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Endoscopic orbital decompression

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Orbital decompression for the treatment of Graves' orbitopathy is an invaluable technique for patients with proptosis, exposure keratopathy, or optic neuropathy. The expanding role for transnasal endoscopic surgery leads to a natural extension for the management of selected orbital tumors and fibro-osseous lesions with orbital extension. Traditional open approaches that have been described over the past century are limited by suboptimal visualization and carry the morbidity of incisions within the facial skin, oral cavity, or conjunctiva. Endoscopic orbital decompression allows for safe and effective decompression of the medial and inferior orbital walls with minimal morbidity to the patient.

Graves' disease is an autoimmune disorder that most commonly presents in patients with hyperthyroidism. In 30% to 50% of patients, an ophthalmopathy develops caused by enlargement of orbital fat and muscles with resultant proptosis.[1,2] Although the mechanism for these changes is not completely understood, autoantibodies directed against the extraocular muscles and intraorbital adipose tissue are thought to stimulate a lymphocytic inflammation and deposition of mucopolysaccharides into the orbital tissues. In addition to proptosis, clinical manifestations of Graves' orbitopathy include tearing, photophobia, and conjunctival injection. More severe disease can lead to diplopia and visual loss from exposure keratopathy with corneal ulceration and optic neuropathy.

In Graves' disease, the clinical course of the thyroid disease is independent to the progression of orbitopathy. Patients may experience ophthalmic findings at any point during the course of Graves' disease, even after the hyperthyroidism has been treated.

During the past century, a variety of techniques for decompressing the orbit by removal of 1 to 4 bony walls have been described by specialists in the fields of ophthalmology, otolaryngology, plastic surgery, and neurosurgery.[2-6] In the early 1990s, advancement of endoscopic sinus surgery led to the application of these techniques for transnasal decompression of the orbit.[7,8] Experience has demonstrated endoscopic orbital decompression to be a safe and effective technique for the treatment of Graves' orbitopathy. Compared with previously described approaches for orbital decompression, the endoscopic technique allows for enhanced visualization of the orbital walls and skull base with decreased patient morbidity.

Patient selection

Endoscopic orbital decompression is indicated for patients with moderate-to-severe symptoms of Graves' orbitopathy. Indications include exophthalmos, exposure keratopathy, diplopia, and optic neuropathy. Corticosteroids may be used as a temporizing measure to decrease orbital inflammation and halt enlargement of orbital contents, but are not successful in providing long-term benefit without prolonged usage. Orbital radiation for Graves' disease is controversial, and its efficacy has been challenged by 2 randomized prospective trials.[9,10] It is preferable to perform orbital decompression at least 18 months after the onset of Graves' orbitopathy, however, severe symptoms with optic neuropathy during the acute phase may warrant immediate treatment.

Endoscopic orbital decompression also can be used to gain access to the orbit for removal of benign orbital tumors, biopsy of indeterminate lesions, or as palliative therapy for malignant tumors causing visual symptoms. This endoscopic orbital decompression approach may be suitable for tumors located medial to the optic nerve, as well as sinona-

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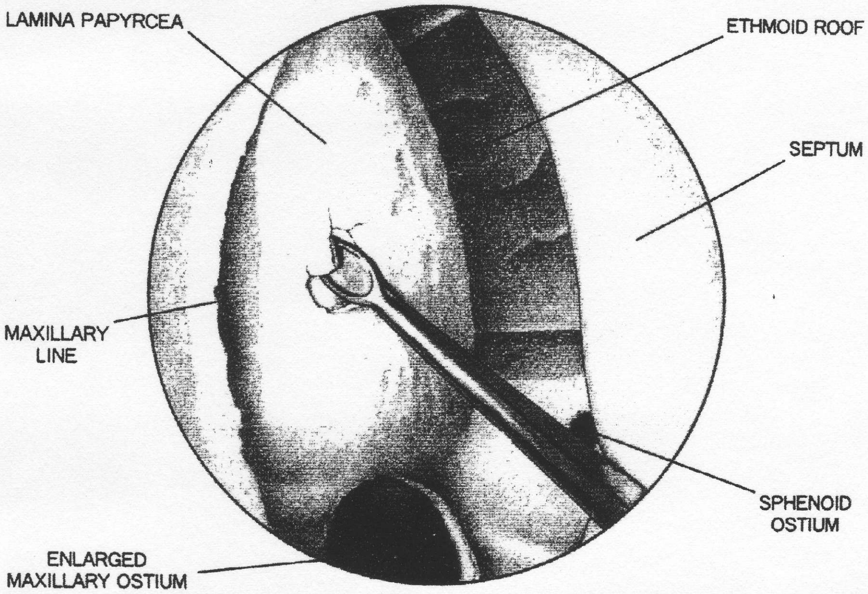

Figure 1 View of the right nasal cavity after a wide maxillary antrostomy and sphenoethmoidectomy are performed. The skeletonized lamina papyracea is fractured with a spoon curette.

sal or skull-base tumors with extension into the orbital compartment.

Surgical technique

Endoscopic orbital decompression allows for removal of the entire medial orbital wall, as well as the medial portion of the orbital floor. This procedure is usually performed in patients under general anesthesia; however, local anesthesia with sedation can be used for patients with significant medical comorbidities or for surgery on an only-seeing eye.[11]

The patient is positioned supine on the operating room table with a similar surgical set-up for that of endoscopic sinus surgery. Topical vasoconstriction is achieved with either oxymetazoline (0.05%) or cocaine (4%). The eyes are maintained in the surgical field, and scleral shells are placed to protect the cornea during surgery. The mucosa of the middle turbinate and lateral nasal wall is infiltrated with lidocaine (1%) with epinephrine (1:100,000). If a septal deviation obstructs visualization of the middle meatus region, a septoplasty is performed before commencing orbital decompression.

Removal of the medial orbital wall and floor

Exposure of the lamina papyracea and orbital floor is achieved through standard endoscopic sinus surgery techniques, with several modifications. Routine removal of the middle turbinate is performed to allow for wide exposure of the orbit. A large maxillary antrostomy is created to provide access to the orbital floor. Sphenoethmoidectomy with skeletonization of the lamina papyracea is performed to allow room for the herniated orbital contents, and provide landmarks of the sphenoid ostia and ethmoid roof for maximal decompression.

The lamina papyracea is penetrated with a blunt instrument such as a spoon curette (Figure 1). Elevators are used to clear the underlying periorbital from the thin bone of the lamina papyracea. Bony fragments are removed with a Blakesley forceps (Figure 2). Excision of bone proceeds superiorly to the skull base, posteriorly to the anterior wall of the sphenoid sinus, and anteriorly to the maxillary line. Removal of bone in the region of the frontal recess is avoided to prevent obstruction of the frontal sinus by the herniated orbital fat.

The medial portion of the orbital floor is excised by downfracturing the bone with a spoon curette or heavier mastoid curette (Figure 3). This step can be a challenging

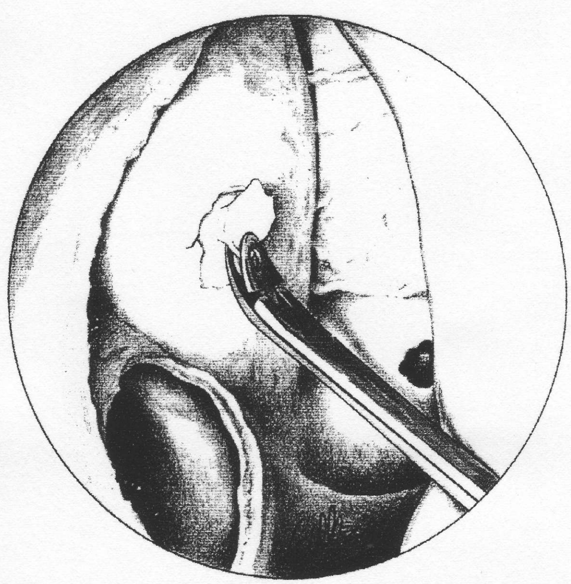

Figure 2 A Blakesley forceps is used to remove fragments of the lamina papyracea. A Freer elevator may be used to separate the thin orbital bone from the underlying periorbita.

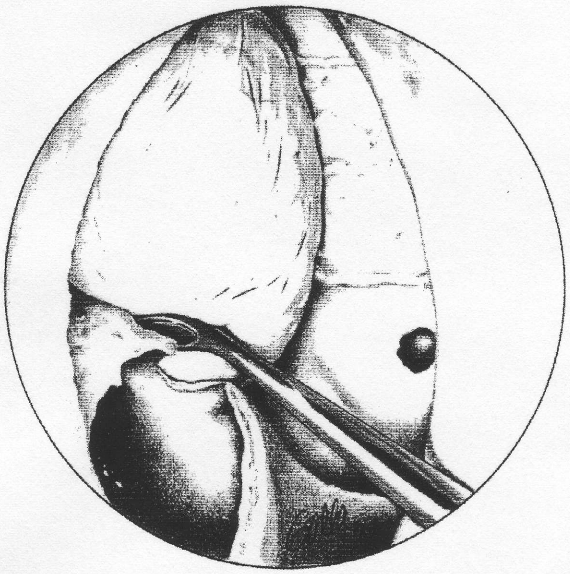

Figure 3 A spoon or mastoid curette is used to down-fracture the medial portion of the orbital floor. The floor is removed medial to the infraorbital canal.

maneuver if there is thick bone along the medial orbital floor. A 30° endoscope and angled forceps may facilitate removal of bone. The infraorbital nerve marks the lateral limit of bone removal, and the canal of this nerve is a natural cleavage plane during downfracture maneuvers.

Incision of the periorbita

Once the lamina papyracea and medial orbital floor have been removed and the periorbita exposed, a sickle knife is used to penetrate the periorbita at the posterior limit of decompression (anterior wall of the sphenoid sinus). Care should be taken to not bury the tip of the sickle knife, because there is potential for injury to orbital contents. The incisions are made in a posterior-to-anterior direction, so that prolapse of herniated fat does not obstruct visualization. In patients without preoperative diplopia or optic neuropathy, a sling technique is used to reduce herniation of the medial rectus muscle and minimize postoperative diplopia.[12] This technique places parallel incisions spaced 10 mm apart to preserve a strip of periorbita over the medial rectus muscle (Figure 4). The sling technique is not employed when maximal decompression is needed, such as in the case of visual loss from optic neuropathy. A sickle knife is used to carefully incise remaining fibrous bands that are often found within the orbital fat. Palpation over the globe can help identify these bands and facilitate prolapse or fat herniation (Figure 5). Nasal packing is avoided to avoid pressure in the region of the orbital apex and optic nerve.

Extended applications

For select orbital tumors or adjacent lesions with intraorbital extension, endoscopic orbital decompression can be used to gain access to the orbit for excision, biopsy, or palliation of these masses. The orbital walls are exposed in similar fashion; however, removal of lamina papyracea may be limited to the specific area of resection. Identification and retraction of the medial and inferior rectus muscles can be performed to allow for dissection of intraconal lesions posterior to the globe. Care should be taken to avoid injury to the optic nerve. The use of image guidance can be helpful in identifying

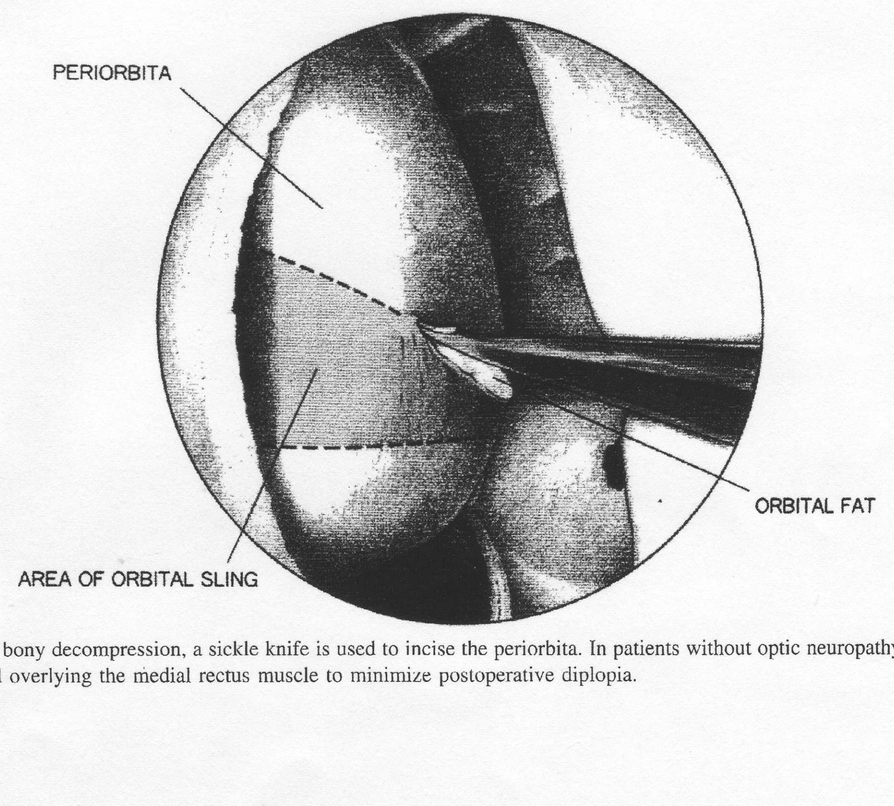

Figure 4 After bony decompression, a sickle knife is used to incise the periorbita. In patients without optic neuropathy, a sling of fascia may be preserved overlying the medial rectus muscle to minimize postoperative diplopia.

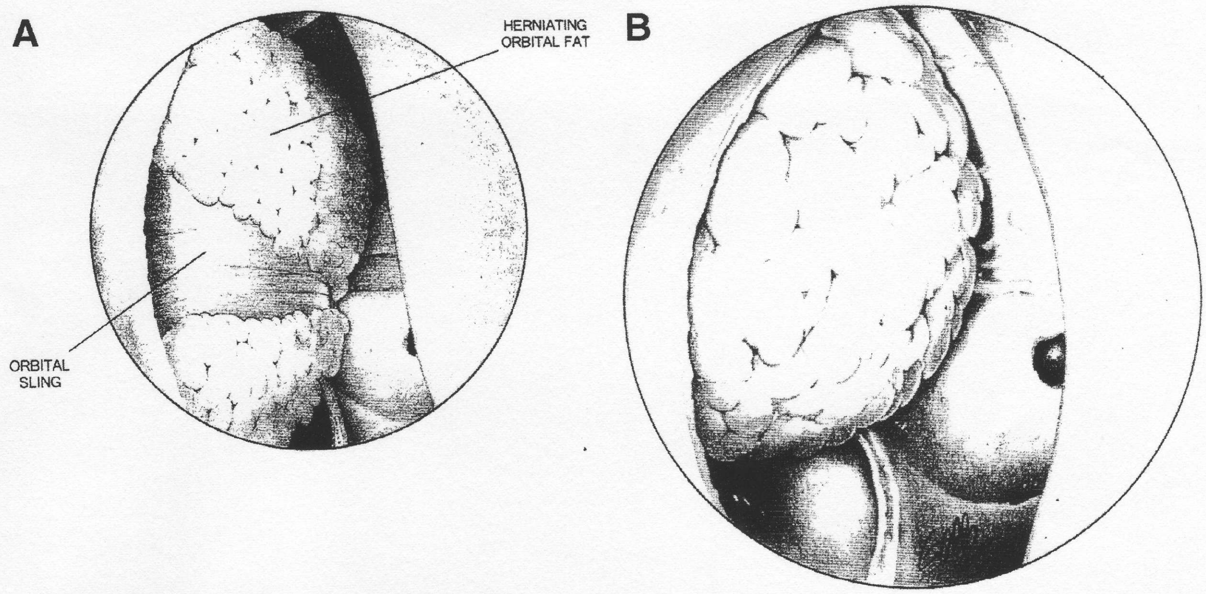

Figure 5 After decompression, orbital fat protrudes into the ethmoid and maxillary spaces. (A) With the orbital sling technique, a strip of periorbita remains to support the medial rectus muscle and reduce the incidence of postoperative diplopia. (B) Maximal decompression can be obtained for patients with optic neuropathy by removal of the entire periorbita, including the sling.

landmarks, but should not be solely relied on as the orbital contents shift with decompression maneuvers.

Postoperative care

Patients typically are monitored for bleeding in the hospital overnight. They are discharged with a 10-day course of antistaphylococcal antibiotics and instructed to irrigate the nose with saline solution twice a day to clear mucus and debris. Any remaining debris is cleared from the operative site under endoscopic visualization at the first postoperative office visit 1 week after surgery.

Results

The goals of orbital decompression vary depending on the indication for the procedure. In patients with compressive optic neuropathy, restoration of visual deficits is the goal, whereas in patients with corneal exposure or severe proptosis, ocular recession may be the primary endpoint. The amount of orbital decompression that is needed depends on the clinical scenario, and will dictate the technique and approaches that are used. Endoscopic decompression alone averages an ocular recession of 3.5 mm (range 2-5.5 mm), whereas the addition of concurrent lateral decompression provides an additional 2 mm of globe recession.[13]

Complications

New-onset diplopia or worsening preexisting diplopia has been reported to occur in anywhere from 15% to 64% of patients undergoing orbital decompression for Graves' disease.[8,11,13-16] This finding is thought to be the result of change in vectors of the abnormal extraocular muscles with ocular recession. All patients should be informed of the possibility of postoperative diplopia and need for strabismus surgery. Although several techniques have been described to decrease diplopia, the aforementioned orbital sling technique[12] and a balanced decompression[14,17-18] with a concurrent lateral external component are advocated by the authors.

Postoperative epistaxis, which occurs in less than 5% of patients, is most commonly observed along the posterior remnant of the resected middle turbinate. Bleeding is managed through the use of endoscopic identification and cauterization of the bleeding site. Packing is avoided to limit pressure on the orbital contents. Persistent bleeding is managed with ligation of the sphenopalatine artery.

The incidence of postoperative infection is reduced with the use of antistaphylococcal antibiotics. Creation of a large maxillary antrostomy and limited bone removal in the region of the frontal recess helps to prevent postoperative ostial obstruction and sinusitis.

If the maxillary antrostomy is extended too far anteriorly through the thick bone of the frontal process of the maxilla, transection of the lacrimal duct with postoperative epiphora and dacryocystitis may be seen. In this scenario, endoscopic dacryocystorhinostomy may be performed to re-establish lacrimal drainage. Cerebrospinal fluid leak and blindness are very rare complications that have been reported with endoscopic sinonasal surgery.

Conclusion

Endoscopic orbital decompression provides successful treatment for patients with Graves' orbitopathy. Excellent visualization of the orbital apex and skull base allows for effective reduction in proptosis with minimal patient morbidity. The expanding role for transnasal endoscopic surgery leads to a natural extension for the management of selected orbital tumors and fibro-osseous lesions with orbital extension. These advanced procedures should be performed by surgeons who have significant experience in endoscopic techniques.

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