
The factors affecting surgical success rate for the patients with congenital esotropia

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ABSTRACT

Objective. To evaluate the factors and preoperative clinical features affecting surgical success rate in patients with congenital esotropia. **Method.** The medical files of patients who underwent surgery for congenital esotropia between June 2012 and September 2014 were retrospectively reviewed. Data from the patients' full ophthalmological examination included visual acuity, ocular alignment, duction, versions and sensory tests for binocularity, cycloplegic retinoscopy and fundus evaluation. Presence of previous amblyopia treatment, fixation preference, cross-fixation, anisometropia >1.5D, ocular motility abnormalities were noted. The relationship of these variables with the surgical success rate was evaluated. **Result.** A total of 48 patients (25 female, 52.1%) were included. The mean age of the patients was 4.4±5.2 years. Successful surgical outcome was achieved in 39 (81.3%). All the patients were followed for 14.1±4.4 months. There was no relation between surgical success and patients' gender, positive family history, consanguinity, previous amblyopia treatment, anisometropia, abnormal ocular motility and cross-fixation and mean cycloplegic refraction ($p>0,05$). However, fixation preference and mean preoperative deviation found to be related with surgical failure ($p<0,05$). **Conclusion.** In this study many variables such as epidemiologic characteristics and clinical features of patients were investigated for their possible association with surgical success rate. Only preoperative fixation preference without amblyopia and mean preoperative deviation were found to be risk factors for the surgical failure in this group of patients with infantile esotropia.

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Keywords: Congenital esotropia, surgical success, amblyopia, anisometropia, fixation preference

Introduction

Strabismus is an ophthalmological disorder in which the eyes are misaligned; it affects 2-4% of children [1]. About half of these disorders are esodeviations, whose causes are anatomical,

neurological, mechanical, refractive, genetic and accommodative [2,3]. Congenital esotropia is a common type of esotropia, representing 28% to 54% of all esotropias and having an incidence of about

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1% to 2% of general population [4,5]. It is characterized by a constant esodeviation with onset prior to 6 months of age. The treatment of choice is surgery [6-10]. The surgical success rate is reported in a range of 19% to 79% in the literature [6-11]. The risk factors for surgical failure and reoperation are still controversial. However, earlier surgery before 15 months of age, larger angle, presence of amblyopia, positive family history and accompanying ocular motility abnormalities such as inferior oblique muscle overaction (IOOA), dissociated vertical deviation (DVD), latent nystagmus are suggested to be the risk factors for reoperation [6-8]. However, for congenital esotropia, the impact of consanguineous marriage, fixation preference, presence of cross-fixation or anisometropia on postoperative outcomes are not investigated previously.

The purpose of this study was to evaluate the factors and preoperative clinical features affecting surgical success rate in patients with congenital esotropia with a minimum postoperative follow-up period of 6 months.

Materials and methods

Medical records of consecutive patients who underwent surgery for congenital esotropia in Harran University, Faculty of Medicine, Department of Ophthalmology between June 2012 and September 2014 were reviewed. The study design was approved by Institutional Ethics Committee and the study was carried out in accordance with the Declaration of Helsinki. The patients who underwent surgery for the correction of esotropia were included in the study. The patients who had ocular, neurological, chromosomal, or congenital disease and history of previous ocular surgery were excluded from the study. Among patients, only ones who had postoperative follow-up for at least 6 months were eligible for the study.

Data from the patients' full ophthalmological examination included visual acuity (if visual acuity assessment could not be performed with Lea figures or Snellen, then fixation pattern was evaluated), fixation preference, presence of cross-fixation, ocular alignment (if the patient was cooperative, measurements were performed with alternating prism cover test; if not, the Krimsky test was the preferred

method), duction, versions and sensory tests for binocularity (Worth 4 dot test) and stereopsis (Titmus fly test), as well as cycloplegic retinoscopy and detailed biomicroscopic and fundus evaluation. Presence of positive family history, previous amblyopia treatment and consanguineous marriage were noted from medical history.

Fixation preference was defined as fixing with one eye during examination period however, there was spontaneous alternating of fixation with cover test. According to the mean cycloplegic refraction obtained, patients were classified as emetropic (-1 to +1 diopters D), mild hyperopic (+1 to +3 D), moderate hyperopic (+3 to +6D), severe hyperopic (more than +6 D) and myopic (more than -1 D). Oblique muscle function was subjectively graded on a scale of -4 (underaction) to +4 (overaction), with 0 being normal. A difference of 1.5 D or more in spherical equivalent between the two eyes, was defined as anisometropia. A successful outcome was defined as orthotropia or a horizontal tropia of 10 prism diopters (PD) or less, at distance and/or near in the primary position. The preoperative examination which was performed 1 or 2 days before surgery and postoperative examinations were performed at final visit were analysed.

Statistical Analysis

All analyses were performed with SPSS (Statistical Packages for Social Sciences) for Windows version 17.0 (SPSS®, Chicago, IL, USA). All data were expressed as mean and standard deviation. Histogram graphs and the Kolmogorov-Smirnov test were used to test whether the distribution of the data differed significantly from normal. The differences between the patient groups were assessed for statistical significance using the Mann Whitney U test, chi-square test and Fisher Exact test when appropriate. A p value less than 0.05 was considered as statistically significant.

Results

After reviewing the medical charts, 48 patients who met the criteria were included in the study. The mean age of the patients was 4.4 ± 5.2 years, with a range of 0.5 to 23 years at initial examination. There were 25 (52.1%) female and 23 (47.9%) male patients. The mean follow-up was 14.1 ± 4.4 months, with a

preoperative clinical characteristics of all patients are shown in Table 1

Thirty-eight patients underwent bilateral medial rectus recession, three underwent monocular resection-recession for correcting esotropia in primary position. Combined bilateral medial rectus recession and inferior oblique weakening procedure was performed in 7 patients who had IOOA more than 2+. Surgical success was achieved in 39 (81.3%) of the cases. Further surgery was planned for the remaining patients who could not have successful outcome at final visit. The mean preoperative esotropia in the primary position was 49.1±11.4 with a range of 30 to 80 PD and the mean postoperative deviation was 7.6±13.9 PD with a range of 0 to 60 PD at the final follow-up visit (p<0.001).

As shown in Table 2, there was no relation between surgical success and patients' gender, positive family history, consanguinity, previous amblyopia treatment, anisometropia, abnormal ocular motility and cross-fixation and mean spherical equivalent (p>0.05). However, fixation preference and mean preoperative deviation were found to be related with surgical failure (p<0.05). All the patients with failure had fixation preference although alternation was demonstrated in last preoperative visit. Only five had been treated for amblyopia preoperatively. The mean preoperative esotropia in the primary position was 46.9±10.3 PD in surgical success group and 58.3±11.7 PD in surgical failure group and in surgical failure found to be associated with higher preoperative deviation (p=0.009).

Table 1. Demographic data and preoperative clinical characteristics of patients

	N=48 (%)
Gender	
Male	23 (47.9%)
Female	25 (52.1%)
Family history	8 (16.7%)
Consanguinity	14 (29.2%)
Amblyopia history	20 (41.7%)
Cycloplegic refraction (D) (mean±SD)	1.9±2.1
Refractive error	
Emetropia	8 (16.7%)
Mild hyperopia	25 (52.1%)
Moderate hyperopia	7 (14.6%)
Severe hyperopia	5 (10.4%)
Miyopia	3 (6.2%)
Anisometropia	4 (8.3%)
Cross-fixation	8 (16.7%)
Abnormal ocular motility	
IOOA	28 (58.3%)
DVD	9 (18.7%)
Latent nystagmus	3 (6.2%)
Preoperative deviation (PD) (mean±SD)	
Fixation preference	31 (64.6%)

D=dioptr, DVD=dissociated vertical deviation, F=female, IOOA=inferior oblique overaction, M=male, PD=prism diopter, SD=standart deviation

Table 2. Preoperative clinical characteristics of the patients in the success and failure groups

	Patients with successful outcome (n=39)	Patients without successful outcome (n=9)	<i>P</i>
Gender (M/F)	18/21	5/4	0.444*
Family history	8	0	0.148*
Consanguinity	12	2	0.437*
Amblyopia history	15	5	0.285*
spherical equivalent (D) (mean±SD)	2.0±2.2	1.4±1.5	0.084†
Refractive error			0.398‡
Emetropia	5	3	
Mild hyperopia	22	3	
Moderate hyperopia	5	2	
Severe hyperopia	4	1	
Miyopia	3	0	
Anisometropia	2	2	0.155*
Cross-fixation	5	3	0.159*
Abnormal ocular motility			
IOOA	24	4	0.285*
DVD	5	4	0.05*
Latent Nystagmus	2	1	0.472*
Preoperative deviation (PD) (mean±SD)	46.9±10.3	58.3±11.7	0.009†
Fixation preference	22	9	0.012*

D=dioptr, DVD=dissociated vertical deviation, F=female, IOOA=inferior oblique overaction, M=male, PD=prism diopter, SD=standart deviation

* Fisher Exact test

‡ chi-square test

† Mann Whitney U test

Discussion

Although, spontaneous resolution of congenital esotropia can occur, surgery is accepted as the standart treatment [6-9,12]. The aim of the surgery for congenital esotropia is the earliest recovery of deviation, improvement in binocular visual functions with the least possible number of surgeries. In our study, surgical success was achieved in 81.3% of the children with congenital esotropia in a mean follow-up of 14 months. The overall surgical success rate was reported in a range of 19% to 79% in the literature [6-11].

The mean preoperative esotropia in the primary position was 47 PD in surgical success group and 58 PD in surgical failure group and in surgical failure found to be associated with higher preoperative

deviation. This compares well with some similar studies which reported higher rate of surgical failure in large angle esotropia [10,13]. In a retrospective large scale study, Louwagie reported higher reoperation rate in larger angle congenital esotropia [14]. Contrary to these results, Vroman et al reported that bilateral medial rectus muscle recession was equally effective for both large and small angle congenital esotropia [7].

Fixation preference testing, in which fixation preference is considered a proxy for visual acuity, has commonly been used to assess for strabismic amblyopia in preverbal children [15,16]. However, its reliability for prediction of amblyopia has been questioned by several investigators [17-19]. In our

study, we observed fixation preference in 64.6% of the overall patients and in all of the failure group. Although, we only included patients who had fixation preference with obvious alternation in cover test and excluded patients who had strong fixation preference without alternation, an indicator for amblyopia, we have observed a significant effect of fixation preference on surgical failure rate. Owing to the fact that, 66.7% of our patients were younger than 4 years of age and fixation preference is a subjective test with doubtful reliability, we might include true amblyopic patients without previous patching treatment.

Congenital esotropia affects both gender equally [20]. Among our patients, 52.1% was female and 47.9% was male. We did not observe a significant difference in respect of surgical success in both genders. Similarly, in two studies also did not report any effect of gender on surgical success [10,13]. Inheritance was shown to play a role in the pathogenesis of congenital esotropia in related studies, binocular vision anomalies were reported in 16% of parents having children with congenital esotropia [21,22]. In our study, 8 patients (16.7%) had a positive family history and surgical success was achieved in all of these patients. Regarding surgical success, we did not observe a significant effect of family history. The risk for birth defects and congenital anomalies in the offsprings of parents having consanguineous marriage is substantially higher than in the offspring of non-consanguineous parents [23]. Although, the frequency of consanguineous marriages have been decreased, it is still common especially in developing countries. In our study, 14 patients (29.2%) had consanguineous parents and represents well the high prevalence of consanguineous marriage in Turkey. Different nationwide surveys indicated that 20-25% of marriages are consanguineous in Turkey [23]. In our study, we did not observe a significant effect of consanguinity on surgical failure rate. In the literature no study has evaluated the effect of consanguinity on congenital esotropia but in only one study, investigated prevalence of consanguineous marriage in parents of patients with different types of comitant strabismus in which they found a higher risk in patients with consanguinity compared to normal population [24].

Mild hyperopia affecting more than 50% of our patients was the most frequent refractive error, consistent with the literature [10,25]. Trigler and

Siatkowski have reported hyperopia greater than +2 D in 29 % of patients with congenital esotropia, accordingly 25% of our cases had hyperopia greater than +3 D [6]. We did not observe any significant effect of refractive error on surgical success whereas Ravaji et al reported more surgical success rate in patients with hyperopia greater than +3.5 D [10]. Anisometropia and amblyopia are interrelated factors. We took account only patients who were treated previously for amblyopia and resulted in almost equal visual acuity in both eyes. We thought that it is more reasonable to define persistent amblyopia in sensory group esotropia and we did not include this group of patients. In our study we noted anisometropia in 8.3% of patients and 41.7% of patients were treated due to amblyopia. We observed in our study group that neither anisometropia nor previous amblyopia treatment was a factor for surgical success. Presence of amblyopia was suggested to be the risk factor for surgical failure [2,6,8]. Keenan et al reported that surgical success was significantly lower in children with amblyopia [8]. Because we only included patients who were successfully treated for amblyopia and excluded children with true amblyopia, our results were not comparable to these reports. Similar to our results, Rajavi et al could not detect any relation of anisometropia or amblyopia on the reoperation rate of surgery [10].

Abnormal ocular motility problems such as IOOA, DVD or latent nystagmus sometimes accompany congenital esotropia. We have detected IOOA in 58.3%, DVD in 18.7% and latent nystagmus in 6.2% of the patients. Although the detection of IOOA in an infant with severe esotropia is difficult, it has been reported in up to half of the patients with congenital esotropia, which is similar to our results [6-8,10,25]. Dissociated vertical deviation was observed in 5% to 15% of patients in the literature [8,10,25]. Latent nystagmus was observed in 3.2% to 15% of patients in the literature [10,25]. The rates of abnormal ocular motility in our study were in line with previous studies in the literature. We could not detect an association between any of these abnormal ocular motility problems and surgical failure. Rajavi et al also did not report any effect of abnormal ocular motility on the reoperation rate of surgery [10].

The limitations of this study include the small sample size and disadvantages related to retrospective nature. The number of patients in surgical failure group was smaller compared to success group and this may influence the comparison. These may have affected the power of the study.

Conclusions

In this retrospective study, gender, family history, consanguinity, refractive error, anisometropia, previous amblyopia treatment, abnormal ocular motility such IOOA, DVD and latent nystagmus were not found to be associated with surgical success rate. Only preoperative angle of deviation and preoperative fixation preference without amblyopia was found to be risk factors for the surgical failure in patients with infantile esotropia.

Conflict of Interest Statement

None of the authors has any proprietary or financial interest in conception and design of this study. No financial support was received for the construction of this study.

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