatine foramen,¹ from where they can expand to the nasopharynx, nasal cavity, paranasal sinuses, pterygopalatine fossa, infratemporal fossa, and intracranial space, including the cavernous sinus. The classification of JNAs described by Andrews et al² is based on this pattern of tumor spread (Table 1).

Small type I and type II tumors commonly have been removed via a transpalatal incision³; alternatively, they can be excised via a midfacial degloving technique, which provides access to the nasal cavity, paranasal sinuses, and anterior base of the skull.⁴ Type IIIa tumors, with infratemporal fossa or orbital involvement but without intracranial involvement, can be resected via a transpalatal approach combined with a midfacial degloving approach.⁵ The infratemporal fossa approach advocated by Fisch also has been used successfully for type IIIa tumors.^{2,6}

The surgical resection of more extensive JNAs with

intracranial extension (types IIIb and IV) has been accomplished with a variety of techniques, generally involving a combination of extracranial and intracranial approaches. If dural invasion by tumor is present, a frontolateral or frontotemporal craniotomy is typically combined with a transpalatal, lateral rhinotomy approach.³ A transpalatal, Caldwell-Luc procedure combined with a lateral infratemporal middle fossa approach also has been used for resection of these extensive tumors.^{5,7} For type IIIb tumors that have invaded the infratemporal fossa or orbit and have intracranial, extradural involvement, various approaches are available: (1) a combined frontotemporal and lateral infratemporal fossa approach via a preauricular incision^{5,8}; (2) the facial translocation approach described by Janecka et al⁹; (3) a transzygomatic approach combined with a transpalatal or midfacial degloving approach^{10,11}; and (4) an infratemporal fossa type C approach.^{2,6} The purpose of this article is to report a modification of the infratemporal fossa type C technique combined with a midfacial degloving approach, which preserves middle ear function while providing good access to the tumor without a craniotomy. A representative case is reported.

Table 1. Classification of Nasopharyngeal Angiofibromas

Type	Definition
I	Tumor limited to the nasopharynx and nasal cavity. Bone destruction negligible or limited to the sphenopalatine foramen
II	Tumor invading the pterygopalatine fossa or the maxillary, ethmoid, or sphenoid sinus with bone destruction
IIIa	Tumor invading the infratemporal fossa or orbit region without intracranial involvement
IIIb	Tumor invading the infratemporal fossa or orbit with intracranial extradural (parasellar) involvement
IVa	Intracranial intradural tumor without infiltration of the cavernous sinus, pituitary fossa, or optic chiasm
IVb	Intracranial intradural tumor with infiltration of the cavernous sinus, pituitary fossa, or optic chiasm

From Andrews et al.²

OPERATIVE TECHNIQUE

The patient is placed supine and given general anesthesia through an oral endotracheal tube. After the temporal scalp on the involved side is shaved, the face, neck, and scalp are prepared with Betadine solution and draped.

The tumor is first approached via a midfacial degloving technique with a unilateral approach or bilateral Caldwell-Luc approaches as needed for tumor exposure intranasally (Fig. 1). With the head in the midline position, the midface is exposed by sublabial, septocolumella, intercartilaginous, and pyriform aperture incisions as previously described.⁴ Penrose drains are placed through each

nostril and brought out the sublabial incisions to retract the soft tissues of the face. Bone is removed from the ipsilateral anterior maxillary sinus wall or from walls of both sinuses if the tumor has extended past the midline. The ipsilateral pyriform aperture bone is removed with a saw and set aside to be replaced later (Fig. 2). The lateral nasal walls are resected as needed on one or both sides, and the free edges of the tumor are identified and loosened from surrounding tissue so that the tumor is pedicled along the ipsilateral skull base and cavernous sinus region.

The head is rotated away from the predominantly involved side for the lateral orbital apex approach. A curvilinear infratemporal fossa type C incision is started at the scalp hairline and extended postauricularly down to the temporal line. A skin flap is developed anteriorly off the temporalis fascia so that the frontal branch of the facial nerve can be identified and preserved. The flap is raised to expose the superolateral rim of the orbit and the zygomatic arch. An oscillating saw is used to divide the anterior and posterior extents of the zygomatic arch. The temporalis muscle is lifted off the temporal fossa and deflected inferiorly with the zygomatic arch; the deep temporal vessels are left intact to protect the blood supply to the temporalis muscle. This maneuver exposes the bone of the lateral orbital apex and the greater wing of the sphenoid for subsequent bone removal over the middle cranial fossa dura. With a diamond-burr drill, the lateral orbital wall and the contiguous bone of the orbital apex and greater sphenoid wing are removed until the periorbita and the middle fossa/cavernous sinus dura are reached (Fig. 3).

Through the access provided by these approaches the tumor is gently dissected away from all dural attachments, reflected into the nasopharynx, and removed. The previ-

Figure 1. The tumor is approached from two directions: anteriorly via a midfacial degloving with unilateral or bilateral Caldwell-Luc, and laterally via the orbital apex.

Figure 2. The pyriform aperture and zygomatic arch bone are removed and saved for replacement after the tumor is removed.

Figure 3. Bone overlying the lateral orbit and middle fossa is removed. The dashes demonstrate how the approach can be extended to include a craniotomy should one be necessary.

ously removed lateral nasal rim and zygomatic arch bone are replaced and stabilized with titanium maxillofacial reconstruction plates. The temporalis muscle is rotated into the defect to protect the exposed dura, the maxillary sinuses are packed with antibiotic ointment gauze, and the incisions are closed. One week later the nasal packing is removed in the operating room under general anesthesia.

CASE HISTORY

A 9-year-old boy was seen by his local otolaryngologist with a 9-month history of nasal congestion and a 3-week history of left frontal headaches and left proptosis. Work-up revealed a large JNA invading the left infratemporal fossa with extension into the sphenoid sinus and destruction of the sella turcica with upward displacement of the cavernous portion of the left internal carotid artery (type IIIb). Because the neoplasm was extensive relative to the patient's age and size, radiation therapy was chosen, and over the next month he received 3454 cGy to his nasopharynx and the base of his skull via a linear accelerator.

The tumor decreased in size and the patient became asymptomatic. He was followed closely with serial magnetic resonance imaging scans, which showed a stable mass size for 3.5 years. He then began complaining of increasing nasal obstruction, and subsequent computed tomography showed the tumor to have enlarged approximately 20% with extension into the right nasal cavity and sphenoid sinus (Fig. 4). The erosion of the middle cranial fossa and infringement of the left cavernous sinus had not progressed, and there was no obvious intradural extension.

The patient was admitted to the Department of Oto-

laryngology at the Wake Forest University Medical Center for tumor extirpation. The tumor was embolized via the ipsilateral maxillary artery, and 24 hours later the patient underwent tumor excision via the lateral orbital and anterior midfacial degloving approaches described above. The tumor was found to be a highly vascular angiofibroma occupying the entire nasopharynx, with bone erosion over the left orbital apex, cavernous sinus, and lateral wall of the left sphenoid sinus (Figs. 5 and 6). Secondary to the prior irradiation, the tumor was densely adherent to the middle fossa and cavernous sinus dura, although ultimately a plane was defined. Intense bleeding was encountered in the area of the petrous carotid artery and the wound had to be packed intermittently. Total blood loss was estimated at 10 000 mL. No intradural extension was present and all visible tumor was removed with the dura remaining intact.

Postoperatively the patient did well and did not have any complications. He was returned to the operating room on postoperative day 6 for removal of all nasal packing and discharged home the following day. Postoperative trismus was mild and the frontal branch of the facial nerve remained intact. Eighteen months later, the patient has a mild left temporal concavity (Fig. 7) without visible external scarring. Postoperative computed tomography scans have shown no evidence of residual tumor (Fig. 8). The patient enjoys an active, normal lifestyle free of symptoms.

DISCUSSION

Controversy exists regarding the best way to treat large JNAs. Surgical morbidity and concern over the resectability of these tumors has made radiation therapy the primary treatment modality.¹² However, in addition to the possibility of recurrence, the potential disadvantages of radiation therapy include radionecrosis, cranial nerve palsies, induction of carcinogenesis, and extensive adhesions, which may destroy dissection planes.

Goepfert et al¹³ have reported the use of chemotherapy for aggressive JNAs.

Multiple surgical approaches have been described for the removal of large intracranial, extradural JNAs (type IIIb). The facial translocation approach utilizes a modified Weber-Ferguson incision combined with a coronal incision and incorporates a frontotemporal craniotomy.⁹ A direct approach to the skull base is obtained with a unified surgical field. The temporal branches of the facial nerve are transected and reanastomosed, causing at least temporary paralysis of the ipsilateral forehead, and the infraorbital nerve is sacrificed, leading to hypesthesia of the ipsilateral cheek and upper lip. Multiple facial scars remain.

The combined transzygomatic approach via a bicoronal incision and transpalatal approach via an extended palatobuccal incision have also been used to resect large JNAs.¹⁰ While useful for tumors with only a small amount of intracranial extension, limited exposure of the middle

A

B

Figure 4. Preoperative computed tomography scans demonstrating a large juvenile nasopharyngeal angiofibroma invading the left infratemporal fossa with intracranial/extradural extension.

Figure 5. Midfacial degloving approach with bilateral Caldwell-Luc and removal of left pyriform operative bone. The tumor can be seen (at the tip of the arrow) in the left maxillary sinus.

cranial fossa necessitates removal of the bulk of the tumor via the transpalatal approach.

An infratemporal fossa approach has been recommended by Fisch and colleagues for removal of types III and IV JNAs.^{2,6} This technique involves a retroauricular dissection, which includes blind-sac closure of the external auditory canal with sacrifice of the middle ear structures. A mastoidectomy and subtotal petrosectomy are

performed, and by following the dura of the middle cranial fossa medially, the mandibular branch of the trigeminal nerve is exposed and transected. The advantages of this approach include good exposure of the skull base without a craniotomy or facial scarring. Disadvantages include a permanent conductive hearing loss, lower lip numbness, and a depression in the lateral scalp where the temporalis muscle is rotated into the surgical defect.

Figure 6. Lateral orbital apex approach with inferior deflection of the temporalis muscle and zygomatic arch. The tumor can be seen at the tip of the arrow.

Figure 7. Eighteen months postoperatively the patient shows no evidence of residual tumor. His facial nerve and middle ear functions are normal; a mild left temporal concavity is present.

A combined frontotemporal and lateral infratemporal fossa approach to the skull base via a preauricular incision evolved from this infratemporal fossa approach.⁸ This modified approach provides wide exposure of the medial middle cranial fossa, infratemporal fossa, and lateral orbit. Postoperatively, patients experience at least temporary trismus due to dissection of the temporalis and pterygoid muscles. Complete removal of the lateral wall of the orbit can produce mild enophthalmos.

The surgical technique described here for the resection of a type IIb JNA contains elements of several of these approaches. The postauricular infratemporal fossa-type incision is used with translocation of the temporalis muscle. The advantages of the midfacial degloving approach used include good tumor visualization without sacrifice of conductive hearing in the ipsilateral ear. Should the tumor extend through the dura, a frontotemporal craniotomy can be added with extension of the infratemporal fossa incision (Fig. 3). The approach can be extended further into a classic ipsilateral type C approach if necessary for internal carotid artery control and dissection. There is no visible external scarring, although a mild temporal concavity results due to rotation of the temporalis muscle. As with other infratemporal fossa-type resections, transient trismus is present initially, due to disruption of the muscles of mastication. Temporary paralysis of the temporal branch of the facial nerve may also develop due to traction during surgery.

Figure 8. Six-month postoperative computed tomography scans demonstrating large nasal cavity and no evidence of residual tumor. (Figure continued on next page.)

Figure 8. (Continued).

In our illustrative case report, dural dissection was impeded by dense postirradiation scarring with subsequent persistent hemorrhage. Despite this impediment to expeditious dural dissection, the lateral orbital apex approach combined with a midfacial degloving approach was an effective alternative surgical technique for the removal of the patient's large intracranial extradural JNA. This technique provides good visualization of tumor without sacrifice of conductive hearing or significant facial scarring, and it should be considered in selecting a technique for removal of such challenging lesions.

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