

Research Article

Strabismus in paediatric age (3-16 year): a clinical study

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ABSTRACT

Background: Strabismus is a clinical condition in which the eyes are not aligned with each other properly. The main objective of the study was to study the prevalence, aetiology and the most common type of strabismus in children between 3- 16 years of age.

Methods: This was a prospective study conducted from November 2012 to October 2014 at Government regional eye hospital Visakhapatnam. A total of 50 patients included in this study. Children between 3-16 years of age presenting with squint included in this study. All children below 3years and above 16 years excluded from this study. Detailed history regarding the complaint, birth history, developmental history was taken. Patients were thoroughly evaluated for Visual acuity, both distance and near vision with naked eye as well as best corrected visual acuity. Thorough anterior segment evaluation using slit lamp, cycloplegic refraction using atropine (<7 years) or cyclopentolate (>7 years), fundus examination was done.

Results: A total of 9678 children attended GREH during the period of the study. Among them total number of children with strabismus was 59. Thus the prevalence of strabismus is 0.6%. Children in the age group of 3-10 years of age are more involved 37 (62.7%). Exotropia was seen in 34 cases and esotropia in 24 cases. Comitant esotropia was more common, seen in 16 (27.1%) of cases. In exotropia comitant exotropia was more common, seen in 32 cases and incomitant in 2 cases and divergence excess seen in 9 cases. History of consanguinity present in 22% of cases.

Conclusions: Prevalence of squint in children in 3 - 16 years age group was 0.6%. Comitant squint was more common than incomitant squint. Among comitant squint, exotropia was more common than esotropia. More research is needed to validate the role of consanguinity in strabismus.

Keywords: Strabismus, Esotropia, Exotropia, Refractive errors, Consanguinity, Divergence

INTRODUCTION

Strabismus is a clinical condition in which the eyes are not aligned with each other properly. Strabismus, also called "Squint", is derived from the Greek word strabismus. Normally, our eyes are aligned together in a way that when looking at an object, both visual axes

always intersect at the object of interest. With proper ocular alignment, we can see things without diplopia or confusion. In contrast, people with strabismus have abnormal alignment of the two eyes in which one of the eyes is deviated in or out or up or down. In simple terms strabismus is the condition where the visual axes of the two eyes do not meet at the point or object of regard.¹

This abnormal ocular alignment could occur constantly or intermittently and may be accompanied by abnormal ocular motility, double vision, poor vision or abnormal head positioning. A neglected case of strabismus may lead to loss of binocular single vision along with cosmetically undesirable appearance. These findings suggest all patients with strabismus need to have their eyes aligned, either surgically or optically, to maximise their binocular vision outcome.²

In addition, children and adults with strabismus often suffer from several psychosocial and emotional consequences viz. poor self-image, negative social bias, ridicule at school, depression, anger and outrage, increased social anxiety, poor interpersonal relationship, inhibition and poor job opportunities in adults.³ Its early detection is, therefore, important for both, the restoration of normal ocular alignment and the establishment of binocular single vision preferably at early age.² Hence, it makes sense to study the prevalence, causes and common type of strabismus in pediatric age group (3-16 years).

METHODS

This was a prospective study conducted from November 2012 to October 2014 at Government regional eye hospital Visakhapatnam. A total of 50 patients included in this study. Children between 3-16 years of age presenting with squint included in this study. All children below 3years and above 16 years excluded from this study. Detailed history regarding the complaint, birth history, developmental history was taken. Patients were thoroughly evaluated for Visual acuity, both distance and near vision with naked eye as well as best corrected visual acuity.

Thorough anterior segment evaluation using slit lamp, cycloplegic refraction using atropine (<7 years) or cyclopentolate (>7 years), fundus examination was done.

Strabismus was evaluated using HCRT, CT, ACT, PBCT, WFDT, Bagolini’s striated glass test, Titmus Flytest. Appropriate radiological / clinical investigations were done as and when necessary.

RESULTS

A total of 9678 children attended GREH during the period of the study. Among them total number of children with strabismus was 59. Thus the prevalence of strabismus is 0.6%. Prevalence of strabismus in boys was 0.3% and in girls 0.299.

Table 1: Gender distribution.

Gender	Boys	Girls
Number	30 (51%)	29 (49%)

Boys (50.85%) and girls (49.15%) were almost equally involved (table 1). Esotropia was more common in boys and exotropia was more common in girls. Strabismus was more common in the age group of 3-10 year, account for 0.38% of prevalence.

The prevalence in the age group is 0.22%. Esotropia was more common in 3-10 years of age and exotropia more common in 11-16 years. History of consanguinity was present in 22% Of cases. In 3.3% of cases history of prematurity was present. Family history of strabismus was seen in 3.3% of cases (Table 3)

Table 2: Age distribution and type of deviation.

Age (years)	Esotropia	Exotropia	Hypertropia
3 - 10	19	17	1
11 - 16	5	17	0

Table 3: Positive history data.

Deviation type	Consanguinity	Family history of squint	Prematurity	Antenatal Infections	Total
Esotropia	4 (6.25%)	1 (1.7%)	2 (3.3%)	0	7 (11.9%)
Exotropia	13 (15.25%)	1 (1.7%)	0	1 (1.7%)	14 (23.7%)

Table 4: Gender distribution of various types of strabismus.

Deviation	Exodeviation	Esodeviation	Vertical deviation
Girls	19	9	1
Boys	15	15	0

In this study Exotropia is more common than Esotropia. Exotropia accounts for 34 (57.6%) and Esotropia 4 (40.6%) Of cases. Accommodative esotropia is the most common type of esotropia seen in 27% (16) of cases.

Refractive errors were seen in 52.4 (31%) of cases. Myopia is the most common type of refractive error. 18 (30.4%) and hypermetropia seen in 22% (13). In this study, myopic refractive error more in exotropia 13

(22%) and hypermetropic refractive error more in esotropia 12 (20.3%) (Table 5). Refractive errors were seen in 31 (52.4%) children.

Table 5: Refractive errors.

	Myopia	Hypermetropia
No. of children	18 (30.4%)	13 (22%)

DISCUSSION

The prevalence of strabismus in the current study was found to be 0.6%. This is close to the figure of 0.7% prevalence of squint in a study by Kalikivayi V et al conducted in South India.⁷ Another study in North India by Gupta M et al gave a prevalence of 2.5%.⁸

Table 6: Prevalence.

Study	Boys	Girls
Current study	50.85%	49.15%
Graham PA ¹⁵	prevalence 7.3%	prevalence 6.9%
CBO Yu et al ²¹	46.8%	53.2%
Adelstein A.M et al ²⁶	52.3%	47.7%
Cass EE ¹⁵	30%	70%

Table 7: Region wise prevalence comparison.

Current study	South India	0.6%
Kalikivayi V et al ⁴⁶	South India	0.7%
Gupta M et al ⁴⁷	North India	2.5%
Graham PA ¹⁵	Cardiff, England	7.1%
Adelstein A.M et al ²⁶	England	4.3%
Rantanen A et al ²³	Finland	4.6%
Ayanru ²⁵	Nigeria	1.9%
Matsuo T et al ²⁴	Japan	1.28%

Table 8: Gender wise prevalence comparison.

Study	Boys	Girls
Current study	50.85%	49.15%
Graham PA ¹⁵	prevalence 7.3%	prevalence 6.9%
CBO Yu et al ²¹	46.8%	53.2%
Adelstein A.M et al ²⁶	52.3%	47.7%
Cass EE ¹⁵	30%	70%

In other countries, prevalence of strabismus found to be 4.3% in England by Adelstein AM et al while Graham PA gave a prevalence of 7.1%.^{15,26} In Africa, study by Ayanru JO showed a prevalence of 1.9%.²⁵ In Japanese elementary school children, it was 1.28%.⁴ Rantanen A et al in Finland gave a prevalence of 4.6% (Table 6) and (Table 7).

The above table shows a considerable variation in prevalence rates in various studies. One of the factors responsible for this variation are the differences in the age group of children included in the study. The current study included children in 3 - 16 years age group, while the study by Matsuo T et al in Japan was conducted in elementary school children.⁴ Furthermore, current study and the study in England by Adelstein AM et al are

hospital based studies while the remaining studies are population based studies.⁹

Prevalence of strabismus in current study was found to be 0.3% in boys and 0.299% in girls compared to 7.3% in boys and 6.9% in girls in study by Graham PA.¹³ This difference was found to be statistically insignificant. The percentage of girls with strabismus was 49.15% and in boys was 50.85%.

The comparison of gender distribution in other studies is shown in the following (Table 8) In studies by Graham PA, Adelstein AM et al and also in the current study there is slight male preponderance but this difference was not statistically significant. While CBO Yu et al, and Cass EE reported a female preponderance.^{13-16,19}

Exotropia was found to be more common in boys while esotropia was found to be more common in girls. But this difference was not statistically significant (Table 4).

On the whole strabismus was more common in 3-10 years age group (prevalence of 0.38%) when compared to children in 11-16 (0.22%) year's age group prevalence. This difference is statistically significant. But this could also be because the current study is an institution based study. Several young children who might not have developed vision loss and so haven't yet consulted an ophthalmologist. These children were likely missed in the current study.

When esotropia and exotropia were compared separately, Esotropia was found to be more common in 3-10 years age group while exotropia was more common in 11-16 years age group (Table-2). But this difference was found to be statistically insignificant. This is in tune with study by Abrahamsson M et al which found out that esotropia is detected early, between 1 and 4 years of age while exotropia was detected in older children.⁵

Similar conclusions were also given by Mohny BG et al i.e. esotropia is the most common form in the first six years of life; beyond this age exotropia predominates until the teenage years when the three forms have a similar but decreased incidence.

But this implication cannot be considered in the current study because of the difference in the age group of children included for the study. In study by Abrahamsson M et al children were screened at 1 year and also the data of children under 8 years who attended ophthalmic clinics for various complaints were screened. Mohny BG et al included children under 19 years of age.^{5,18} In the current study, children under 3 years of age were excluded. Hence, the age of onset cannot be determined as the history obtained from parents becomes the only source and by itself is not very accurate.

According to writing committee for the multi-ethnic pediatric eye disease study and the baltimore pediatric eye disease study groups, esotropia was associated independently with prematurity, maternal smoking during pregnancy, older preschool age (48-72 months), anisometropia, and hyperopia.¹⁹ Exotropia was associated with prematurity, maternal smoking during pregnancy, family history of strabismus, female sex, astigmatism and anisoastigmatism.

According to Remaly NA et al risk of strabismus increased with low birth weight.²⁰ Maternal cigarette smoking during pregnancy also increased the risk of each type of strabismus. Maternal age was also a significant risk factor for esotropia. The risk of esotropia increased with increasing age until age 34 years. Cass EE stated that a family history of squint was present in only 28% of the cases.²¹ In study by Graham PA, 8.1% of children in control group had a family history of squint, while 19%

of children with squint had a positive family history.¹³ In the current study, 3.3% of children had a positive family history. History of prematurity was present in 3.3% of children (all of them were esotropes).

Another interesting finding was the presence of consanguinity in 22% of children evaluated. This is a relatively less explored facet of squint that needs further investigation to decide whether it is a confounding factor or a genuinely important risk factor. The classical teaching about the distribution of esotropia and exotropia is that esotropia is more common than exotropia.^{1,3,7} This idea is based on studies conducted in Western population. But, studies conducted on Asian population revealed that exotropia is more common than esotropia (Table 8).

Studies by Rachael H et al have shown that intensity and duration of exposure to sunlight may play a role in pattern distribution of strabismus along with racial factors.²² Thus, higher the intensity of light, higher the frequency of exotropia. In the current study, which involved a population belonged to a coastal region of Southern India where the sunlight is harsh, a similar prevalence of exotropia was noted. In the current study, esotropia was seen in 40.6% of cases (prevalence 0.25%) while 57.6% had exotropia (prevalence 0.35%). Hypertropia was seen in 1.8% of children (prevalence 0.01%).

In current study, accommodative esotropia was found to be the most common type of esotropia (27.1%). Non accommodative and sensory types were next more common at 5.8% each and finally incomitant esotropia was found in 5.08%.

This correlates with study by Graham PA, in which accommodative esotropia was found to be more common than non-accommodative esotropia and also with Mohny BG.^{13,18} According to this study, the five most common forms of strabismus, in declining order, included accommodative esotropia (27.9%), inter-mittent exotropia (16.9%), acquired non accommodative esotropia (10.2%), esotropia in children with an abnormal CNS (7.0%), and convergence insufficiency (6.4%).

Similar results were also seen in study by Chia A et al.²³ In their study, 53% had accommodative esotropia and 23% had congenital esotropia. In yet another study by Greenberg AE et al, on incidence and types of childhood esotropia, fully accommodative 36.4%; acquired non accommodative 16.6%; esotropia associated with an abnormal central nervous system 11.4%; partially accommodative 10.1%; congenital 8.1%; sensory, 6.5%; paralytic 6.5%; undetermined 3.4%; and other 1.0% which correlates with the current study.²⁴

The current study, intermittent exotropia accounted for only 14.7% of children with exotropia in comparison to 16.9% in study by Mohny BG and 92% in study by Chia A et al.²³ In study by Graham PA and in the study by

Rantanen A et al intermittent exotropia was the most common type.^{10,25}

The less number of cases of intermittent exotropia can be explained by the fact that the study population is predominantly rural and illiterate. Parents of these children do not seem to be overly concerned about a deviation that is present only during a part of the day. Moreover there is a superstitious belief among the general population of this region that squint is a harbinger of good luck. This makes the parents reluctant to consult an Ophthalmologist unless there is loss of vision or any other visual morbidity.

Sensory strabismus was seen in 32% of the children in the current study. Among them majority (78% of children with sensory strabismus) had exotropia. Age of these children varied from 5 - 13 years in those with esotropia and 7 - 16 years in those with exotropia. Etiology in esotropia was found to be predominantly congenital causes while that in exotropia was predominantly due to acquired causes.

This corresponds to according to Havertape SA et al, who state that of patients with congenital vision loss, 67% developed sensory esotropia and 33% developed sensory exotropia.²⁶ Of those with acquired vision loss, 10% developed sensory esotropia and 90% developed sensory exotropia. According to the authors, patients with congenital vision loss are significantly more likely to develop esotropia, and those with acquired vision loss are significantly more likely to develop exotropia.

In the current study, the age distribution of children with sensory esotropia ranged from 5 - 13 years, while that in those with sensory exotropia ranged from 7 - 16 years. Thus there is a considerable overlap in the age distribution in both the groups. But because the age of onset cannot be accurately known, this discrepancy is not significant. Refractive errors were seen in 52% of children examined. Of these myopia was most common refractive error overall hypermetropia was most common error in children with esotropia, but also seen in 1 child with exotropia (Table 5).

This corresponds to several previous studies including the study by Abrahamsson M et al and also with classic text book teaching (Duke Elder S).^{5,3} One case of hypertropia was seen in the current study which seen in association with abnormal Central Nervous System (mid brain Tuberculoma). But according to previous studies, the most common cause for hypertropia in childhood are 4th Cranial nerve palsy, primary inferior oblique overaction, Brown syndrome, or a vertical tropia in the setting of an abnormal central nervous system.²⁷

One case of Duane's Retraction syndrome with esotropia was seen. Among the other cases of incomitant squint observed in the current study, 4 children had paralytic squint (prevalence - 0.04%); which included a case each

of Congenital and acquired 3rd cranial nerve and 6th cranial nerve palsy.

In the study by Holmes JM et al on paediatric third, fourth and sixth nerve palsies, the most commonly affected nerve was the fourth (36%), followed by the sixth (33%), the third (22%), and multiple nerve palsies (9%).²⁸ The most common cause was congenital for third and fourth nerve palsy, undetermined for sixth, and trauma for multiple nerve palsies. Although three cases were associated with neoplasia, cranial nerve palsy was not present at the time of diagnosis in any case. The study by Mahoney NR et al on benign recurrent sixth nerve palsies in children concluded that a new onset sixth nerve palsy presenting in children can be benign in approximately 13% of cases, so a thorough history and physical examination to evaluate for any other neurological symptoms or signs followed by MRI of the brain with and without contrast is recommended.²⁹

Amblyopia was present in 15.25% of children with strabismus in the current study when compared to 53% of all cases of manifest strabismus as reported by Abrahamsson A et al.⁵ There is an inexplicable superstitious belief in the study population that strabismus brings good luck to the family of these children. So the parents of boys were unwilling to let their children undergo surgery. The majority of girls with strabismus do not seek surgery until marriageable age. By this time there could be gross loss of stereopsis and probably even loss of vision.

Parents are not aware of the adverse outcome of untreated strabismus is thought to be a major reason of their affected child not being discovered earlier. Between 1993 and 1995, 862 elementary students in the first, third, and sixth grade at Keelung Ann-Lo Community were screened.³⁰

Of those with strabismus, only 21.4% knew that they had strabismus. Neither the prevalence nor the self-known proportion of strabismus changed substantially with school grade, suggesting that the majority of strabismus afflicted children remain unrecognized during their elementary school years. The amblyopia proportion in those with tropia was 42.9% and reduced to 21.5% after abnormal refractive error was excluded. Parents are not aware of the timing of treating strabismus. This study has shown that many parents are not aware of the need for timely treatment of strabismus, suggesting that childhood strabismus is often neglected by the public at large.³⁰ This highlights the need for a greater emphasis on health education at the community level.

Limitations of the study

But the interpretation of this study is limited by the fact that the sample size is relatively small. It is an institution based study, so the problem statement in the society cannot be accurately made out.

CONCLUSION

Prevalence of squint in children in 3 - 16 years age group was 0.6%. Comitant squint was more common than incomitant squint. Among comitant squint, exotropia was more common than esotropia. Divergence excess type and accommodative esotropia type were the most common type of exotropia and esotropia respectively. Sensory strabismus accounted for 32% of cases of strabismus. Appropriate ante natal checkups, early diagnosis and appropriate management can greatly reduce the disease burden due to this cause.

Approximately 52% of children had refractive errors (Table 5). Myopia was the most common refractive error overall. This warrants an annual checkup of all children. Specifically, those found to have any visual morbidity should be examined more often to prevent progression. Prevalence of amblyopia was found to be 0.09%. Regular school based / community based screening of children is necessary for early diagnosis of strabismus in children. An option that can be looked into for this purpose is a comprehensive health examination including complete eye check up at the time of enrolment in primary school.

More research is needed to validate the role of consanguinity in strabismus. Extensive health education campaign among children as well as their parents is needed to alleviate superstitious beliefs.

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