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Endoscopic orbital decompression for Graves' ophthalmopathy

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Abstract

Graves' disease may occasionally result in significant proptosis that is either cosmetically unacceptable or causes visual loss. This has traditionally been managed surgically by external decompression of the orbital bony skeleton. Trans-nasal endoscopic orbital decompression is emerging as a new minimally-invasive technique, that avoids the need for cutaneous or gingival incisions. Decompression of the medial orbital wall can be performed up to the anterior wall of the sphenoid sinus. This can be combined with resection of the medial and posterior portion of the orbital floor (preserving the infra-orbital nerve). This technique produces decompression which is comparable to external techniques.

We present a series of 10 endoscopic orbital decompressions with an average improvement of 4.4 mm in orbital proptosis. There was an improvement in visual acuity in all patients with visual impairment. Endoscopic orbital decompression is recommended as an alternative to traditional decompression techniques.

Key words: Graves' Disease; Endoscopy; Paranasal Sinuses, surgery

Introduction

Graves' disease is an autoimmune disease with complex pathophysiology. It is believed that orbital involvement in Graves' disease results from the deposition of immune complexes that in turn cause oedema and fibrosis of the extraocular muscles and fat.[1] This increase in the retro-orbital pressure causes proptosis or exophthalmos. As well as being cosmetically disfiguring, this raised pressure can threaten the vision if the pressure causes vascular compromise and/or stretches the optic nerve. This visual loss occurs in two to seven per cent of patients with Graves' disease.[2,3] Medical arrangement, with high dose corticosteroids is considered first-line management, but if this fails or if repeated treatments are required then surgical decompression is indicated.[4]

Traditionally, orbital decompression has been performed with external approaches via the antrum (Caldwell-Luc approach), external ethmoid or anterior cranial fossa.[5] Such techniques are now known to reduce proptosis by a mean of between 4.0 and 6.0 mm but have the disadvantage of cosmetic morbidity in terms of a cutaneous scar and a high incidence of post-operative complications.[6]

Following the advent of the Hopkins' rod and the technique of nasal endoscopy, visualization of the nasal cavity and paranasal sinuses has improved significantly.[7] This has led to the adoption of endoscopic sinus surgery for the treatment of nasal conditions by the majority of otolaryngologists. As the surgeons' endoscopic experience has improved, the spectrum of minimally invasive trans-nasal procedures has extended to include dacryocystorhinostomy, CSF leak repairs, hypophysectomy and major arterial ligation.[8] The progression to surgery on the medial and inferior orbital skeleton was logical and has allowed access to the entire medial orbital wall and the floor of the orbit medial to the infra-orbital nerve.[9] To date, endoscopic approaches for orbital decompression have been shown to reduce proptosis by up to a mean of 4.7 mm.[5,7]

We report a series of cases where an endoscopic approach was utilized to decompress the orbit in patients with Graves' ophthalmopathy.

Materials and methods

Seven patients underwent orbital decompression with three having bilateral decompressions. This resulted in 10 orbits undergoing decompression. There were four men and three women with a mean age of 48 years. The three patients who underwent bilateral decompressions did so for cosmetic reasons. Of these patients, two had only the medial orbital wall removed and one patient had a three-wall decompression. Of the remaining four

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orbits, three were decompressed for failing vision. In all these patients there was significant unilateral proptosis with the other eye having only mild proptosis not sufficient to warrant decompression. One of the three patients underwent decompression for failing vision in an only-seeing eye as the other eye had suffered a retinal detachment. One patient had a blind eye and significant proptosis following orbital surgery by the ophthalmologists. These four patients had both the medial orbital wall and floor removed as part of their decompression.

Surgical technique

The first step is to perform a complete uncinectomy and to enlarge the maxillary sinus ostium from the natural ostium until the posterior wall of the maxillary sinus is exposed (Figure 1). It is important to establish a large ostium as fat prolapse may block the ostium and result in sinusitis. The agger nasi cells are removed and the frontal sinus ostium exposed. The bulla ethmoidalis is removed and the posterior ethmoids entered through the basal lamella. All posterior ethmoid cells are cleared and the skull base clearly identified so that the junction of the lamina papyracea and skull base is clear. The anterior face of the sphenoid is identfiied and exposed. If there is any doubt as to whether the anterior face of the sphenoid has been reached, the sphenoid should be opened through the natural ostium and its anterior face confirmed. Next the thin lacrimal bone immediately behind the thick bone of the frontal process of the maxilla is exposed and the lacrimal sac identified. A blunt-tipped Freer elevator is used to penetrate the lamina papyracea directly posterior to the thin lacrimal bone and then to gently flake off the lamina papyracea from the underlying periosteum. The periosteum is kept intact at all times as rupture of the periosteum would lead to prolapse of orbital fat and obscure further dissection of the lamina papyracea. The lamina papyracea is removed up until the junction of the lamina with the skull base and up to the anterior face of the sphenoid (Figure 2). It is important to keep the lamina papyracea bone intact in the region of the frontal recess to prevent prolapsed fat from blocking the frontal sinus drainage pathway. As the maxillary antrostomy is approached, the thin lamina papyracea thickens to form a strut between the medial orbital wall and floor. After removal of the medial lamina papyracea the orbital periosteum can either be incised at 3 mm intervals or excised in one piece (Figure 3). All of the

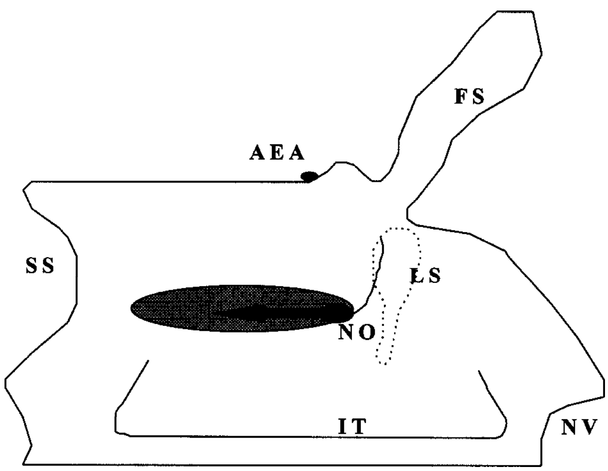

FIG. 1

Uncinectomy is performed and the natural sinus ostium is enlarged posteriorly and inferiorly until a large ostium is created

NO = Natural ostium; SS = Sphenoid sinus; LS = Lacrimal sac; AEA = Anterior ethmoidal artery; IT = Inferior turbinate; FS = Frontal sinus; NV = Nasal vestibule.

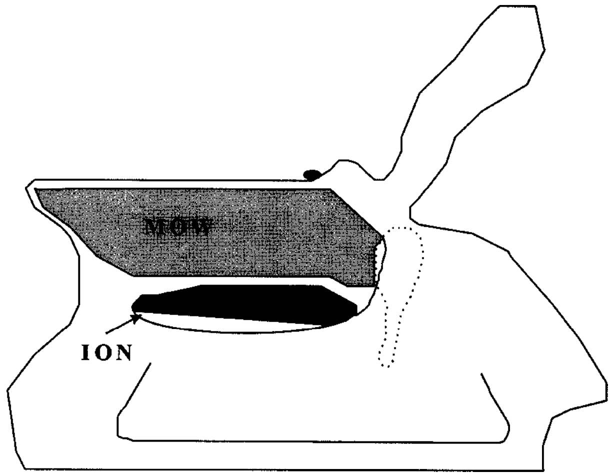

FIG. 2

The extent of endoscopic orbital decompression is illustrated. The medial orbital wall (MOW) and orbital floor (OF) are removed with preservation of the underlying orbital periosteum. Lamina papyracea in the frontal recess is preserved to prevent blockage of the frontal ostium.

OF = Orbital floor; ION = Infra-orbital nerve; MOW = Medial orbital wall.

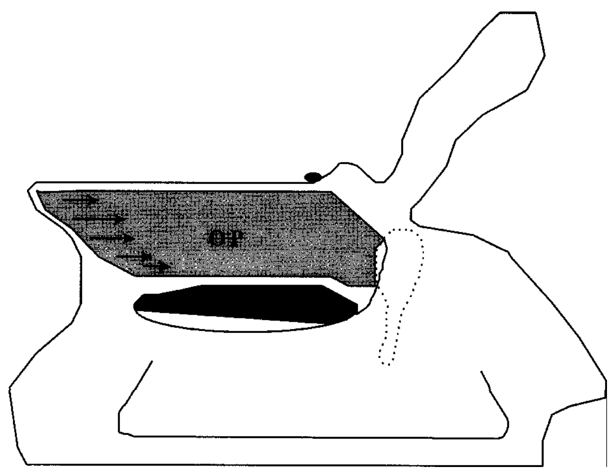

FIG. 3

The exposed orbital periosteum (OP) is incised with small incisions 3 mm apart starting at the orbital apex and bringing all incisions forward together to ensure maximal removal of orbital periosteum.

OP = Orbital periosteum.

TABLE I

REPORTED SERIES OF A PURELY ENDOSCOPIC APPROACH FOR ORBITAL DECOMPRESSION

Series	N	Mean reduction	Range (mm)	Complications
Kennedy *et al.*[7]	5	4.7 mm	3–5	Nil
Michel *et al.*[16]	12	3.3 mm	3–4	Nil
Mann *et al.*,[17]	14	4.0 mm	—	Sinusitis
Metson *et al.*,[18]	6	3.2 mm	2–4.5	Nil
Metson *et al.*,[19]	8	3.5 mm	2–5.5	Nil
Neugebauer *et al.*,[20]	42	3.0 mm	1–6.5	Nil
Koay *et al.*,[21]	15	3.9 mm	2–8	Nil
Lund *et al.*,[5]	24	4.4 mm	1–10	Epiphora (1)
Asaria *et al.*,[1]	14	3.8 mm	2–7	Nil
Wee *et al.*, present study	10	4.4 mm	1–12	Nil

N = Number of orbits.

orbital periosteum must be removed to achieve maximal prolapse of orbital fat. Small septae in the fat can be gently incised under direct vision always keeping in mind that the medial rectus muscle lies a millimetre or two under the prolapsed fat. If the orbital floor is to be removed, curved instruments are placed through the maxillary ostium and the orbital floor can be removed up to the infra-orbital nerve (Figure 3). Again the periosteum is either excised or incised to allow maximal fat prolapse into the maxillary sinus (Figure 3).

Results

The average regression of proptosis in the 10 orbits decompressed was 4.4 mm (Standard deviation (STD) = 3.37; 95 per cent Confidence Interval (CI) = ± 2.3). In the four orbits that had the medial wall and floor of the orbit removed, the average regression of proptosis was 5.75 mm (STD = 3.6; 95 per cent CI = ± 3.6). In the four orbits which had the medial orbital wall only removed, the average regression of proptosis was 1.75 mm (STD = 1.0; 95 per cent CI = ± 1.1). In the two orbits that had the three wall decompression the average regression of proptosis was 7 mm (STD = 2.8; 95 per cent CI = ± 2.8). Table II details the amount of orbital retrogression with the corresponding improvement in visual acuity in the patients who underwent both medial orbital wall and floor decompression. It can be seen that one patient had an orbital decompression for a blind eye that followed a bleed into the orbital apex which occurred at a previous operation. Although there was a large orbital retrogression, there was no visual improvement in this eye as the eye had lost vision some weeks prior to the decompression. In two patients there was a transient diplopia which resolved within a month of surgery. The patient that underwent three-wall decompression had significant pre-operative diplopia, that remained after surgery. She is currently having surgical correction. No other complications occurred.

TABLE II

CORRELATION BETWEEN ORBITAL RETROGRESSION AND VISUAL IMPROVEMENT AFTER MEDIAL ORBITAL WALL AND FLOOR REMOVAL

Patient	Pre-operative vision	Retrogression (mm)	Post-operative vision
1	6/12	3.5	6/9
2	3/200	3.5	9/200
3	320/200	4	20/40
4	NLP	12	NLP

NLP = no light perception.

Discussion

Surgical orbital decompression for Graves' ophthalmopathy has traditionally been performed via the transantral approach (The Walsh-Ogura decompression).[10] This technique employs a two-wall removal in which both medial and inferior orbital walls are removed. However, this technique provides poor access to the posterior lamina papyracea and this may be inadequately removed with this technique.[11] In addition the fovea ethmoidalis is also approached obliquely, making it vulnerable to injury.[4] This approach also requires a generous Caldwell-Luc antrostromy and hence complications are not infrequent.[3,12] These include antral pain, facial swelling, painful gingival scars, paraesthesia from damage to the infra-orbital nerve, damage to the nasolacrimal duct, dental problems and oro-antral fistulas.[3,13,14] Hypoglobus (inferior displacement of the globe) is also a well-recognized phenomenon if the entire orbital floor is removed. Endoscopic decompression of the medial wall and floor results in removal of the posterior half of the floor medial to infra-orbital nerve. The anterior portion of the orbital floor is inaccessible through the maxillary ostium. Thus a significant anterior buttress of orbital floor remains, that supports the globe and it is unusual to see any significant inferior orbital displacement. Further decompression can be achieved by adding a subconjuctivial incision and decompressing the anterior orbital floor, the floor lateral to the infra-orbital nerve and the lateral orbital wall. This three-wall decompression may also balance the decompression by allowing lateral as well as medial prolapse of orbital fat. Although additional recession of the globe is usual with the three-wall decompression, there is a greater risk of inferior orbital displacement with the loss of the anterior orbital floor and support of the globe.[7] Two large recent series have reported mean ocular recession of 4 mm and 5.5 mm in patients undergoing the standard Walsh-Ogura transantral decompression.[3,12] However, up to 20 per cent of patients suffered from post-operative complications with five per cent having permanent anaesthesia in the distribution of the inferior orbital nerve and 3.5 per cent suffering oro-antral fistulae.[3,12] A recent review of 75 patients undergoing trans-antral decompression found that only 65 per cent of patients found the procedure beneficial.[15]

Endoscopic orbital decompression was first reported in 1990 with axial proptosis being reduced by a mean of 5.7 mm when combined with lateral orbitotomy and 4.7 mm when decompressed by an endoscopic approach alone.[7] As other surgeons have developed the technique, reported mean reductions in proptosis now range from 3.0 to 4.7 mm[1,5,7,16–21] (Table I). These figures are similar to the endoscopic decompression achieved in this series with a mean retrogression of 4.4 mm. This varied from 1.75 mm inpatients who had only their medial orbital wall removed to 5.75 mm in patients who had both medial wall and floor removed. In this series there were no complications while in other series complications have been few. These have included a less than five per cent incidence of epiphora and sinusitis.[5,17]

Despite having many advantages, a purely endoscopic approach does have some limitations. It is difficult to remove bone lateral to the inferior orbital nerve or anterior to the middle meatal antrostomy.[21] Decompression of the medial wall and floor only may result in significant medial orbital prolapse. This imbalance may cause diplopia and patients should be counselled about this risk. In this series two patients suffered transient diploplia and one patient who had pre-operative diploplia failed to improve post-operatively. There may be rare occasions where the severity of the disease is such that the inferior orbital wall and lateral orbital wall need to be completely resected and in such cases, it is well recognized that a combination of an endoscopic and trans-conjunctival approach may be necessary.[11,22]

As techniques for orbital decompression have advanced, the minimal morbidity from surgery has meant that an increasing number of patients are now requesting intervention for purely cosmetic reasons.[1,23,24] In this series and others endoscopic decompression of the medial orbital wall and floor gives reasonable proptosis reduction with minimal morbidity and, therefore, should be considered as a treatment option.

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