Decompression of the Orbital Apex

An Alternate Approach to Surgical Excision for Radiographically Benign Orbital Apex Tumors

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Objective: To study the outcome of patients with orbital apex lesions treated with endoscopic decompression alone.

Design: Retrospective medical chart review with a mean follow-up of 25.6 months.

Setting: Departments of Ophthalmology and Otolaryngology, University of Washington, Seattle.

Patients: Five individuals seen at the University of Washington Medical Center from November 2003 through December 2005 with visual disturbance caused by orbital apex lesions as documented by preoperative magnetic resonance imaging or computed tomographic scan.

Intervention: All patients underwent endoscopic decompression of the medial wall of the orbital apex with incision of the periorbita.

Main Outcome Measures: Postoperative visual acuity, presence or absence of a relative afferent pupillary defect, color vision, and visual field were recorded.

Results: All 5 patients presented with visual field deficits, 4 of whom improved postoperatively. Three patients had dyschromatopsia preoperatively, 2 of whom improved postoperatively. Visual acuity improved or stabilized in 4 of 5 patients postoperatively. One patient had progressive visual loss during the course of her follow-up, which, after obtaining postoperative imaging, was attributed to inadequate decompression of the apex at its most posterior aspect. This same patient also developed postoperative sinusitis that resolved with antibiotic treatment. Two patients developed diplopia, 1 in primary gaze requiring treatment with prismatic lenses. All patients presented with and maintained normal intraocular pressures.

Conclusion: Orbital apex lesions can often be effectively and relatively safely treated by endoscopic decompression alone.


Individuals with diseases involving the orbital apex can present with declining visual acuity, visual field deficits, disturbance in color perception, extraocular movement limitation, diplopia, and pain. This constellation of symptoms relates to the complex anatomy of the orbital apex, which confines several neural and vascular structures in a limited space. The differential diagnosis of orbital apical afflictions includes inflammatory, infectious, traumatic, and neoplastic etiologies. Neoplasms known to occur in this location include cavernous hemangioma, schwannoma, lymphoma, and, rarely, metastases (such as breast, lung, and, less commonly, gastrointestinal or genitourinary). Many of these masses may be slow-growing.

When compressive optic neuropathy occurs, surgical decompression of the orbital apex is considered, either by tumor excision or by enlargement of the orbital apex. The traditional approach for vision-compromising orbital apex lesions was complete excision. Several surgical approaches to achieve this goal are described in the literature, including transconjunctival, transnasal, transantral, lateral orbitotomy, supraorbital, and via craniotomy. However, access to the orbital apex is challenging and often requires an external incision. In addition, this approach risks injury to the globe, extraocular muscles, cranial nerves, carotid artery, cavernous sinus, and brain. In recent years, endoscopy-assisted decompression of the orbit has been introduced as part of the treatment armamentarium, most notably in the treatment of Graves ophthalmopathy. With the addition of intraoperative image guidance, the endoscopic approach has already been applied to surgically access the anterior skull base, clivus, pituitary gland, petrous apex, and orbital apex.

We propose that many orbital apex lesions may be addressed with endoscopic decompression alone for 2 reasons: (1) most tumors at this location are benign and slow
growing and (2) depending on the approach, complete excision of tumors in the orbital apex is associated with potentially serious morbidities (vision loss, impaired extraocular movements, and injury to the internal carotid artery, among others). To date, one case series described by Kloek et al\(^3\) has demonstrated the efficacy of this approach based on improvement in visual function (acuity, visual fields, color perception) with decompression alone for radiographically benign apical tumors. Our retrospective case series again demonstrates the feasibility of this approach, with the additional refinement of using image-guided endoscopy to permit access to these masses.

### METHODS

We reviewed the outcomes of 5 patients who underwent endoscopic decompression of the bony wall of the medial orbital apex with incision of the periorbita for progressive loss of visual function. These patients were seen at the University of Washington Medical Center, Seattle, from November 2003 through December 2005 and underwent endoscopic decompression by the same surgeon (S.P.M.). A comprehensive ophthalmologic and otolaryngologic evaluation was performed preoperatively and postoperatively and included radiologic assessment with computed tomographic (CT) and/or magnetic resonance imaging (MRI) preoperatively. Patient information, including demographics, presenting signs and symptoms, and preoperative and postoperative physical examination, was reviewed.

Medial orbital apex decompression was performed via an endoscopic approach. In all cases except case 5, an intraoperative image-guided navigation system (Stealth LandmarX; Medtronic, Minneapolis, Minnesota) was used. We began with maxillary antrostomy, complete ethmoidectomy, and sphenoidotomy. The lamina papyracea was then removed from the level of skull base to orbital floor, which was left intact. Dissection extended posteriorly where the lateral wall of the posterior ethmoid cells and sphenoid sinus was resected. This allowed exposure of the periorbita, which was then incised at the orbital apex with additional fenestration of the annulus of Zinn when appropriate. This allowed for the extirpation of the orbital apex contents into the aforementioned sinuses.

### RESULTS

#### CASE 1

A 66-year-old woman with fibrous dysplasia was seen for a 9-month history of reduced vision of the left eye associated with subjective dyschromatopsia. On examination, her visual acuity was 20/20 OD (right eye) and 20/70 OS (left eye) with a left relative afferent papillary defect. Dilated fundus examination of the left eye showed mild temporal pallor and blurring of the nasal margin of the optic nerve. Visual field evaluation revealed areas of peripheral and para-central depression. A CT scan showed narrowing of the orbital apex by bony overgrowth caused by fibrous dysplasia. The patient underwent endoscopic decompression of the orbital apex with intraoperative image guidance. Twenty-eight months after surgery, her visual acuity was 20/25 OD and 20/40 OS with a persistent afferent papillary defect. She had dyschromatopsia in the left eye (Ishihara color plate test score of 7/14 OS) and stable mild temporal pallor of her left optic nerve. Humphrey visual field testing revealed clinically significant improvement in comparison to preoperative testing.

#### CASE 2

A 49-year-old woman was seen for a 4-month history of gradually decreasing vision in her left eye without associated pain. Ophthalmologic examination revealed visual acuity of 20/15 OD and 20/40 OS and dense superotemporal visual field loss in the left eye (Figure 1) associated with a left relative afferent pupillary defect. A CT scan with contrast showed a 12 × 12 × 10-mm well-circumscribed intraconal mass in the left orbital apex, consistent with a benign mass (ie, hemangioma or schwannoma). Three months after presentation, the patient reported increasing difficulties relating to her vision (her best spectacle-corrected visual acuity had worsened from 20/40 to 20/50 OS), and she elected to undergo surgery. Endoscopic orbital decompression with intraoperative image-guided navigation was performed as described in the “Methods” section (Figure 2). Her vision improved to 20/20−2 OS postoperatively with a persistent afferent papillary defect at 17 months. Humphrey visual field testing showed diminution of her superotemporal scotoma at 13 months (Figure 1), and color plates remained full. However, postoperatively, she did develop diplopia on far left gaze, which did not interfere with her activities of daily living.

#### CASE 3

A 52-year-old woman was seen for a 5-month history of superior visual field defect in the right eye. Examination showed a visual acuity of 20/20 OD and OS and scores on the Ishihara color plate test of 5/11 OD and 8/11 OS. A right relative afferent pupillary defect was present, with dense superonasal visual field loss confirmed by Goldmann field testing. An enhancing lateral orbital apex mass was identified on MRI, with radiographic findings consistent with hemangioma or schwannoma. Given the dense visual field defect encroaching on her central vision, the patient underwent endoscopic orbital decompression with image-guided navigation rather than surgical resection. Sixteen months after surgery, her visual acuity remained at 20/20 OD and 20/20 OS, and the afferent papillary defect resolved. Results from the Ishihara color plate test were 8/15 OD and 10/15 OS, and there was no progression of the right superior visual field deficit. The patient did develop diplopia involving primary gaze and upgaze 10 months after surgery, but this was successfully treated with prisms and remains stable.

#### CASE 4

A 58-year-old woman was seen for symptoms of light flashes in her right eye without visual loss. Physical examination revealed a visual acuity of 20/25 OD and OS, and normal color vision in each eye, and superonasal visual field loss in the right eye. An MRI scan identified a 5-mm, moderately enhancing intraconal mass that was located lateral to the optic nerve. This lesion also showed a high T2-weighted signal on MRI scans and was presumed to be a hemangioma. The patient underwent endoscopic decom-
chromatopsia with results on the Ishihara color plate test to have a visual acuity of 20/30 OD and 20/20 OS, dys-
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lution of the photopsias without changes in her visual function. She remained free of symptoms at her 33-month fol-

CASE 5

A 32-year-old woman was seen for blurry peripheral vi-
sion in her right eye of 6 months’ duration. She was found to have a visual acuity of 20/30 OD and 20/20 OS, dys-
chromatopsia with results on the Ishihara color plate test of 3/14 OD and 14/14 OS, and a dense superotemporal scotoma in the right eye. A right relative afferent pup-

Figure 1. Humphrey visual fields for case 2. Preoperative (A) and postoperative (B) views.

The dense visual field defect persisted in the right eye with testing by confrontation, as did the afferent pup-

lary defect. Results of the Ishihara color plate tests were

Figure 2. Case 2. A, Axial computed tomographic scan of case 2 shows a left orbital apex intracanal lesion, which enhances with gadolinium on magnetic resonance imaging scan (not shown). B, An endoscopic approach to remove the medial orbital wall successfully decompressed the orbital apex.


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dysplasia involving the lateral orbital apex. Endoscopic decompression limited to the medial bony orbit successfully reversed her visual disturbance without complications. We applied a similar surgical approach to the other 4 patients who presented with visual disturbance caused by orbital apex tumors.

Neoplasms that most commonly occupy the orbital apex include cavernous hemangioma, schwannoma, lymphoma, neuriloma, and, rarely, metastases. Most of these lesions are benign and vascular and demonstrate characteristic appearance on imaging. For lesions that have benign clinical and radiographic characteristics, it is reasonable to decompress the orbital apex alone without attempts at incision or excisional biopsy. By removing the medial bony wall of the orbital apex and incising the peri-orbita, it is possible in some cases to reverse the compressive optic neuropathy. Avoiding subtotal or total excision of these tumors minimizes the additional iatrogenic risk to visual function, that is, visual acuity/field limitation or impaired ocular motility secondary to cranial neuropathies. This option is most appropriate for neoplasms with slow growth and no invasive or metastatic potential. Orcutt et al8 found that patients with orbital cavernous hemangiomas with benign clinical characteristics can be safely followed. Using our described decompressive approach for symptomatic patients with orbital apex lesions, all but 1 of our patients showed objective improvement or stabilization in visual function, including visual acuity, visual field, color perception, and pupillary reflex. The lone case of progressive visual loss was due to suboptimal decompression compounded by growth of the tumor as demonstrated on follow-up CT. The orbital apex of patient 5 was decompressed endoscopically without the use of image-guided navigation, which we believe contributed to insufficient decompression. As such, we have modified our technique and currently recommend using intraoperative image-guided navigation systems in all such cases to ensure complete bony decompression of the apex. The high success rate with relatively minor complications seen in our series (ie, diplopia compared with vision loss) is comparable with previous studies on transnasal orbital decompression for Graves disease11,12 and orbital apex lesions.15

Among our patients, the mean duration of the postoperative follow-up period was 25.6 months (median follow-up period, 28 months). There were no reports of loss of vision owing to surgery and 3 relatively minor complications, namely, diplopia and sinusitis. Two patients developed persistent diplopia postoperatively; in 1 of these patients, primary gaze was affected and required the use of Fresnel prisms. Although this complication may be quite troublesome for patients, in this patient it was easily treatable and minor compared with vision loss with inadequate decompression, as seen in patient 5. One patient with preexisting allergic rhinitis developed postoperative sinusitis that resolved with antibiotic treatment. In conclusion, radiographically benign lesions of the orbital apex causing vision loss can be treated effectively and relatively safely by endoscopic medial orbital decompression. This conservative approach requires careful selection of patients with slow-growing lesions with benign clinical and radiographic characteristics. More aggressive surgical intervention can be postponed until vision is further compromised or malignant behavior is observed.

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Study concept and design: Almond, Sires, Most, and Jian-Amadi.

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Analysis and interpretation of data: Almond, Cheng, Schiedler, Sires, and Jian-Amadi.

Drafting of the manuscript: Almond, Cheng, Schiedler, and Jian-Amadi.

Critical revision of the manuscript for important intellectual content: Almond, Cheng, Schiedler, Most, and Jian-Amadi.

Statistical analysis: Cheng and Jian-Amadi.

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Study supervision: Schiedler, Sires, Most, and Jian-Amadi.

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