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Endoscopic surgery of the orbital apex

Angelo Tsirbas, MD,[a] Benjamin O. Burt, MD,[b] Ronald Mancini, MD,[b] Peter John Wormald, MD[c]

From [a]Orbitofacial Surgery, Eye Institute, Sydney, Australia;
[b]Orbital and Ophthalmic Plastic Surgery Division, Jules Stein Institute, UCLA, Los Angeles, California; and the
[c]Department of Surgery–Otolaryngology Head and Neck Surgery, University of Adelaide, Australia.

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In recent years, there has been an increase in the use of endoscopic surgery in the disciplines of otolaryngology, ophthalmology, and neurosurgery. The orbit is in a unique anatomic position in which a multidisciplinary approach is often the best solution to complex surgical pathologies.

Endoscopic management of orbital apex lesions

The use of endoscopic approaches to the posterior orbit and orbital apex allows better visualization, with minimal manipulation of tissues in an area in which surgical access is limited. Traditionally, orbital lesions, especially intraconal ones, have been managed with a variety of external approaches. Apically based orbital lesions are a complex problem and biopsy, resection, or complete debulking may be required. Recently, endoscopic approaches have been applied to the biopsy of orbital lesions for which diagnosis is difficult to make on clinical and radiologic grounds.[1-3] Modified biopsy techniques have been used to remove lesions of the posterior orbit.[4] Access to the posterior medial orbit can be gained transnasally through the ethmoid and sphenoid sinuses. The endonasal endoscopic approach also permits decompression of the medial wall of the orbit. However, the removal of larger lesions is limited with this approach. The transantral approach through the maxillary sinus allows greater access to the floor of the posterior orbit and facilitates removal of larger lesions as a result of the more capacious nature of the maxillary sinus.[4,5]

Address reprint requests and correspondence: Peter John Wormald, MD, ENT Department, Queen Elizabeth Hospital, Woodville South 5011 SA, Australia.
E-mail address: peterj.wormald@adelaide.edu.au.

Lesions that abut the sinus cavities are especially amenable to endoscopic removal. The transnasal route is especially useful for medial and inferomedial lesions, whereas a direct transantral approach may be useful for more laterally based lesions.

A transantral endoscopic approach allows direct visualization of the posterior orbital floor, and incision of the periosteum can allow well-circumscribed benign lesions to prolapse into the maxillary sinus and be removed transantrally. This may be useful for cavernous hemangiomas of the posterior orbit.

The transnasal endoscopic approach can be used to remove the orbital floor and medial orbital walls in the posterior third of the orbit to allow tumor removal or in the case of aggressive lesions a debulking. This approach can at times allow direct visualization of the optic nerve at the level of the canal and allow safer debulking of this area.

The preferred surgical approach to lesions located in the posterior orbit must be customized. Ultimately, the goal is to preserve ocular function and effectively treat the pathology. This treatment is particularly challenging in the orbital apex, where critical structures are crowded into a small area. Further limiting ease of dissection is the lack of dead space.

Because of this lack of dead space, it is difficult to identify structures, and manipulation of tissue is hazardous. It is difficult to access lesions of the posterior orbit without exerting undue pressure on the globe and optic nerve, thereby risking loss of vision. Even with the use of an

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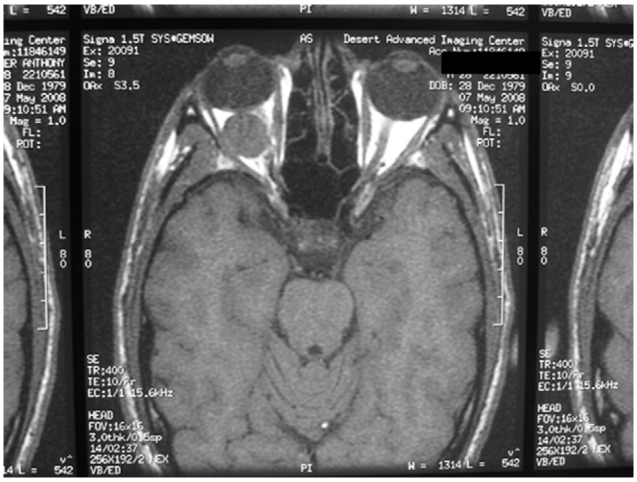

Figure 1 Computed tomography of an extraconal inferomedial orbital apex lesion: Cavernous hemangioma, mucocele.

operating microscope,[6] visualization in the orbital apex through a direct orbital approach is limited.

The single most critical limitation inherent to the orbit is the lack of dead space as a result of the intermuscular septations and ubiquitous fat that obscure visualization. Endoscopic approaches to the orbit through the periorbital sinuses benefit from the air-filled sinus cavities and instrumentation designed for use through the transnasal approach. The view of the lateral orbital floor through a transnasal endoscopic approach is more limited.[7,8] When the same endonasal approach is used, extraconal lesions are accessible by means of an endoscopic approach and have been removed from the orbital apex.[9,10] Intraconal lesions are not as easily approached endoscopically because they require transit across the extraocular muscles and intermuscular septa.

A transantral approach to the posterior orbit may be more useful for inferior and medial apex lesions. This approach has been used to remove cavernous hemangiomas and for tumor debulking. The removal of a cavernous hemangioma with a transnasal approach[1,9] has been described in these cases; however, the lesion was approached through an ethmoidectomy and limited sphenoidectomy. The transantral approach provides access to more inferiorly based extraconal apex lesions.[10,11] This approach can also be used to biopsy atypical lesions and to provide visualization of the orbital floor that may be helpful in the repair of orbital floor fractures that extend posteriorly.[4] In this situation, the transantral approach can help visualize posterior bone supports and proper placement of an implant across the defect.

Endoscopic surgery is a useful adjunct to standard posterior orbital approaches. It may be especially useful for extraconal processes that involve the orbital apex inferiorly or medially, as these areas have good access from the paranasal sinuses. It allows removal of extraconal large lesions that would otherwise be difficult to access even with the use of a large lateral orbitomy. It has the advantage over the intranasal and orbital approaches, when used individually, of allowing more instrumentation to be used to access and visualize the operative site.

Lesions of the orbital apex pose unique surgical problems. When the lesion is extraconal and inferomedially located, the use of the endoscopic approach—either transantrally or transnasally—should be considered.[12] These approaches may help in accessing lesions in the apex with improved visualization and limited manipulation within the orbit.

Radiological evaluation and surgical planning

Computed tomography scanning is the imaging mode of choice for orbital disease. It allows one to evaluate sinus anatomy as well note any displacement of orbital structures (Figure 1). Magnetic resonance imaging is more useful when one is looking for intracranial complications of orbital inflammation as well as any malignancy that extends intracranially. It may also show marrow space involvement, such as osteomyelitis, earlier than computed tomography. The surgical plan for these lesions is to perform an uncinectomy and middle meatal antrostomy, followed by an anterior ethmoidectomy. Depending on the size of the lesions, this may need to be extended into a posterior ethmoidectomy and sphenoidotomy if the lesion extends posteriorly or into the cavernous sinus.

Operative technique

Endoscopic transnasal approach to these apex lesions is performed under general anesthesia with endotracheal intubation. The patient is in a reverse Trendelenburg position, and the nasal mucosa is decongested with mixture of 10% cocaine, adrenalin, and saline-soaked pledgets. It is important to do this in a minimally traumatic way because the inflamed mucosa has a tendency to bleed. Infiltration of the lateral nasal wall above the middle turbinate insertion is performed with 2 mL of 2% lidocaine with 1;80,000 adrenaline. The first step is to perform an uncinectomy and identify and enlarge the natural ostium of the maxillary sinus (Figure 2). The maxillary sinus ostium should be maximally enlarged to ensure that obstruction of the ostium does not occur with prolapse of orbital fat once the orbital periosteum is opened. Depending on the site and size of the orbital lesion, a varying amount of lamina papyracea can be exposed. In most cases, complete exposure is preferred, because it allows space for the fat to prolapse while the lesion in the orbit is addressed.

The first step is to open the bulla ethmoidalis and expose the vertical portion of the ground lamella. This is perforated at the junction of the horizontal an vertical portions and the superior meatus entered medially. Once this meatus is clearly identified, the posterior ethmoids and sphenoid ostium can be exposed and the sphenoid opened if the lesions is in the orbital apex (Figure 2). Anterior lesions will also require dissection of the frontal recess with clearance of all cells and exposure of the frontal ostium. Once the lamina papyracea is fully exposed, it is fractured with the blunt end of the Freer elevator, with the surgeon ensuring that the orbital periosteum is kept intact. The Freer is used to establish the plane between the bone and the underlying orbital periosteum. The bone is then fractured off the periosteum keeping the periosteum intact. In most cases it is prudent to remove all the lamina papyracea thereby creating the largest

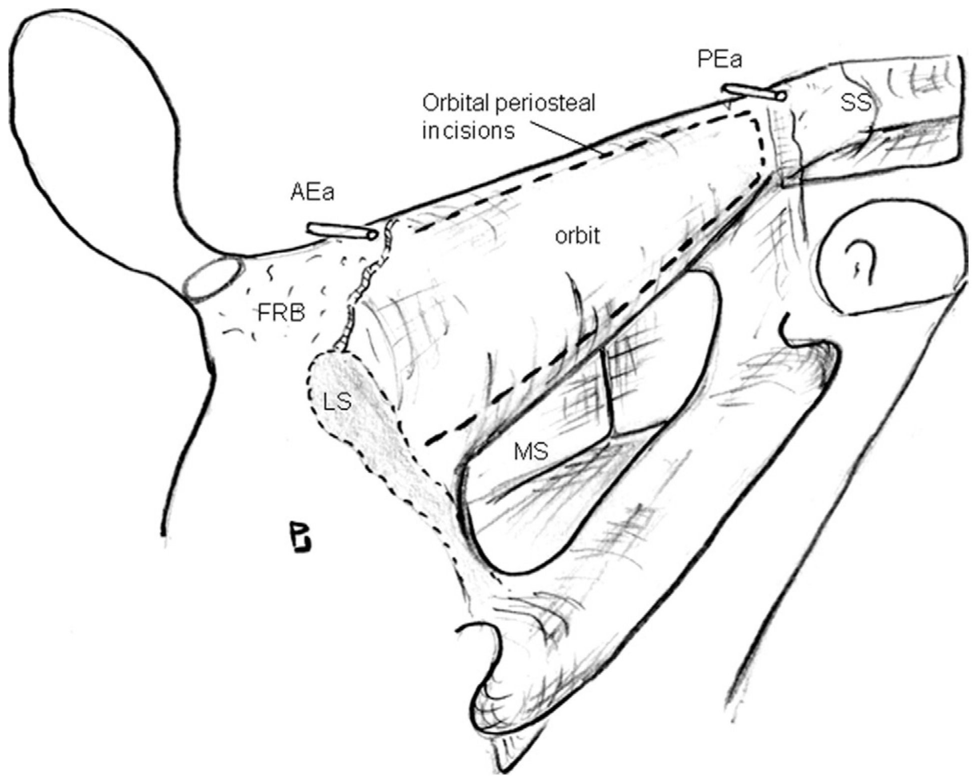

Figure 2 After a large maxillary antrostomy has been created, a complete spheno-ethmoidectomy is performed with exposure of the frontal ostium. The frontal recess lamina, located approximately 1 cm below the frontal ostium, is preserved to prevent orbital fat prolapse with obstruction of the ostium. The broken line outlines the incision lines in the orbital periosteum. AEa, anterior ethmoidal artery; PEa, posterior ethmoidal artery; MS, maxillary sinus; SS, sphenoid sinus; LS, lacrimal sac; FRB, frontal recess bone (lamina papyracea).

possible access into the orbit. Approximately 1 cm of lamina papyracea below the frontal sinus ostium is preserved to prevent orbital fat from prolapsing and blocking the frontal sinus drainage pathway. The orbital periosteum is incised vertically just anterior to the sphenoid. This incision is continued anteriorly with 2 horizontal incisions; one just

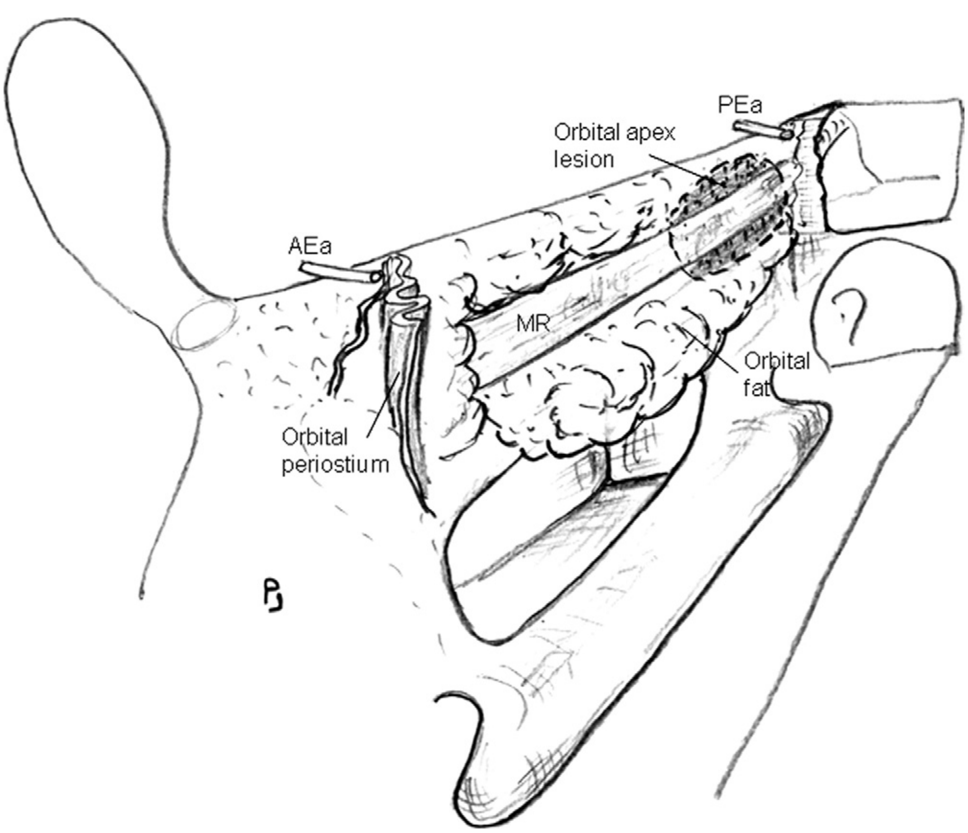

Figure 3 The fat is teased away to expose the medial rectus muscle and lesion. AEa, anterior ethmoidal artery; PEa, posterior ethmoidal artery; MR, medial rectus muscle; SS, sphenoid sinus.

Figure 4 Diagram of the 2-surgeon approach, which illustrates the how the second surgeon uses the left hemitransfixtion and posterior horizontal incisions to allow access to the right orbit. This approach allows traction on the tumor or suction in the field. Surgeon A holds the Suction Freer elevator and endoscope whereas Surgeon B uses the Blakesley forceps to place traction on the lesion.

above the maxillary sinus and one just below the skull base (Figure 2).

The orbital periosteum is then grasped with a Blakesley forceps and gently pulled forward until the entire medial orbital periosteum is removed. Before mobilization of the orbital fat, an image-guided (or computer-aided) probe is placed against the orbit to accurately identify the site of the intraorbital lesion. The medial fat is then gently teased away to identify the underlying medial rectus muscle and lesion (Figure 3). Bipolar cautery can be used to coagulate vessels and to shrink the fat to improve visualization. Depending on the locality of the lesion, the medial rectus or fat may need to be manipulated to expose the lesion. In such circumstances, the 2-surgeon technique is useful. Here a hemitransfixtion incision is made on the anterior septum in the opposite nasal cavity and bilateral submucoperiosteal flaps are raised as for a standard septoplasty. A small horizontal segment of cartilage and bone is resected from the septum and a horizontal incision made in the opposite mucosal flap. This allows the second surgeon to place a retractor or suction into the surgical field from the opposite nostril across the septum and aid the primary surgeon with retraction and dissection in the orbit. This allows 2 surgeons to operate together in the field which may be essential if the lesion is to be excised as traction is often necessary to facilitate excision (Figure 4). Once the lesion is excised/biopsied, the orbital fat that has prolapsed is left untouched and will mucosalize within weeks. At the end of surgery, a Vicryl Rapide 30 suture is used to perform a plication stitch through the septum. The fact that the two incisions in the nasal septum are not close together makes the likelihood of a septal perforation very small. No packing is placed with routine postoperative broad spectrum antibiotics given for 5 days.

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