Follow-up of Transnasal Orbital Decompression in Severe Graves' Ophthalmopathy

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Objective: To evaluate the safety and efficacy of transnasal orbital decompression for severe Graves' ophthalmopathy.

Design: Retrospective noncomparative case series with extended clinical follow-up.

Participants: Seventy-eight consecutive subjects who were operated on for compressive optic neuropathy with loss of visual acuity or visual field defects after failure of medical and radiation therapy.

Intervention: Strictly transnasal, endoscopic-controlled bilateral decompression of the medial and inferomedial wall of the orbit.

Main Outcome Measurements: Preoperative and postoperative examination, including vision, Hertel exophthalmometry, ocular motility, visual fields, Goldmann perimetry, and notification of complications, intranasal signs of inflammation, and subjects' assessment of the procedure.

Results: One hundred forty-five endonasal decompressions were performed on 78 subjects (63 women, 15 men, 52.2 ± 10.3 years) during a 10-year period. Sixty five patients were bilaterally operated on; 15 required only unilateral decompression. Four of 78 needed repeat surgery. Visual acuity increased from a preoperative average of 0.50 ± 0.27 (range, 0.01–1.25) to 0.75 ± 0.21 (range, 0.01–1.25) postoperatively. An average reduction of proptosis of 3.94 ± 2.73 mm (range, −1.0–11.0 mm) was achieved with a mean preoperative Hertel measurement of 22.19 ± 3.13 mm (range, 15–34 mm). Ocular motility was corrected by recession of the medial rectus muscle in 58 of 78 cases. Twenty-six of these 58 cases were simultaneously operated on in the same surgical session immediately after the transnasal decompression, and the others after a period of 2 to 3 months.

Conclusions: The transnasal orbital decompression procedure improved vision, decreased proptosis in a range comparable to more invasive techniques, and had favorable cosmetic results without additional disfiguration by scars. Morbidity was far less than with other approaches. Postdecompression strabismus was successfully managed by recession of both medial orbital muscles in the same surgical session. *Ophthalmology 2001;108:400–404 © 2001 by the American Academy of Ophthalmology.*

Compressive optic neuropathy (CON) with visual loss is the most serious clinical sign encountered in Graves' ophthalmopathy. This severe ophthalmopathy is caused by an increase in volume of the orbital contents, particularly of the extraocular muscles and extrabulbar fat tissue. Presenting signs may include loss of visual acuity, visual field defects, dyschromatopsia, and exposure keratopathy. The pathophysiology of Graves' disease has not yet been clarified. Autoimmunity against eye muscle and orbital fat antigens have been proposed.[1] At the onset of the disease, the inflammatory response of the extraocular muscles may be diminished by corticosteroids, radiotherapy, or immunosuppressive drugs. Later, when fibrosis has set in, medical treatment fails. If treatment fails or is contraindicated, surgical decompression is indicated to relieve CON.

The standard approaches are transfacial, include bone removal, and are relatively invasive. None of the decompression techniques are able to cure the disease but only reduce vision-threatening nerve injury. Any additional stigmatizing effects stemming from interventions should be minimized, especially in desperate and psychologically affected patients, mostly women.[2]

In the past 10 years, two new approaches have been introduced: transpalpebral fat removal and transnasal decompression. Fat removal, promulgated by Olivari,[3] consists of the elimination of orbital fat cells, reducing the soft tissue volume and, consequently, the pressure on the optic nerve. The restrictions of this technique are that only the anterior parts of the orbit can be surgically reached, the lower lid position frequently needs to be corrected, and the

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operation must be carried out unilaterally because of the risk of bleeding complications and possible blindness. Because of the enlargement of the extraocular muscles, which directly contact the optic nerve in the orbital apex, this technique has a limited role. It is used primarily to correct the cosmetic appearance rather than to reverse the compressive neuropathy.[4]

In 1991, we described the method of transnasal orbital decompression (TOD) and reported the results of the first 13 subjects[5] shortly after Kennedy et al[6] published an expedited report of eight subjects, of whom only two were completely transnasally decompressed.

Our series is comprised of 145 eyes (78 subjects) that underwent TOD as our approach of choice for severe Graves' ophthalmopathy with compressive optic neuropathy.

To assess the long-term outcome and the limits of this method, a retrospective chart review was conducted.

Subjects and Methods

Transnasal orbital bone decompressions on 145 orbits of 78 subjects (mean age, 52 ± 10.3 years; range, 24–83 years) were performed from October 1989 to December 1998. In all cases, decompression was recommended by an ophthalmologist and carried out on subjects with rapidly decreasing vision caused by CON or with corneal ulceration or other severe symptoms. All subjects were examined by an endocrinologist and had previously received conservative treatment either with corticosteroids (mostly 1 mg prednisolone equivalent per kg body weight as a daily application for 5 days, then tapered), radiotherapy (16 to 20 Gy, administered in low doses), or a combination of both.

Preoperative and postoperative neuroophthalmologic examinations were performed at the Department of Neuroophthalmology and Motility Disturbances. A diagnosis of CON was made by consideration of the following findings: visual acuity—decrease in visual acuity not explained by the refractive state or anterior segment findings; defective visual fields with no prior record of glaucoma, neurologic disease, or other medical history; presence of optic disc congestion or signs of retrobulbar compression (e.g., choroidal folds) were taken as criteria of CON. In all subjects Goldmann perimetry was performed. In cooperative candidate subjects, Humphrey perimetry was done in addition. Diagnostic evaluations included magnetic resonance imaging or scanning computed tomography of the sinuses and orbits to clarify the anatomic situation, to rule out sinusitis, and to document compression of the optic nerve, especially in the apical region of the orbit.

We followed the intervention previously described.[5] Intranasal hemostasis was achieved by coagulation with bipolar forceps and temporary packing.

All subjects were examined in conjunction with an ophthalmologist. Nasal cavities were endoscopically inspected, and the findings documented. To evaluate the subject's satisfaction with the surgical treatment and its result, a questionnaire was completed. The questionnaire included a visual analog scale and a structured interview. In the visual analog scale, the complaints were categorized from 0 (no problems) to 100 (extreme problems). All items were evaluated by descriptive statistical analysis, including preoperative and postoperative mean visual acuity and exophthalmometry. A graphical display was used to obtain an overview of the whole group.

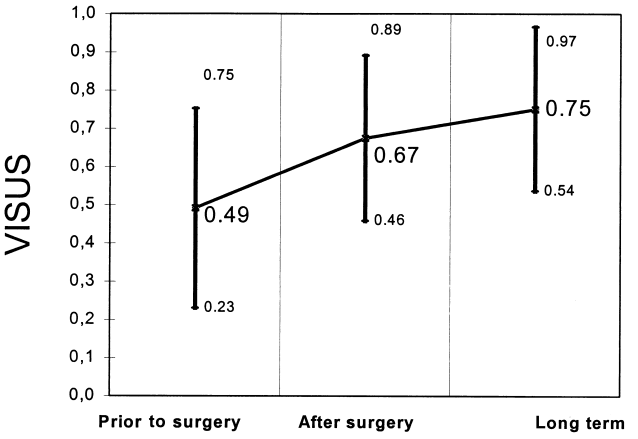

Figure 1. Improvement of visual acuity prior to endonasal decompression, two days post and in the long-term (over 6 months) in n = 145 eyes.

Results

Since 1989, TOD was performed on 145 eyes in 78 subjects (63 women, 15 men) with CON. In 15 cases unilateral decompression was carried out.

Follow-up

Follow-up examination data range from 6 to 116 months postoperatively, with an average of 41.5 months. Forty-one subjects were reexamined and responded to the questionnaire, 18 subjects responded only to the questionnaire, 2 subjects had died, and 17 subjects were lost to follow-up. Thus, a total of 59 questionnaires could be evaluated.

In four cases, one with a primary unilateral procedure, reintervention was required three times unilaterally, when the visual acuity declined 6 months after the initial decompression. In all cases, unexpected extensive mucosal scars were the reason for surgical revision.

Presenting Symptoms

Sixty-one (78.2%) subjects had CON, three (3.8%) had corneal involvement, six (7.7%) had singular extraocular muscle involvement, seven (11.5%) had corneal and extraocular muscle involvement, and one African woman was operated on transnasally for cosmetic reasons to avoid keloid formation.

Before surgery, 69.2% of the subjects received high-dose steroids, 46.2% received bilateral orbital radiotherapy, and 12.8% of subjects underwent a transpalpebral fat resection *alio loco*.

Vision

Vision improved from 0.50 ± 0.27 to 0.67 ± 0.22 directly after the intervention. In the follow-up examination it was noticed that three subjects experienced a decrease in vision, which was due to additional cataract, glaucoma, or maculopathy. In no case was the decrease a result of the surgical procedure. In the measurements taken 6 months after intervention, an additional increase in visual acuity was noted, to an average of 0.75 ± 0.21. The change totaled 0.25 (Fig 1). The change in visual acuity for individual subjects is depicted in Figure 2.

Hertel

The changes in ocular protrusion measured by the Hertel exophthalmometer were determined by comparing the immediate post-

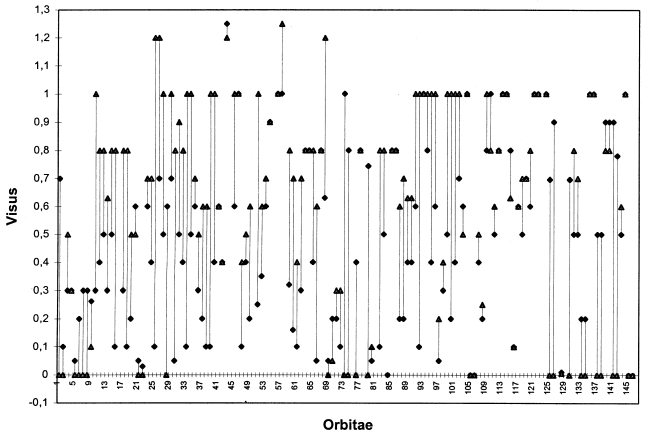

Figure 2. Change in visus for all decompressions (n = 145).

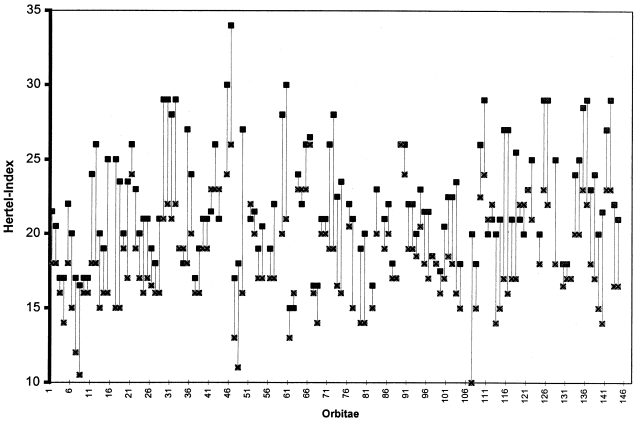

Figure 4. Change in proptosis for all patients.

operative measurements with measurements 2 days postoperative, which decreased from an average of 22.19 ± 3.13 mm (range, 15.0–34.0 mm) to 19.16 ± 2.74 mm (range, 10.5–31.0 mm).

Measurements more than 6 months after TOD showed additional reduction compared with the initial results at an average of 18.3 ± 2.65 mm (range, 10.0–26.0 mm). The protrusion of the eyes decreased in total an average of 3.94 mm (range, −1–11 mm) (Fig 3). The change in proptosis for all subjects is given in Figure 4.

No correlation between recession in the Hertel measurement and improvement in visual acuity could be found by statistical analysis (Fig 5).

Ocular Motility Imbalance

Ocular motility imbalance was found in 53.7% before the intervention and increased to 81.2% immediately after decompression. At the beginning of our series, corrective eye muscle surgery was performed 3 to 4 months after the decompression. Later, 26 subjects received recession directly after decompression during the same surgical intervention. Two surgeons (AN and WR) performed the operations with fixed sutures. The recession of the medial rectus muscle varied from 4.0 mm to 7.0 mm on both sides, depending on the preoperative angle of the squint and preoperative motility.

In total, 58 (74.4%) subjects required recession. A field free of double vision within margins of 20° in each direction could be achieved in 31 of 58 subjects after the initial operation and in the rest of the subjects after additional operations.

Complications and Side Effects

Total intraoperative blood loss was 100 to 200 ml on average and did not exceed a maximum 1000 ml. Postoperative nasal packing was removed within 24 hours. Hospitalization was required for 6 days. Theoretical complications, such as failure of effect in optic nerve decompression, cerebrospinal fluid leakage, dacryostenosis, visual loss, and ocular motility disturbance caused by extraocular eye muscle injury, were not seen. In one subject, who had an extensive decompression (−8 mm), an obstruction of the middle meatus occurred with a consequent obstructive maxillary sinus disease. This problem was solved by the surgical opening of the nasoantral window in the lower meatus. This remedy was regularly repeated, because the orbital tissue tended to fill out the entrance of the maxillary sinus. In another case, frontal sinusitis was noticed 2 months postoperatively. This was due to a blockage of the frontonasal recess caused by orbital fat. In the ensuing cases, this type of complication was avoided by omitting the resection of the periosteum in this anatomic region.

Persistent infraorbital nerve compromise was observed in 4 of

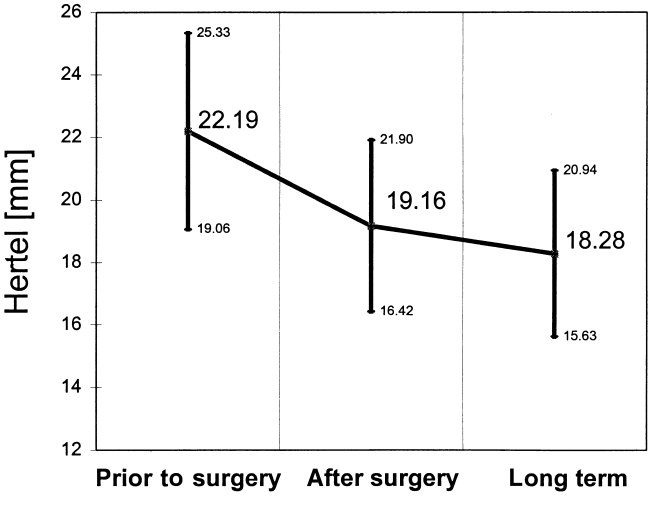

Figure 3. Change in Hertel-measurement prior to endonasal decompression, two days post and long term (over 6 months) in n = 145 eyes.

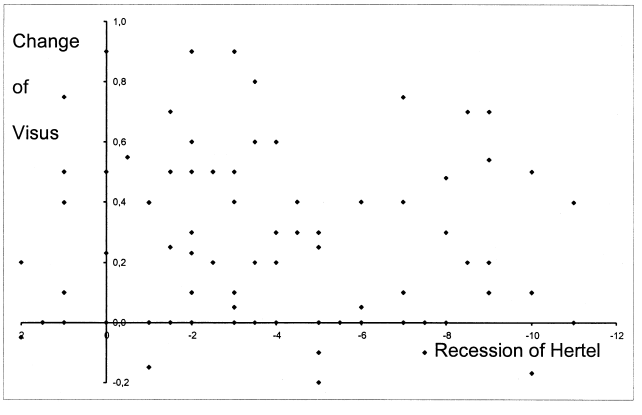

Figure 5. Statistical analysis between recession of Hertel measurement and change in visual acuity as obtained post surgery: no correlation.

the 78 subjects. No direct postoperative bleeding or infection of the orbital contents occurred.

Further Treatment

A stabilization of the parameters named was usually achieved within 1 week. Binocularity was achieved in most cases when a combined surgery was performed.

Of the 45 subjects who took corticosteroids before the operation, only 8 received corticosteroids afterwards. None of the subjects needed radiotherapy postoperatively.

Subjective Assessment

Subjects reported improvement in both appearance and comfort. In visual analog scale the average was 79.9 ± 20.3 for subjective contentment with the success of the intervention regarding life quality. The major and most impressive result was, in the opinion of the subjects, the often immediate (on the following day) and noticeable increase in visual acuity. Only one subject was affected by decreased sense of smell; 34.8% of the subjects complained of a dry nose; and 50.0% noticed increased crusting.

Discussion

Among the various techniques described for surgical decompression in endocrine CON, the favored and most common procedure employs a transfacial (transconjunctival) or transantral approach.[7] Several studies have documented the success of this method not only in CON[8–10] but also in disfiguring exophthalmos.[2] In rhinology, the external approaches to the paranasal sinuses have been abandoned in favor of the endonasal endoscopically controlled techniques.[11] Within the last 10 years, members of our department performed more than 8000 endonasal interventions because of sinus disease. The increase in our experience led us to begin strictly TOD in 1988. When we were convinced of the efficacy of this new approach, we published the results of the first 13 subjects in 1991.[5] Shortly before the expedited publication of Kennedy et al,[6] concerning two endonasally treated patients, appeared.

The advantages of the endonasal approach include avoiding bone removal and lessened morbidity compared with external ethmoidectomy or transantral surgery. There is also less dysesthesia of the infraorbital nerve, with fewer tooth problems and cosmetic disfiguring by uncontrolled scars.[12,13]

This series of 145 decompressions is the largest series reported and reflects our experience with this technique. In all subjects, acute visual loss by CON or severe keratopathy was the only indication for the intervention. No intervention was performed for cosmetic reasons or disfigurement except in one young black woman.

The extent of decompression did not correlate with gain of acuity and thus for the decompression of the optic nerve. We believe that the lack of correlation between the amount of decompression and the improvement in visual acuity relates to the role of the orbital apex in causing optic nerve compression.

The orbital apex is reached and visualized by the rigid 4-mm 30° and 2.7-mm 70° telescopes. The orientation and identification of anatomic landmarks within the sinus is facilitated by preoperative computed tomography, which is highly recommended when this technique is used.

As an undesired side effect of the surgical decompression, diplopia may develop and worsen postoperatively. We observed this phenomenon in 81.2% of the subjects. Increase in diplopia also occurs in transcutaneous techniques and is explained mainly by the restriction and impaired contractility of the swollen, fibrous extraocular muscles and also by the postoperative anatomic displacement of the medial rectus muscle.[14]

In a series of 305 subjects with dysthyroid exophthalmopathy undergoing TOD, Warren et al[15] reported that immediate postoperative diplopia was noted in 206 subjects. The diplopia is always mostly horizontal because of the predominant myopathy of the medial rectus.[16] When binocular vision is not spontaneously regained, corrective ocular muscle surgery some months later may restore function, as in 69 subjects in the series of Warren et al[15] and in 76% to 89% of 38 subjects in the series of Mourits et al.[17] Although the individual outcome cannot be predicted, every subject with Graves' ophthalmopathy has nearly a 90% chance of binocular single vision after extraocular muscle surgery. The chance of retaining binocularity is even higher when ocular motility imbalance is not present before the intervention.

The analysis of our cases showed that induction of horizontal strabismus was similar to that with other approaches. Upgaze and downgaze did not show any major change. The immediate postoperative results proved to be stable for the period of follow-up.[18] Encouraged by the stability of muscle function, we have performed recession of the medial rectus muscle immediately after decompression in 26 cases (report in preparation).

Most recently, the transpalpebral removal of orbital fat has been recommended to relieve symptoms of Graves' orbitopathy, with nearly no side effects in regard to binocular fusion.[3] Whether or not this approach is suitable for CON is still under discussion. The protagonists argue that an intraconal "shift" of fat decreases the pressure on the optic nerve in the "crowded" region of the orbital apex and that less motility disturbances occur because of the "symmetric" removal of fat around the globe. Critics doubt that this method can relieve optic nerve compression in severe cases and point out potential risks, the time-consuming preparation, the two-stage operation, and a higher rate of lower lid corrections.[4] Indeed, a careful analysis of the statistics of Olivari[3] and Stark and Olivari[19] reveals that the percentage of Werner class V and VI of their series was less than 2%, which means that CON and ocular motility disturbances have been rare (both the majority in our series). Because of limited efficiency in decompression of the apex, the main indication will therefore be cosmetic in functionally less severe cases.[20] The reductions of proptosis range between an average of 1.8 mm and 5.9 mm.[3]

The extent of decompression obtained in our series was comparable to classic transfacial techniques and to other series.[12] Globe retrodisplacement depended not only on the configuration and diameter of the bony opening but also on the amount of removal of the periosteum and the compli-

ance of orbital tissue. Patients with a long history of Graves' ophthalmopathy, older age, and previous radiotherapy showed more severe fibrosis and a lesser degree of reduction of proptosis because of a greater "stiffness" of the orbital tissue.

After TOD, the orbital contents epithelialized quickly during the postoperative period. The cleaning of the cavities is of major importance to the final surgical result. In addition, aeration remained stable over the longest period of postoperative survey of 5 years. Surprisingly, an inflammation of the orbital contents was not displayed on drainage of the frontal sinuses when established by a lesser degree of decompression in this area.

The results of the follow-up corroborate that the advantages of the TOD lie in the absence of any scars, which may rarely become prominent in the vicinity of the lids, the absence of bony defects in the maxilla, and the avoidance of later complications and morbidity such as in lasting postoperative hypesthesia, oroantral fistula (3.3% requiring surgical closure), tooth problems, nasolacrimal drainage system obstruction,[21] and facial swelling.

Even complications described for the transantral approach, such as cerebrospinal fluid rhinorrhea[15,22] (with pneumocephalus) and oroantral fistula,[15] may be avoided using telescopes for direct visualization. In summary, the main advantages of TOD include good functional results and few side effects.

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