Alternating Esotropia and Surgical Correction in Both Eyes

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SUMMARY

Strabismus is an eye deviation, when both eyes cannot be directed at the same time towards the object that is being viewed. Strabismus is observed in approximately 25% of children under 3 years of age, and in approximately 3% of all children. There were 77 patients involved in this study, with Esotropia Alternans, that had surgical operations at the Ophthalmology Clinic, University Clinical Centre of Kosovo (UCCK), from 2005-2006. Patients were divided in two groups: 1. Researched group – involving 33 patients that had surgical interventions for weakening the functions of the inner straight muscle in both eyes, and 2. Control Group – involving 44 patients that had surgical interventions in one eye intervening in two muscles with contrary actions – the inner straight muscle, weakening it in retro-position, and the outer straight muscle, strengthening its function through myectomy. Medium value of the objective angle after the operation, in distance of 6 meters, in the patients with Esotropia alternans from the Experimental group was 6.5 Δ dyoptry (standard deviation 1.9 Δ dyoptry). In the Control Group, the medium value of the objective angle was 9.3 Δ dyoptry (standard deviation 3.6 Δ dyoptry), with significant distinction (p<0.01). There were 16.9% patients with Esotropia alternans who had complications during the operation. In the Experimental group, complication occurred in 4 patients, or 12.1% during the surgery. It the Control Group, complications were observed in 9 patients, or 20.5%, without significant difference between the groups.

Keywords: Esotropia alternans, alternating esotropia, surgery.

1. INTRODUCTION

We can distinguish two main groups of eye movement disorders: Concomitant Strabismus and Paralytic Strabismus (1,2,3,4).

Strabismus concomitant alternans.

Such strabismus we have in case when both eyes, one at a time, are distorted. Therefore, when the patient fixates with the right eye – the left eye distorts, and vice versa. Concomitant Strabismus varies from Paralytic Strabismus because the deviation angle remains the same no matter the direction of the gaze; the deviating eye follows the normal eye with constant angle. Concomitant Strabismus is more often in children, since it is found in almost 6% of children. In 60-65% of cases, these disorders are found in the child's first two years of life.

There are many surgical methods for correction of Esotropia Alternans, which aim to weaken the retraction of the inner straight muscle with retro-position, or enforce the retraction effect of the outer straight muscle with myectomy (2).

In esotropia, adduction is usually very strong, while the abduction is enforced. The aim of surgical intervention is to normalize the abduction and adduction aiming to normalize the eye movement.

2. AIM OF THIS STUDY

The aim of this project is to compare the results of surgical intervention of Esotropia Alternans, by weakening the function of the inner straight muscle in both eyes through surgical intervention in one eye, intervening in two muscles with contrary actions – the inner straight muscle, weakening it in retro-position, and in the outer straight muscle, enforcing its action through myectomy.

3. MATERIALS AND METHODS

There were 77 patients involved with Esotropia alternans, which had surgical interventions at the Ophthalmology Clinic, University Clinical centre of Kosovo (UCCK), during the period 2005-2006.

Patients are divided in two groups:

- Experimental group – which involved 33 patients that had surgical intervention in weakening the function of the inner straight muscle in both eyes, and
- Control Group – which involved 44 patients that had undergone the surgical intervention in one eye, intervening in two muscles with contrary actions – the inner straight muscle, weakening it in retro-position, and in the outer straight muscle, enforcing its action through myectomy.

Patients with Esotropia alternans have undergone surgical intervention, in which case, the objective angles (cross-eyed) have remained after the application of standard methods, such as: correction of refractory anomalies, occlusion and orthoptical exercises.

In all the examined cases from both groups, (Experimental group and Control Group), the cross-eyed angle was measured before and after the surgical intervention in the distance of 6 meters, 1 meter and in synoptophore. Cross-eye angle in distance of 6 meters and 1 meter is expressed in prism dyoptry, while in synoptophore in scales.

Depending on the size of the objective angle (cross-eye), the size of retro-position or myectomy is determined.

The data were elaborated with the statistical package InStat 3. From the statistical parameters, the following calculations were done: structural index, arithmetical average and standard deviation. Differences between groups were tested with the students test and with X² test. As the lowest level for statistical significance, it was considered p<0.05.

4. RESULTS OF THE WORK

With case distribution based on gender, out of 77 cases that were operated, 37 or 48.1% were female, and 40 or 51.9% were male, without significant difference based on gender (X² – test = 0.12, p=0.732). In the group of pa-

<table>
<thead>
<tr>
<th>Gender</th>
<th>Experimental group</th>
<th>Control group</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>F</td>
<td>13</td>
<td>39.4</td>
<td>24</td>
</tr>
<tr>
<td>M</td>
<td>20</td>
<td>60.6</td>
<td>20</td>
</tr>
</tbody>
</table>

Χ² - test =1.734, p = 0.1879*, patients based on groups and gender
* non significant difference

TABLE 1. Cases with Esotropia alternans operated in UCCK for the period 2005-2006 based on gender and groups (type of operation)
tients that had surgery for weakening the function of inner muscle in both eyes (Experimental group) 13 or 39.4% were females, and 20 or 60.6% were male, while in the Control Group we had more females – 24 or 54.5% and 20 or 45.5% male, but without any significant statistically important difference (X²-test = 1.734, p = 0.1879) (Table 1).

Table 2 presents the average age and standard deviation of cases with Esotropia Alternans based on groups. The average age of the patients in the Experimental group was 10.0 years, standard deviation 4.7 years, the youngest one was 4 years old, and the eldest was 24. The average age of cases in the Control Group was 10.5 years, standard deviation 4.7 years, the youngest one was 4 years old, and the eldest was 22 years. With T-test, we didn’t gain significant statistically important difference (X²-test = 1.734, p = 0.1879 ) (Table 1).

Table 2. Patients operated for Esotropia Alternans based on age and groups

<table>
<thead>
<tr>
<th>Groups</th>
<th>Average ± SD</th>
<th>Min</th>
<th>Max</th>
<th>t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>10.0 ± 4.7</td>
<td>4 yrs</td>
<td>24 yrs</td>
<td>t = 0.497</td>
</tr>
<tr>
<td>Control Group</td>
<td>10.5 ± 4.1</td>
<td>5 yrs</td>
<td>22 yrs</td>
<td>p = 0.6204</td>
</tr>
</tbody>
</table>

Table 2. Patients operated for Esotropia Alternans based on age and groups

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Table 2. Patients operated for Esotropia Alternans based on age and groups

<table>
<thead>
<tr>
<th>Type of operation</th>
<th>Average ± SD</th>
<th>Average ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repositioning of the inner straight muscle</td>
<td>5.2 ± 0.8</td>
<td>4.6 ± 1.4</td>
</tr>
<tr>
<td>Myectomy of outer straight muscle</td>
<td>-</td>
<td>5.7 ± 1.3</td>
</tr>
</tbody>
</table>

Table 4. Average values of retro-position of ISM and myectomy of OSM based on groups

After the operation, at Esotropia Alternans, the objective angle was measured in distance of 6 meters, 1 meter close and in synoptophore at both groups. The results of the measuring are presented in the following tables. Average value of the objective angle after the operation in 6 meter distance at the patients with Esotropia Alternans, at the Experimental group was 20.1 degrees (standard deviation 8.1 degrees), without significant difference (T-test = 0.375, p = 0.7087). The average value of the objective angle after the operation in 1 meter close at the patients with Esotropia Alternans, in the Experimental group was 6.5 Δ dyoptry (standard deviation 1.9 Δ dyoptry). At the control group the average value of the objective angle was 9.3 Δ dyoptry (standard deviation 3.6 Δ dyoptry), without significant difference (T-test = 4.06, p = 0.0001). The average value of the objective angle after the operation in 1 meter close at the patients with Esotropia Alternans, in the Experimental group was 7.8 Δ dyoptry (standard deviation 1.7 Δ dyoptry). At the control group the average value of the objective angle was 11.0 Δ dyoptry (standard deviation 3.6 Δ dyoptry), with significant difference (T-test = 4.721, p = 0.0001). Average value of the objective angle after the operation in synoptophore at the patients with Esotropia Alternans at the Experimental group was 3.5 Δ dyoptry (standard deviation 1.3 Δ dyoptry). At the control group the average value of the objective angle was 4.9 Δ dyoptry (standard deviation 2.1 Δ dyoptry), with significant difference (T-test = 3.373, p = 0.0012) (Table 3).

Average values of retro-positioning of the inner straight muscle and the myectomy of outer straight muscle based on groups is presented in table 4. At the experimental group, during the operation we had complications in four patients, or 12.1%. In one patient, we had perforation of sclera’s, 3 times muscle “sliding”, two sub-conjunctive haematomas, and twice in the synoptophore we had bleeding. At the patients with Esotropia Alternans at the Experimental group was 19.5 degrees (standard deviation 5.0 degrees). At the control group, the average value of the objective angle was 20.1 degrees (standard deviation 8.1 degrees), without significant difference (T-test = 0.817, p = 0.7087).

Table 3. Average values of the objective angle in various distances based on groups before and after the operation

Table 5. Complication during the operations at Esotropia alternans based on groups

<table>
<thead>
<tr>
<th>Complications during operation</th>
<th>Experimental group</th>
<th>Control Group</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Porfaction of sclera</td>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Sliding of the muscle</td>
<td>2</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Sub-conjuctive haematomas</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Bleeding</td>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Total with complications</td>
<td>4</td>
<td>12</td>
<td>16</td>
</tr>
</tbody>
</table>

Table 5. Complication during the operations at Esotropia alternans based on groups
DISSCUSSION

Common type of strabismus and it is characterized with the deviation of the inner towards the object that is being viewed. Strabismus is observed in approx. 25% of children under 3 years old, and in approx. 3% of all children. Esotropia is the most common type of strabismus and it is characterized with the deviation of the inner muscles (7,8,9,10,11).

Tychsen emphasizes that when the surgeon ophthalmologist documents that the child has constant esotropy, therefore the surveillance is necessary for the patients during the first decade (2,4).

According to Helveston, chosen technique for correction of esotropia is bi-medial retro-positioning of rectus. It is done for any angle of cross-eyed in esotropy. This author does not prefer the surgical intervention in more than two muscles in the initial operation. He divides the eso-deviation in small, medium, and large, and the bi-medial retro-positioning of rectus is divided the same way. Small deviation is from 20-30 prisms dyoptry, medium is 30-40 PD and the large is 50 and beyond. For the small eso-deviation the medial muscles are re-positioned 9.5-10.0 mm from limbus, while in the large deviation the muscles are re-positioned 10.5-11.0 mm. For children under 1 year old, to these values he adds 0.5mm (2).

5. DISCUSSION AND CONCLUSION

Strabismus is an eye deviation, when both eyes cannot be directed at the same time towards the object that is being viewed. Strabismus is observed in approx. 25% of children under 3 years old, and in approx. 3% of all children. Esotropia is the most common type of strabismus and it is characterized with the deviation of the inner muscles (7,8,9,10,11).

Tychsen emphasizes that when the surgeon ophthalmologist documents that the child has constant esotropy, in excess of 12 prism dyoptry, surgical intervention for re-directing the eyes is necessary. He also emphasizes that there are two measuring to be done with high quality equipment so that the exact scale of esotropy is measured before the operation (8).

Esotropy with high angle of cross-eye often requires series of surgical interventions. Kadircan and associates has surveyed 214 patients which have undergone bilateral retro-positioning of the medial rectal muscles. They were surveyed for an average time period of 54.2 months (range 36-93 months). During this period, 21% of patients have undergone re-operation due to residual esotropy, 15% due to following esotropy (horizontal deviation), and 18% due to enforcement of oblique muscles or vertical deviation (7). Patients included in our research were followed up to one year after the operation, therefore, the scale of re-operations due to residual esotropy and esotropia is lower. Adjusting the size of correction is very important. Chang with his associates describe the one phase operation adjusted with sutures as in the simple operation, well tolerated and effective.

One of the controversy issues is also the age of mediation through surgical intervention. As long as the effect of straiitening the eyes at the age of two is widely practiced, surgical intervention before this age is still being discussed. This has initiated debates between many strabologists.

Zak and Morin claim that surgical intervention for correction of esotropia in the age between 5-24 months is successful and reaches the orthophoria up to 10 prisms dyoptry with high prevalence of fusion and stereopsis and low prevalence of dissociated vertical deviation (DVD). Moreover, over-action of inferior oblique muscle and amblyopia are less frequent when the initial operation is done before 12 months of age (2,6).

Shirabe and associates agrees with this conclusion, but adds that it is necessary to confirm the size of the cross eye angle with careful pre-operative evaluation and to monitor after the operation, in order to reach and sustain binocular visual function, after this early surgical intervention.

Birch and associates describe that the best stereopsis is achieved with early surgical intervention, since the duration of eye distortion is shorter and not because the eye straightening is achieved during the early critical period of visual maturity (6). These data illustrate instability of the condition of the patients with infantile esotropia, therefore the surveillance is necessary for the patients during the first decade (2,4).

REFERENCES


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<table>
<thead>
<tr>
<th>Complications after the operation</th>
<th>Experimental Group</th>
<th>Control Group</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>Granuloma</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Duction limitation</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Esotropia</td>
<td>-</td>
<td>2</td>
<td>4.5</td>
</tr>
<tr>
<td>Diploia</td>
<td>-</td>
<td>1</td>
<td>2.3</td>
</tr>
<tr>
<td>Total with complications</td>
<td>-</td>
<td>3</td>
<td>6.8</td>
</tr>
<tr>
<td>Total</td>
<td>33</td>
<td>100.0</td>
<td>44</td>
</tr>
</tbody>
</table>

Tab. 6. Post operative complications at Esotropia Alternans based on groups.