Original article

Intermittent exotropia: Bilateral lateral rectus recession treatment and long term results

M. Pérez-López*, F.J. Hurtado Ceña, J.M. Rodríguez Sánchez, M.F. Ruiz Guerrero, F.J. Muñoz-Negrete

Servicio de Oftalmología, Hospital Ramón y Cajal, Madrid, Spain

Abstract

Purpose: To describe the long-term surgical outcomes of bilateral lateral rectus recession in patients with intermittent exotropia.

Methods: Retrospective review of 18 patients diagnosed with intermittent exotropia between 1995 and 2005 who underwent surgical treatment in the Ramon y Cajal Hospital.

Results: Of the 18 patients with intermittent exotropia, 50% were basic subtype. All of them underwent bilateral lateral rectus recession, associated with a previous failed botulinum toxin injection in 8 of them. Satisfactory results (less than 10 PD orthophoria) were obtained in 68.2% of the patients after a 4.5-year follow-up period.

Conclusions: Bilateral lateral rectus recession is an effective and stable surgical procedure in the long-term motor control of intermittent exotropia, especially in basic subtype. Previous injection of botulinum toxin did not affect the results.

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Exotropías intermitentes: tratamiento mediante retroinserción bilateral de rectos laterales y resultado a largo plazo

Resumen

Propósito: Evaluar los resultados a largo plazo de la cirugía de retroinserción bilateral de los rectos laterales para la corrección del estrabismo divergente intermitente.

Método: Estudio retrospectivo de 18 pacientes diagnosticados de estrabismo divergente intermitente (EDI) entre los años 1995 y 2005 que precisaron tratamiento quirúrgico en el Hospital Ramón y Cajal de Madrid.

Resultados: De los 18 pacientes con exotropia intermitente, un 50% fueron de tipo básico. Todos ellos fueron intervenidos mediante retroinserción bilateral de los rectos laterales asociado con inyección de toxina botulínica previa en ocho. Se obtuvieron resultados satisfactorios (ortoforia menor de 10DP) en un 68.2% de los pacientes tras un periodo de seguimiento medio de 4,5 años.


* Corresponding author.
E-mail address: marperlo@hotmail.com (M. Pérez-López).

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**Introduction**

Intermittent exotropia is the most frequent form of divergent strabismus.\(^1\)\(^2\) It is characterized by fluctuations in the visual sensory system involving binocular vision with stereopsis when the eyes are aligned and suppression with abnormal retinal correspondence when the deviation occurs.\(^3\)\(^4\)

In general, visual acuity and stereacuity are good and usually there are no great changes in the mean deviation, although there is a tendency towards worsening deviation in far vision.\(^5\)\(^6\) In fact, over 50% of patients experience deviation increases of 10 or more diopters within 20 years from diagnosis,\(^7\) which means that half of patients with intermittent exotropia shall undergo surgical treatment.\(^8\)

Intermittent exotropia expresses early in childhood and rarely associates neurological development anomalies in children,\(^9\) with amblyopia being infrequent unless the disease progresses to constant exotropia at an early age or additional ambylogenic factors coexist.\(^10\)

The diagnosis is made assessing the deviation in the occlusion test and, more recently, measuring the occlusion test with prism.\(^11\) There is intermittent or constant exotropia for far fixation only or also intermittently for media fixation. The identification of the difference between near and far deviation is what allows the classification in basic and far types, respectively. In the basic type, the far vision deviation is differentiated in under 10 prismatic diopters from the near deviation, which is the opposite of what occurs in the far type. When the exodeviation is greater in near than in far vision, there is convergence insufficiency.

Traditionally, it has been considered that the division in subtypes is important for planning the surgical technique to be applied. However, recently the need of this division for the management of patients has been questioned.\(^12\) Some authors have proposed early intervention to improve stereacuity\(^13\) as over half of patients would be able to develop a high of degree of stereopsis.\(^14\)\(^17\) Said intervention is generally a bilateral resection of the lateral rectus as it constitutes the standard technique.\(^18\)

A retrospective study was performed on patients diagnosed with EDI who were intervened with bilateral retrocessions of the lateral rectus for correcting strabismus in order to assess the long-term results of this surgical technique.

**Material and methods**

A retrospective study of 18 patients diagnosed with intermittent exotropia between 1995 and 2005 in the Ramón y Cajal Hospital of Madrid, who underwent some type of surgery, including intramuscular botulin toxin (BOTOX® Allergan Labs).

The study excluded patients that were unable to carry out follow-up, as well as those who had only received treatment with botulin toxin or without study parameters. In addition, patients with other form of diverging strabismus such as consecutive exotropia were also excluded.

The data collected preop were: visual acuity (VA) measured by the Piggason or E for Snellen scales in preschool children and according to the Snellen scale in the rest, mean deviation in prismatic diopters after the alternating cover test with prisms at distances of 6 m and 35 cm (deviation after prolonged dissociation), associated deviation and secondary hyperfunction, presence of torticollis (wryneck yes/no), degree of stereopsis measured in arc seconds if available (near TNO test), existence of ocular predominance and/or suppression (by means of vectograph and near and far Worth test) if available, refractive condition (sphere, cylinder and axes) based on retinoscopy under cycloplegia, as well as previous treatment followed by the subject.

The same data were collected during the last assessment, together with post-surgery complications and possible re-treatments which may have been carried out in the period comprised between the first and last visits.

The duration of the follow-up was considered for each patient from the time of the intervention (surgery or intramuscular botulin toxin) up to the last assessment in which ocular alignment was recorded.

**Surgical technique**

The surgeries were performed under topical or general anesthesia depending on patient age and cooperation. Intramuscular botulin toxin injections were applied under pulmonary anesthesia (Sevorane®, Abbott Laboratories SA) in all cases.

**Statistical analysis**

The statistical analysis was carried out with the SPSS13.0 software (SPSS Inc., Chicago, USA). The quantitative data of the study variables were presented as mean and standard deviation (SD). The McNemar statistical test was applied for paired dichotomic data and the Wilcoxon test for paired continuous variables. Statistical significance was considered when \( p < 0.05 \).

**Results**

Of all the records reviewed between 1995 and 2005, 18 fulfilled the inclusion criteria as they included the main variables.
established for the study. The mean age of included patients was of 7.2 ± 8.05 years, with a similar proportion of males and females (8/10). The demographic patient characteristics, as well as their visual acuity and refraction at diagnostic time are summarized in Table 1. Half of the diverging strabismus cases were of the basic type, with differences under 10 DP between the maximum far and near deviation after the cover test. Of all the patients, 94.4% visited the practice due to ocular deviation and only one case consulted for wryneck. The refraction myopia values ranged between −0.50 and −2.50 while the hypermetropia values were between +0.50 and +3.50 and the astigmatism values (absolute value) were between 0 and 2.50. No statistically significant differences were found in the percentage of success between the groups of myopic of hypermetrope patients (p = 0.465, McNemar test).

Only 3 patients exhibited amblyopia (anisometropic) at some point in the follow-up (one patient with vision of 0.7 and 0.9, another with 1.0 and 0.8 and a third one with 1.5 and 0.6 respectively, measured with the Snellen test) and in all these cases, vision was recovered with occluder treatment prior to surgery. The mean maximum deviation for far vision prior to surgery was of 28.71 (14.73) DP far and 28.06 (17.58) near. In all cases a bilateral surgery was performed for retinosertion of lateral rectus (mean of 6.45 mm) and 8 patients were also previously treated with botulin toxin injection in the lateral rectus. The mean maximum deviation in the last assessment was of 7.45 (9.47) DP for far vision and 6.06 (5.11) DP for near vision, with the deviation difference pre-post treatment being statistically significant (p < 0.001).

The data of the treatments received by the patients as well as the post-surgery results are summarized in Tables 2 and 3. The torticollis, which was the reason for consultation for only one patient, was detected in the pre-surgery exploration in a further 2 patients (total 3/18). In only one case post-surgery vertical wryneck persisted, associated to a hyperfunction of the inferior oblique muscles. The mean follow-up time from intervention up to the last recorded assessment was of 54.55 months (4.54 years).

Analysis based on subtypes of diverging strabismus was not carried out due to the small number of patients in the insufficient convergence (n = 2) and excessive convergence groups (n = 2).

Table 4 details the results in the patient groups treated only with surgery or with toxin and surgery. Neither the differences in far or near deviation nor the visual acuities were statistically significant between the two groups, including the follow-up period.

**Discussion**

Intervention in intermittent exotropia aims at improving ocular alignment while maintaining or improving binocular functions. The treatment can be surgical or nonsurgical and, even though the nonsurgical treatment is preferred for small deviation angles, there is no consensus in the literature about specific indications or the best time for the intervention.\(^\text{19}\) The nonsurgical treatment options include myopic optical overcorrection on the patient refraction in order to induce convergence due to adaptation, partial monocular occlusions as anti-suppression treatment or convergence exercises for near exo-deviations in convergence insufficiency cases.

Simulated and basic remote exotropia has been proposed as a surgical treatment (where the basic deviation angle is the same in near and far) and must be treated with lateral rectus unilaterally recession plus medial rectus resection, and true distance exotropia (where the far angle is greater than the near angle) should be treated with bilateral recessions of the lateral rectus. More recent studies have found contradictory results, with better success rates in patients submitted to bilateral recessions of lateral rectus than with unilateral surgery.\(^\text{20}\)

In the series of cases presented here, bilateral recessions surgery of lateral rectus muscles achieved a high rate of success, 50% of which are diverging strabismus of the basic type.

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**Table 1** - Epidemiological data of patients with intermittent diverging strabismus.

<table>
<thead>
<tr>
<th>No.</th>
<th>Mean age (years, SD)</th>
<th>Gender (male, female)</th>
<th>Suppression</th>
<th>Amblyopia</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>7.2 (8.05)</td>
<td>(8.10)</td>
<td>3 (13.6%)</td>
<td>3 (13.6%)</td>
</tr>
<tr>
<td>Visual acuity</td>
<td>Pigassou test ≤ 4 years(SD)</td>
<td>1.5 (0.37)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Snellen &gt; 4 years (SD)</td>
<td>0.82 (0.18)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reason for consultation</td>
<td>Strabismus (%)</td>
<td>17 (94.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Torticollis (%)</td>
<td>1 (5.6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refraction [% min.–max.]</td>
<td>Miopi ≤ 1D</td>
<td>1 (4.5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Miopi &gt; 1D</td>
<td>3 (13.6%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hipermetropia ≤ 1D</td>
<td>3 (13.6%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hipermetropia &gt; 1D</td>
<td>8 (36.4%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Astigmatism &gt; 1D</td>
<td>3 (13.6%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of diverging strabismus</td>
<td>Basic</td>
<td>9 (50.0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Insufficient convergence</td>
<td>2 (11.1%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Excessive divergence</td>
<td>2 (11.1%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not defined</td>
<td>5 (27.8%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

D: diopters; SD: standard deviation; No.: sample size.

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**Table 2** - Data of treatments received by patients with intermittent diverging strabismus.

<table>
<thead>
<tr>
<th>No.</th>
<th>Mean evolution time up to consultation (SD)*</th>
<th>Mean time from consultation to treatment (SD)*</th>
<th>Mean number of botulin toxin injections (SD)</th>
<th>Aggregate number of muscles injected with botulin toxin*</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>22.47 (28.95)</td>
<td>11.57 (9.02)</td>
<td>0.86 (1.11)</td>
<td>1.75 (2.27)</td>
</tr>
<tr>
<td>Mean aggregate dose in IU (SD)*</td>
<td>5.87 (7.93)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean number of surgeries (SD)</td>
<td>0.86 (0.57)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean number of surgeries for each muscle (SD)*</td>
<td>6.45 (2.79)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean maximum follow-up time (SD)*</td>
<td>54.55 (47.24)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SD: standard deviation; No.: number of patients; IU: international units.

*Expressed in months.

*Sum of muscles that received toxin during the follow-up.

*Total dose of botulin toxin applied to the patient.

*Mean lateral rectus retinosertion millimeters.
The published results reporting the success of motor control in patients intervened for intermittent exotropia varied between 50% and 79% in different series. In general, studies with shorter follow-up periods associated higher rates of surgical success than those with longer follow-up periods. The post-surgery success presented in this study and defined as orthophoria under 10 DP in the last recorded assessment, is 62.2% higher than studies with comparable follow-up periods.

The results shown in Tables 3 and 4 indicate that the anatomic and functional results do not depend on patients having received prior treatment with botulin toxin. The role of said treatment could be to delay surgery in children under 5–6 years, being focused on controlling deviation but not on the end result or the anatomic success rate. In addition, amblyopia or focus defects did not play a relevant role in the results. The mean amount of retroinsertion of each lateral rectus (6.45 mm) seems adequate for a correction of 28.71 dipters of mean deviation, even though the mean deviation of surgery (2.79 mm) demonstrates that some retroinsertions reached or exceeded 8 mm. In the post-surgery period, hyper-correction was sought, proposed by some publications as 10 DP. This provides better long-term results and can justify the good results of the study.

The instant study involves several limitations. Its retrospective nature entails lack of precision in inclusion criteria as well as irregular follow-up. In addition, it limits the number of valid cases that can be studied, thus making a scarce sample. A further limitation is the inability to carry out a reliable study of sensory function parameters in intervened patients, such as the degree of stereopsis and its evolution after surgery, because these parameters were not always included in the records. Even so, the obtained results demonstrate that the rectus muscles bilateral recessions technique has proven to be effective for the long-term control of intermittent diverging strabismus, with a high rate of success in a sample of which 50% were defined as the basic type.

### Conflict of interests

The authors have no conflict of interests to declare.

### References


