MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi: 10.36478/makrjms.2024.7.444.448

Assessment and Management of Strabismus Among Paediatric at Tertiary Care Teaching Hospitals

[1]Nathani Manisha Arif and [2]Arif Aziz Nathani

[1]Department in Ophthalmology, RVM Institute of Medical Sciences and Research Center, India

[2]Department in Paediatrics, RVM Institute of Medical Sciences and Research Center, India

Abstract

Strabismus is derived from a Greek word that translates to eyes looking obliquely and means misaligned eyes. Often, strabismic eyes are referred to as squinting eyes, crossed eyes and wall eyes. Typically, both eyes fixate equally while focusing on an object with the head held in the primary position. In strabismus or squint, 1 or both eyes deviate inwards or outwards and appear to be in nonalignment towards the direction of the focused object. It can be due to refractive error, binocular fusion abnormalities, or neuromuscular anomalies of ocular movements. This hospital-based cross-sectional study was conducted in the Department of Paediatrics and Ophthalmology at RVM Medical College. The hospital serves more number of patients in this region, with services that include tertiary comprehensive eye care. All children aged =15 years who visited the Department of Ophthalmology and Paediatrics during the study period were eligible for inclusion in the study. Furthermore, the sampling technique used was a consecutive sampling method to collect the data. A total of 390 medical records of paediatric patients with strabismus were reviewed; the seven to 12 years age group had the highest frequency with 195 (50%) patients, followed by the one to six years group with 95 (24.36%) and the 13-18 group with 66 (23.5%) patients. A total of 390 medical records of paediatric patients with strabismus were reviewed, 206 (52.82%) patients were female and 184 (47.18%) were male. Among the 390 patients, 320 (82.01%) showed bilateral involvement, whereas 70 (17.99%) showed unilateral involvement. The most common ophthalmic tests employed in our study were the cover test, followed by cycloplegic refraction, Hirschberg test and Krimsky test, which were performed in 128 (32.7%), 246 (22.4%), 61 (15.7%)38 (9.6%) patients, respectively. The findings of this study indicated a relatively high prevalence of strabismus among children who visited the Department of Ophthalmology and Optometry for ophthalmic care. The presence of amblyopia, clinically significant refractive error, age and family history of strabismus were factors significantly associated with childhood strabismus. Therefore, early screening for childhood strabismus is essential. A well-controlled community-based study is needed to confirm strabismus prevalence and predictors.

OPEN ACCESS

Key Words

Strabismus, pediatric, esotropia, exotropia, hypertropia, dissociated vertical deviation

Corresponding Author

Nathani Manisha Arif,
Department in Ophthalmology, RVM Medical College

Author Designation

[1]Associate Professor
[2]Professor

Received: 20 April 2024
Accepted: 22 June 2024
Published: 23 June 2024

Citation: Nathani Manisha Arif and Arif Aziz Nathani, 2024. Assessment and Management of Strabismus Among Paediatric at Tertiary Care Teaching Hospitals. Res. J. Med. Sci., 18: 444-448, doi: 10.36478/makrjms.2024.7.444.448

INTRODUCTION

Strabismus is derived from a Greek word that translates to eyes looking obliquely and means misaligned eyes[1]. Often, strabismic eyes are referred to as squinting eyes, crossed eyes and wall eyes. Typically, both eyes fixate equally while focusing on an object with the head held in the primary position. In strabismus or squint, 1 or both eyes deviate inwards or outwards and appear to be in nonalignment towards the direction of the focused object[2]. It can be due to refractive error, binocular fusion abnormalities, or neuromuscular anomalies of ocular movements[3]. If diagnosed and treated early, strabismus has an excellent prognosis. Treatment is usually by refractive error correction, orthoptic exercises, occlusive patching, topical medications extra ocular muscle surgery[4].

Strabismus can manifest in various forms and degrees and typically develops in childhood. Left untreated, strabismus can lead to multiple visual impairments and even impact an individual's self-esteem and quality of life[5]. Adult-onset strabismus is due to neurological causes or can result from childhood strabismus[6].

The prevalence of strabismus is 2%-5% in the general population. In the U.S., 5-15 million individuals are affected by strabismus. In a National Health Survey, exotropia was seen in 2.1% and esotropia in 1.2% of the population aged 4-74 years. This difference is due to the higher prevalence of exotropia in the population between 55-75 years of age[7].

Fifty per cent of all childhood Exotropia are either fully or partially accommodative. Non-accommodative esotropia is seen in 10% of all strabismus cases and is the second most common form of childhood esotropia[8]. Infantile esotropia affects 1 in every 100-500 persons, which accounts for 8.1% of cases of esotropia[9].

Intermittent esotropia is seen in 1% of the population and is the most common form of exotropia[10]. Exotropia is more prevalent in Asian and black populations[11]. Women make up 60%-70% of exotropia cases.

We have surveyed to determine what systems are in place within ophthalmic services for the assessment and management of children suspected of having strabismus. We also enquired about methods of assessment of these children. This study reviews the evaluation and treatment of strabismus and highlights the role of the interprofessional team in evaluating and treating patients with this condition.

MATERIALS AND METHOD

This hospital-based cross-sectional study was conducted in the Department of Paediatrics and Ophthalmology at RVM Medical College. The hospital serves more number of patients in this region, with services that include tertiary comprehensive eye care. All children aged =15 years who visited the Department of Ophthalmology and Paediatrics during the study period were eligible for inclusion in the study. Furthermore, the sampling technique used was a consecutive sampling method to collect the data.

Data Collection: Sociode mographic data and other relevant information were collected using structured questionnaires through face-to-face interviews with children and their parents or care givers. Visual acuity was measured using a Snellen chart at 6m or light fixation behaviour depending on the age of the child. External ocular examinations were performed using a penlight, 2.5×magnifying loupeslit-lamp biomicroscope. Direct and indirect ophthalmoscopes were used to examine the posterior segment of the eye in a dark room by a trained optometrist. Assessments of eye alignment at 6 m and 40 cm were performed using a unilateral cover/uncover test with a distant picture fixation target and a near-figure puppet, with and/or without spectacles.

Moreover, any movement of the uncovered eye after occlusion of the test eye for 3 s was considered to indicate the presence of strabismus. Infants who could not fixate a target during the cover test were assessed by corneal reflex (i.e., Hirschberg test). Normal fixation was noted as central steady and maintained behaviour. Furthermore, children who were tested only at one fixation distance and who did not exhibit strabismus during the distance test were considered non-strabismic. Ocular motility was assessed using a penlight to identify the presence of any incomitance. Furthermore, refractive status was determined using cycloplegic refraction after 30 minutes of application of two drops of 1% cyclopentolate at 5-minute intervals. The type and amount of refractive error were recorded separately for each eye.

Definitions Used in this Study:

- **Strabismus**: only one eye is directed at the object of interest, as detected objectively on a cover test or near/distant Hirschberg test.
- **Unilateral amblyopia:** =2-line difference in best-corrected monocular visual acuity, together with amblyogenic factors such as past or present history of strabismus, anisohyperopia of=+1.00 diopter sphere, anisometropia of=-3.00 diopter sphere, or anisoastigmatism of=1.50 diopter cylinder and past or present obstruction of the visual axis[13].
- **Bilateral amblyopia:** best-corrected visual acuity of = 20/40 in both eyes in the presence of amblyogenic factors such as hyperopia = 4.00

diopter sphere, myopia = 6.00 diopter sphere, or astigmatism = 2.50 diopter cylinder and past or present obstruction of the visual axis[13].

- **Clinically significant refractive error:** at least one of the following three refractive abnormalities: (1) hypermetropia, = +3.00 diopter sphere in one or both eyes, (2) myopia, = -0.50 diopter sphere in one or both eyes and (3) astigmatism, = 1.00 diopter cylinder in any meridian in one or both eyes.12
- **Anisometropia:** refractive status difference of = 1.00 diopter sphere between the two eyes.12
- **Maternal smoking:** positive if the child's mother reported cigarette smoking at any time during pregnancy.12
- **Prematurity:** birth of a child before 32 weeks (approximately 8 months gestational age).7
- **Birth weight:** weight of the child at birth, where low weight was <2.5 kg.7
- **Dense cataract:** any lens opacity involving the entire cortex from the nucleus to the capsule preventing fundus visualization and resulting in an absence of red reflex on direct ophthalmoscopic evaluation in one or both eyes.14-16
- **Family history of strabismus:** at least one first- or second-degree relative had strabismus.7

Statistical Analysis: All questionnaires were visually checked and entered into EpiData Software, version 3.1 (The EpiData Association, Odense, Denmark), then exported to SPSS Statistics, version 20 (IBM Corp., Armonk, NY, USA) for statistical analysis. Variables are shown as frequencies (percentages) or means ± standard deviations. In addition, bivariate and multi variate logistic regression analyses were used to assess the statistical significance of differences in categorical variables among study groups. Variables with bivariate p<0.2 were included in multi variate analysis. p<0.05 was considered to indicate statistical significance.

The study was performed by the World Medical Association's Declaration of Helsinki. The study protocol was fully explained to each eligible patient and their family. Written informed assent was obtained from study participants, while written informed consent was obtained from their parents/legal guardians. The confidentiality of participant data was ensured during the study.

RESULTS AND DISCUSSIONS

A total of 390 medical records of paediatric patients with strabismus were reviewed, the seven to 12 years age group had the highest frequency with 195 (50%) patients, followed by the one to six years group with 95 (24.36%) and the 13-18 group with 66 (23.5%) patients. (Table 1).

A total of 390 medical records of paediatric patients with strabismus were reviewed; 206 (52.82%) patients were female and 184 (47.18%) were male in Table 2.

Among the 390 patients, 320 (82.01%) showed bilateral involvement, whereas 70 (17.99%) showed unilateral involvement. The most common ophthalmic tests employed in our study were the cover test, followed by cycloplegic refraction, Hirschberg testKrimsky test, which were performed in 128 (32.7%), 246 (22.4%), 61 (15.7%)38 (9.6%) patients, respectively.

Table 4 shows that 247 (63.3%) patients had no associated conditions with strabismus, whereas 143 (36.7%) had associated conditions. The most common condition associated with squint was developmental delay.

No significant relationship was observed between the affected eye (unilateral or bilateral) and exotropia or dissociated vertical deviation, however, a significant association was observed with esotropia and hypertropia (p = 0.026 and p = 0.000, respectively). No significant relationship was observed between developmental delay and esotropia or exotropia (p = 0.925 and p = 1.00, respectively). However, there was a significant association between prematurity and esotropia and exotropia (p = 0.024 and p = 0.037, respectively).

Esotropia was the most common condition in the one to six (56 [74.7%] patients) and six to 12 (91 [65%] patients) age groups. Exotropia was most common in the 13-18 years age group (33 [50%] patients). We observed a significant relationship between esotropia, exotropiaall age groups (p = 0.001 for esotropia, p = 0.002 for exotropia). No significant association was observed between sex and any type of strabismus.

This study highlights diversity in aspects of the assessment and management of strabismus: first in the systems in place for assessment and management second in the techniques used to assess infants and young children suspected of having these conditions.

Children suspected of having strabismus enter the ophthalmic service predominantly by three routes: preschool screening, referral of an asymptomatic child from an at-risk group (eg, ex-preterm, neuro-developmental delay and a child with a disability)symptomatic referral. The last name can arise from several community or hospital healthcare sources.

The association between hypermetropia and the development of strabismus is well documented[11]. However, studies linking refractive error (eg astigmatism, spherical error and anisometropia) with strabismus and amblyopia show that because of refractive changes during childhood, more than one

TABLE 1: Distribution of Age Groups of the sample (n=390).

Age groups	Type of strabismus			
	Esotropia No. (%)	Exotropia No. (%)	Hypertropia No. (%)	Dissociated vertical deviation No. (%)
1-6 years	94(35.4)	32 (16.7)	9 (30)	2 (25)
7-12 years	112 (51.4)	108 (49)	9 (30)	2(25)
13-18 years	45 (16.9)	66(34.4)	12 (40)	4 (50)

TABLE 2: Distribution of Gender of the sample (n=390).

Gender	Type of strabismus			
	Esotropia No. (%)	Exotropia No. (%)	Hypertropia No. (%)	Dissociated vertical deviation No. (%)
Male	109 (50.3)	49 (50)	15 (50)	6 (75)
Female	99 (49.7)	119 (50)	15 (50)	2(25)

TABLE 3: Distribution of Affected eye of the sample (n=390)

Affected eye	Type of strabismus			
	Esotropia No. (%)	Exotropia No. (%)	Hypertropia No. (%)	Dissociated vertical deviation No. (%)
Unilateral	34 (13.1)	27 (17.9)	24 (80)	0 (0)
Bilateral	183 (86.9)	78 (82.1)	6(20)	10 (100)

TABLE 4: Frequency and percentage of associated conditions.

Associated conditions		Frequency	Percentage %
Psychiatric/developmental disorders:	Developmental delay	49	10.3
	Autism	5	0.7
	ADHD	2	0.7
	Mental retardation	1	0.4
Neurological disorders:	Epilepsy	19	5.7
	Hydrocephalus	19	5.7
	Cerebral palsy	12	4.3
	Brain tumour	5	1.4
Ophthalmic disorders:	Cataract	6	2.1
	Glaucoma	3	1.1
	Optic atrophy	5	0.7
	Duane syndrome	5	0.4
Infectious disorders:	Hepatitis C	8	2.5
	Congenital toxoplasmosis	2	0.4
	Infectious mononucleosis	2	0.4
	Hypothyroidism	19	5
Endocrine disorders:			
	Diabetes Mellitus	9	1.1
	Down syndrome	2	2.5
	Alagille syndrome	1	0.4
	Dandy-walker syndrome	4	0.4
Syndromes:	William's syndrome	4	0.4
	Kabuki syndrome	2	0.4
	ROOHAD syndrome	2	0.4
	Freeman-Sheldon syndrome	29	0.4
Other:	Prematurity	12	8.2
	Craniofacial anomalies	10	3.9
	Anemia	4	3.2
	Asthma	1	1.1
	Low birth weight	2	0.4
	Chiari malformation	2	0.4
Non		247	63.3

measurement is required to determine a child's risk of developing amblyopia or strabismus[12]. This is due to the process of emmetropisation which is largely complete by the age of 2 years but may continue until 4 years of age[13].

The management of a child, with what is considered to be a borderline error under the age of 4, is controversial due to uncertainty over the significance of these findings. Relative risks have been assigned to certain refractive errors, however, in terms of screening, hypermetropia in the order of 3.5 spherical dioptres or 2 dioptres in one meridian, are both risk factors for amblyopia[14]. Increasing astigmatism, oblique astigmatism and the presence of strabismus have the highest relative risk[15]. The benefit of early detection and treatment of refractive errors has also been the subject of considerable debate, with evidence both for and against early correction[16]. Thus, the appropriate management of a child with a refractive error depends on the age of the child, the type of refractive error and the presence or absence of strabismus.

The incidence of strabismus increases to 17.6% (vs 3-4%) when a positive family history is elicited[17]. The risk of developing esotropia in patients with a positive family history is increased four-fold in the presence of hypermetropia[18]. Rosner and Rosner showed that

given superficial instruction, parents can detect 66-76% strabismus, although in the absence of strabismus (as in anisometropia) only 17% of children with amblyopia were noticed by their parents[19]. While the predictive value of family history, in the absence of other amblyopia risk factors, is not known, a positive family history of amblyopia is probably a valid reason on its own for reviewing the amblyopia and strabismus suspect. The healthy child without a positive family history, or evidence of refractive error, strabismus or amblyopia on initial assessment is most unlikely to develop amblyopia or strabismus.

CONCLUSION

The findings of this study indicated a relatively high prevalence of strabismus among children who visited the Department of Ophthalmology & Optometry for ophthalmic care. The presence of amblyopia, clinically significant refractive error, age and family history of strabismus were factors significantly associated with childhood strabismus. Therefore, early screening for childhood strabismus is essential. A well-controlled community-based study is needed to confirm strabismus prevalence and predictors.

REFERENCES

1. Shah, J., S. Patel, 2015. Strabismus:-symptoms, pathophysiology, management & precautions. IJSR 4: 1510-1514.
2. Hatt, S.R., D.A. Leske, Y.S. Castañeda, S.M. Wernimont and L. Liebermann et al., 2020. Association of strabismus with functional vision and eye-related quality of life in children. JAMA Ophtha. 138: 528-535.
3. Fieß, A., R. Kölb-Keerl, A.K. Schuster, M. Knuf, B. Kirchhof, P.S. Muether and J. Bauer, 2017. Prevalence and associated factors of strabismus in former preterm and full-term infants between 4 and 10 years of age. BMC Ophthalmol., Vol. 17 .10.1186/s12886-017-0605-1.
4. Danish, E.Y., R.M. Shaikh and M.T. Hadrawi 2015. Pattern of pediatric eye diseases at King Fahad Armed Forces Hospital, Jeddah. PJHMS 9: 945-947.
5. Amer, A., 2015. Relative prevalence of various types of strabismus in patients attending ngo's medical centers in gaza strip. Sci. J. Public Health, 3: 1-5.
6. Darraj, A., W. Barakat, M. Kenani, R. Shajry and A. Khawaji et al., 2016. Common eye diseases in children in Saudi Arabia (jazan). Ophthalmol. Eye Dis., Vol. 8 .10.4137/oed.s39055.
7. Garvey, K.A., V. Dobson, D.H. Messer, J.M. Miller and E.M. Harvey, 2010. Prevalence of strabismus among preschool, kindergarten, and first-grade tohono o'odham children. Optometry J. Am. Optometric Assoc., 81: 194-199.
8. Shimauti, A.T., L.D. Pesci, R.L.F. de Sousa, C.R. Padovani and S.A. Schellini, 2012. Estrabismo: Detecção em uma amostra populacional e fatores demográficos associados. Arquivos Brasileiros Oftalmologia, 75: 92-96.
9. Chen, X., Z. Fu, J. Yu, H. Ding and J. Bai et al., 2015. Prevalence of amblyopia and strabismus in eastern China: Results from screening of preschool children aged 36–72 months. Br. J. Ophthalmol., 100: 515-519.
10. Pan, C.W., H. Zhu, J.J. Yu, H. Ding and J. Bai et al., 2016. Epidemiology of intermittent exotropia in preschool children in China. Optometry Vision Sci., 93: 57-62.
11. Hashemi, H., A. Yekta, E. Jafarzadehpur, H. Ostadimoghaddam and B. Eshrati et al., 2015. The prevalence of strabismus in 7-year-old schoolchildren in Iran. Strabismus, 23: 1-7.
12. Torp-Pedersen, T., H.A. Boyd and G. Poulsen, 2010. In-utero exposure to smoking, alcohol, coffee, and tea and risk of strabismus. Am. J. Epidemiol. 171: 868-875.
13. Ndlovu, D., S. Nhleko, Y. Pillay, T. Tsiako, N. Yusuf and R. Hansraj, 2011. The prevalence of strabismus in schizophrenic patients in durban, kwazulu natal. Afr. Vision Eye Health, 70: 101-108.
14. Onua, A., 2019. Risk factors of strabismus in children in a southern Nigerian tertiary hospital. World J. Ophthalmol. & Vision Res., 2: 1-4.
15. Griffin, D., N. Parsons, E,. Shaw, Y. Kulikov and C. Hutchinson,et al 2014. Operative versus non-operative treatment for closed, displaced, intra-articular fractures of the calcaneus: randomised controlled trial. BMJ. ul., 24: 4483-4483.
16. Zhu, H., C. Pan, Q. Sun, D. Huang and Z. Fu et al., 2019. Prevalence of amblyopia and strabismus in hani school children in rural southwest China: A cross-sectional study. BMJ Open, Vol. 9 .10.1136/bmjopen-2018-025441.
17. Rajavi, Z., H. Sabbaghi, A. Baghini, M. Yaseri and H. Moein et al., 2015. Prevalence of amblyopia and refractive errors among primary school children. J. Ophthalmic Vision Res., Vol. 10 .10.4103/2008-322x.176909.
18. Afsari, S., K.A. Rose, G.A. Gole, K. Philip, J.F. Leone, A. French and P. Mitchell, 2013. Prevalence of anisometropia and its association with refractive error and amblyopia in preschool children. Br. J. Ophthalmol., 97: 1095-1099.
19. Faghihi, M., H. Ostadimoghaddam and A. Fatemi. 2012. The prevalence of refractive errors, strabismus and amblyopia in schoolboys of Varamin, Iran, in 2010. Iran. J. Ophthalmol. 24: 33-39.