Anteromedial Approach to the Orbit

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ABSTRACT

This study evaluated the surgical results of the anteromedial approach for treatment of orbital lesions in 16 patients. Pre- and postoperatively, all patients underwent a complete physical examination focusing on the head and neck area including a thorough ophthalmologic evaluation, computerized tomography, and magnetic resonance imaging. The surgical approach was limited to a medial orbitotomy in five patients; the remaining 11 patients underwent a medial orbitotomy combined with an external sphenoethmoidectomy. The tumor was removed completely without damaging the intraorbital neurovascular structures in all but one patient whose recurrent clival chordoma extended beyond the limits of an extracranial approach. Fibro-osseous lesions, cavernous hemangiomas, and dermoid cysts were the most common pathologies. The follow-up ranged from 18 to 48 months, and no patient has shown evidence of a recurrence. One patient with a clival chordoma received radiation therapy. The lateral nasal skin incision healed with acceptable cosmetic results. The anteromedial approach to the orbit provides a wider working space and direct exposure while protecting neurovascular structures.

KEYWORDS: Orbital tumors, surgical approach, medial orbitotomy, cavernous hemangiomas

Removing tumors within the medial orbital space is challenging with standard neurosurgical procedures. The most commonly used neurosurgical approaches for retrobulbar tumors, orbital unroofing through a pterional craniotomy and cranio-orbito-zygomatic approach, provide limited exposure for medially placed orbital tumors, particularly when they extend anteriorly and inferiorly.¹⁻³ It is logical that tumors of the medial orbital space

should be removed through a more direct approach to the orbit, which can provide a shorter route and avoid a craniotomy, thus minimizing functional deficits that may result from a transcranial orbitotomy. Otolaryngologists are familiar with the anteromedial approaches commonly used to treat diseases of the ethmoid sinuses, but the anterior transfacial medial orbitotomy procedure is less familiar to neurosurgeons.^{1,4-11} Whether such an

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approach can provide adequate exposure, whether the facial skin incision is cosmetically acceptable, and how to determine which patients are candidates for an external ethmoidectomy may be concerns. This article presents the authors' experience with 16 patients with orbital tumors that were removed through an anteromedial orbitotomy approach with or without an ethmoidectomy and describes the surgical technique.

MATERIAL AND METHODS

Patients

Sixteen patients (10 females and 6 males) with space-occupying lesions of the orbit underwent the anteromedial approach. Their ages ranged from 2 to 52 years old (mean 22.6 ± 4.7 years). The most common presenting symptom was slowly progressive exophthalmos (10 cases), followed by swelling of the eyelid and diplopia in two cases, partial loss of vision in one case, and bleeding from the nose in one case. All patients underwent a complete physical examination focusing on the head and neck area, a thorough ophthalmological evaluation, computed tomography, and magnetic resonance imaging (Fig. 1). One patient diagnosed with a recurrent clival chordoma had a preoperative unilateral visual disturbance caused by compression of the optic nerve. There were four fibro-osseous lesions, including a fibrous dysplasia, an ossifying fibroma, a giant cell reparative granuloma, and a cementifying fibroma (Table 1). Three cavernous hemangiomas were not evident at birth and showed progressive enlargement.

Surgical Technique

A Lynch-type medial orbital or lateral rhinotomy skin incision was used, and the periosteum over the medial orbital wall was elevated. The medial can-

Figure 1 Preoperative axial magnetic resonance image showing a medially placed orbital cavernous hemangioma suitable for an anteromedial approach.

thal ligament was identified and divided, and the remnant of the ligament was marked with a 1-0 nylon suture to be fixed on the nasal bone at the end of the operation to prevent postoperative lateral displacement of the medial canthus.

The lacrimal fossa was identified, and the lacrimal sac was displaced inferiorly. To increase visualization inferiorly into the maxillary sinus, the lacrimal duct was either divided sharply near its nasal entrance or was spared by temporarily removing an inferomedial maxillary bone window. When the lacrimal duct was divided, the proximal end was marked with a suture, which guided reconstruction of the lacrimal apparatus at the end of the operation.

Table 1 Number of Cases According to Histopathological Diagnosis

Diagnosis	Number of Cases
Fibro-osseous lesion (ethmoid)	4
Cavernous hemangioma (orbit)	3
Dermoid cyst (orbit)	3
Mucocele (ethmoid)	2
Osteoma (ethmoid)	1
Hydatid cyst (orbit)	1
Chordoma (clivus)	1
Squamous cell carcinoma (ethmoid)	1

Parentheses indicate origin of tumors.

The frontonasal suture line was identified to judge the level of the anterior cranial fossa dura and ethmoid arteries. When necessary, the trochlea was elevated from its bony fossa with the attached periosteum and reflected toward the orbit. The orbital contents were gently displaced laterally using a cerebral retractor. On the lateral aspect of the lamina papyracea, the anterior ethmoid artery was identified about 20 mm posterior to the anterior lip of the lacrimal fossa, cauterized with a bipolar device, and sharply divided to prevent bleeding into the operative field or retrobulbar area. Further dissection revealed the posterior ethmoid artery about 12 mm posterior to the anterior ethmoid foramen, which was also cauterized and divided.

Small, medially placed tumors were resected without further bone removal through this medial approach (Fig. 2). When the tumor extended posteriorly to the orbital apex and when the maneuvers to resect the tumor reflected excessive pressure on the globe, an external ethmoidectomy was performed. The external ethmoidectomy provided a larger angle of exposure to the medial aspect of the orbit and increased room for instrumentation (Fig. 3).

The ethmoidectomy was started by penetrating the lamina papyracea through its most an-

terior aspect and removing it posteriorly to reach the posterior ethmoid artery. The upper limit of the ethmoidectomy was determined according to the level of the ethmoid arteries, which travel inferior to the anterior cranial fossa dura. Posterior ethmoid cells were exenterated with further removal of lamina papyracea, and a sphenoid sinusotomy was performed to identify the course of the optic nerve on its superolateral wall.

Upon completion of bone removal, the periorbit was opened to visualize the lesion. Use of the operating microscope was helpful in further dissection. The medial rectus and superior oblique muscles were retracted to mobilize and displace the tumor medially. When the lesion was near the optic nerve, the optic foramen was identified 3 to 5 mm deep to the posterior ethmoid foramen and the nerve was secured during tumor removal. After the tumor was removed, either the periorbit was resutured or the medial turbinate was lateralized to prevent medial displacement of orbital fat into the ethmoidectomy cavity. The medial canthal tendon was reattached to its original position through drill holes on the nasal bone. When removed, the medial maxillotomy bone window was returned to its donor site and fixed with titanium microplates and screws. When the duct was divided, either an external dacryocystorhinostomy or an end-to-end anastomosis of the lacrimal duct was performed with silicone tubing of the lacrimal apparatus. The skin incision was closed in double layers.

Figure 2 Medial orbitotomy with external sphenoidectomy.

RESULTS

Five patients underwent a medial orbitotomy; the remaining 11 patients underwent a medial orbitotomy combined with an external sphenoidectomy. All tumors were removed without damaging the intraorbital neuromuscular structures in all but one patient whose recurrent clival chordoma extended beyond the limits of an extracranial approach. Postoperatively, none of the patients lost

Figure 3 Angle of view through a medial orbitotomy without ethmoidectomy and through a medial orbitotomy with sphenoidectomy.

their vision. One week after surgery, the visual acuity of the patient with the recurrent clival chordoma improved. None of the patients complained of double vision, and none had ophthalmoplegia after surgery. Two of five patients whose lacrimal apparatus had to be transected and repaired had mild epiphora within 2 weeks of surgery, but none experienced permanent problems with their lacrimal system or developed infection. The lateral nasal skin incisions healed with acceptable cosmetic results and were well tolerated by all patients. The duration of hospitalization ranged from 5 to 12 days (mean 8.1 ± 2.1 days).

DISCUSSION

The basic surgical approaches to the orbital lesions are as follows: a lateral orbitotomy, a superior orbitotomy through an eyebrow incision or a frontotemporal craniotomy, an inferior exposure through a subciliary incision or transantral decompression, and a medial approach using a Lynch incision or transconjunctival route.^{4-8,12-15} Because most orbital soft tissue is on the temporal side of the optic nerve, most primary tumors are accessible through a lateral orbitotomy. This approach provides good visualization of the retrobulbar area with minimal deformity. Superior orbitotomy through an eyebrow incision or a frontotemporal craniotomy is usually used for lesions with an intracranial extension, or for tumors located in the apex and optic canal. Inferior orbitotomy is preferred for small tumors limited to the orbita.

These three kinds of approaches are appropriate for most intraconal masses but do not allow masses on the medial side of the optic nerve to be removed easily. Visualizing the entire medial orbital wall and gaining enough space to remove the mass without damaging orbital structures is difficult to achieve and requires considerable time with these techniques. Thus, the better plan to gain access to this area is to use the most direct surgical approach and to protect the important neuromuscular and vascular structures without creating cosmetic defects. The anteromedial approach is ideal

for patients with tumors involving the anteromedial intraconal compartment. There are three main medial approaches to the orbita: the transconjunctival medial orbitotomy, the medial orbitotomy without external ethmoidectomy, and the medial orbitotomy with external ethmoidectomy.

Transconjunctival medial orbitotomy is usually appropriate when tumors lie adjacent to the surface of the globe. Its greatest advantage over transcutaneous techniques is that it leaves no visible scar; however, this technique is unsuitable for deep intraconal and extraconal superior lesions.^{16,17} Neurosurgeons are unfamiliar with the transconjunctival approach. Therefore, the literature on its application is limited. Fewer than one-third of primary orbital tumors originate from the nasal side of the optic nerve.

The principal uses of the medial orbitotomy are drainage and evacuation of mucocèles associated with orbital invasion of benign or malignant lesions of the paranasal sinuses.^{1,4,8-10} The medial and inferomedial spaces can be connected by dividing the medial canthal tendon, mobilizing the lacrimal sac, and dividing it at its junction with the proximal duct. These maneuvers make it possible to reach the entire medial half of the orbit, and a medial rectus muscle traction suture aids globe rotation. In the most common instance, the tumor is displaced into the previously opened ethmoid or maxillary sinus to obtain a visible plane of dissection between the extraocular muscle and the lesion.

The advantage of a medial orbitotomy without external ethmoidectomy is ready access to the medial retrobulbar space. However, excessive lateral traction on the globe could exceed the ocular perfusion pressure and lead to visual loss. To prevent this complication, especially if the lesion is in the medial portion of the central surgical space, a lateral orbitotomy must be performed. A lateral orbitotomy permits the globe to be retracted further laterally and provides excellent visualization.

The optic nerve can be injured during posterior dissection because the central retinal artery enters the medial portion of the optic nerve about

1 cm posterior to the globe. We have never encountered these disadvantages with our approach. The globe is retracted only slightly to avoid complications, and visualization and protection of the optic nerve are excellent. The benefits of using an external ethmoidectomy in the pathologies infiltrating the orbita medial wall are apparent. Through an ethmoidectomy, not only is the tumor tissue better decompressed as a whole mass but also unnecessary retraction of the orbita can be avoided.

The underlying question is whether an ethmoidectomy is needed to reach cavernomas present in the orbita anteromedially but not infiltrating the medial orbital wall or those with hydatid cysts, which have a more benign prognosis. In such cases, an external ethmoidectomy is beneficial because even minimal pressure from retraction added to the already increased intraorbital pressure can lead to irreversible damage of the neurovascular structures of the orbita. An external ethmoidectomy eliminates this problem and improves surgical vision to insure adequate decompression or total excision of the tumor in these patients. In our series, the external ethmoidectomy increased the angle of exposure to the medial aspect of the orbit and increased room for instrumentation. If the mass is located in the anteroinferior space of the orbita, the incision also can be extended below the medial canthal tendon to improve exposure of the lacrimal fossa. The nasolacrimal duct, however, limits retraction. Thus, we prefer to cut the nasolacrimal duct to gain more exposure. At the completion of the procedure, the nasolacrimal duct is anastomosed end-to-end with 10-0 sutures.

CONCLUSION

The anteromedial approach to the orbit is a direct and short route for the removal of medially placed orbital tumors. This technique provides optimal exposure of the medial orbital space and can be extended inferiorly and superiorly without needing

an additional skin incision. Cosmesis is acceptable, and the procedure is safe and reliable.

COMMENTS FOR PUBLICATION

The authors report 16 patients who underwent the removal of space-occupying lesions of the orbita through either a medial orbitotomy alone or a medial orbitotomy combined with sphenoethmoidectomy. Historically, the anteromedial approach was introduced to decompress the optic nerve for papilledema in patients with pseudotumor cerebri.¹ Later, it was used to remove mass lesions located in the intraconal compartment medial to the optic nerve.² It provides direct access to this part of the orbit but only limited access to the apex. Although the addition of a sphenoethmoidectomy to the medial orbitotomy may widen the exposure, this combination may be associated with relatively high complication rates. Alternative approaches to an anteromedial orbitotomy include a frontotemporal craniotomy with or without orbitotomy, especially for large lesions that extend to the apex and involve the optic nerve.

Overall, this is a useful clinical study, which may reflect the bias of the authors' institution. We suspect that most of the lesions described in this series might be managed by ophthalmic surgeons at other institutions. We applaud the authors for their acquired expertise in this arena and their very low rates of morbidity.

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Deda et al. discuss treatment of 16 tumors occupying the medial orbital space. They obtained excellent results: complete tumor removal without neuro-ophthalmological complications in all but one patient who harbored a recurrent clival chordoma.

A medial orbitotomy was performed in five patients, and a medial orbitotomy combined with external sphenoethmoidectomy was performed in 11 patients. This approach appears efficient and adequate for small lesions confined to the medial orbital tissue. However, for lesions that have both intraorbital and intracranial extensions, a frontotemporal craniotomy with removal of the roof of the orbit would permit safe and complete removal. At our institution, an orbitozygomatic craniotomy as described by Zabramski et al.¹ would be preferred for this type of lesion. Possibly, the recurrent clival chordoma should have been treated in this fashion.

The approach described by the authors appears to be safe and effective for lesions confined to the medial orbital space. For lesions not confined to the medial orbital space, a different surgical approach may be needed to obtain optimal outcomes.

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