Surgical Treatment Modalities of Thyroid Ophthalmopathy

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This report presents the use of various surgical treatment modalities in patients who were diagnosed as having thyroid ophthalmopathy. The records of 53 patients who received surgery because of thyroid ophthalmopathy at the Department of Ophthalmology, Yonsei University College of Medicine between Sept. 1996 and Jan. 2000 were retrospectively evaluated. Among the 53 patients, there were 30 females and 23 males. The mean ages of the patients were 40.8 ± 17.1 years. Orbital wall decompression (52.8%) was the most frequently performed surgery followed by lid surgery (49.1%) and strabismus surgery (26.4%). Only one type of surgery was performed on 86.8% of the patients while 13.2% received more than one type of surgery. Among the many different types of surgeries possible in patients that have thyroid ophthalmopathy, orbital wall decompression, lid surgery, and strabismus surgery are the most commonly used surgical methods for treatment.

Key words: thyroid ophthalmopathy, Graves' ophthalmopathy, orbital wall decompression, lid surgery, strabismus surgery

INTRODUCTION

Thyroid ophthalmopathy is an inflammation accompanied by the deposition of extracellular matrix components, in particular glycosaminoglycans. This results in an increase of the orbital volume contents which leads to periorbital swelling, extraocular muscle dysfunction, a disfiguring proptosis, exposure keratitis, increased intraocular pressure, and optic nerve compression. It is also known to be the most common cause of exophthalmos in adults with bimodal peak incidence rate at the age groups 40 to 44 years and 60 to 64 years in women, and 45 to 49 years and 65 to 69 years in men. The natural course of thyroid ophthalmopathy is characterized by an acute phase, with exacerbation and remissions that evolve into a static phase over a period of months to years. Treatment modalities generally consist of conservative management, medical therapy, radiotherapy, and surgery. Surgical management involves orbital decompression, surgery on the extraocular muscles, and eyelid surgery. It is known that the treatment of the ophthalmopathy whether by surgical or non-surgical means and the dysthyroid state seem to be independent of one another. Therefore, a systemic treatment of the dysthyroidism may have no effect on the state of the ophthalmopathy. In this report, we present a retrospective review of patients who had thyroid ophthalmopathy to illustrate the types of surgical procedures that are used and the results of such surgical interventions.


**Table 1.** The percentage of surgery alone vs. combined for each surgical procedure

<table>
<thead>
<tr>
<th></th>
<th>Alone</th>
<th>Combined</th>
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<tr>
<td>Orbital wall decompression</td>
<td>67.9%</td>
<td>32.1%</td>
</tr>
<tr>
<td>Lid surgery</td>
<td>65.4%</td>
<td>34.6%</td>
</tr>
<tr>
<td>Strabismus surgery</td>
<td>71.4%</td>
<td>28.6%</td>
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**Table 2.** The average reduction amount of exophthalmos after decompression surgery

<table>
<thead>
<tr>
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<th>Average reduction amount (mm)</th>
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<tbody>
<tr>
<td>Medial wall decompression</td>
<td>1.2</td>
</tr>
<tr>
<td>2 wall decompression</td>
<td>3.6</td>
</tr>
<tr>
<td>2 wall &amp; fat decompression</td>
<td>4.4</td>
</tr>
<tr>
<td>3 wall decompression</td>
<td>4.7</td>
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</tbody>
</table>

**MATERIALS AND METHODS**

The records of 53 patients who received surgery at the Department of Ophthalmology, Yonsei University College of Medicine between Sept. 1996 and Jan. 2000 due to thyroid ophthalmopathy were retrospectively evaluated. The 53 patients consisted of 30 females (56.6%) and 23 males (43.4%). The mean age of the patients were 40.8 ± 17.1 years ranging from 8 to 70 years. Thyroid ophthalmopathy was diagnosed according to the diagnostic criteria for Graves’ ophthalmopathy that has been proposed by Bartely et al. such that if the presence of eyelid retraction occurred in association with objective evidence of thyroid dysfunction or abnormal regulation, exophthalmos (a Hertel exophthalmometry measurement of 20 mm or more), optic nerve dysfunction, or extraocular muscle involvement. If eyelid retraction was absent, then thyroid ophthalmopathy was diagnosed only if an exophthalmos, optic nerve involvement, or restrictive extraocular myopathy was associated with a thyroid dysfunction or abnormal regulation and if there was no other apparent cause for the ophthalmic features. Among the 53 patients who fulfilled our diagnostic criteria of thyroid ophthalmopathy, 48(91%) patients presented eyelid retraction in combination with the necessary diagnostic features. These patients were retrospectively reviewed with respect to the type and results of their surgical treatments.

**RESULTS**

Among the 53 patients, 28 patients (52.8%) underwent orbital wall decompression surgery. Nineteen patients (67.9%) received orbital wall decompression surgery alone (3 received three-wall, 4 received medial wall, 6 had two-wall decompression, and 6 had two-wall with fat decompression surgery). The other 9 patients received orbital wall decompression surgery and later an additional strabismus surgery (2 patients) or lid surgery (7 patients) (Table 1). The reasons for the orbital wall decompression surgery were because of optic nerve compression in 12 patients (42.9%), corneal problems such as exposure keratitis and ulcers in 10 patients (35.7%), and for cosmetic problems in 6 patients (21.4%). Among the 12 patients who received orbital wall decompression surgery because of optic nerve compression, the pre-operative visual acuity in 10 patients was below 20/50. After the operation, 11 out of 12 patients had an increase of vision with the best-corrected visual acuity above 20/30 in 10 patients and had an average increase of 4 visual acuity lines. The average preoperative amount of exophthalmos was 20.7 ± 3.3 mm. Medial wall decompression resulted in an average reduction of 1.2 mm, two wall decompression resulted in an average reduction of 3.6 mm, two wall with fat decompression resulted in an average reduction of 4.4 mm, and three wall decompression resulted in an average reduction of 4.7mm 6 month after the operations (Table 2).

Of the 53 patients who received surgery because of thyroid ophthalmopathy, 21 patients (39.6%) were observed to have extraocular muscle limitations or heterotropic deviations preoperatively. However, only 14 (26.4%) patients underwent a muscle operation; 10 patients received strabismus surgery alone while 4 patients received strabismus operation after an orbital wall decompression (2 patients) or preceding lid surgery (2 patients). The type of heterotropia that occurred in the surgery group was hypotropia in 50.0% who had an average prism diopter of 28.8 ± 12.2, esotropia in 21.4%
Table 3. The type and amount of ocular deviation in patients who received strabismus surgery

<table>
<thead>
<tr>
<th>Deviation</th>
<th>Patients (%)</th>
<th>Prism dioptr (average)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Esotropia</td>
<td>3 (21.4)</td>
<td>58.3 ± 15.2</td>
</tr>
<tr>
<td>Hypotropia</td>
<td>7 (50.0)</td>
<td>28.8 ± 12.2</td>
</tr>
<tr>
<td>Esotropia &amp; Hypotropia</td>
<td>4 (28.6)</td>
<td>34.0 ± 16.1</td>
</tr>
</tbody>
</table>

who had an average prism dioptr of 58.3 ± 15.2, and there was esotropia combined with hypotropia in 28.6% patient that had an average esotropic prism dioptr of 34.0 ± 16.1 and an average hypotropic prism dioptr of 21.0 ± 14.6 (Table 3). Surgery consisted of an inferior rectus muscle recession for the hypotropia and a medial rectus muscle recession for the esotropia which resulted in a post-operative EOM of “straight” at near and at distance in 9 patients and a residual hypotropia (25 PD, 80 PD, 10 PD) and esotropia (30 PD, 25PD) in 5 patients.

Lid surgery was performed on 26/53 patients (49.1%). Lid surgery alone was performed on 17 patients (15 levator resections, 1 levator recession with mullerectomy, 1 mullerectomy) followed other operations in 9 patients. The average amount of lid retraction was 3.1 ± 1.5 mm before the operation. In 23 of 26 patients (88.5%) who received lid surgery, the upper lid margin rested below the limbal margin 6 months after operation.

**DISCUSSION**

In the majority of patients who have thyroid eye disease, signs and symptoms are transient and respond to only observation or conservative therapy. Perros et al. noted that 64.4% of patients with thyroid eye disease improved without having treatment. The discomforts from exposure keratopathy can be conservatively managed by using artificial tear drops, ointment instillation, the use of tinted glasses with side shields, nightly lid taping, or a bubble patch placement over an ointment salve. Head elevation, especially while asleep, decreases lid edema and prism glasses can occasionally alleviate a mild diplopia.

In many cases, surgical treatment is necessary for the rehabilitation of patients. Indications for orbital decompression include a longstanding and severe proptosis, especially if it is unresponsive to glucocorticoids and/or orbital radiotherapy and if an exposure keratitis is present, and there is optic neuropathy caused by compression of the optic nerve. Severe proptosis and optic neuropathy represented 41% and 39%, respectively, of the indications for decompression in a survey of American ophthalmologists. The remaining 20% were submitted for surgery because of cosmetic reasons. Similarly, we found that optic neuropathy (42.9%) was the most common reason for decompression followed by corneal problems caused by proptosis (35.7%) and for cosmetic reasons (21.4%). The treatment of optic neuropathy must incorporate the release of crowding at the orbital apex. To enhance the effects of decompression, the medial wall must be completely removed up to the apex in order to obtain the effective maximal space. Most surgeons achieve this goal by a two-walled decompression that involves the removal of the orbital floor and medial wall to the orbital apex. Because of the prompt release of the pressure on the optic nerve, visual acuity increases 76% to 94%. The visual increase in our review occurred in 11/12 patients (91.7%) who had an average increase of 4 visual acuity lines. The amount of globe retrorplacement after orbital decompression appears to vary from patient to patient and does not correlate with the type of decompression or the amount of bone or fat that is removed.

However, a review of the literature leads to generalizations such as that a two-walled decompression reduces the exophthalmos by about 3 to 7 mm, a removal of a third wall adds about 3 to 4 mm, and a four-walled decompression can give a total reuction of up to 14 to 17mm. Our review showed that a three-wall decompression had the greatest amount of reduction (4.7 mm) followed by two-wall with fat decompression (4.4 mm), a two wall decompression (3.6 mm), and a medial wall decompression (1.2 mm). These differences may be, in part, due to the variation in the amount of fat and muscle increase among patients and also because Asians are known to have a more compact orbital configuration.

Ocular motility problems such as acute or chronic processes or both may occur. Approximately 9% to 15% of all patients with thyroid ophthalmopathy
have a symptomatic restrictive ocular motility disorder, which is most commonly impaired in the up gaze due to a tight inferior rectus muscle. Of those patients who had undergone orbital decompression, 5% to 70% eventually required treatment for restrictive ophthalmoplegia. 39.6% of those patients in our study who received surgery of some type showed an extraocular muscle limitation or heterotropias. Although mere observation, prisms, patching, and botulinum toxin can lessen diplopia, extraocular muscle surgery is the definitive treatment. Nevertheless, Burch et al. state that more than 40% of patients may require two or more surgical procedures to achieve single binocular vision in the primary and reading positions. Only 21.4% of our patients underwent two or more strabismus operations, yet 5 of 14 had presented significant residual deviations after operation. Patients who have exophthalmos may benefit from orbital decompression prior to muscle surgery because the muscle recession may increase the amount of proptosis and cause an exposure keratopathy. Due to the spontaneous resolution of strabismus during the acute phase of thyroid ophthalmopathy and the progressive nature of the problem, most authors recommend that there be a waiting period of up to 6 months or more after the motility measurements stabilize before proceeding with the strabismus surgery. However, Coats et al. reports favorable outcomes after strabismus surgery in selected patients with marked disability during the documented period of instability of ocular alignment. The average pre-operative follow up before operation was 4.86 ± 2.43 months in our case review which tends to suggest an earlier operation than the recommended 6 months waiting period.

Retraction of the eyelids is the most frequent sign of thyroid ophthalmopathy and Bartley et al. reports that 12.5% patients required surgical repair of the eyelid retraction to improve the appearance as well as to alleviate the exposure keratopathy. Rhee et al. also reported that the most frequent sign they observed was an upper lid retraction (90%). In our review, lid surgery was performed in 26/53 patients (49.1%). Unless a severe exposure keratopathy is present, any eyelid surgery should be delayed until any orbital inflammation subsides and the eyelid position remains stable for at least 6 months. This must postdate orbital decompression and muscle surgery. A myriad of surgical procedures to alleviate upper eyelid retraction exist. In general, the surgical approach adopted depends on the degree of upper lid retraction, such that 1 to 2 mm of a superior or scleral show responds adequately to Müller’s muscle excision or recession and a greater than 3 mm of superior scleral show responds adequately to Müller’s muscle and levator surgery. Variations in techniques continue to evolve to improve the postoperative contour, symmetry, and height in order to reduce the re-operation rate. The patients who received lid surgery in our case review had upper lid surgery involving levator recession, mullerectomy, and lateral canthoplasty.

Our clinical review showed thyroid ophthalmopathy to generally be a disease of middle to older age yet can also involve patients at young ages and shows a higher incidence in females. Although a significant number of patients can be treated conservatively, most of the patients required some type of surgery. Orbital wall decompression (28/53 patients; 52.8%) was the most frequently performed surgery followed by lid surgery (26/53 patients; 49.1%) and strabismus surgery (14/53 patients; 26.4%). One type of surgery alone was performed on 46/53 (86.8%) of the patients while 7 patients (13.2%) received more than one type of surgery. Analysis of our data also showed that among the patients who received more than one type of surgery, there were a noticeably greater number of males than females (9:5). Kendler et al also reported that thyroid orbitopathy was a disease that was more common in younger women, yet more severe, by most indexes, in men and patients who were older than 50 years. The fact that a more severe disease course occurs in the elderly and in men, this should prompt more careful monitoring of these patients and perhaps lead to an earlier definitive intervention. Controlled prospective clinical trials with rigorous documentation of clinical outcomes are needed to determine the optimal treatment modalities in patients likely to have a worsening disease course. This may point to a greater degree of disease severity in males or may just be the result of a treatment procrastination of men. In any case, optimal therapy for thyroid ophthalmopathy patients requires careful planning, timing, and tailoring of the currently available treat-
ment modalities. Although difficult to cure, a conservative treatment and surgery helps in controlling the ophthalmic manifestations that are associated with thyroid ophthalmopathy.

REFERENCES


