INTRAOCULAR PRESSURE AFTER TREATMENT FOR THYROID-ASSOCIATED OPHTHALMOPATY

RESUMEN

Objetivo: Evaluar los cambios en la presión intraocular (PIO) en pacientes afectos de oftalmopatía tiroidea (OT) tratados mediante descompresión orbitaria, cirugía sobre músculos extraoculares, o pulsos endovenosos de 6-metil-prednisolona.

Material y métodos: Se han analizado los datos de 31 pacientes que fueron tratados en nuestro Servicio entre 1998-2004. Las variables utilizadas han sido: edad, sexo, diagnóstico y tratamiento de glaucoma, uso de esteroides sistémicos, tipo de operación, PIO pre y postoperatoria en posición primaria de mirada (PPM) y posición en mirada hacia arriba (PMA).

Resultados: En los 20 ojos que se realizó descompresión orbitaria, la PIO media preoperatoria en PPM fue de 17.35 (3.86 SD) mmHg y de 22.45 (6.36 SD) mmHg en upgaze. La PIO postoperatoria fue 14.24 (3.43 SD) mmHg y de 18.20 (4.74 SD) mmHg en upgaze. En los 10 ojos de pacientes intervenidos de estrabismo, la PIO preoperatoria en PPM fue 18.9 (3.07 SD) mmHg y de 22.4 (6.14 SD) mmHg en upgaze. La PIO postoperatoria fue 16.6 (3.50 SD) mmHg y 18.6 (3.33 SD) mmHg en upgaze. En los 12 pacientes, 24 ojos, que recibieron pulsos la PIO en PPM era de 21.33 (4.38 SD) mmHg y de 24.45 (8.15 SD) mmHg en upgaze. After the treatment the mean IOP was 17.33 (4.38 SD) mmHg

ORIGINAL ARTICLE

ABSTRACT

Objective: To evaluate the change in the intraocular pressure (IOP) in subjects with thyroid-associated orbitopathy (TAO) treated with orbital decompression, extraocular muscle surgery or methylprednisolone pulse therapy.

Methods: The charts of 31 subjects with TAO who visited in our department between 1998 and 2004 were analyzed. Subject age, gender, diagnosis and treatment for glaucoma, use of systemic steroids, procedure performed and pre-operative and post-operative IOP in the primary position and in upgaze, were all evaluated.

Results: Of the 20 eyes that underwent orbital decompression, the mean pre-operative IOP was 17.35 (3.86 SD) mmHg and 22.45 (6.36 SD) mmHg in upgaze. The mean pre-operative IOP was 14.24 (3.43 SD) mmHg and 18.20 (4.74 SD) mmHg in upgaze. The mean pre-operative IOP in the 10 eyes who had strabismus surgery was 18.9 (3.07 SD) mmHg and 22.4 (6.14 SD) mmHg in upgaze. The post-operative IOP was 16.6 (3.50 SD) mmHg and 18.6 (3.33 SD) mmHg in upgaze. In the 12 patients treated with methylprednisolone pulse therapy, the mean pre-treatment IOP was 21.33 (6.42 SD) mmHg and 24.45 (8.15 SD) mmHg in upgaze. After the treatment the mean IOP was 17.33 (4.38 SD) mmHg

Received: 31/5/06. Accepted: 20/9/07.
1 Graduate in Medicine. Ophthalmology Resident.
2 Graduate in Medicine. Ophthalmology Service Assistant.
3 Ph.D. in Medicine. Service Chief.

Correspondence:
Jaume Crespí
C/. Castellnou, 42, 2-1
08017 Barcelona
Spain
E-mail: 38685jcv@comb.es
INTRODUCTION

Thyroid disorders may cause a series of ophthalmologic disorders called thyroid-associated orbitopathy (TAO), including glaucoma or ocular hypertension (OHT) (1), although its etiopathogenesis remains unknown. Several theories have been postulated: contraction of infiltrated and fibrous extraocular muscles against the eye globe, increase in episcleral venous pressure secondary to orbital congestion or increase in retrobulbar pressure may aid in increasing intraocular pressure (IOP) (2).

The purpose of the present study is to assess IOP changes in patients suffering from TAO that required treatment and to determine its impact on the evolution of glaucoma or OHT patients.

SUBJECTS, MATERIAL AND METHODS

The data under analysis referred to patients diagnosed with TAO at the ophthalmology unit in our hospital between January 1 1998 and December 31 2004. A retrospective review included 31 consecutive patients treated by means of orbital decompression surgery, surgery on extraocular muscles (EOM) or intravenous 6-methylprednisolone (6-MPDN) pulses. Patients for whom not all variables were available were excluded from the study, together with two other patients who suffered from pseudoexfoliation. The average age for the whole group was 48 (range: 28-73). Eighty-three percent of patients were females (26 females and 5 males). Table I shows these data, along with the treatment indication.

Overall, analysis included data obtained for 54 eyes from 31 patients. Ten patients had undergone decompression surgery (20 eyes), nine underwent EOM surgery (ten eyes: in eight, retroinsertion of the inferior rectus and in two, retroinsertion of the inferior and medial rectus), while twelve were administered corticoid pulses (24 eyes). In all cases, decompression surgery involved three orbital walls with bicoronal approach. During EOM surgery, the inferior rectus muscle was retroinserted sometimes in combination with a medial rectus muscle retroinsertion. In patients receiving corticoid pulses, doses were as follows: 500 mg of intravenous 6-MPDN pulses twice a day for three days. Subsequently, they were prescribed a decreasing pattern of oral corticoids, beginning at 40 mg and decreasing by 10 mg per week.

IOP before surgery was recorded 2 weeks earlier, while IOP after surgery was recorded one to two months later. In patients receiving pulses, it was recorded two to four months later. IOP was measured using Goldmann’s applanation tonometry and was always performed by the same ophthalmologist. OHT was diagnosed based on IOP values ≥21 mmHg in at least two instances. In patients previously diagnosed with glaucoma, this was defined as an increase in IOP and/or documented progression of papillary excavation or alteration of the visual field consistent with the thinning of the neuroretinal rim in absence of a comprehensive dysthyroid optic neuropathy. Table II summarizes the number of patients suffering from OHT or glaucoma.
ma, as well as the mean number, standard deviation (SD) and range of hypotensor drugs used.

Variables in the present study included: age, gender, diagnosis and glaucoma treatment, treatment with systemic steroids, type of procedure, IOP before and after treatment in gaze primary position (GPP) and in upwards gaze position (UGP).

Statistical Methods

All data were dumped in Microsoft Excel (Microsoft Inc., Redmond, WA, USA) for statistical analysis. The means and standard deviation were estimated. The two-tailed t-Student test was used, defining p < .05 values as statistically significant.

RESULTS

Orbital Decompression

The mean IOP after surgery for this group was 17.3 (SD: 3.86, range 12-25) mmHg in GPP and 22.45 (SD: 6.36, range 19-39) mmHg in UGP. After decompression surgery, the mean IOP was 14.25 (SD: 3.43, range 12-19) mmHg in GPP and 18.2 (SD: 4.74, range 12-33) mmHg in UGP, amounting to a decrease in IOP by 17.86 percent in GPP and by 18.93 percent in UGP (p < .005).

Results were also analyzed based on surgical indication, the presence of an IOP before surgery ≥21 mmHg and glaucoma patients.

Decompression surgery was advised for optic neuropathy in three patients (six eyes) and for proptosis in seven patients (14 eyes). Patients suffering from optic neuropathy showed a decrease in IOP by 20.37 percent (5 mmHg) in GPP, compared to the group of patients suffering from proptosis, whose IOP dropped by 13.5 percent (2.1 mmHg).

Four eyes whose IOP before surgery =21 mmHg recorded a mean IOP of 23.2 (SD: 1.07) mmHg in GPP while IOP after surgery stood at 13.75 (SD: 2.87) mmHg, a decrease for this subgroup amounting to 40.86 percent.

As for patients under hypotensor treatment for glaucoma (two patients, four eyes), mean IOP before surgery was 23 (SD: 2.16) mmHg in GPP and 15 after surgery (SD: 3.46) mmHg, a decrease by 34 percent (8 mmHg). The number of hypotensor drugs per eye for treated patients also dropped (from 1.55 SD 1.09 to 1.2 SD 0.57 drugs).

EOM Surgery

Mean IOP before surgery was 18.9 (SD: 3.07, range 16-24) mmHg in GPP and 22.4 (SD: 6.14, range 17-37) mmHg in UGP. Mean IOP after surgery was 16.6 (SD: 3.50, range 13-21) mmHg in

<table>
<thead>
<tr>
<th>Table I.</th>
<th>Decompression</th>
<th>EOM surgery</th>
<th>6-MPBDN pulses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years) m SD (r)</td>
<td>43.4 SD 5.44 (35-45)</td>
<td>49.9 SD 1.06 (37-61)</td>
<td>52.5 SD 3.66 (28-73)</td>
</tr>
<tr>
<td>Gender male/female (n)</td>
<td>10/0</td>
<td>7/2</td>
<td>9/3</td>
</tr>
<tr>
<td>Treatment indication (n)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dyplbia</td>
<td>Ø</td>
<td>9</td>
<td>Ø</td>
</tr>
<tr>
<td>Proptosis</td>
<td>7</td>
<td>Ø</td>
<td>Ø</td>
</tr>
<tr>
<td>Optic neuritis</td>
<td>3</td>
<td>Ø</td>
<td>1</td>
</tr>
<tr>
<td>Inflammatory disorder</td>
<td>Ø</td>
<td>Ø</td>
<td>11</td>
</tr>
</tbody>
</table>

n = number of patients; m = mean; SD = Standard Deviation; r = range.

Table II.

<table>
<thead>
<tr>
<th>Number eyes analyzed/OHT eyes (%)</th>
<th>Decompression</th>
<th>EOM surgery</th>
<th>6-MPBDN Pulses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eyes diagnosed with glaucoma (%)</td>
<td>20/4 (20%)</td>
<td>10/4 (40%)</td>
<td>24/11 (45%)</td>
</tr>
<tr>
<td>Number of eyes with hypotensor treatment (%)</td>
<td>4 (20%)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mean number of hypotensor drugs per eye in treated patients SD (range)</td>
<td>5 (25%)</td>
<td>1 (10%)</td>
<td>3 (12.5%)</td>
</tr>
</tbody>
</table>

EOM: Extraocular muscle; MPDN: Methylprednisolone; SD = Standard Deviation.
GPP and 18.6 (SD: 3.33, range 14-25) mmHg in UGP. This resulted in a decrease by 12.16 percent in GPP and 16.96 percent in UGP (p < .05). No statistically significant differences were found among both groups (inferior rectus surgery and medial and inferior rectus surgery). In those cases (four eyes) with IOP ≥ 21 mmHg, the mean IOP in GPP was 22 (SD: 1.41) mmHg and 27.75 (SD: 6.80) mmHg in elevation. Mean IOP after surgery for these patients was 19 (SD: 2.82) mmHg in GPP (decrease by 13.86 percent) and 20.75 (SD: 3.68) mmHg (decrease by 25.22 percent).

Corticoid Pulses

In total, 12 patients (24 eyes) were administered pulses. Mean IOP before treatment was 21.23 (SD: 6.42, range 13-39) mmHg in GPP and 24.45 (SD: 8.15, range 15-39) mmHg in UGP. Mean IOP after treatment was 17.33 (SD: 4.38, range 9-22) mmHg in GPP, a decrease by 18.75 percent (p = .0003). Mean IOP after treatment in elevation was 20.08 (SD: 4.86, range 13-26) mmHg, a decrease by 17.86 percent (p<.001).

In the subgroup of patients with IOP ≥ 21 mmHg (n=11), mean IOP was 26.63 (SD: 5.62) mmHg, and mean IOP after treatment dropped down to 19.72 (SD: 3.25) mmHg, that is, 25.94 percent less (p = .0008). The number of hypotensor drugs went from 1.25 SD 0.57 to 0.33 SD 0.57 drugs per eye. Results are summarized in table III.

### DISCUSSION

For more than eighty years, it is common knowledge that IOP may be increased in patients suffering from TAO (2). Several papers have also documented an increase in IOP in upward gaze in TAO patients due to fibrosis of the inferior rectus muscle, which blocks the output of aqueous humor through the episcleral vein and orbital congestion (2,3).

Nevertheless, very few papers in medical literature have addressed changes in IOP after TAO treatment. Ohtsuka et al (4) were the first to contribute some data when describing changes in IOP for 4 patients treated by means of orbital decompression. Danesh-Meyer et al (5) confirmed with the longest series of cases the decrease in IOP after treatment with orbital decompression and strabismus surgery, unlike orbital radiotherapy. Kikkawa et al (6) have also demonstrated a decrease in IOP with strabismus treatment using botulinum toxin.

The present study demonstrates that IOP decreases significantly after treatment with decompression and strabismus surgery. Furthermore, unlike radiotherapy (5), treatment with pulses has brought IOP down in the subgroup of patients analyzed.

The results obtained in the group undergoing orbital decompression match those published in other studies. IOP after surgery is lower, regardless of IOP before surgery (reduction by 17.86 percent), whereas in the subgroup of patients whose IOP > 21 mmHg, reduction is almost doubled (40.86 percent).

<table>
<thead>
<tr>
<th></th>
<th>Decompression</th>
<th>Strabismus</th>
<th>6-MPDN</th>
</tr>
</thead>
<tbody>
<tr>
<td>IOP before surgery, m SD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GPP</td>
<td>17.35 (SD: 3.86)</td>
<td>18.9 (SD: 3.07)</td>
<td>21.33 (SD: 6.42)</td>
</tr>
<tr>
<td>UGP</td>
<td>22.45 (SD: 6.36)</td>
<td>22.4 (SD: 6.14)</td>
<td>24.45 (SD: 8.15)</td>
</tr>
<tr>
<td>IOP after surgery, m SD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GPP</td>
<td>14.24 (SD: 3.43)</td>
<td>16.6 (SD: 3.50)</td>
<td>17.33 (SD: 4.38)</td>
</tr>
<tr>
<td>UGP</td>
<td>18.20 (SD: 4.74)</td>
<td>18.6 (SD: 3.33)</td>
<td>20.8 (SD: 4.86)</td>
</tr>
<tr>
<td>% Decrease</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GPP</td>
<td>17.86%</td>
<td>12.16%</td>
<td>18.75%</td>
</tr>
<tr>
<td>UGP</td>
<td>18.93%</td>
<td>16.96%</td>
<td>17.86%</td>
</tr>
<tr>
<td>IOP before surgery &gt; 21 mmHg</td>
<td>40.86% (in GPP)</td>
<td>13.86% (in GPP)</td>
<td>25.94% (in GPP)</td>
</tr>
<tr>
<td>Mean number of hypotensor drugs per eye</td>
<td>1.55 SD 1.09</td>
<td>1</td>
<td>1.25 SD 0.57</td>
</tr>
<tr>
<td>Before surgery M SD + R</td>
<td>(1-3)</td>
<td>(1-3)</td>
<td>(1-3)</td>
</tr>
<tr>
<td>Number of hypotensor drugs</td>
<td>1.2 SD 0.57</td>
<td>0</td>
<td>0.33 SD 0.57</td>
</tr>
<tr>
<td>After treatment M SD + R</td>
<td>(0-2)</td>
<td>(0-1)</td>
<td>(0-1)</td>
</tr>
</tbody>
</table>

In patients diagnosed with glaucoma, the average decrease was 8 mmHg and IOP values «went back to normal»; although the number of hypotensor drugs was lowered, treatment could not be completely suppressed. This suggests the existence of factors leading to an increase in IOP that are not adequately addressed with glaucoma drugs. Several theories have attempted to explain this decrease in IOP by orbital decompression. Riemann et al (7) performed direct orbital manometries on 18 orbits belonging to patients suffering from TAO and observed an increase in orbital tissue tension and the decrease in orbital compliance, resulting in increased retrobulbar pressure. Otto et al (8) measured retrobulbar pressure during decompression surgery in eight patients suffering from TAO, obtaining a mean pressure of 28.7 mmHg (in healthy individuals, pressure ranges from 3 to 4.5 mmHg) (9). After surgery, retrobulbar pressure was brought down to 18.7 mmHg. This suggests that OHT in patients suffering from TAO is partly due to the increase in intraorbital pressure and venous congestion, which would lead to increased episcleral venous pressure (EVP). When orbital congestion decreases in response to decompression surgery, EVP will also drop, along with IOP (Goldmann’s coefficient = aqueous input/output + EVP) (9).

Patients undergoing EOM surgery also registered a significant decrease in IOP. IOP decreased by 2.3 mmHg in GPP and by 3.8 mmHg in elevation. The outcome is very similar to that reported by Danesh-Meyer et al (5). Contraction of the superior rectus in elevation exerts pressure on the globe against a lower fibrous or inflamed rectus, leading to an increase in IOP in elevation. Patients whose inferior rectus suffers from a marked fibrosis tends to push the eye downwards and exert pressure in elevation in order to keep it in its primary position. This would result in an increased IOP in primary position through the same mechanism present in elevation.

As for patients treated with 6-MPDN pulses, IOP after treatment went from 3.9 mmHg in PPM down to 4.37 mmHg in elevation. In patients with IOP > 21 mmHg, IOP decreased by 25 percent. Rutecka-Debniak et al (10) reported a series of cases where systemic steroids proved to be more efficient than orbital radiotherapy to control patients with high IOP and TAO. Danesh-Meyer et al (5) found that orbital radiotherapy did not decrease IOP significantly. In patients suffering from TAO there is an increase in orbital content secondary to an increase in extraocular muscles, deposits of glycosaminoglycan and lymphocytic infiltration of orbital fat. Treatment with corticoids decreases inflammation in patients suffering from TAO by reducing the orbital volume. This could explain the decrease in IOP in these patients.

Therefore, one may conclude that treatment of TAO by means of orbital decompression (which mainly decreases orbital congestion), strabismus surgery (which decreases restriction over fibrotic muscles) and 6-MPDN pulses (which decrease orbital inflammation) have led to a significant reduction in IOP for all three groups. The most pronounced decrease in IOP was recorded among patients suffering from OHT or diagnosed with glaucoma. Thus, we believe that, after receiving treatment for TAO, the diagnosis of glaucoma and its treatment should be reassessed in these patients. However, randomized prospective studies are needed to confirm these findings.

REFERENCES


