



Clinical Variability and Treatment Outcomes of Pediatric Esotropia at Sohag University Hospital

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Abstract

Purpose: To evaluate the clinical features and treatment outcomes of convergent squint (esotropia) among children at Sohag University Hospital.

Methods: A prospective, case series, interventional study was conducted to evaluate esotropia among children presented to the strabismus outpatient clinic at Sohag University Hospital, in the period between April 1st, 2018 and December 31th, 2018; with a follow-up period of 12 months. A standard protocol for examination was followed for all patients including history, visual acuity, slit lamp /biomicroscopy, fundus examination, ocular motility, cover test, ocular deviation and cycloplegic refraction. Children with esotropia in this study were classified into 3 main groups, congenital (infantile) esotropia, accommodative esotropia and non-accommodative esotropia.

Results: A total of 52 children with non-paralytic (concomitant) esotropia were included; 27 (51.9%) were males & 25 (48.1%) were females. There were 23 (44.2%) patients with congenital (infantile) esotropia, 19 (36.5%) patients with accommodative esotropia, and 10 (19.2%) patients with non-accommodative esotropia. Successful (favorable) outcome was seen in 18(78.2%) cases of congenital (infantile) esotropia, 19(100%) cases of accommodative esotropia, and 9(90%) cases of non-accommodative esotropia.

Conclusion: Pediatric esotropia can present at birth, during the first year of life, or acquired during early childhood. Treatment should be initiated as early as possible to achieve binocularity, improve visual outcome, and prevent psychosocial effects.

Keywords: Strabismus, esotropia, concomitant, accommodative, outcome.

Introduction

Strabismus (or squint) is a common presenting ocular disorder at ophthalmology outpatient clinics, with a worldwide incidence varying from 3% to 5%. Many studies were conducted in the field of strabismus including those evaluated the prevalence, types, and treatment outcomes.¹⁻⁷

Pediatric strabismus causes cosmetics, visual, and psycho-social problems affecting all qualities of life. Abnormal binocular function usually develops if

strabismus appears early in life and untreated before visual maturity, resulting in amblyopia, suppression and abnormal retinal correspondence. Therefore, treatment of strabismus should be initiated as early as possible to achieve binocular single vision, improve visual outcome, and prevent the resulting bad psycho-social effects.^{8,9}

Management of pediatric strabismus involves careful preoperative assessment, treatment of refractive errors with

glasses, prisms, or orthoptic exercises, and treatment of amblyopia. However, the majority of these cases require eye muscle surgery which is usually indicated to correct the eye position in primary gaze, and improve the range of binocular single vision.^{10,11}

Few studies were conducted on pediatric strabismus in our locality. Therefore, this study was carried out to evaluate the clinical types, clinical features, and treatment outcomes of esotropia among children presented to the strabismus clinic at Sohag University Hospital.

Patients and methods

A prospective, case series, interventional study was conducted to evaluate children presented to the strabismus outpatient clinic at Sohag University Hospital with esotropia, in the period between April 1st, 2018 and December 31th, 2018; with a follow-up period of 12 months. Inclusion criteria included patients aged ≤ 12 years, presented with non-paralytic (concomitant) esotropia which was not associated with ocular pathology, nor with the neurological disorder. Patients with paralytic esotropia, ocular pathology, esotropia associated with neurological dysfunction, a history of previous strabismus surgery, or a postoperative follow-up period of fewer than 12 months were excluded from the study. The study was done in accordance with the Helsinki Declaration Principles, after obtaining the approval of the medical ethics committee at Sohag Faculty of Medicine. Informed consent was obtained from the parents of children participating in this study.

A standard protocol for examination was followed for all patients including:

i) History: including age, sex, age of onset of squint, history of previous

- treatment (glasses, occlusion therapy, or surgery), and associated symptoms.
- ii) Visual acuity of both eyes separately (with & without glasses if available). From 6 months to 1 year, the method used was fixation and follow; from 1 year to 3 years with picture cards or chart; from 3 to 6 years with E chart; from 6 years and up with Land-olt's C chart.
 - iii) Slit-lamp biomicroscopy of the anterior segment (For cooperative children).
 - iv) Fundus examination with fully dilated pupils (under general anesthesia for infants, and in a clinic for cooperative children).
 - v) Ocular motility examination in the 6 cardinal positions of gaze.
 - vi) Cover test for distance and near.
 - vii) Measurement of deviation in distance and near vision with Hi-rschberg test (in children below 3 years), and with prism bar (in cooperative children above 3 years).
 - viii) A cycloplegic refraction using cyclopentolate 1% eye drops.
 - ix) A record of any abnormal head posture, nystagmus, or amblyopia.

Children with esotropia in this study were classified into 3 main groups:

Group A: Congenital (Infantile) esotropia; **Group B:** Accommodative esotropia (which was subdivided into 3 subtypes: fully accommodative, partially accommodative, and accommodative esotropia with convergence excess); and **Group C:** Non-accommodative esotropia

The following parameters were accurately defined before the study: Congenital (Infantile) esotropia was defined by an onset before 6 months of age, angle > 40 PD, cross fixation, normal neurological status, and normal cycloplegic refraction

for patient’s age. Fully accommodative esotropia was defined as an esotropia which was totally corrected for distance and near with hypermetropic correction; partially accommodative esotropia was defined as a reduction in the angle of esotropia of ≥ 10 PD for distance or near with hypermetropic correction, and accommodative esotropia with convergence excess was defined as esotropia with the near angle exceeded the distance angle by 15 PD while using the hypermetropic correction. Non-accommodative esotropia was defined with the angle of esotropia not changed by hypermetropic correction (glasses).

Postoperative follow up (For patients undergoing squint surgery)

Post-operative follow up was done on the 1st day, 1st week, 1st month, 3 months, 6 months, and 1 year.

Surgical outcome: Patients were classified according to the surgical outcome into 2 groups based on their post-operative alignment: (1) Successful (Favorable) outcome; (2) Re-operation for either

under-correction “residual esotropia” or over-correction “consecutive exotropia”. A successful (Favorable) outcome was defined as final alignment within ± 10 degrees of straight.

Results

Among all strabismus cases presented to the strabismus clinic during the period of the study, a total of 52 children with non-paralytic (concomitant) esotropia were included (27 males & 25 females); 23 patients (44.2%) with congenital (infantile) esotropia, 19 patients (36.5%) with accommodative esotropia, and 10 patients (19.2%) with non-accommodative esotropia. The age group of patients varied from 6 months to 12 years. There were 7 (13.5%) children in 6 months to 1-year age group, 12 (23.1%) in 1–2 years group, 4 (7.7%) in 2–3 years group, 14 (26.9%) in 3–6 years group, 6 (11.5%) in 6-8 years group, and 9 (17.3%) in 8-12 years group (**Table 1**). The results of each of the 3 groups will be discussed separately (**Table 2**).

Data	No.	%
Age:		
6 m – 1 y	7	13.5
1-2 y	12	23.1
2-3 y	4	7.7
3-6 y	14	26.9
6-8 y	6	11.5
8-12	9	17.3
Sex:		
Male	27	51.9
Female	25	48.1
Total	52	100

Table 1. Demographic data of children with esotropia in this study

Group A: congenital (infantile) esotropia (Fig. 1, 2)

There were a total of 23 (10 males & 13 females) cases of infantile esotropia. The age of patients at presentation ranged

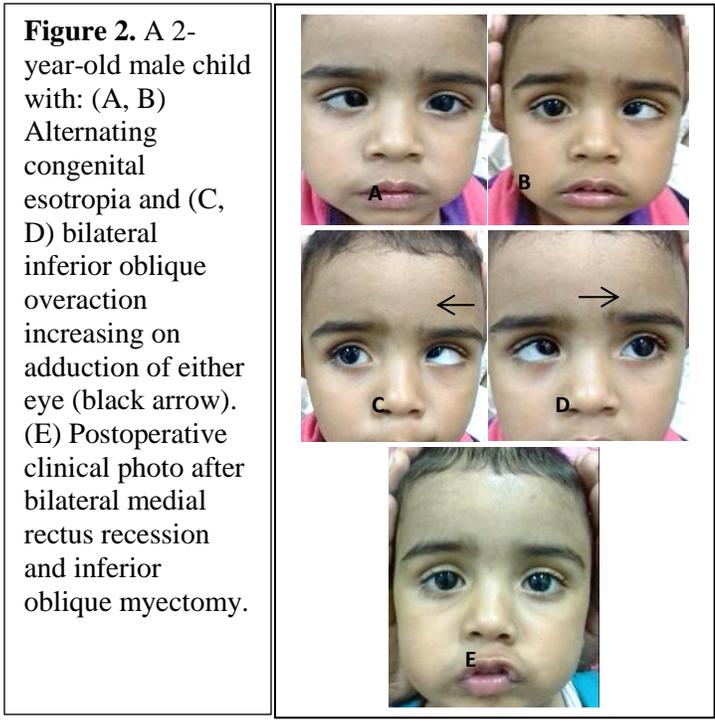
Type of esotropia	No.	%
(1) Congenital (Infantile) esotropia	23	44.2
(2) Accommodative esotropia	19	36.5
a. Fully accommodative esotropia	16	30.8
b. Partially accommodative esotropia	3	5.8
(3) Non-accommodative esotropia	10	19.2
Total	52	100

Table 2. Types of esotropia in this study

from 6 months to 3 years. There were 7 (30.4%) cases presented at the age of 6 months – 1 year, 12 (52.2%) at 1–2 years, and 4 (17.4%) at 2-3 years. Cycloplegic refraction was below +3 diopters in all

cases The preoperative angle of esotropia was > 40 prism diopter (PD) in all cases. Inferior oblique overaction (IOOA) was seen in 5 cases (2 mild, 2 moderate & one severe), latent nystagmus in 3 cases, and dissociated vertical deviation (DVD) in one case. All cases were planned for early surgical correction with bilateral medial rectus recession in 19 cases, and recession of medial rectus/resection of lateral rectus in the non-dominant amblyopic eye in the remaining 4 cases.

Inferior oblique myectomy was done in one case with severe IOOA. A successful (Favorable) outcome was seen in 18 cases, and re-operation for correction of residual esotropia was done in 5 cases, with unilateral lateral rectus resection in 4 cases, and unilateral medial rectus recession in one case, 3 months after the initial surgery. Patients with preoperative amblyopia were further followed up with occlusion therapy for varying periods.



Group B: Accommodative esotropia (Fig. 3)

A total of 19 (11 males & 8 females) cases of accommodative esotropia were included in this study; of whom 16 patients (30.8%) of fully accommodative esotropia, and 3 patients (5.8%) of partially accommodative esotropia. Cycloplegic refraction was $> + 4$ D in all cases. For fully accommodative esotropia, the deviation was totally corrected for near and distance with hypermetropic correction (glasses), and no patient underwent

surgery. For partially accommodative esotropia, the deviation was partially corrected with glasses, and surgery was indicated for the correction of the residual esotropia based on the angle of deviation at distance vision, while the child wearing his/her glasses). Unilateral medial rectus recession was done in one case, and unilateral medial rectus recession/lateral rectus resection in 2 cases. A successful (Favorable) outcome was seen in the 3 cases during the follow-up period after surgery.



Figure 3. Four cases of fully accommodative esotropia corrected with glasses (hypermetropic correction).

Group C: Non-accommodative esotropia (Fig. 4, 5) There were 10 children (6 males & 4 females) with non-accommodative esotropia in this study. The mean age at presentation was 7 years (range 3 - 12). The mean cycloplegic refraction was ± 1.50 D to ± 2.50 . The mean esodeviation for near and distance fixation was ± 40 PD (range 20-80). None had near/distance disparity. Inferior oblique overaction was present in 2 cases. Bilateral medial rectus recession was done for 7 children, a bilateral medial rectus recession with unilat-

eral lateral rectus resection in 2 children, and a unilateral recession/resection in the non-dominant amblyopic eye for one child. Post-operative amblyopia treatment was required for one child. A successful (favorable) surgical outcome was achieved in 9 cases, and reoperation for correction of residual esotropia (> 10 PD) was done in one case. Treatment outcomes of pediatric esotropia are summarized in (Table 3).

Type of esotropia	Type of treatment (Glasses vs Surgery) (No.)	Success (Favorable) outcome*	Residual angle > 10 PD (Re-operation)
(1) Congenital (Infantile) esotropia	Surgery (23)(All cases)	18	5
(2) Accommodative esotropia	(19)		
a. Fully accommodative esotropia	Glasses (16)	16	0
b. Partially accommodative esotropia	Glasses + Surgery (3)	3	0
(3) Non-accommodative esotropia	Surgery (10)	9	1

Table 3. Treatment outcomes of pediatric esotropia in this study

* Orthotropia or residual angle < 10 PD.



Discussion

Strabismus is a common presenting ocular problem at outpatient clinics of ophthalmology. Pediatric esotropia is the most common type of strabismus disorder presenting at the pediatric ophthalmology and strabismus clinics. Early diagnosis and treatment of pediatric strabismus are essential before brain full maturity. Apart from improving the cosmetic appearance, strabismus surgery in children helps to restore binocular vision and improve psychosocial aspects.^{12,13}

The present study aimed to evaluate the clinical types, clinical features, and treatment outcomes of esotropia among children presented to the strabismus clinic.

For the purpose of discussion and analysis of results, among all patients with esotropia, pediatric patients aged ≤ 12 years were included in this study. They were fully evaluated, and classified into 3 main groups namely, congenital (infantile), accommodative, and non-accommodative esotropia. The results of each group were further studied and analyzed. Infantile esotropia was the commonest type (23 patients, 44.2%), followed by accommodative esotropia (19 patients, 36.5%), then non-accommodative esotropia (10 patients, 19.2%). Fully accommodative esotropia was the commonest type of accommodative esotropia group (16 patients, 30.8%). The age of

presentation of patients in this study ranged between 6 months and 12 years. Some patients with infantile esotropia were presented late, even beyond 2 years of age. This may be explained by the fact that parents of those children were late for seeking medical consultation due to different causes such as poor financial condition, false beliefs, or ignorance.

The age for surgery in infantile esotropia has been discussed by many authors in the literature over the last five decades.^{14,15} Whether to do an early or late surgery for infantile esotropia was a matter of controversy in the literature. Some authors¹⁶⁻¹⁸ had recommended 4 – 6 months as the earliest age for congenital esotropia surgery; while others recommended late surgery. Many studies in the literature had been conducted to compare early versus late surgery for congenital (infantile) esotropia.^{19,20} However, in our study, all infantile esotropia cases were operated upon as early as 6 months and thereafter, so, this factor (early vs late surgery) could not be compared with other studies in the literature.

The success rate of surgery for pediatric esotropia in our study was 69.2% (cases of esotropia in whom squint surgery was done). The outcome of strabismus surgery, in general, have been reported in many studies in the literature, with great variability of the results ranging from 30% to 80%.²¹ Several pre-operative, intra-operative, and postoperative factors are suggested to play a role in the final outcome of surgery such as the type of strabismus,^{22,23} age at strabismus surgery,^{24,25} pre-operative angle of deviation,²⁶ sensory and motor outcomes,²⁷ types of surgery and muscles operated upon,^{26,28} binocular vision,²⁹ postoperative alignments,³⁰ and surgeon's experience (residents versus consultant strabismus surgeons).^{21,32,33} All the previous factors

are important in the final results of strabismus surgery. However, a comparison between ours and other studies may not be very accurate because of many differences in the previously mentioned factors. For example, our study was conducted on the pediatric age group (not adult strabismus), and for patients with concomitant (non-paralytic) esotropia only. Patients with paralytic esotropia, or associated with neurological disorders like cerebral palsy were excluded from our study.

Accommodative esotropia usually manifests between ages 1 and 3 years (usually after 2 years) and can be sub-classified into fully and partially accommodative types. Fully accommodative esotropia requires no surgical intervention and is treated by full hypermetropic correction (glasses) following cycloplegic refraction. Acquired non-accommodative esotropia is a specific type of esotropia that refers to a group of esotropia patients not associated with accommodative effort. The onset of this condition may be acute, or it can result from deterioration of existing, previously controlled, esotropia.³³ Several risk factors have been suggested for the decompensation of fully accommodative esotropia into acute non-accommodative type, including the onset of esotropia before age 2 years,^{34,35} -oblique dysfunction,³⁴ and a greater esodeviation at near than at distance.³⁶⁻³⁹

Conclusion

Pediatric esotropia may present at birth, during the first year of life, or acquired during early childhood. Treatment of pediatric strabismus should be initiated as early as possible to achieve binocularity, improve visual outcomes, and prevent psychosocial effects. Early surgery for infantile esotropia is recommended by the authors in this study with a successful outcome in most cases. Post-operative

alignment within ± 10 PD of straight was considered as a significant indicator of a successful outcome. Fully accommodative esotropia cases were totally corrected with glasses with no need for surgery. Surgery was performed in partially accommodative esotropia cases to correct the residual angle while wearing glasses.

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