Original Article

Ocular manifestations in children with developmental delay at a tertiary center in South India

Vidya Hegde, Rashmi Jain, Anupama Bappal, Rashmi Shambhu

Access this article online

Quick Response Code:

Website: www.saudijophthalmol.org

DOI: 10.4103/1319-4534.325773

Abstract:

PURPOSE: Developmental delay occurs when a child exhibits a significant delay in the acquisition of milestones, in one or more domains of development. This study was planned to determine the distribution of ocular disorders and to assess the correlation between ocular findings and systemic co morbidity, antenatal and postnatal factors, and perinatal history.

METHODS: This cross-sectional study included children with developmental delay <16 years of age. All children underwent complete ophthalmological evaluation including full cycloplegic refraction. Vision assessment was done as appropriate for age. Spearman's correlation test was used to analyze the correlation between ocular findings and causes for developmental delay and antenatal, perinatal, and postnatal history.

RESULTS: A total of 128 children were evaluated. Mean age of the study group was 5.59 ± 2.12 years, 64.8% were males, and 76.6% of children were from rural area. Ocular findings were seen in 110 (85.93%) children, refractive error being the most common finding seen in 87 children (astigmatism $n = 47$, hypermetropia $n = 28$, and myopia $n = 12$). Strabismus was seen in 65 children, esotropia being the most common ($n = 36$). Vision impairment was present in 39.84% of children. Other ocular findings included disc pallor, cataract, ptosis, amblyopia, keratoconus, telecanthus, lagophthalmos, blepharitis, retinitis pigmentosa, and morning glory syndrome. Spearman's correlation showed no statistical association between ocular findings and various causes for developmental delay. There was a weak negative correlation between antenatal history, mode of delivery, gestational age, and ocular findings.

CONCLUSION: More than three-fourths of children with developmental delay had ocular findings which necessitates the need for ocular evaluation.

Keywords:

Child, developmental delay, refractive errors, strabismus, vision disorders

Introduction

Neurodevelopmental disabilities are seen commonly in children. They are a group of chronic clinically distinct disorders that all share a documented disturbance, quantitative, qualitative, or both, in developmental progress in one or more developmental domains compared with established norms.[1] The domains include motor (gross or fine), speech and language, cognition, personal-social, and activities of daily living. Developmental disabilities affect 5%–10% of children.[2] Global developmental delay is defined as significant delay (two or more standard deviations) below the mean on age-appropriate standardised norm-referenced testing in two or more developmental domains. The term is usually referred for younger children, aged <5 years, and mental retardation is usually for older children where intelligent quotient testing is valid and reliable. The causes of developmental delay include cerebral palsy, genetic syndromes, postinfectious syndromes, central nervous system malformations, prematurity, and low birth weight.[3]

In a study done in Denmark, the prevalence of developmental delay was 1.21% in 4–12 years

Department of Ophthalmology, Yenepoya Medical College, Deralakatte, Mangalore, Karnataka, India

Address for correspondence:
Dr. Rashmi Jain, Department of Ophthalmology, Yenepoya Medical College, Deralakatte, Mangalore - 575 013, Karnataka, India.
E-mail: rashmijain@yenepoya.edu.in

Submitted: 22-Mar-2019
Revised: 10-Jul-2020
Accepted: 21-Nov-2020
Published: 09-Sep-2021

How to cite this article: Hegde V, Jain R, Bappal A, Shambhu R. Ocular manifestations in children with developmental delay at a tertiary center in South India. Saudi J Ophthalmol 2021;35:1-4.

of age group.[4] In India, the prevalence of developmental delay is found to be 1.5%–2.5% in children < 2 years of age.[5] Vision impairment and ocular manifestations are seen very common in these children. Vision impairment will affect mobility, fine movement coordination, language development, communication and self-care, and overall quality of life. This goes unnoticed in these children due to child's inability to recognize poor vision. Further, it may be overlooked as these children have many health problems. Hence, it is important to screen these children early for vision impairment. Literature search showed few studies about ocular findings in children with developmental delay in India.[6-9] The study was planned to know the various ocular manifestations in children with developmental delay with the following objectives – (1) to determine the demographic profile of children with developmental delay, (2) to know the distribution of ocular disorders, and also (3) to assess the correlation between ocular findings and various systemic conditions and also antenatal, perinatal, and postnatal history.

Methods

A cross-sectional study was conducted at a medical college hospital over a period of 1 year (April 2015 to March 2016). Consecutive children aged 16 years or younger, having developmental delay, who came for ophthalmic consultations, or who were referred by pediatrician were included in the study. The study protocol was approved by the institution ethics committee, and all the participating parents or legal guardian gave their written informed consent. Sample size was calculated usingG*Power (Erdfelder, Faul, & Buchner, 1996, Germany) with level of significance $\alpha = 5\%$; power $\beta = 80\%$; effect size $d = 0.13$, and 95% confidence interval. The minimum sample size calculated was 119 children.

Relevant demographic, maternal, perinatal, and pediatric history including development milestones was sought during consultation from the parent. The clinical diagnosis of delayed milestones was made by the consulting pediatrician. All the children underwent complete anterior segment evaluation, dilated posterior segment evaluation, and cycloplegic refraction. Orthoptic examination was performed using Hirschberg's corneal reflex test, Krimsky's test, and/or by Prism Bar Cover test. Vision was assessed as appropriate for age. For preverbal children, their ability to maintain a central and steady fixation and follow light was noted. In case of older and cooperative children, Snellen chart optotypes were preferred for visual acuity assessment. Vision was defined as normal if fixation was central, steady, and maintained. Any abnormality in fixation and vision less than 6/18 was labeled as visual impairment.[10]

For the purpose of study, a refractive error in one or both eyes of more than +3 D spherical equivalent (SE) was defined as hypermetropia, while myopia was labeled if SE was more than −0.50 D, and astigmatism was defined as cylinder powers of more than 1.00 DC.

The data were entered in the Microsoft Excel Sheet and were analyzed using SPSS 11.5 software IBM SPSS Statistics for Windows, version 20 (IBM Corp., Armonk, N.Y., USA)'. Descriptive statistics such as mean, standard deviation, proportions, and percentage were calculated. Spearman's correlation test was used to analyze the correlation between ocular findings and causes for developmental delay and also antenatal, perinatal, and postnatal history. Statistical significance was attributed if the $P < 0.05$.

Results

A total of 256 eyes of 128 children with developmental delay were evaluated. The diagnosis of developmental delay and its causes were made by the pediatrician and are depicted in Figure 1. The demographic profile of the children is shown in Table 1. The age of children ranged from 6 months to 16 years, with mean age being 5.59 ± 2.12 years. Majority of children were in the 1–5 years of age group (47.7%). 76.6% of children were from rural area and 64.8% were males. History of consanguinity was present in 9 children. The history was elicited from the accompanying adult including mother (103), grandmother, aunt, and father. Significant antenatal history was noted in 26 children (20.31%) that included hypertension (n = 10), bleeding (n = 5), fever (n = 5), gestational diabetes (n = 4), epilepsy (n = 1), and epistaxis (n = 1). Of the 128 children, 85 were born of normal delivery, 43 were born of cesarean section, and 31 (24.22%) were preterm. Sixty-four children (50%) had history of admission into neonatal intensive care, the most common indication being neonatal hyperbilirubinemia and birth asphyxia. History of seizures was noted in 21 children.

Ocular findings were seen in 110 (85.93%) children. Fifty-eight children had more than one ocular condition. The various ocular manifestations observed in the study group are shown in Figure 2. Nineteen children had nystagmus. Strabismus was seen in 65 children (50.78%), and esotropia was the most common type (n = 36). Refractive error was the most frequently found (n = 87) ocular finding. The types of refractive error noted were astigmatism (n = 47), simple hypermetropic astigmatism (n = 19) being the most common,

Table 1: Demographic profile of children

Variable	Attribute	Frequency (%)
Age	6 months-1 year	15 (11.7)
	1-5 years	61 (47.7)
	6-10 years	29 (22.7)
	11-16 years	23 (17.9)
Gender	Males	83 (64.8)
	Females	45 (35.2)
Place of residence	Urban	30 (23.4)
	Rural	98 (76.6)
Type of family	Nuclear	55 (43)
	Joint	73 (57)
Socioeconomic status	APL	63 (49.2)
	BPL	65 (50.8)

APL: Above poverty line, BPL: Below poverty line

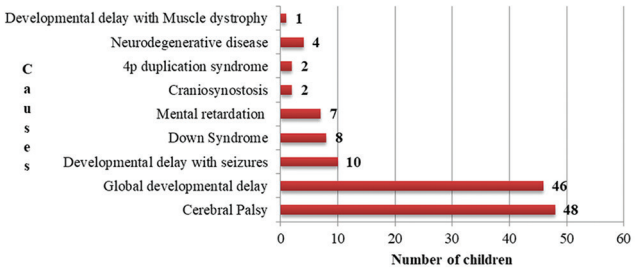

Figure 1: Various causes for developmental delay

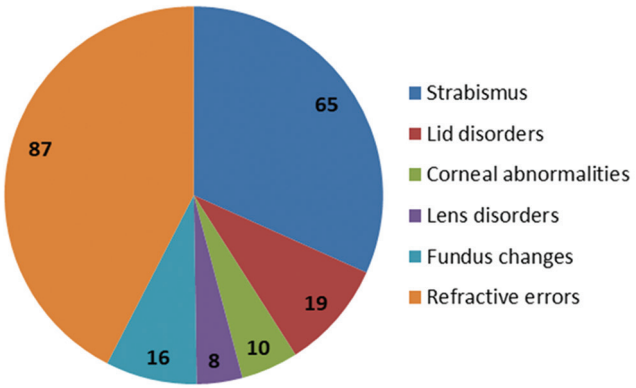

Figure 2: Distribution of ocular conditions in the study group

hypermetropia ($n = 28$), and myopia ($n = 12$). Anisometropia was seen in three children. Fifty-one (39.84%) children had vision impairment, while vision could not be assessed in six children. The causes of impaired vision were cortical visual impairment (CVI, $n = 28$), optic disc pallor ($n = 10$), cataract ($n = 5$), amblyopia ($n = 3$), and keratoconus, congenital nystagmus, heredomacular dystrophy, macular coloboma, and morning glory syndrome with retinal detachment ($n = 1$ each).

The various lid abnormalities observed were lagophthalmos, blepharitis, and ectropion (1 each) and ptosis in 8 children (4 bilateral). Telecanthus was noted in five children, while mongoloid slant with epicanthus in three children. Two children in the study group had microcornea and two had megalocornea. Corneal opacities were found in four children unilaterally, of which one was central in location. Six children had lenticular opacification and 2 were pseudophakic. Fundus changes noted were myopic degeneration, macular coloboma (2 children each), retinitis pigmentosa and morning glory with retinal detachment (1 each), and optic disc pallor (10 children).

Ocular findings were seen in 42 out of 48 (87. 5%) children with cerebral palsy, 41 out of 46 (89.13%) children with global developmental delay, 7 out of 10 (70%) children with developmental delay with seizure, 7 out of 8 (87.5%) children with Down syndrome, and all seven children (100%) with mental retardation. Spearman's correlation showed no statistical association ($P = 0.543$) between ocular findings and various causes for developmental delay.

There was a weak negative correlation between antenatal history, mode of delivery, gestational age and ocular findings but a weak positive correlation between postnatal history and ocular findings, as depicted in Table 2.

Table 2: Correlation between ocular findings and antenatal, perinatal, and postnatal history

	Spearman's correlation coefficient	*P*
Antenatal history	−0.049	0.584
Mode of delivery	−0.036	0.686
Gestational age	−0.153	0.084
Postnatal history	0.017	0.847

Discussion

Developmental disabilities seen in childhood are manifested as physical, psychological, cognitive, or speech impairments. As per the 2011 Census of India, there are 7,862,921 children with disability in the age group below 19 years and 1,410,158 have visual impairment.[11] Ocular manifestations are seen in children with developmental delay. Comprehensive examination of these children is therefore very essential. In our study, 85.93% of children with developmental delay had ocular findings. In a study done on children with developmental delay by Joshi *et al*., ocular findings were seen in 84.8% of children.[12] A study done by Smitha *et al*. showed the presence of ocular manifestations in 83.6%.[6] Despite the high prevalence of ocular findings, our study showed no statistical association between ocular findings and the various causes for developmental delay.

Demographic profiling of a disease may help create awareness regarding the condition in policymakers and in practitioners catering to these areas. In our study, 76.6% of children were from rural area and 64.8% were males. This is in accordance with studies done by Solomon *et al*. and Gogate *et al*. (63.2% and 61.4%, respectively).[7,13] The mean age of our study group was 5.59 years that was comparable to other studies.[4,12]

Refractive errors are the most common cause for treatable blindness in children. One of the priorities of VISION 2020 initiative is to manage the uncorrected refractive errors.[14] Children with intellectual disabilities are known to have refractive errors.[15] The prevalence of refractive errors is found to be higher in these children compared with healthy ones.[16] Our study showed higher prevalence of astigmatism (47 out of 128 children). A study done by Sandfeld Nielsen *et al*. found a high prevalence of hyperopia and astigmatism in children with developmental delay.[17] Kwok *et al*. reported astigmatism as the most common refractive error seen in children and adolescents with severe mental deficiency.[18] Presence of uncorrected refractive errors in these children predisposes them to the risk of developing amblyopia. This necessitates the need for early vision screening of these children. Refractive error correction at early age prevents the child from spending the productive years of life with avoidable blindness. Strabismus was noted in 50.78% of children in our

study, and esotropia was the most common type. A study done by Reena *et al*. showed the presence of strabismus in 40%.[8] Joshi *et al*.[12] reported occurrence of strabismus in 46.4%.

Visual impairment is commonly seen in children with developmental delay, and this can affect the overall development of the child. In our study, we found vision impairment in 39.84% of children and the most common causes were CVI and disc pallor. In a study done in Denmark, the prevalence of vision impairment was 10.5% among 923 children with developmental delay and the causes included cerebral visual impairment, optic atrophy, retinal dystrophies, and congenital nystagmus.[4] The higher prevalence of visual impairment may be related to prenatal and perinatal factors. In this study, antenatal history was significant in 20.31%, and 50% of children had neonatal intensive care unit admission. However, we found a weak negative correlation between antenatal history, mode of delivery, gestational age, and ocular findings and a weak positive correlation between postnatal history and ocular findings. The need for eye care often goes unnoticed in children with developmental delay as these children have multiple health problems. There is a need to impart health education to the parents about the need for early eye screening. The onus of counseling the parents about the ocular condition of these children and also the management rests on the ophthalmologist.

Limitations of the study

This was a cross-sectional study. These children require long-term follow-up. Hence, a longitudinal study would be better. The degree of mental retardation was not considered in our study.

Conclusion

More than three-fourths of children with developmental delay had ocular findings, with strabismus and refractive errors being the most common. This necessitates the need for ocular evaluation when these children come to seek medical help.

Acknowledgment

We would like to acknowledge Mrs. Himani Kotian for statistical assistance.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Kinsbourne M. Disorders of mental development. In: Menkes J, Sarnat B, Maria B, editors. Child Neurology. 6th ed. Baltimore (MD): Lippincott Williams and Wilkins; 2001. p. 1155-211.
2. Simeonsson RJ, Sharp MC. Developmental delays. In: Hoekelman RA, Friedman SB, Nelson NM, Seidel HM eds. Primary pediatric care. St.Louis: Mosby-Year Book, 1992;867–70.
3. Sandfeld Nielsen L, Jensen H, Skov L. Risk factors of ophthalmic disorders in children with developmental delay. Acta Ophthalmol 2008;86:877-81.
4. Nielsen LS, Skov L, Jensen H. Visual dysfunctions and ocular disorders in children with developmental delay. I. Prevalence, diagnoses and aetiology of visual impairment. Acta Ophthalmol Scand 2007;85:149-56.
5. Poon JK, LaRosa AC, Pai GS. Developmental delay timely identification and assessment. Indian Pediatr 2010;47:415-22.
6. Smitha KS, Harshavardhan P, Patil SB, Bhagyajyoti BK, Sheetal VG, Kathyayini SV. Prevalence of ocular manifestations in children with developmental delay. Med Innov 2014;3:42-4.
7. Solomon CB, Bindu N, Raju KV, George MS. Ocular association in children with developmental delay. Kerala J Ophthalmol 2011;23:367-71.
8. Reena A, Lekshmy SR, Lekshmi H, Appukuttan BK. Ophthalmic manifestations in children with delayed milestones - A clinical study. Kerala J Ophthalmol 2009;21(3):264-9.
9. Katoch S, Devi A, Kulkarni P. Ocular defects in cerebral palsy. Indian J Ophthalmol 2007;55:154-6.
10. Blindness and Vision Impairment. Available from: https://www.who.int/news-room/fact-sheets/detail/blindness-and-visual-impairment. [Last accessed on 2018 Dec 24].
11. Ministry of Home Affairs, Government of India. Census of India; 2011. Available from: http://censusindia.gov.in/2011-common/censusdataonline.html. [Last accessed on 2018 Dec 24].
12. Joshi MS, Telang OJ, Morepatil VG. Ocular disorders in children with developmental delay. J Evid Based Med Healthc 2017;4:4065-70.
13. Gogate P, Soneji FR, Kharat J, Dulera H, Deshpande M, Gilbert C. Ocular disorders in children with learning disabilities in special education schools of Pune, India. Indian J Ophthalmol 2011;59:223-8.
14. World Health Organization. VISION 2020 Action Plan 2006-2010 for Global Initiative for the Elimination of avoidable Blindness 'ACTION PLAN 2006–2011'. Available from: http://www.vision2020.org/documents/publications/Vision2020_report.pdf. [Last accessed on 2018 Dec 24].
15. Akinci A, Oner O, Bozkurt OH, Guven A, Degerliyurt A, Munir K. Refractive errors and ocular findings in children with intellectual disability: A controlled study. JAAPOS 2008;12:477-81.
16. Vora U, Khandekar R, Natrajan S, Al-Hadrami K. Refractive error and visual functions in children with special needs compared with the first grade school students in Oman. Middle East Afr J Ophthalmol 2010;17:297-302.
17. Sandfeld Nielsen L, Skov L, Jensen H. Visual dysfunctions and ocular disorders in children with developmental delay. II. Aspects of refractive errors, strabismus and contrast sensitivity. Acta Ophthalmol Scand 2007;85:419-26.
18. Kwok SK, Ho PC, Chan AK, Gandhi SR, Lam DS. Ocular defects in children and adolescents with severe mental deficiency. J Intellect Disabil Res 1996;40:330-5.