

Prevalence and Clinical Patterns of Essential Infantile Esotropia in Tertiary Care Hospital, Erode District, Tamil Nadu: Prospective Observational Study

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Received: 18-10-2023 / Revised: 21-11-2023 / Accepted: 26-12-2023

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Conflict of interest: Nil

Abstract:

Introduction: Essential infantile esotropia (EIE) is the most common type of childhood esotropia. Aim of this study is to study the clinical patterns of essential infantile esotropia, etiological and demographic profile of patients with Essential infantile esotropia between ages 0-12 years in a tertiary care hospital to assess various clinical patterns and refractive errors.

Materials and Methods: It is a prospective observation study of patients with Essential infantile esotropia conducted at Government Erode Medical College Hospital, Perundurai, from January 2023 to September 2023. The study included 25 patients with typical features of Essential infantile esotropia, under 12 years of age were included. Amount of deviation, refractive status of the eye and associated features like inferior oblique overaction were recorded. Amblyopia was treated with occlusion therapy.

Results: The study involved 25 children, with 28% under 2 years old and 72% over 2 years old. The mean age of surgery (change as mean age of patients presenting to hospital) patients was 5.43 years, with 14 males and 11 females. The study found that 48% of the 25 patients were emmetropic, while 44% had mild hypermetropia and Myopia was seen in 24% of cases. Amblyopia was seen in 69% of cases which majority improved with amblyopia therapy. 36% of patients in the study exhibited cross fixation, while 52% demonstrated abduction limitation. In our study, DVD was seen in 4 % of patients, Inferior oblique overaction was seen in 16 % of the patients

Conclusion: This study provides data on the most prevalent forms and associations of Essential infantile esotropia and knowledge of various clinical types. Timely intervention will help in the development of binocular single vision.

Keywords: infantile esotropia, binocular single vision, amblyopia, Prevalence, hypermetropia, Myopia.

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Introduction

The term "esotropia" refers to an eye misalignment when one eye veers toward the nose.[1] Greek is the source of the term "esotropia," where "Eso" means "within" and "Tropia" means "a turn." It may be acquired or congenital, intermittent or continuous, and its patterns may gradually shift from intermittent to constant. Furthermore, depending on whether it is classified as contemporaneous or incomitant, the deviation may be constant or change in different gaze directions. Squinting may manifest in one or both eyes. Infantile (congenital) esotropia, accommodative esotropia, acquired non-accommodative esotropia, sensory esotropia, and

sequential esotropia are other classifications for the concomitant esotropias. [2][3] Infantile esotropia is the manifestation of ocular deviation occurs within six months after birth. These children generally exhibit a substantial degree of deviation, frequently exceeding 30 degrees that is observable both at a distance and up close. A different fixation is observed when looking straight ahead, while a crossed fixation occurs when looking to the sides. The dolls' head maneuver can be used to provoke abduction movements, aiding in the differentiation from bilateral sixth nerve palsy. The visual acuity or retinoscopy values in these youngsters are typically

within the normal range due to cross fixation, and it is not anticipated that there will be any substantial underlying refractive problems.[4]

According to a meta-analysis conducted by Hashemi et al., the estimated prevalence of esotropia was found to be 0.77%,[5] A further study conducted on school-aged children revealed that 3.11% of the children examined had strabismus, with a ratio of 1:9.75 between esotropia and exotropia diagnoses. In addition, it was noted that there were no notable variations in age within the 6-8 year range or in gender among the participants of the study. [6]

Moreover, the occurrence of strabismus and its many kinds differs among different racial groups. The Baltimore Pediatric Eye Disease Study found that the occurrence of visible abnormalities in eye alignment was 3.3% among individuals of Caucasian ethnicity and 2.1% among children of African American heritage. [7]

Both groups exhibited nearly equal occurrences of esotropias and exotropias. A retrospective cohort study conducted in Minnesota among patients identified with Esotropia found that 36% had fully accommodating esotropia, 17% had non-accommodative esotropia, and 10% had partially accommodative esotropia. By comparison, 8% of the cases were congenital, 6.5% were paralytic, and the remaining cases had an unknown underlying etiology of esotropia. [8].

Esotropia, which makes up 40% of strabismus, can happen periodically or continuously, giving the person the appearance of having crossed eyes. Children who experience esotropia may develop amblyopia. The brain suppresses the picture of the esotropic eye to prevent blurry vision from the deviated eye. If this suppression persists without treatment, amblyopia will eventually occur. To stop the development of amblyopia, which is common in esotropia, or to lessen its density, early diagnosis of the type and relationships as well as the advocacy of proper treatment are essential. If not, it will have an impact on the person's social and mental growth, as well as their academic achievement.

This study was envisaged to find out the prevalence and the clinical patterns of essential infantile esotropia, etiological demographic profile of patients with Essential infantile between ages 0-12 years in a tertiary care hospital to assess various clinical patterns and refractive errors.

Methodology

It is a prospective observational study of Essential infantile esotropia conducted at Government Erode Medical College Hospital, Perundurai, Erode, Tamilnadu from January 2023 to September 2023. The patients who attended the outpatient ophthalmology department, with the chief complaint of inward deviation of the eyes. 25 patients with

features of Essential infantile esotropia who attended the Department of Strabismus and Paediatric ophthalmology (to change as Department of Ophthalmology) at Government Erode Medical College Hospital, Perundurai were selected.

The inclusion criteria for this study encompassed children under 12 years of age exhibiting characteristic signs of essential infantile esotropia. Conversely, exclusion criteria encompassed conditions such as congenital abducens palsy, nystagmus blockade syndrome, Duane's retraction syndrome, and pseudosquint, which could mimic or confound the diagnosis. Additionally, children with central nervous system anomalies and those with notable refractive errors were excluded from the analysis to ensure a more homogeneous sample and to minimize potential confounding factors.

Any patient with esotropia who comes into the outpatient department needs to have a thorough examination and a complete history. Important details such as the patient's age, the deviation's beginning, and its type—constant, intermittent, unilateral, or alternating—should all be included in a thorough history taking.

Atypical head posture, complaints of double vision, headaches, asthenopia, and a history of closing one eye in direct sunlight are other important details to note. It is important to aggressively investigate any potential risk factors, such as viral sickness, head trauma, and excessive near-vision employment. Noting down any notable perinatal history or family history of squinting is also recommended. It is also crucial to have previous management, whether it be optical, occlusion therapy, or surgical.

Patient evaluation in this study was comprehensive, capturing essential demographic details such as age and sex, alongside specific clinical information including presenting complaints, age of symptom onset, duration of symptoms, family history, birth history, and developmental milestones. To ensure thoroughness, a meticulous general and systemic examination was conducted to exclude any anomalies. Visual acuity assessment and retinoscopy were performed universally; utilizing different methods based on age—pen torch fixation for preschoolers and Snellen optotypes for school-age children. Prism bar cover tests were employed for near and distance targets, with the Hirschberg test utilized for very young children to estimate deviation. Additional features of essential infantile esotropia were noted if present.

Amblyopia was managed with occlusion therapy, and outcomes were documented. Beyond ophthalmic assessments, patient evaluation extended to encompass general physical examination, evaluating factors like build and nutritional status. Specific observations regarding head posture, lid features, intercanthal distance,

interpupillary distance, and the presence of any characteristic facial features such as epicanthal folds or anomalies like exophthalmos or enophthalmos were recorded to provide a comprehensive clinical profile.

Prior to data collection, formal authorizations were obtained from the relevant authorities of the colleges. The participants were informed about the study aims and assured of data anonymity and confidentiality. Voluntary participation was required for the study. The authors affirm that the study adhered to the ethical guidelines established by the appropriate national and institutional bodies on human research. The project was also authorized by the Institutional Ethical Committee. Participants provided informed consent. All unfinished questionnaires were discarded.

The data were inputted, verified, and analyzed using the Statistical Package for the Social Sciences (SPSS) version 22 software. The study utilized 95% confidence intervals (95% CIs) to determine the important components linked to stress in college students. The threshold for statistical significance was established at a p-value of less than 0.05.

Results:

In our study, among 25 children, 7 children (28%) were less than 2 years of age. 18 children (72%) come under more than 2 years age group. Mean age at which patients underwent surgery (To Change AS presented at Ophthalmology OPD) is 5.43 years (Table 1).

Table 1: Age Distribution

Age group	No. of patients	Percentage
≤ 2years	7	28%
>2 years-12 years	18	72%

Table 2 outlines the gender distribution among patients in the study. Of the total patients, 25 were included, with males comprising 14 cases, accounting for 56% of the cohort. Conversely, females constituted 11 cases, making up 44% of the total sample. This indicates a slightly higher representation of males compared to females in the study population.

Table 2: Gender Distribution

Gender	No. of patients	Percentage
Male	14	56%
Female	11	44%

Among the patients included in the study, notable familial and perinatal factors were documented. Three patients, constituting 12% of the cohort, had a family history of squint, suggesting a potential genetic predisposition.

Additionally, a history of consanguineous marriage was noted in five cases, accounting for 20% of the total sample, potentially highlighting a hereditary

component. Furthermore, one patient, representing 4% of the study population, had a history of birth asphyxia, indicating a perinatal event that may contribute to the development of essential infantile esotropia.

These findings underscore the importance of considering familial and perinatal factors in understanding the etiology of the condition.

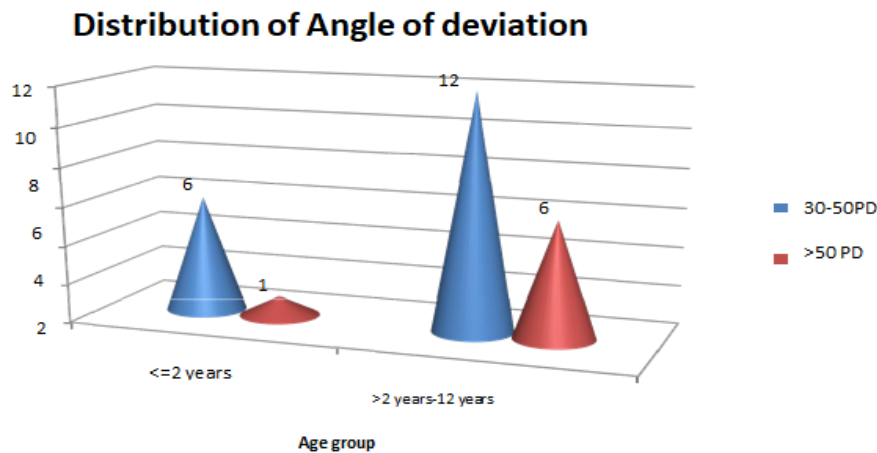


Figure 1: Angle of Deviation

The figure 1 presents data on essential infantile esotropia categorized by age and angle of deviation. In the group aged two years or younger, seven cases were recorded, with six having an angle of deviation between 30 and 50 prism diopters (PD), and one exceeding 50 PD. In the older age group, spanning from over 2 years to 12 years, a total of 18 cases were observed. Among these, 12 had an angle of deviation falling within the 30-50 PD range, while six cases surpassed 50 PD

Table 4: Distribution of Refractive Error

Refractive error	No. of patients	Percentage
Emmetropia	12	48%
Mild hypermetropia (< + 2.00 D)	11	44%
Moderate hypermetropia (+2.00 - +4.00 D)	1	4%
Myopia	1	4%

Table 4 presents the distribution of refractive errors among the patients included in the study. Among the total cohort, comprising 25 patients, 12 individuals, representing 48% of the sample, were classified as emmetropic, indicating a normal refractive state. Mild hypermetropia, defined as less than +2.00 diopters, was observed in 11 patients, accounting for 44% of the population. Additionally, one patient, constituting 4% of the cohort, exhibited moderate hypermetropia falling within the range of +2.00 to +4.00 diopters. Similarly, one patient, also representing 4% of the sample, presented with myopia. These findings elucidate the distribution of refractive errors among patients with essential infantile esotropia, emphasizing the prevalence of hypermetropia in this population. 36% of patients in the study exhibited cross fixation, while 52% demonstrated abduction limitation.

The assessment of binocular single vision was conducted using the Worth four-dot test in older children, aged over 5 years. Among the 10 children assessed, none demonstrated binocular single vision. Consequently, all children with amblyopia continued part-time occlusion therapy. Among them, three children who exhibited improvement during the study period maintained this progress regardless of age and maintained stable ocular alignment. However, therapy was discontinued in seven children who did not demonstrate improvement after three months. Among these, one patient exhibited residual esotropia less than 8 prism diopters (PD), while the remaining patients had large-angle residual esotropia exceeding 20 PD.

In our study, 48% of patients were emmetropic, 44% had mild hypermetropia, and small proportions had moderate hypermetropia and myopia. This contrasts with Costenbader's findings, where 46% had emmetropia to mild hyperopia, 41.8% were moderate hypermetropes, and 5.6% were myopes. The disparity may stem from potential underestimation of hypermetropia due to age-related factors.

In our study, 10 out of 25 patients had amblyopia, accounting for 40% of the population, with one patient under 2 years old and nine aged over 2 years.

Different studies have reported varied prevalence rates; for example, Von Noorden reported 35%, Costenbader 41%, and Shauly and colleagues 48%.

Amblyopia, a poor predictor of surgical outcome, requires treatment before surgery. Among the 10 children with amblyopia, 3 showed improvement in visual acuity after one month of part-time occlusion therapy, while 7 did not. Therapy was continued for all preoperative amblyopic children, with the 3 showing improvement maintaining progress regardless of age. After 12 weeks, therapy was discontinued in the 7 children who did not improve, with one having residual esotropia less than 8 PD and the others having large-angle residual esotropia exceeding 20 PD.

Discussion

The prevalence of Essential Infantile Esotropia (EIE) has been reported to be around 0.1% [9]. However, a study conducted on 2000 children at the Department of Strabismus and Paediatric Ophthalmology found a prevalence rate of 1.25% [10]. This higher prevalence rate observed in the study indicates a deviation from the previously documented prevalence by Helveston and co-workers.

Early surgery in children with infantile strabismus has been linked to improved stereoacuity due to minimizing the duration of misalignment rather than the eyes being aligned during the critical period of visual maturation.[11] The critical period for susceptibility of stereopsis in children with infantile strabismus starts at 2.4 months, peaks at 4.3 months, and extends through late infancy and early childhood, continuing to at least 4.6 years of age 4.

Furthermore, infantile esotropia, characterized by constant esotropia with an onset before 6 months of age, is less prevalent and is found in 5% to 12% of individuals with Down syndrome. [12] Additionally, infantile esotropia is one of the most common forms of pediatric strabismus, with a birth prevalence of 25 per 10,000 newborns.[13]

Studies have indicated that the timing of ocular misalignment manifestation plays a role in post-operative outcomes [14]. Moreover, maintaining

long-term stability of ocular alignment is crucial for the development of stereopsis.[15] Nystagmus has been linked to a higher likelihood of needing additional operations for residual deviation correction (Feng et al., 2015).[16] Patients with persistent amblyopia and manifest-latent nystagmus tend to have less favorable alignment outcomes (Bothun et al., 2016).[17] Conversely, infants who sustain satisfactory ocular alignment over time are more likely to achieve stereopsis (Molloy et al., 2013).[18]

Conclusion

In our study center, the prevalence of essential infantile esotropia was found to be 1.25%. Notably, only 28% of the children belonged to the age group of less than 2 years, a crucial period with higher chances of attaining stereopsis. Moreover, compared to Western populations, the prevalence of dissociated vertical deviation (DVD), inferior oblique overaction, and nystagmus was lower in our cohort. However, amblyopia was a significant concern, affecting 40% of the children. It's important to note that addressing amblyopia should take precedence before considering surgical correction, as failure to do so may result in postoperative instability of alignment. These findings underscore the importance of early detection and comprehensive management strategies for amblyopia in pediatric patients with essential infantile esotropia.

Limitation: The study at hand is subject to several limitations. Firstly, the duration of the research period may not provide sufficient insight into the long-term alignment stability and binocular single vision. Additionally, assessing amblyopia in young children poses challenges, potentially impacting the accuracy of the incidence reported in our study. Moreover, our investigation did not encompass the evaluation of amblyopia therapies beyond part-time occlusion. These constraints highlight the need for further research to address these aspects comprehensively and enhance our understanding of amblyopia management in pediatric populations.

Acknowledgments: The authors would like to thank all of the study participants and the administration of Department of Ophthalmology, Government Erode Medical College, Perundurai, Tamilnadu, India for granting permission to carry out the research work.

Ethical statement: Institutional ethical committee accepted this study. The study was approved by the institutional human ethics committee, Government Erode Medical College, Perundurai, Erode. Informed written consent was obtained from all the study participants and only those participants willing to sign the informed consent were included in the study.

The risks and benefits involved in the study and the voluntary nature of participation were explained to the participants before obtaining consent. The confidentiality of the study participants was maintained.

Authors' contributions

Dr. Pramila.M - conceptualization, data curation, investigation, methodology, project administration, visualization, writing—original draft, writing—review and editing; Dr. V. Praveen-conceptualization, methodology, writing—original draft, writing—review and editing; Dr.Sasikala Gunasekaran & Dr Panneerselvam Periasamy - methodology, writing—original draft, writing, review and editing.

All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work. All authors have read and agreed to the published version of the manuscript.

Data Availability: All datasets generated or analyzed during this study are included in the manuscript.

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