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Journal of Clinical and Experimental Ophthalmology

Research Article

Acquired Esotropia, Results of Surgical Treatment in Albania

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ABSTRACT

Background: Acquired esotropia is a type of strabismus, which usually manifests around the age of 1-3 years. The aim of this study was to evaluate the outcomes of the surgical treatment of acquired partially accommodative and non-accommodative esotropia in a group of esotropia patients in Albania.

Methods: In total 52 patients aged 2-27 years, diagnosed with acquired partially or non-accommodative esotropia during the period January 2012-December 2017, participated in the study. Patients with complete accommodative esotropia were excluded. Ocular deviation and other parameters were assessed before and after operation and the results were compared to check whether differences were statistically significant.

Results: Half (50%) of patients were 2-7 years of age (54% males). Retroposition was the most common surgical procedure, carried out in 50% of cases. Compared to before the intervention, after the intervention there was a significant universal reduction of ocular deviation in all patients at distance or near vision, with or without correction; a significant increase in the proportion of patients acquiring/retaining 3D vision and binocular vision, experiencing no suppression and no excyclotorsion. The most common complication related to surgical intervention was anesthesia-related vomiting (23.1%) and under correction or overcorrection (23.1% of cases). No significant changes were detected in the average visual acuity and the level of manifest and cycloplegic refraction.

Conclusion: Surgical treatment for acquired esotropia is an effective procedure, based on significant reduction of mean ocular deviation and improved results of sensory tests after the intervention. Patients with post-surgical undercorrection and overcorrection need to be appropriately followed-up and treated.

Keywords: Albania; Acquired esotropia; Partially accommodative esotropia; Non-accommodative esotropia; Ocular deviation

INTRODUCTION

The binocular single vision (BSV) is one of the most unique features of the human race. It is realized by a perfect sensomotor coordination of both eyes, both at rest and in motion. The two-dimensional images of an object, which fall on the fovea of each eye, are transmitted to the corresponding visual cortex and are perceived as a single three-dimensional view. This is also mediated by the action of the related muscles to keep both eyes fixed on the object being observed, regardless of object and observer's movements as well as the accommodation mechanism to see more clearly, regardless of whether the object moves near or far.

Of seven extraocular muscles, the surgical intervention is focused on two horizontal ones, i.e., medial rectus muscle (MRM) and lateral rectus muscle (LRM), for the correction of esotropia. In the primary position, the MRM is the adductor muscle, while the LRM is the abductor one.

In order to have binocular vision, it is essential that the optical axes of both eyes must be placed at the same place and at the same time on the object being watched; if this does not occur than the binocular vision is lost and strabismus might develop. Esotropia is a form of strabismus when one or both eyes are turned inwards.

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Received: August 03, 2020; **Accepted**: August 17, 2020; **Published**: August 24, 2020

Citation: Tandili A, Stermilli A, Solis F, Toçi D (2020) Acquired Esotropia, Results of Surgical Treatment in Albania. J Clin Exp Ophthalmol. 11:856. DOI: 10.35248/2155-9570.20.11.856

There are many physiological adaptations that occur in order to counteract strabismus. These include motor changes (motor fusion, abnormal head posture, blindspot mechanism, etc.) and sensor changes (confusion and diplopia, suppression, amblyopia, abnormal retinal correspondence, and eccentric fixation). The most common causes of esotropia include interruption of fusion, physical and psychological stress, myopia, intracranial diseases (tumors, hydrocephalus, etc.), neurological conditions, etc. The main complains of these patients are double vision, eye crossing and lazy eye.

If esotropia occurs after a child is 2 years of age, it is called acquired esotropia. Acquired esotropia is classified into three main types: Accommodative, partially accommodative and non-accommodative esotropia. Accommodative esotropia (fully or partially) usually develops in children aged 2-5 years with a family history of esotropia and amblyopia. For these patients the correction with bifocal lenses or other therapeutic options is possible. Partially accommodative esotropia might results from the decompensation of fully accommodative esotropia patients and the full hyperopic correction might be needed. Non-accommodative esotropia developing in children older than 6 months of age is not accompanied by an accommodative component and in many cases a central nervous system lesion is involved; the therapy consists in treating amblyopia and surgical correction as soon as possible after the onset of the disease.

The major surgical techniques for correction of acquired partially accommodative and non-accommodative esotropia include: retroposition, resection, anteroposition of inferior oblique muscle and transposition of adjacent muscles. However, surgical correction of acquired esotropia might be associated with various complications related with the procedure itself (intervening in the wrong eye or muscle, wrongly performing the intervention, hemorrhage, scleral perforation, loosening of sutures, muscle loss, vision loss, etc.), anesthesia (cardiac arrest, bradycardia, malignant hyperthermia, allergy, etc.) and those occurring after the intervention (postoperative diplopia, vomiting, infections, tenon capsule prolapse, conjunctival cysts, suture reactions, ischemia of the anterior segment, etc.). Therefore, the benefits of surgical corrections must always be weight against potential harms.

In this context, the aim of this study was to evaluate the results of surgical treatment of acquired esotropia among Albanian patients, in terms of effects in various parameters and complications. To the best of our knowledge, this is the first time that such figures are reported for Albania.

METHODS

This was a pretest-posttest pseudo experimental study carried out among a group of patients diagnosed with partially accommodative and non-accommodative esotropia in the Ophthalmology Service, University Hospital Center "Mother Theresa", in Tirana, Albania, during 2012-2017.

The inclusion criteria were: patients with partially accommodative and non-accommodative esotropia not correctable with lenses. The exclusion criteria were: Patient with esotropia and secondary pathologies, those with congenital esotropia and patients with accommodative esotropia. After applying inclusion and exclusion criteria, a total of 52 patients aged 2-27 years old were included in the study.

For all included patients basic socio-demographic and clinical data were retrieved. In addition, we evaluated the far and near visual acuity using various cards according to patient's age such as Alen, HOTV, Snellen, etc.; manifest and cycloplegic refraction through Sph, Cyl and Axic parameters. In addition, the sensorimotor evaluation and the external examination and biomicroscopy of the eye was carried out. Also, information was retrieved about the surgical procedure conducted and the eye intervened. This enabled us to compare various parameters before and after the surgical intervention.

Student's t-test for related samples was used to compare the mean values of numerical variables. McNemar was used to compare the distribution of categorical variables before and after dhe intervention. Otherwise, the chi square test was used for comparing categorical variables. General Linear Model, univariate and multivariate, was used to assess the association of mean number of affected eye muscles with independent variables.

In all cases, a p-value of ≤0.05 was considered as statistically significant.

Statistical Package for Social Sciences (SPSS, version 20.0) was used for all the statistical analyses.

RESULTS

The general socio-demographic of the included patients are presented in Table 1. Half of patients were between 2 and 7 years old, about 54% were males, about two-thirds resided in urban areas, about 19% had low education level and more than one-third (34.6%) reported a not-good economic situation. Retroposition was carried out in half of patients, followed by resection (28.9% of cases) while other procedures were used more rarely. Also, in about one-third of patients (3.6%) the intervention was carried out in the right eye, in about 29% of patients it was intervened only in the left eye and in the remaining 34.6% of patients both eyes were intervened.

Table 1: Basic socio-demographic characteristics and intervention data for included esotropia patients.

Variable	Absolute number	Percentage
Total	52	100
Age-group		
2-7 years old	26	50
8-14 years old	14	26.9
15-27 years old	12	23.1
Gender		
Female	24	46.2

Male	28	53.8
Place of residence		
Rural	18	34.6
Urban	34	65.4
Education level		
Low	10	19.2
Middle	25	48.1
High	17	32.7
Economic situation		
Not good	18	34.6
Average	20	38.5
Good	14	26.9
Type of surgery		
Retroposition	26	50
Resection	15	28.9
Retroposition+Resection	8	15.4
Anteroposition of IOM	2	3.8
Transposition	1	1.9
Eye intervened		
Oculus dexter (OD)	19	36.5
Oculus sinister (OS)	15	28.9
Both eyes (OU)	18	34.6

Table 2 displays the results of the effects of surgical intervention on the magnitude of ocular deviation among esotropia patients. It is clear that surgical intervention is associated with a highly statistically significant reduction of the ocular deviation in both distance and near vision, in patients with and without correction, as demonstrated by the much lower mean values of ocular deviation after the intervention compared to respective values before the intervention. For example, among esotropia patients using lenses, the mean value of ocular deviation assessed in distance vision was 36.0 before intervention but it was reduced to 7.0 after the intervention and this difference is highly significant ($p<0.001$) (Table 2).

Table 2: The magnitude of ocular deviation and its type in esotropia patients, by distance of measurement and correction status, before and after intervention.

Level of measurement	Use of lenses (correction status)	Time of measurement		p-value
		Before intervention	After intervention	
Distance	With correction	36.0 ± 13.5*	7.0 ± 5.8	<0.001
	No correction	38.8 ± 14.9	5.2 ± 5.8	<0.001
Near	With correction	42.5 ± 15.0	9.8 ± 6.0	<0.001
	No correction	43.7 ± 14.4	8.7 ± 7.2	<0.001

*Mean value of ocular deviation (in dioptry) ± standard deviation.

**p-value according to student's t-test for two related samples

Table 3 displays the results of surgical intervention in terms of various vision sensor tests. Surgical intervention is associated with a highly significant increase in the proportion of esotropia patients that have 3D vision, proportion of those who have no suppression and proportion of esotropia patients that acquire binocular vision compared to respective proportions before the intervention (Table 3). Also, after intervention there was a significant reduction of the proportion of esotropia patients with exyclotorsion (0%) compared to the proportion of patients with this condition before the intervention (7.7%).

Table 3: Results of surgical intervention on various vision sensor tests and fundus oculi examinations among esotropia patients.

Variable	Time of measurement	p-value †

	Before intervention	After intervention	
Sensor test: Titmus			
No 3D vision	52 (100.0)*	12 (23.1)	<0.001
3D vision	0 (0.0)	40 (76.9)	
Sensor test:			
Worth-Supression			
No	2 (3.8)	48 (92.4)	<0.001
Oculus dexter	26 (50.0)	2 (3.8)	
Oculus sinister	24 (46.2)	2 (3.8)	
Sensor test:			
Worth-Binocular vision			
No	52 (100.0)	12 (23.1)	<0.001
Yes	0 (0.0)	40 (76.9)	
Fundus oculi examination:			
Excyclotorsion			
No	48 (92.3)	52 (100.0)	<0.001
Yes	4 (7.7)	0 (0.0)	

* Absolute number and column percentage (in parenthesis)

† p-value according to McNemar test for two-related samples for 2 × 2 tables and chi square test for 2 × k tables.

On the other hand, surgical intervention did not have any significant effect on the proportion of esotropia patients with incyclotorsion, or mean number of affected ocular muscles.

In addition, the comparison of mean values of distance and near visual acuity before and after intervention, in patients with and without lens correction of the sight, largely did not find any statistical difference, meaning that the surgical intervention did not have any significant impact in visual acuity of esotropia patients. Similarly, surgical intervention did not have any influence in lens parameters (spherical, cylindrical) ofesotropia patients, or spherical and cylindrical cycloplegic refraction (results not shown in Tables).

With regard to intervention related complications, bradycardia was noticed in 11.5% of esotropia patients, vomiting was present in 23.1% of patients, slight and moderate conjunctival hemorrhage was observerd in 11.5% and 3.9% of patients, respectively, suture granuloma in 1.9% of cases, undercorrection in 15.4% of cases and overcorrection in 7.7% of patients (Table 4).

Table 4: Intra and post-operative complications of surgical intervention among esotropia patients.

Variable	Absolute number	Percentage
Intra-operative complications from anesthesia		
Bradycardia	6	11.5
Post-operative complications from anesthesia		
Vomiting	12	23.1
Intra-operative complications from surgery		
Slight conjunctival hemorrhage	6	11.5

Mild conjunctival hemorrhage	2	3.9
Post-operative complications from surgery		
Suture granuloma	1	1.9
Undercorrection	8	15.4
Overcorrection	4	7.7

DISCUSSION

Binocular vision is very important to live the life in all its dimensions. In order to have binocular vision, the image of the objects we see falls on the fovea of each eye at the same time and the vertical meridians are superimposed. The eyes are straight when their visual axes intersect over the object of fixation. But each eye can be distorted, and only the eye that is straight fixes the gaze on the object we are looking at. Any deviation from the perfect direction of the eyes is called strabismus. When the deviation of the eyes is directed inwards then we are dealing with esotropia. According to the WHO, about 12 million children have low vision due to refractive errors, associated or not with strabismus, which can be easily diagnosed and corrected.

In our study, patients diagnosed with acquired esotropia were included, where the deviation cannot be corrected or only partially corrected with glasses. Surgical treatment is indicated in these patients. Treatment should be done as soon as possible in order to reduce the deviation and to preserve the binocular vision. Treatment aims not only to direct the eyes for aesthetic purposes, but also to combat amblyopia, suppression, and loss of 3D vision that are among the major complications of strabismus in general.

Among our esotropia patients, the most preferred surgical technique was bilateral retroposition of the muscles responsible for esotropia, but also the retroposition-resection combination in the muscles of one eye yielded very good results. The surgical intervention was associated with a significant reduction of mean ocular deviation in all categories of patients, a significant increase in the proportion of patients gaining and/or retaining 3D vision, patients with no suppression, those with binocular vision and the proportion of those without excyclotorsion. On the other hand, the most common complication of surgical intervention was vomiting related to anesthesia(23.1% of cases) followed by undercorrection (15.4% of cases), bradycardia (11.5%) and mild conjunctival hemorrhage observed in 11.5% of patients.

The success of surgical treatment of acquired esotropia is also reported in the international literature. For example, a study among 45 patients with acute acquired comitantesotropia reported a significant reduction of the mean angel of deviation in both distance vision (from 40.5 pre-operation to 0.8 post-operation) and near vision (from 35.6 pre-operation to 0.7 post-operation) after the surgical intervention [1]. Another study among 72 patients with acquired non-accommodative esotropia who underwent surgery showed that, similarly to our results, after the intervention the median angle of deviation was significantly reduced from 30 dioptry before intervention to 8 dioptry after the intervention; also, again in accordance with our results, this study reported that surgical intervention did not have a significant effect on vision acuity among these patients [2]. Apparently, the international literature offers a wealth of information about the outcomes of surgical treatment of acquired non-accommodative esotropia. In this line of discussion, a study among 35 patients analyzed the surgical outcomes for patients diagnosed with acquired non-accommodative estropia and reported a highly significant reduction of mean angle of deviation from 37.3 prism diopters to 4.2 prism diopters at day 1 after operation ($p<0.001$), and this positive effect was retained until the end of follow-up (more than 1 year) [3].

Another study among 47 patients (average age 2.9 years) who received surgery for accommodative esotropia, also reported a significant reduction of ocular deviation and a significant increase of sensory fusion [4]. Although accommodative esotropia can be corrected *via* optical solutions in the majority of cases, surgical correction might be necessary for about one-third of patients [5].

Also, similarly to our results, undercorrection seems to be the most common complication of surgical treatment of esotropia [6]. In another study, about 50% of accommodative esotropia patients were detected with overcorrection or undercorrection after surgical treatment of esotropia [7-9]. In our study, patients detected with undercorrection (8 patients or 15.4% of cases) or overcorrection (4 patients or 7.7% of cases) after the surgical intervention to correct non-accommodative or partially accommodative esotropia, were appropriately followed-up in order to offer them the most appropriate treatment [10-12].

CONCLUSION

The results of this study suggest that surgical intervention is very useful for the treatment of acquired non-accomodativeesotropia and partially accommodative esotropia. There is need for dynamically tracking or following-up of patients in order to get a more complete picture of the results of the surgical intervention, as in our study patients were evaluated only one day up to a week after the intervention.

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