OVERCORRECTION AFTER SURGERY FOR UNILATERAL SUPERIOR OBLIQUE PALSY

HIPERCORRECCIONES QUIRÚRGICAS DE LAS PARÁLISIS UNILATERALES DEL OBLICUO SUPERIOR

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ABSTRACT

Purpose: To study causes of overcorrection after surgery for unilateral oblique superior palsy and treatment options.

Methods: Nine cases with overcorrection following surgery for unilateral oblique superior palsy between 2004 and 2006 were identified. Their causes were divided into three types: excessive surgery, bilateral masked palsy and antielevation or adherence syndrome. Treatment was required when there was diplopia in primary and reading positions. A good result was achieved if vertical deviation was inferior to 5 prismatic diopters (PD) in primary position (PP) and 10 PD in oblique diagnostic positions.

Results: Overcorrection was present in 27.27% of cases. Mean hyperdeviation was 17 PD in PP, 18.4 in oblique positions and 25.22 for the Bielschowsky test. Seven patients underwent two-muscle surgery, and topical anaesthesia was used in eight patients. Overcorrection was diagnosed between 15 days and 6 months following surgery. The etiology was distinct, with 2 patients with bilateral masked palsy, 2 with antielevation or adherence syndrome, and 5 with excessive surgery. Surgical intervention was performed in 6 cases and botulinum toxin used alone.

RESUMEN

Propósito: Estudiar las causas de la hipercorrección quirúrgica de las parálisis unilaterales del oblicuo superior (POS), y su tratamiento.

Material y método: Se identificaron nueve casos con hipercorrección clínicamente significativa intervenidos de POS entre 2004-2006. Se analizaron sus causas dividiéndolas en tres patrones: exceso de cirugía, parálisis bilateral enmascarada y síndrome adherencial o antielevación. Se realizó tratamiento si había diplopía en PPM (posición primaria de la mirada) o en posición de lectura. Se consideró buen resultado la eliminación de la diplopía y una desviación vertical menor de 5 dp (dioptrías prismáticas) en PPM y menor de 10 dp en posición diagnóstica de los músculos oblicuos.

Resultados: El porcentaje de hipercorrecciones quirúrgicas de la POS fue del 27,27%. La hipertropía media preoperatoria fue de 17 dp en PPM, de 18,44 en posición diagnóstica de oblicuos y de 25,22 en la maniobra de Bielschowsky. En siete pacientes se operaron dos músculos. Se empleó anestesia tópica en ocho enfermos. La hipercorrección ocurrió entre los 15 días y los 6 meses de la cirugía. Sus causas fueron: parálisis bilateral enmascarada (dos casos), síndrome antielevación o adherencial (dos casos), y...
INTRODUCTION

Treatment of unilateral superior oblique (SO) palsies is predominantly surgical. The objective is to remove diplopia in the primary gaze position (PGP) and in reading position, eliminating or reducing vertical deviation in PGP and in diagnostic positions in which hypertopia (Ht) is greater, correcting torticollis (1,2). The surgical technique and number of muscles to be intervened is a matter for debate, although some patterns based on preop diagnostic have been published (1-3). Even though the results of said surgery are generally satisfactory, they can also be unpredictable with a higher percentage of hypo-corrections than hyper-corrections (3-7).

The instant article presents nine cases of postsurgical hyper-corrections of unilateral superior oblique palsies, carried out between 2004 and 2006. The causes and treatment are analyzed below.

SUBJECTS, MATERIAL AND METHODS

A retrospective study was made of nine cases identified for surgical hyper-correction out of 33 unilateral superior oblique palsies which were operated in our hospital between 2004 and 2006.

Surgical hyper-correction was defined as an inversion of hypertopia to hypotropia (Ht) over 5 prismatic dioptres in PGP, with or without inversion of torticollis and the side involved in Bielschowsky’s maneuver. Three hyper-correction patterns were defined: surgical hyper-correction due to excessive surgery, with no significant hyper-action or hypo-action of the contralateral inferior and superior oblique respectively; hyper-correction due to masked bilateral paralysis in Ht inversion in PGP, of Bielchowsky’s maneuver and in severe hyper-action or hypo-action of contralateral inferior and superior oblique, respectively; and finally, hyper-correction due to an adherence syndrome or anti-elevation against progressive hypotropia with difficulty in elevation (grade -2 or -3) of the intervened eye with torticollis on raised chin. The time elapsed since the palsy surgery and hyper-correction was recorded.

The pre-op and post-op motor exploration was made measuring vertical deviation with the alternating cover test with prisms in the nine gaze positions and in Bielschowsky’s maneuver. Ductions and versions were analyzed, classifying muscular hyper- and hypo-actions from +3 to -3. Torticollis was studied exploring visual acuity at 6 meters in binocularity conditions. The Lancaster screen was used before and after each surgery, and the subjective twist was studied with Maddox lens.

The diagnostic of congenital or idiopathic palsy was defined on the basis of photographic records of the torticollis since childhood, without other causes, and acquired palsy when associated causes existed.

The palsy surgery was planned in a single surgical period with the following criteria: one muscle was operated when the vertical deviation in PGP was equal to or under 15 dp, and two muscles were operated if that figure was exceeded. The choice of muscles was based on the following analysis: study of versions, measure of deviation with prisms, maximum diplopia position and Lancaster’s screen.

For a second period we considered treatment of hyper-correction in the presence of diplopia in PGP.
or reading position and if the hypertropia inversion exceeded 5 dp in PGP or over 10 dp in the diagnostic positions of the oblique. If the cause of hypercorrection was adherence syndrome or anti-elevation we initially considered surgery, but if the cause was excessive surgery of masked bilateral paralysis, we proposed to begin with a botox injection unless the hypertropia inversion exceeded 10 dp.

The end result was considered to be good if the diplopia was eliminated in the functional gaze positions (frontal and reading), if torticollis improved and if hypertropia in PGP was under 5 dp or 10 dp in the diagnostic positions of the oblique.

The evolution time was measured in months counted from the first surgery for treating the palsy in the period comprised between 2004 and 2006 and the end of the study.

RESULTS

Out of 33 cases operated on for unilateral superior oblique palsy between 2004 and 2006 nine hypercorrections were obtained, representing 27.27%. Table I shows the pre-op data. The mean age of the sample was 45.22 years, standard deviation (SD): 13.55 (range: 30-64). Six were men and three women. The etiology of the palsies was idiopathic in seven cases and acquired in 2. The left eye was involved in 5 patients and the right one in 4. The mean vertical deviation in PGP was of 17 dp, SD: 9.48 (range: 5-30). The mean Ht in superior and/or inferior oblique diagnostic positions was of 18.44, SD: 7.73 (range: 6-30). The mean vertical deviation with the head inclined towards the side of the affected eye was of 25.22 dp, SD: 13.89 (range: 6-50).

The surgery was as follows: weakening of inferior oblique as per Apt technique combined with resection of superior rectum in 3 cases: Apt inferior oblique technique associated to a resection of the contralateral inferior rectum in 2 cases; resection of superior rectum isolated in two (one is case #9 which had previous Apt surgery in the inferior oblique carried out 7 years earlier). A resection of the contralateral inferior rectum was made in 1 case and an isolated Apt inferior oblique technique followed in a second stage by a contralateral inferior rectum resection in another case. In 7 of the 9 cases two muscles were operated, 5 in the same operation and 2 cases in 2 different surgical acts. Topical anesthesia was used in 8 cases and general anesthesia in 1.

Table II summarizes data referring to surgical hypercorrection. Ht was inverted in all cases towards hypo-trophy. Bielchowsky was reverted to the other side in 6 and torticollis in 4 (2 with raised chin due to grade -2 elevation deficit). Hyper-correction occurred between 15 days and 6 months from surgery with a mean of 68.33 days, SD: 49.24

Table I. Pre-op data

<table>
<thead>
<tr>
<th>Case</th>
<th>Age (Y)</th>
<th>Sex</th>
<th>Eye</th>
<th>Post etiology</th>
<th>VD PGP (prismatic dioptres)</th>
<th>VD diagnostic position of oblique (prismatic dioptres)</th>
<th>VD Bielschowsky (prismatic dioptres)</th>
<th>Surgery</th>
<th>Type of anesthesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>59</td>
<td>M</td>
<td>L</td>
<td>Congenital</td>
<td>20</td>
<td>20</td>
<td>25</td>
<td>APT Iob LE/RET SR LE 5mm</td>
<td>Topical</td>
</tr>
<tr>
<td>2</td>
<td>50</td>
<td>M</td>
<td>L</td>
<td>Congenital</td>
<td>8</td>
<td>14</td>
<td>14</td>
<td>RET IR RE 4mm</td>
<td>Topical</td>
</tr>
<tr>
<td>3</td>
<td>26</td>
<td>M</td>
<td>L</td>
<td>Congenital</td>
<td>20</td>
<td>20</td>
<td>30</td>
<td>APT Iob LE/RET SR LE 5 mm</td>
<td>Topical</td>
</tr>
<tr>
<td>4</td>
<td>30</td>
<td>M</td>
<td>R</td>
<td>Congenital</td>
<td>30</td>
<td>30</td>
<td>40</td>
<td>APT Iob RE/RET SR RE 5 mm</td>
<td>General</td>
</tr>
<tr>
<td>5</td>
<td>48</td>
<td>F</td>
<td>R</td>
<td>Congenital</td>
<td>14</td>
<td>14</td>
<td>16</td>
<td>RET SR RE 5 mm</td>
<td>Topical</td>
</tr>
<tr>
<td>6</td>
<td>56</td>
<td>M</td>
<td>R</td>
<td>Acquired</td>
<td>20</td>
<td>16</td>
<td>30</td>
<td>APT Iob RE/RET IR LE 6 mm</td>
<td>Topical</td>
</tr>
<tr>
<td>7</td>
<td>38</td>
<td>F</td>
<td>L</td>
<td>Congenital</td>
<td>30</td>
<td>30</td>
<td>50</td>
<td>APT Iob LE/RET IR RE 4 mm</td>
<td>Topical</td>
</tr>
<tr>
<td>8</td>
<td>36</td>
<td>M</td>
<td>R</td>
<td>Acquired</td>
<td>5</td>
<td>16</td>
<td>16</td>
<td>1º/APT Iob RE 2º/RET IR LE 2 mm</td>
<td>1º/Topical</td>
</tr>
<tr>
<td>9</td>
<td>64</td>
<td>F</td>
<td>R</td>
<td>Congenital</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>RET SR 2 mm</td>
<td>2º/Topical</td>
</tr>
</tbody>
</table>

M. Male; F: Female; R: Right; L: Left; VD: Vertical Deviation; PGP: Primary Gaze Position; Iob: Inferior oblique; Ret: Retro insertion; SR: Superior Rectum; IR: Inferior rectum; RE: Right eye; LE: Left eye; SOP: superior oblique paralysis.
In 2 cases it worsened progressively while in the other 7 it stabilized. The causes were: masked bilateral paralysis in 2 patients (2/33: 6.06%); adherence syndrome or anti-elevation in 2 cases (6.06%); and excessive surgery in a further 5 (15.15%). Of the 9 hyper-corrections, 6 required surgical treatment, an additional case was treated with 3 botox injections, another patient needed prisms and a final case did not require treatment due to exhibiting intense suppression caused by poor VA and visual field of the involved eye.

Table II describes all the surgeries. Four patients received one or more botox injections as a supplementary treatment to surgery (before or after). The final result was positive in 8 patients and negative in 1 (awaiting a second operation). The mean evolution time was of 20.33 months, SD: 9.89 (range: 4-33 months).

### DISCUSSION

Superior oblique palsies are the most frequent cause of eye paralysis. These can be congenital or acquired and the adequate treatment for resolving symptoms and signs is usually surgery (1,2). The type of surgery will depend on the preferences of the surgeon, on the magnitude of the vertical deviation in the different gaze positions, the degree of subjective twist and the associated torticollis. In bilateral palsies we find a greater exycle twisting than in unilateral palsies, which increases the severity of the surgical prognosis (4,8,9).

Published results about surgical treatment of unilateral paralysis of the superior oblique are very good, with a success rate between 70 and 85% (3,7). The percentage of post surgical hypo corrections is greater than that of hyper corrections. This can be because in most published studies only one muscle is operated, mainly the hyperactive inferior oblique, with myectomy techniques, deinsertion, resections or anterior transpositions (6,10-14). The percentage of surgical hyper corrections published in surgery is variable, ranging from 4% to 8.33% (3,5,7,10). Other authors obtained percentages of 1.88% of early hyper corrections and 6.91% of late corrections, including masked bilateral paralysis (15). In this series of 33
patients intervened in a three year period we have obtained 27.27% of hyper corrections. The causes have been grouped in three categories based on the clinical condition, i.e. excessive surgery (found in five cases), masked bilateral paralysis, diagnosed in two patients, and adherence or anti-elevation syndrome, which occurred in a further two. Other studies considered that post surgical hypotropia could be due to hyper corrections or masked bilateral paralysis, excluding these from the typical hyper corrections (10,15). The frequency of masked bilateral paralysis varies between 10 and 30% according to the series (16,17). Our prevalence was lower (6.06%). For some authors, surgery over the vertical straight muscles would account for the majority of hyper corrections obtained in their series. Accordingly, they recommend suturing the muscles firmly to the sclera during retro insertion (15). Another cause described in literature to account for hyper corrections of superior oblique paralysis is an excessive surgery of the hyper-active inferior oblique muscle, particularly the anterior transposition (11,18). The resulting clinical condition would be a hypotrophy in PGP and an important limitation of the elevation in adduction. If this occurs early and the deviation remains, it would be an anti-elevation syndrome, whereas if it occurs months after the surgery it would be an adherence syndrome (13). We had two cases of hypotrophy in PGP with limitation of innovation in degree -2, with passive positive duction and chin up, which occurred after an inferior oblique Apt associated to resection of the superior straight muscle, in one case after 15 days and the other after three months. In both, the deviation progressively worsened and therefore we included them in the category of anti-elevation or adherence syndrome, because it wasn’t possible to discard either. During the second operation we did not find an excess of scar tissue in the area and both cases were resolved advancing the SR to its insertion by adding a 3 mm resection of inferior straight in one.

Surgery on the paretic SO, either isolated or associated to another muscle, is a further treatment found in publications to address these paralyses. The drawback of this method is the iatrogenic Brown syndrome obtained with the resections and folds as well as the in-cycle torsions in bilateral paralysis. However, these are usually temporary and do not cause clinically significant hypotropia in PGP (5, 7, 8, 19, 20). In this series none of the Piper correction cases was secondary to SO surgery.

If we analyze the surgeries in which significant hyper correction was obtained, we must emphasize that in seven of nine cases the inferior oblique muscle was operated by means of an Apt associated to SR or IR resection, in five patients in the same intervention and in a further two in two different operations. Anesthesia was topical in eight patients and general in one. Perhaps the fact of performing the inferior oblique surgery with topical anesthesia may have influenced the surgical technique because, as no muscular traction was carried out, a small resection may have been done inadvertently, thus causing a greater depression of ocular globe and a greater surgical effect, just like the resection of the horizontal straight muscles achieve a greater effect with topical anesthesia. In the second operation we verified that the already operated vertical straight muscles did not slide (17).

The time elapsed up to the emergence of hyper correction was between 15 days and six months, which is within the limits of published data. Masked bilateral paralysis and other hyper corrections were found up to four years after the initial surgery (3, 7, 10, 15). The results of the treatment of the hyper correction of OS paralysis were good in all cases except one which is awaiting a second operation. Surgery was required in six cases, a similar number to that of other series which obtained good surgical result in hyper corrections (3, 10, 15, 16, 18). Another case was resolved with prisms and a further one with three Botox injections. In addition, one patient did not require any treatment because he did not exhibit diplopia due to the suppression of the affected eye. Botulin toxin has also been utilized as treatment before or after surgery in four cases. No references were found in literature as to the use of botulin toxin for the treatment of hyper corrections.

As conclusion, it can be said that the prevalence of hyper corrections in the surgical treatment of SO unilateral paralyses has been above the data provided in other publications. The excess of surgical response prevailed over other causes. Masked bilateral paralyses was one cause of hyper correction which in this series had a lower percentage than in others. Surgical hyper corrections have been permanent and in almost all cases have required surgical treatment for their resolution, obtaining good results in the end.
REFERENCES