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Infantile Esotropia: Clinical Features and Results of Bilateral Medial Rectus Recession

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ABSTRACT

Introduction: To define the characteristics of infantile esotropia and evaluate the results of bilateral medial rectus recession in infantile esotropia.

Methods: A retrospective review was performed on medical charts of patients diagnosed with infantile esotropia. All patients underwent an ophthalmological examination to detect the conditions that accompany infantile esotropia. Patients with two years of age or older and without fixation preference or amblyopia underwent bilateral medial rectus recession.

Results: There were a total of 117 patients with infantile esotropia patients. Infantile esotropia was accompanied by inferior oblique hyperfunction, fixation preference, cross-fixation, pseudoabduction deficit, pattern deviations, nystagmus, dissociated vertical deviation, convergence insufficiency, and abnormal head position. Approximately forty percent of the patients compatible with visual acuity measurements had amblyopia. Bilateral medial rectus recession decreased the mean esotropia from 43.1±15.3 to 7.8±12.8 prism diopters (PD) in 65 patients. Postoperatively, 41 patients had an ocular alignment within 10 PD of orthotropia, 22 patients showed undercorrection and 2 overcorrection.

Conclusion: The characteristics of infantile esotropia in our study are substantially consistent with those of early reports, except for convergence insufficiency. This study also showed that bilateral medial rectus recession appears to have a high percentage of undercorrection in short-term postoperative follow-up in infantile esotropia.

Keywords: Esotropia, fixation, recession, rectus

Introduction

Infantile esotropia is a stable angle convergent eye deviation that has an onset within the first six months of life in neurologically normal children with a reported incidence of approximately 1% in the general population (1-3). Alternating esotropia, cross-fixation with pseudoabduction deficit, manifest-latent nystagmus, inferior oblique overaction (IOOA), dissociated vertical deviation (DVD), mild amblyopia, slight hypermetropia, and reduced binocular vision are often associated with infantile esotropia (3-6).

Although botulinum toxin injection into the medial recti muscles is an alternative therapy, muscle surgery is the mainstay of treatment in infantile esotropia. The aim of surgical treatment is to enhance the development of binocular vision by aligned visual axes. More discussions have centered on the best age for surgery in infantile esotropia for decades. Most investigators advocate that early surgical intervention is useful for obtaining good eye alignment and stereopsis; on the other hand, some point out the low surgical success rate and the scarcity of binocular function in patients with infantile esotropia patients who underwent early surgical correction (1,7-10). Although the most effective surgical procedure has not yet been univocally defined, several surgical options have been introduced for treatment, including unilateral medial rectus recession with lateral rectus resection, bilateral medial rectus recession, bilateral medial rectus recession with resection of one lateral rectus, and bilateral medial rectus recession combined with resections of both lateral recti (7,8,11,12).

The aim of this study aimed to describe the clinical features of patients with infantile esotropia and evaluate the results of bilateral medial rectus recession surgery for the correction of infantile esotropia.

Methods

This study retrospectively reviewed the medical charts of patients who were diagnosed with infantile esotropia during the period from 2011 to 2019. Preoperatively, written informed consent for patient information and images to be published had been obtained from the parents or

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legal guardians of the patients who underwent surgery. The study was ethically approved by the İnönü University Institutional Review Board (approval number: 2020/869) and conducted according to the principles of the Declaration of Helsinki.

All selected patients demonstrated the following characteristics: esodeviation onset before six months of age, esodeviation angle equal to or greater than 30 prism diopters (PD), hypermetropia less than 3D, absence of obvious neurological disorders, or any other ocular diseases. Patients with restrictive or paralytic strabismus, accommodative esotropia, a history of previous strabismus surgery, or uncomplete data were excluded from the study.

All patients underwent complete ophthalmological and orthoptic examinations. Spectacles were prescribed for refractive errors of +2.50 or more to eliminate the accommodative effects on esotropia following cycloplegic refraction measurements in all patients. Amblyopic patients were identified based on visual acuity measurements performed using the Snellen or Lea chart. Amblyopia was always managed with occlusion therapy. In patients with a fixation preference, the preferred eye had patching to obtain alternating fixation. Anterior segment and fundus examination were performed using a slit-lamp and indirect ophthalmoscope, respectively. Horizontal angle deviations were measured at near and distance by the prism cover test or, in too young, uncooperative patients by the Krimsky test after total correction of refractive errors, if necessary. IOOA was graded in all patients, using a scale from 0 to +4, where the +4 indicated the most serious form of inferior oblique hyperfunction. Lateral recti hypofunctions, nystagmus, pattern deviations (A or V variations), cross fixation, DVD, convergence insufficiency and abnormal head posture (AHP) were recorded when present.

Surgical Interventions

Considering the surgical timing, two main parameters were examined: age and the presence of alternating fixation. Surgical intervention was performed only in patients with 2 years of age or older and a freely alternating fixation. All patients underwent bilateral medial rectus recession under general anesthesia. For the medial rectus recession procedure, a limbal conjunctival incision was performed in the nasal quadrant of each eye to expose the nasal aspect of the sclera. The medial rectus muscle was isolated and secured, and then cut from the sclera after a careful dissection. The muscle was then sutured to the sclera with a 6-0 double-needle polyglactin suture with all recession measurements marked with a curved scleral ruler from the original insertion. The amount of recessions was based on the recommendations of a standard surgical dosing table developed by Santiago and Rosenbaum (13), and adjusted based on our clinical experience. The amount of medial rectus recession ranged between 4.5 and 6.5 mm. Patients with IOOA underwent concurrent inferior oblique weakening surgery; more clearly those with +1 or +2 IOOA had inferior oblique recession surgery, and those with +3 or +4 IOOA had myectomy surgery. Postoperative alignment was evaluated at 1 month, 3 months, 6 months, 12 months, and annually after that. A satisfactory outcome was defined as a distance ocular alignment within 10 PD of orthotropia with appropriate refractive correction at the postoperative sixth month. Reoperation was performed when esodeviation greater than 20 PD persisted at 6 months postoperatively despite optical correction.

Statistical Analysis

SPSS for Windows statistical software (ver. 22.0; IBM Corp., Armonk, NY, USA) was used for the analysis. The collected data were summarized using descriptive statistics. The results are expressed as mean ± standard deviation.

Results

Overall, 117 patients were included in the study, 59 (50.4%) males, 58 (49.6%) females. The mean age at the time of diagnosis was 23.0±23.4 months. The mean follow-up time was 34.6±28.7 months. The mean spherical equivalent at the initial visit was +2.15±1.68 D in the right eye and +2.22±1.68 D in the left eye. Thirty-two (27.3%) patients were compatible with the visual acuity measurements at the initial visit, 13 (40.6%) of these compliant patients had amblyopia. The average best spectacle-corrected visual acuity of the right and left eyes were 0.75±0.32 and 0.84±0.2 decimal, respectively. The most common conditions accompanying infantile esotropia patients are presented in Table 1. Convergence assessment could be performed in 39 patients, among them 5 (12.8%) demonstrated convergence insufficiency. Only one (0.8%) patient had an AHP. Spontaneous recovery was observed in one (0.8%) patient.

Bilateral medial rectus recession was performed in 65 (55.5%) patients. The mean age at the time of surgery, mean preoperative and postoperative esotropia, success rate, and mean postoperative follow-up time in the surgical group are presented in Table 2. Twenty-four (37%) patients had an undesirable result, 22 (33.9%) showed undercorrection and 2 (3.1%)

Table 1. The most common clinical features accompanying infantile esotropia patients in our study

Clinical feature	Frequency, n (%)
Alternating fixation	63 (53.8)
Inferior oblique hyperfunction	55 (47)
Cross-fixation	43 (36.7)
Pseudoabduction deficit	22 (18.8)
Pattern strabismus	
V-pattern	12 (10.2)
A-pattern	1 (0.8)
Nystagmus	12 (10.2)
Dissociated vertical deviation	5 (4.2)

Table 2. The mean age at the surgery, mean pre- and postoperative esotropia, success rate and mean postoperative follow-up in the surgical group

Mean age at the surgery	44.6±24.6 (m)
Mean preoperative ET	43.1±15.3 PD
Mean postoperative ET	7.8±12.8 PD
Success rate	63%
Mean postoperative follow-up	26.8±23.4 (m)

m: Months, ET: Esotropia, PD: Prism diopters

showed overcorrection. Of these patients with undercorrection, 8 (12.3%) underwent additional surgery for residual esotropia. In 39 (60.0%) patients with IOOA, the horizontal muscle surgery was performed along with the inferior oblique muscle weakening surgery.

The remaining 52 (44.5%) patients who did not undergo surgery, those with amblyopia and without alternating fixation received occlusion therapy, while those with alternating fixation less than 2 years old waited to reach the age of 2 to undergo surgery.

Discussion

This retrospective study consisted of a very close percentage of female and male gender with 49.6% female and 50.4% male. In a study by Magli et al. (3), the percentage of female and male gender in infantile esotropic patients were reported to be approximately 41% and 59%, respectively. In another study, 42.8% of infantile esotropic patients were female and 57.2% male (5). On the other hand, Shauly et al. (14) reported a close rate of female and male gender with 50.5% female and 49.5 male. Similarly, in a study by Kim and Choi (8), 51.2% of infantile esotropic patients were female and 48.8% male. It seems that the disease has no gender predilection.

In our study, only 32 (27.3%) patients could answer the visual acuity tests, and 40.6% of these cooperative patients were diagnosed with amblyopia. Magli et al. (5) reported amblyopia in 20.2% of infantile esotropic patients who underwent corrective surgery for esotropia before 4 years of age. Birch et al. (15) determined amblyopic patients by fixation preference testing and reported amblyopia in 57% of infantile esotropic patients. In another study by Shauly et al. (14), amblyopia was found in 48.5% of infantile esotropic patients. We believe that the differences in the rate of amblyopia are related to the age of patients in each study, as well as the differences in diagnosing amblyopia in each study.

In a study on the patients with infantile esotropia performed by Birch et al. (15), the mean spherical equivalents of the right and left eyes were reported to be +2.54±1.83 and +2.55±1.82 D, respectively. In another study by Lee et al. (16), the mean preoperative spherical equivalent of both eyes in infantile esotropia patients was found to be +1.61±1.47 D. Kim and Choi (8) reported a mean spherical equivalent of +1.76±1.65 D in patients underwent bilateral medial rectus recession and +0.91±3.29 D in patients underwent unilateral medial rectus recession with lateral rectus resection. In our study, the mean spherical equivalent at the first visit was +2.15±1.68 D for the right eye and +2.22±1.68 D for the left eye. Our findings on the refractive status of infantile esotropia were consistent with the previous reports (8,15,16).

Na et al. (17) observed alternating fixation in 33.9% of infantile esotropic patients at baseline examination. Magli et al. (5) found alternating fixation in 47.5% of infantile esotropia patients who underwent surgery before 4 years of age. In another study conducted by Singh et al. (18), 69.0% of patients with infantile esotropia demonstrated alternating fixation. We found alternating fixation in 53.8% of infantile esotropia patients, which falls into a priorly reported range of 33.9-69.0% (5,17,18).

Infantile esotropia patients with cross-fixation use the right eye to see the left side and the left eye to see the right side (19). We detected cross-fixation in 36.7% of infantile esotropic patients, which is between a previously reported range of 34.1-74.4% (3,5). On the other hand, 18.8% of our patients had lateral recti hypofunction, resulting in a significant pseudoabduction deficit. Our results regarding the rate of lateral recti hypofunction were inconsistent with previous reports, with one study reporting lateral recti hypofunction in 63.8% of infantile esotropia patients (3), while in another, 58.84 of infantile esotropia patients had lateral recti hypofunction (5).

The reported frequency of IOOA in patients with infantile esotropia ranged from 7.5% to 43.3% (8,16,18). We diagnosed IOOA in 47% of infantile esotropia patients. The rate of IOOA found in our study is similar to the formerly reported rates.

In A or V pattern variation associated with esotropia, the angle of horizontal deviation changes with the position of gaze in the vertical meridian (20). The reported incidence of pattern deviations (A or V) in patients with infantile esotropia was between 6.4% and 77.8% (3,5,21,22). We detected A or V pattern strabismus in 11.1% of infantile esotropic patients, which falls in the previously reported range.

In our sample, 10.2% of participants were diagnosed with nystagmus, which was reported to have a variable incidence ranging from 9.7% to 19.4% in previous studies on infantile esotropia (3,5,18).

DVD is a slow upward drifting of the non-fixing eye with unknown etiology (23). DVD is more commonly seen in infantile esotropia with a variable reported incidence ranging between 3.7% and 73.7% (3,5,8,14,16-18,22). In our study, 4.2% of cases demonstrated DVD.

One study reported AHP in 45.9% of infantile esotropia patients (3). In another study, AHP was reported in 35.8% of infantile esotropia patients (5). Elsewhere, no patient was found to have an AHP in infantile esotropia (22). In our sample, one paient developed an AHP.

The Congenital Esotropia Observational Study reported that early-onset esotropia resolved in 46 (27%) patients without surgery, in 42 (24.7%) patients spontaneously, and in 4 (2.3%) with spectacle wear (24). Shon and associates reported spontaneous resolution in 3 cases with a relatively small angle infantile esotropia (25). We observed the resolution of infantile esotropia in one (0.8%) patient without any treatment.

At the initial visit, we determined convergence insufficiency in 5 (12.8%) of 39 patients who were cooperated with orthoptic examination. Previous studies have reported no data on the frequency of convergence insufficiency in patients with infantile esotropia.

Bilateral medial rectus recession is widely used for the surgical treatment of infantile esotropia patients. This procedure is technically simple, not time-consuming, less traumatic, leaving the lateral rectus muscles untouched for cases requiring a second surgical intervention, but it carries a risk for the possibility of undercorrection in large-angle esotropia (8,21,26).

Singh et al. (18) performed bilateral medial rectus recession in 78 infantile esotropia patients and reported that this procedure is most effective in eliminating of infantile esotropia with a reoperation rate of 5.3%. In the study by Shauly et el. (14), bilateral medial rectus recession was used in the majority (83.4%) of patients with infantile esotropia

as an initial surgical procedure and 35 additional surgical procedures required for correcting of residual esotropia or consecutive exotropia in the postoperative period. In the study by Kim and Choi (8), 80 patients with infantile esotropia were selected for either bilateral medial rectus recession or unilateral medial rectus recession with lateral rectus resection, and bilateral medial rectus recession was demonstrated to have a higher final success rate and a lower reoperation rate than the unilateral approach. Lee et al. (16) performed bilateral medial rectus recession in 46 patients for correcting of infantile esotropia and reported surgical success in 31 (67.3%) patients (16).

In our study, patients with fixation preference at the initial examination had occlusion treatment before surgery, and surgery was postponed until they showed alternate fixation. Also, all amblyopic patients had patching therapy before surgery. The surgery was never performed in patients with amblyopia or younger than 2 years of age. In all cases, the amount of medial rectus recession was within the usual limits ranging from 4.5 to 6.5 mm.

We performed bilateral medial rectus recession in 65 patients and obtained a surgical success in 41 (63%) patients when a successful outcome is considered a distance ocular alignment within 10 PD of orthotropia at 6 months postoperatively. The mean preoperative deviation was 43.1±15.3 PD, while the mean postoperative deviation was 7.8±12.8 PD. Figure 1 shows pre- and postoperative images of a patient who underwent bilateral medial rectus recession due to infantile esotropia. In the postoperative period, 22 (33.9%) patients showed undercorrection and 2 (3.1%) showed overcorrection. In patients with undercorrection, the postoperative residual deviation was between 10 and 20 PD in 14 patients, and more than 20 PD in 8 patients. An additional corrective surgery was performed in the 8 (12.3%) patients who had a residual esotropia greater than 20 PD during the follow-up period after 6 months from the initial surgery. Both surgical success and reoperation rates in our study are comparable with those reported in previous studies that used bilateral medial rectus recession as an initial surgery for infantile esotropia (8,14,16,18).

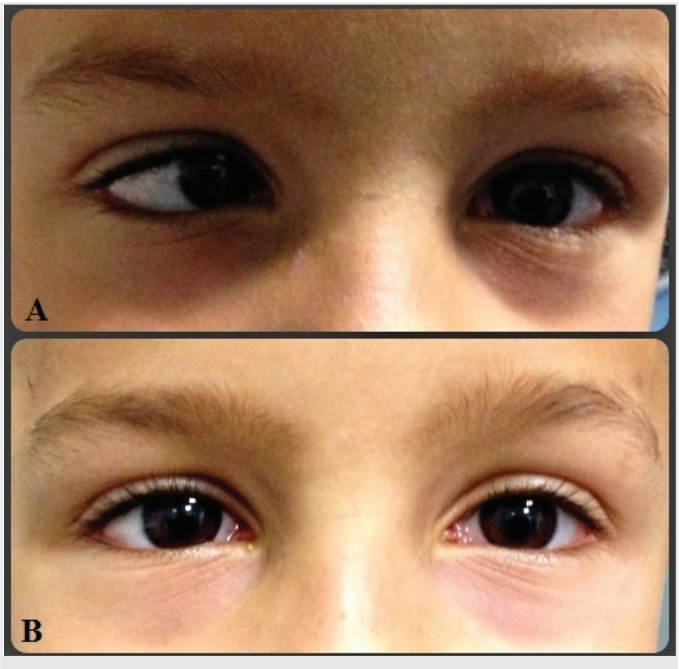

Figure 1. A patient with infantile esotropia, preoperative appearance (A), and postoperative appearance (B). Written informed consent for images to be published had been obtained from the parents

In the presence of an IOOA associated with infantile esotropia, we never postponed the inferior oblique weakening surgery, approaching the medial rectus muscles together with the inferior obliques. Figure 2 represents pre- and postoperative images of a patient who underwent inferior oblique weakening surgery with simultaneous medial rectus muscle recession.

Study Limitations

Our study has some limitations related to the retrospective design. First, the study has no data from the sensory state, which is aimed to be restored with surgery in patients with infantile esotropia. However, most of the younger patients in our sample appeared to have a lack of compliance for sensorial status testing. Moreover, undercorrection, a well -known complication of two-muscle surgery in large-angle infantile esotropia, occurred in 22 cases after the bilateral medial rectus recession procedure. If we had performed three-muscle surgey in patients with large-angle infantile esotropia, undercorrection may not be a serious problem in our study. Finally, the average postoperative follow-up time is short (26.8±23.4 months). It has been shown that consecutive exotropia tends to develop over a long period after infantile esotropia surgery. Thus, a longer postoperative follow-up is needed to assess the outcomes of infantile esotropia surgery, it is likely that longer follow-up periods would be associated with increasing rates of consecutive exotropia.

Conclusion

Most of the clinical features of patients with infantile esotropia in this study were comparable with the findings from previous reports, except for convergence insufficiency. Although, the surgical success and reoperation rates in this study were non-conflicting with those reported in early studies that used bilateral medial rectus recession surgery, the

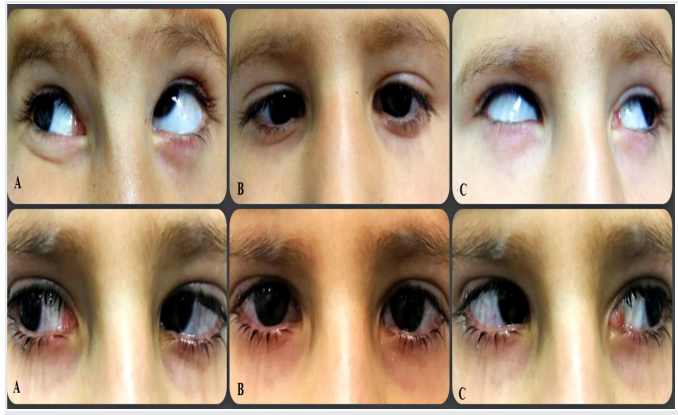

Figure 2. A patient with infantile esotropia and bilateral inferior oblique overaction, preoperative (above); overelevation of the left eye in adduction (A), esotropia in the primary position (B), overelevation of the right eye in adduction (C); postoperative (below); no elevation of the left eye in adduction (A), orthotropia in the primary position (B), no elevation of the right eye in adduction (C). Written informed consent for images to be published had been obtained from the parents

occurrence of high percentage undercorrection may indicate a need for three-muscle surgery in large-angle infantile esotropia. Studies with longer follow-up times were required to confirm our surgical results because the duration of follow-up is an important parameter for evaluating surgical success rates in all strabismus surgeries.

Ethics Committee Approval: The study was ethically approved by the İnönü University Institutional Review Board (approval number: 2020/869) and conducted according to the principles of the Declaration of Helsinki.

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