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Original Article

Frequency of Esotropia and its Management in Pediatric Age Group at CMH Quetta

Sarah Naveed Malik, Hannan Masud, Quratulain Zamir*

Department of Ophthalmology, Combined Military Hospital Quetta/National University of Medical Sciences (NUMS) Pakistan,
*Department of Ophthalmology, National University of Medical Sciences (NUMS) Pakistan

ABSTRACT

Objective: To find the frequency of esotropia, its sub types and subsequent management carried out in pediatric age group presenting to a tertiary care hospital in Quetta.
Study Design: Cross-sectional study.
Place and Duration of Study: Ophthalmology Department, Tertiary Care Hospital, Quetta Pakistan, from Jul to Dec 2020.
Methodology: Two hundred and forty patients were enrolled in the study with age 6 months to 13 years presenting with manifest or latent squint. Data was collected through consecutive sampling technique. A designed form for refraction and orthoptic assessment was used with complete ophthalmological examination on each visit. Diagnosis was made based on international definitions of strabismus and treatment was planned accordingly. Follow up was carried out to observe and analyze the effects of treatment in strabismus.
Results: Among 240 patients with strabismus, 152 patients had esotropia. More common in males (n=88) and most common refractive error was hypermetropia (n=94). Out of these 32 had anisometropia and 47 had amblyopia. According to classification of esotropia, 34.2% of patients had fully accommodative esotropia and 13.2% patients had essential infantile esotropia. Combination of treatment modalities was used. 21 patients were prescribed executive bifocals. Patching for 2 hours daily during activity under observation was advised to patients with amblyopia. 36 patients had surgery and 14 patients were kept under observation.
Conclusion: Our study concluded that esotropia was the most prevalent type of strabismus in pediatric age group at tertiary care hospital in Quetta with accommodative type being the most common which can successfully be treated with glasses. A significant number of patients also had amblyopia with more common being in patients with esotropia. Hence amblyopia must be identified and should be treated in early years.

Keywords: Esotropia, Pediatric age, Strabismus.

How to Cite This Article: *Malik SN, Masud H, Zamir Q. Frequency of Esotropia and its Management in Pediatric Age Group at CMH Quetta. Pak Armed Forces Med J 2024; 74(Suppl-2): S324-S328. DOI: https://doi.org/10.51253/pafmj.v74iSUPPL-2.6037*

INTRODUCTION

Humans are gifted with different senses to regulate their day to day life and by far the most vital sense is of sight. Eyes and visual system help us gather and integrate the information in our surrounding and hence aiding us to perform different tasks daily. If the information reaching the brain is disrupted at any point along the visual pathway by any cause, it can lead to impaired vision and is a common cause of strabismus especially in pediatric age group.

Strabismus also commonly referred to as squint is a common ocular disorder presenting to ophthalmology clinics. It is defined as a state of abnormal alignment of two eyes and has a frequency ranging from 0.5% - 5% varying according to region.[1-3] The main treatment goal in management of strabismus in children is restoration of eye alignment together with fusion and stereo acuity.

Correspondence: Dr Sarah Naveed Malik, Department of Ophthalmology, Combined Military Hospital, Quetta Pakistan
Received: 05 Jan 2021; revision received: 28 Jan 2021; accepted: 16 Mar 2022

Esotropia defined as inward deviation of visual axes is one of the types of pediatric and adult strabismus. In United States population ranging between 5-15 million individuals suffer from strabismus and several studies of clinical populations have reported that 1 in every 50 people suffer from strabismus which has a significant impact on their quality of life.[4] Strabismus is a multifactorial influenced trait and shows variations according to genetic and environmental variables. Study results from India, Japan and China show exotropia frequency to be higher.[3,5,6] However frequency studies from UK, Nigeria, and Sudan show esotropia to be the most common.[7-9]

The aim of our study is to attempt to find out the frequency of esotropia, its different types and subsequent management carried out in pediatric age group presenting to a tertiary care hospital in Quetta.[10]

METHODOLOGY

This study was conducted at Department of Ophthalmology from Jul to Dec 2020. The study

design was cross sectional. Sample size was calculated using WHO taking prevalence at Esotropia 1.93%.[11] A total of 240 patients were included in the study with age 6 months to 13 years presenting with manifest or latent squint. Data was collected through consecutive sampling technique. A designed form for refraction and orthoptic assessment was used with complete ophthalmological examination at each visit.

Inclusion Criteria: Patients of either gender aged 6 months to 13 years presenting with manifest or latent squint were included.

Exclusion Criteria: Patients with the history of any previous squint surgery, and those who did not give consent were excluded.

Patients particulars, detailed history, visual assessment, including gross and best corrected vision with Log MAR SNELLS charts in adequate light, cyclopegic refraction with 1% cyclopen/1% atropine, fundus examination and prescription of glasses were part of the form. Complete orthoptic assessment was conducted with contribution from a trained orthoptist. Diagnosis was made based on international definitions of strabismus and treatment was planned accordingly. Follow up was carried out to observe and analyze the effects of treatment in strabismus.

Ethical approval was taken from institutional review board and all patients were examined after obtaining a fully informed consent.

Data was analyzed using Statistical Package for Social Sciences 20. Continuous data was analyzed as mean and SD. Qualitative data was analyzed as frequency and percentages.

RESULTS

Two hundred and forty patients were included in this study, with age range 6 months to 13 years. 152(63.0%) patients had esotropia whereas 88(37.0%) patients had exotropia (Figure-I).

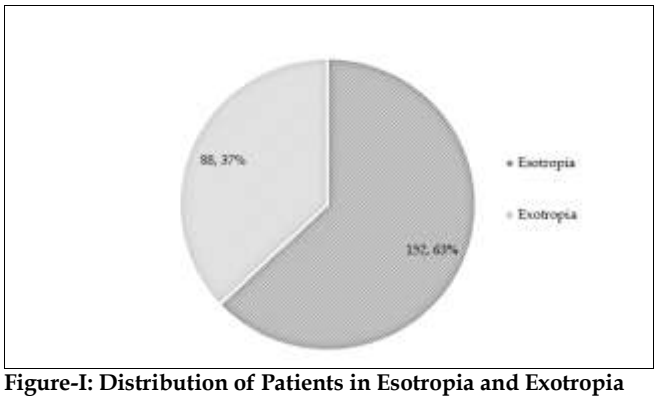

Figure-I: Distribution of Patients in Esotropia and Exotropia

In 152 patients with esotropia, 88 were male and 64 were female. In patients with esotropia, the type of refractive error was assessed. 94 patients had hypermetropia, 51 had mixed astigmatism and 7 had emmetropia. Out of these 32 had anisometropia and 47 had amblyopia. According to classification of esotropia, 52 had fully accommodative esotropia, 10 had partially accommodative and 49 patients had non accommodative esotropia. Convergence excess was seen in 21 patients and 2 patients had high AC/A ratio. 20 patients had essential infantile esotropia (Figure-II, III).

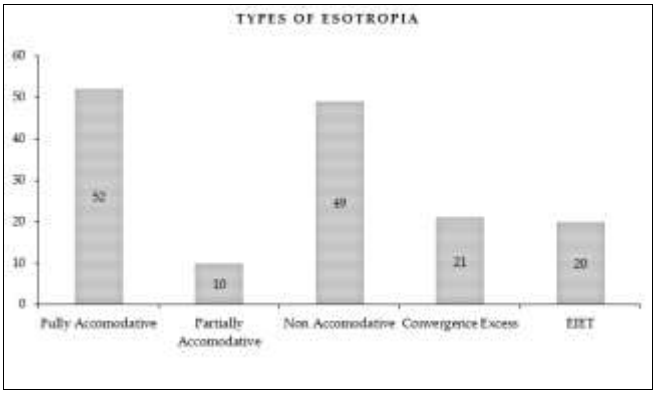

Figure-II: Distribution According to Sub-types of Esotropia

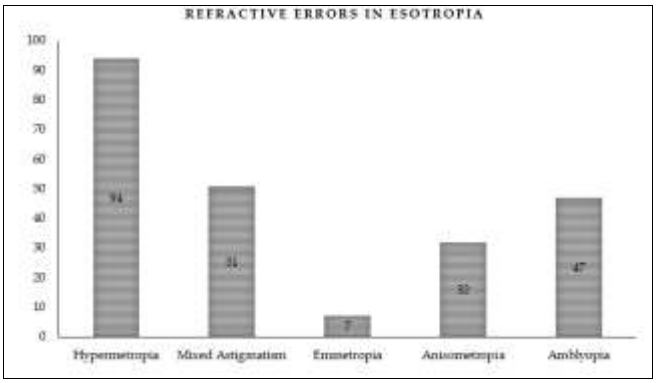

Figure-III: Distribution According to Type of Refractive Error in Esotropia Patients

Combination of treatment modalities was used. All 152 patients were prescribed glasses. 21 patients were prescribed executive bifocals. Patching for 2 hours daily during activity under observation was advised to 54 patients with amblyopia. 36 patients had surgery and 14 patients were kept under observation (Figure-IV).

In 88 patients with exotropia, 41 were male and 43 female. Amongst these 23 patients had myopia, 40 patients had mixed astigmatism and 21 had emmetropia. Out of these 14 had anisometropia and 20

had amblyopia. According to classification of exotropia 15 had constant exotropia and 69 had intermittent exotropia. Treatment included prescription of glasses to all 84 patients, among them 20 were advised amblyopia therapy with patching, 15 patient had surgery, 9 kept under observation and convergence exercises were advised to 13 patients (Figure-V).

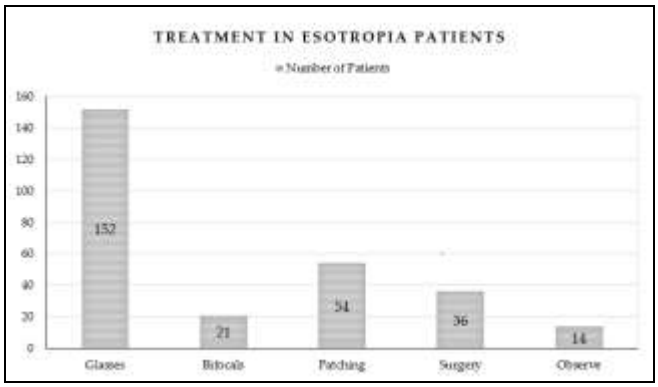

Figure-IV: Distribution According to Treatment Modality in Esotropia Patients

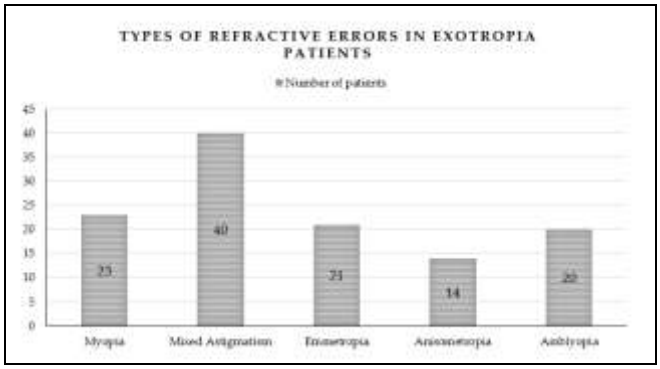

Figure-V: Distribution According to Type of Refractive Error in Exotropia Patients

DISCUSSION

Our study aimed to find out the frequency of esotropia and its various types in children presenting to a tertiary care hospital in Quetta. Esotropia like any other type of strabismus can be associated with amblyopia causing functional disability.[11] When normal binocular vision is disrupted in children with strabismus or amblyopia, balance is also reduced besides the vision being affected . And even if even mild binocular dysfunction (patients with intermittent strabismus and good stereopsis) is present it may lead to postural instability.[17] This vision impairment together with poor self-image and esteem has significant social, economic and psychological repercussion for the children and their families and are more likely to suffer from rejection of jobs as well.[12] Vision problems in Pakistan are the most significant public health issue and they pose huge social and economic impact on the society and nation at large. Results from the Global Burden of Disease (GBD) study conducted in 2017 indicated that in Pakistan; count of blindness and vision impairment increased by 55% in 2017 compared with 1990. Moreover, the statistics also showed an increase in vision loss burden by 2025 and therefore Pakistan needs to make extra efforts to encounter this growing burden of eye diseases. The Pakistan National Blindness and Visual Impairment Survey of 2007 indicated the blindness frequency highest in the provinces of Punjab and Balochistan.

Balochistan is one of the largest province of Pakistan with Quetta being the capital city, however there are very few tertiary care hospitals and hence very little data is available regarding the frequency and subsequent management of strabismus especially in pediatric age group. A study conducted in School/Madaris of a district In Balochistan (lasbela) from Feb 2008 to Sep 2009. The aim of study was to find the pattern of eye problems in children of age 6-15 years and it concluded that approx. 2.4% of children had untreated refractive error and 0.46% (n=119) of children had strabismus.[20]

Esotropia is defined as Essential Infantile Esotropia if the onset is before 6 months of age with a deviation greater than 30-35 degrees and comitant. It accounts for approximately 8% of cases of esotropia affecting 1 in every 100-500 person.[10] Common features associated with EIET include alternating esotropia, cross-fixation, manifest-latent nystagmus (to and fro movement of the eyes, which increases when one eye is covered), inferior oblique overaction, dissociated vertical deviation (DVD), low refractive error or within normal limits and the phenomenon of suppression (resulting in absence of binocular single vision). Gerth *et al.*,[18] studied the effects on cortical visual motion processing of the timing of surgery for EIET. He concluded that early surgery (which is defined as the one before 11 months of age) does promote the development of cortical visual motion processing as compared to the one performed after this age.

Accommodative esotropia is caused by an uncorrected high hyperopia or a high accommodative convergence to accommodation ratio. It may be partially or fully accommodative. Accommodative esotropia develops because of an abnormal relationship between the converging muscles i.e

medial recti and the focusing muscles i.e ciliary muscles. Under normal circumstances, there is a linear relationship between these two groups of muscles which means that a certain amount of convergence is accompanied by a certain amount of accommodation. This linear relationship however is abnormal in this group of children, and there is excessive amount of convergence in order to focus clearly. Eileen *et al.*,[19] identified various significant risk factors for the development of accomodative esotropia. These included a positive family history, subnormal random-dot stereopsis before development of a constant deviation, and in children with hypermetropia <+4.00D, anisometropia. Their study also concluded that assessing the presence or absence of these additional risk factors in combination with the total amount of hypermetropia can help to identify those group of children who are at risk of developing esotropia and hence can most likely benefit from preventive treatment.

Non-accommodative convergent squint refers to esodeviations which are not primarily elicited with direct influence of accommodation. There is usually little or no hyperopia and a normal AC/A ratio.

Esotropia was the most frequently encountered strabismus type as out of 240 patients 63% were found to have esotropia. Our results are consistent with frequency studies from Uk,[7] Iran[13] and Karachi (Pakistan)[14] which show esotropia to be the most common form of strabismus which is in contrast to the study results from China and Japan that show exotropia frequency to be higher.[2,5]

In the subtype analysis approx. 34% had fully accommodative esotropia and 0.07% had partially accommodative esotropia. Hence accommodative type was the most common form of esotropia (40%). Chia *et al.*,[22] also reported higher proportion of accommodative esotropia (53%) in their study and fully accommodative esotropia patients outnumbered partially accommodative ones. Similar results were found in study from Iran, accounting for 25.04% of patients with accommodative esotropia.[13]

We applied statistical test to find out the significance of our results. In our sample of 152 ET patients 32% are non-accommodative (complicated) which shows that at least 25% of ET patient are complicated which are non-accommodative with a *p*-value of 0.03% which is significant at 5% level of significance.

The major refractive error in our study was found to be hypermetropia in esotropia patients while for exotropia mixed astigmatism was found to be common. With similar findings shown in Study by Hassan Hashemi *et al.*,[15]. Shu Min Tang *et al.*, also found in their study that patients with esotropia had pronounced hypermetropia than exotropia cases.[16] It was also noted that hypermetropia increased in deviating eye in esotropia while refractive error was stationary in exotropia.

It is important to highlight that mixed astigmatism and anisometropia was seen in significant number of patients with strabismus. Weakley *et al.*,[21] concluded in their study that anisometropia (>1D) is a significant risk factor for the development of accommodative esodeviation specifically in those patients with hypermetropia of less than three diopters (<3D). It also concluded that anisometropia increases the risk that an accommodative esodeviation will not be fully corrected with hypermetropic correction.

Mixed astigmatism was seen in 91 patients and anisometropia in 46 patients whereas 74 patients had amblyopia. Qualitative visual assessment was done in 81 patients (up to the age of 3 years) and quantitative assessment was done in 155 patients (Figure-VI).

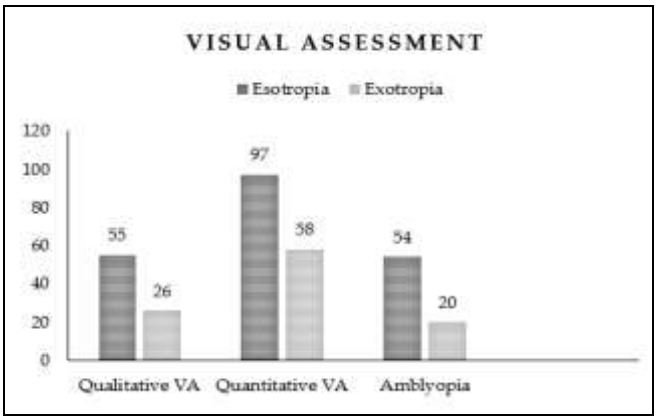

Chart VI: Distribution of Patients According to Type of Visual Assessment Performed and Distribution of Patients with Amblyopia

The data indicated that approx. 50% of children with strabismus had amblyopia in whom quantitative visual assessment was made and the major cause of amblyopia was mixed astigmatism and anisometropia which was treated to a great extent with glasses and patching therapy. This was consistent with studies conducted by Hassan hashem *et al.*, in which over all amblyopia was found to be 1.91% with highest frequency in group having strabismus (61.9%).[15]

This data has given us insight into assessment and treatment of strabismus. The importance of assessment of visual status, refractive error and amblyopia, its treatment and effects on strabismus. A significant number of patients have undergone surgery with the aim to achieve binocular single vision.

Limitations of the study include this data of 240 patients which is a small sample size and short duration of study. In our setup data of 3-5 years is required to make a reasonable sample size to make an inference on frequency of type of strabismus, refractive error and amblyopia in our population.

CONCLUSION

Our study concludes esotropia to be the most prevalent type of strabismus in pediatric age group with accommodative type being the most common which can be successfully treated with glasses. However at least 25% of children had non accommodative esotropia in which surgery should be performed with the aim to achieve BSV. A significant number of patients in both types of strabismus had amblyopia with more common being in esotropia patients. Hence amblyopia must be identified and should be treated in early years.

Conflict of Interest: None.

Funding Source: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

SNM & HM: Data acquisition, data analysis, critical review, approval of the final version to be published.

QZ: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

REFERENCES

1. Achim Fie, Heiki M Elflein, Michael S Urchitz, Konrad Pesudovs, Thomas Munzel, Phillip S Wild et al. Frequency of Strabismus and Its Impact on Vision-Related Quality of Life: Results from the German Population-Based Gutenberg Health Study. Ophthalmol 2020; 127(8): 1113-1122.
2. Pan, CW., Chen, X., Zhu, H. et al. School-based assessment of amblyopia and strabismus among multiethnic children in rural China. Sci Rep 2017; 7: 13410.
3. Attada, T., Deepika, M., & Laxmi, S. Strabismus in paediatric age (3-16 year): a clinical study. International Journal of Research in Medical Sciences 2017; 4(6): 1903-1909.
4. Hashemi H, Pakzad R, Heydarian S, Yekta A, Aghamirsalim M, Shokrollahzadeh F et al. Global and regional frequency of strabismus: a comprehensive systematic review and meta-analysis. Strabismus 2019; 27(2): 54-65.
5. Goseki, T., Ishikawa, H. The frequency and types of strabismus, and average of stereopsis in Japanese adults. Jpn J Ophthalmol 2017; 61: 280–285.
6. Chen D, Li R, Li X, et al. Frequency, incidence and risk factors of strabismus in a Chinese population-based cohort of preschool children: the Nanjing Eye Study. British Journal of Ophthalmology 2020; 316807.
7. Alison Bruce, Gillian Santorelli. Frequency and Risk Factors of Strabismus in a UK Multi-ethnic Birth Cohort 2016; 24(4): 153-160.
8. Olusanya Bolutife A, Ugalahi Mary O, Ayeni Olusola, Fawole Olufunmilayo I, Baiyeroju Aderonke M. Common Forms of Strabismus in a Tertiary Eye Clinic in Southwest Nigeria. 2019; 27(2): 62-67.
9. Taha AO, Ibrahim SM. Frequency of manifest horizontal strabismus among basic school children in Khartoum City, Sudan. Sudanese J Ophthalmol 2015; 7: 53-57.
10. Green-Simms AE, Mohney BG. Epidemiology of pediatric strabismus. In Pediatric ophthalmology. Neuro-ophthalmology, genetics. 2010; 1-9.
11. Saeedeh Hosseinmenni, Mohamad Reza Talebnejad, [...], and Enayatollah Osroosh. P100 Wave Latency in Anisometropic and Esotropic Amblyopia versus Normal Eyes. J Ophthalmic Vis Res 2015; 10(3): 268-273.
12. Darge HF, Shibru G, Mulugeta A, Danachew TM. The Frequency of visual Acuity Impairment among School children at Arada Subcity Primary Schools in Addis Abbaba, Ethiopia, J Ophthalmol 2017; 9326108: 1-7.
13. Khorrami-Nejad M, Akbar MR, Khosravi B. The frequency of strabismus types in strabismic Iranian patients. Clinical optometry. 2018; 10: 19-24.
14. Paras Azam, Neelam Nausheen, Muhammad Faisal Fahim. Frequency of strabismus and its type in pediatric age group 6-15 years in a tertiary eye care hospital, Karachi. Biom Biostat Int J 2019; 8(1): 24-28.
15. Hassan Hashemi, Abbasali Yekta, Ebrahim Jafarzadehpur, Fereidon Nirouzad, Hadi Ostadimoghaddam, Banrak Eshrati, et al. The Frequency of Amblyopia in 7 year old school children in Iran. Strabismus 2014; 22(4): 152-157.
16. Shu Min Tang, Rachel Y. T. Chan, Shi Bin Lin, Shi Song Rong, Henry H. W. Lau, Winnie W. Y. Lau et al. Refractive Errors and Concomitant Strabismus: A Systematic Review and Meta-analysis. 2016; 6: 35177.
17. Anat Bachar Zipori, Linda Colpa, Agnes M. F. Wong, Sharon L. Cushing, Karen A. Gordon. Postural stability and visual impairment: Assessing balance in children with strabismus and amblyopia. PLoS ONE 2018; 13(10): e0205857.
18. Gerth C, Mirabella G, Li X, et al. Timing of surgery for infantile esotropia in humans: effects on cortical motion visual evoked responses. Invest Ophthalmol Vis Sci 2008; 49(8): 3432-3437.
19. Eileen E. Birch; Sherry L. Fawcett; Sarah E. Morale; David R. Weakley, Jr; Dianna Hughbanks Wheaton. Risk Factors for Accommodative Esotropia among Hypermetropic Children Investigative Ophthalmol & Visual Sci 2005; 46: 526-529.
20. Khalil A. Lakho, M. Zahid Jadoon, P.S. Mahar. Pattern of Ocular Problems in School going Children of District Lasbela, Balochistan. Pak J Ophthalmol 2012; 28(4).
21. D R Weakley, Jr and E Birch. The role of anisometropia in the development of accommodative esotropia. Trans Am Ophthalmol Soc 2000; 98: 71–79.
22. Chia A, Roy L, Seenyen L, Comitant horizontal strabismus: an Asian perspective. Br J Ophthalmol 2001; 91: 1337-1340.