

Research Article

Ocular Manifestations Associated with Cerebral Palsy Among Rural Bangladeshi Children

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Abstract

Background: Neurological disorders known as cerebral palsy affect movement and posture in a large number of patients leading to visual complications. Evaluation of ocular symptoms among children with cerebral palsy leads to timely treatment and care procedures. **Objective:** This study investigates the prevalence and patterns of ocular disorders among children with cerebral palsy in rural Bangladesh. **Methodology:** This two-year research period happened at the Centre for the Rehabilitation of the Paralyzed from September 2019 to February 2021. Visual acuity tests, cycloplegic refraction and fundoscopic examinations were performed on 170 children who had cerebral palsy. SPSS-26 and MS Excel software were used to conduct the statistical examinations using a $p < 0.05$ level of significance. **Results:** A high number of refractive errors (75.3%) were detected in the study group and astigmatism (44.7%) turned out to be the most frequently observed condition. Out of all patients examined the researchers discovered strabismus in 34.1% of cases yet exotropia was more common at 18.8% when compared to esotropia at 15.3%. Out of all participants, 10.6% displayed pale optic discs whereas 1.8% exhibited deep cupping during fundoscopic examination. Regular fundus examination results were normal for 87.6% of the total children studied. **Conclusion:** Cerebral palsy children show high occurrence rates of both refractive errors and strabismus as ocular complications. The evaluation of vision along with prompt interventions by an Ophthalmologist plays an important role in enhancing both the visual performance and life quality of patients. The incorporation of eye care services into rehabilitation treatments and increased patient knowledge about these services will produce better long-term results for children with affected vision.

Keywords

Cerebral Palsy, Ocular Manifestations, Refractive Errors, Strabismus, Visual Impairment, Pediatric Ophthalmology, Neuro-ophthalmology

1. Introduction

Cerebral palsy (CP) is a group of permanent neurological disorders of movement and posture due to abnormal development or damage to the immature brain and can limit daily

activities [1]. It is the most common cause of motor disability in children occurring in 2 to 2.5 per 1000 live births [2]. The underlying pathophysiology is premature birth, hypox-

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ic-ischemic encephalopathy, early brain malformations, and congenital or postnatal infections that affect not only the motor areas of the brain but also many levels of the visual pathway such as the retrogeniculate visual system and associated visual cortical areas [3]. The Bangladeshi statistics claim that Cerebral Palsy is present among 3.4 per 1000 children in rural areas [4]. Brain damage in children with CP may affect visual input and visual processing [5]. Damage to the visual cortex can impair visual acuity, visual field, and contrast sensitivity and may restrict visual fields while damage to the higher visual processing centers causes perceptual and cognitive visual impairment [6]. 50-90% of ocular and visual abnormalities are visible in patients with Cerebral Palsy due to the severity of visual impairment related to the area and the extent of the brain damage [7]. 50-90% of CP patients experience ophthalmological errors such as nystagmus, amblyopia, significant refractive errors, and even cortical visual impairments [8]. In terms of motor abnormalities, Cerebral Palsy has four subtypes; spastic, ataxic, athetoid, and atonic [9]. Spastic type of CP is a common risk factor for patients with affected ocular abnormalities like strabismus and refractive errors; Exotropia and hyperopia are the most prevalent ocular abnormalities recorded in children with CP [9]. Visual disorders can be present due to Cerebral Palsy interrupting the psychokinetic development of children [10]. An early ocular, visual, and oculomotor assessment is very important for detecting visual disorders, leading to a complete clinical diagnosis and an appropriate intervention plan. The most common ocular abnormality is strabismus followed by refractive errors. In this study, we assessed the prevalence of ocular manifestation associated with cerebral palsy among Bangladeshi children.

2. Methodology

2 yearlong cross-sectional study on ocular manifestations associated with Cerebral Palsy was conducted at the Centre for the Rehabilitation of the Paralysed (CRP) in the timeline of September 2019 to February 2021. This study protocol adhered to the tenets of the Declaration of Helsinki and a purposive sampling technique was applied to select a total 170 participants with study-specific inclusion and exclusion criteria.

3. Inclusion Criteria

1. Age between 6 months to 18 years old.
2. Children with cerebral palsy.
3. A written informed consent from the legally authorized relative of the participants and ascent from the children.

4. Exclusion Criteria

1. Patients of age < 6 months >18 years.
2. Patients with history of ocular malfunction without cerebral palsy.
3. Patients with a history of ocular trauma.
4. Lack of informed consent; lack of ascent.

Complete clinical evaluation including history, physical examination, and relevant ocular examination and slit lamp examination, both direct and indirect ophthalmoscopic examination to see the retinal findings was done. Visual acuity (VA) was measured using Snellen or the illiterate E chart at a 6 m distance in outdoor illumination or Lea symbols at a distance of 3 m monocularly. After visual acuity testing, cycloplegic refraction by retinoscopy was performed by Cyclopentolate eye drops 3 times at 15-minute intervals. No experimental drugs or placebo was used for this study. The study data including demographic information, relevant history, examination findings, and fundus examination of all the study subjects was recorded in specific case report form. For calculating refractive error, 170 samples have been multiplied by 2 as each of the subjects has a pair of eyes. After a successful data collection, all the data were compiled and sorted properly and the quantitative data were analyzed by using Statistical Package for Social Science (SPSS-26) and MS Excel. P-value <0.05 was considered significant in 95% of a confidence interval.

5. Results

A sum of 170 participants were selected purposively to conduct this study. Chart 01 shows the distribution of the study subjects by age of diagnosis of CP.

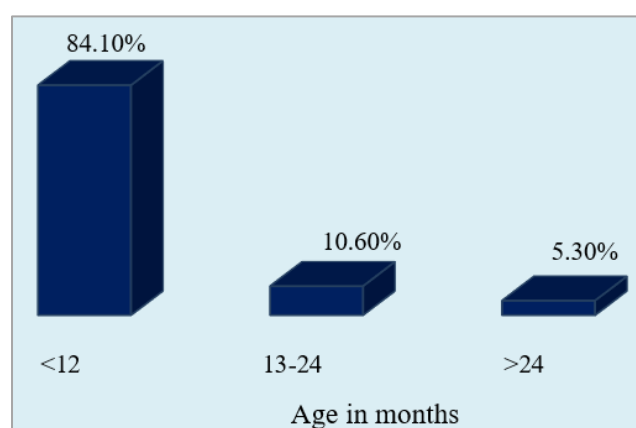


Figure 1. Column chart showed distribution of the study subjects by age of diagnosis of CP (Month) (N=170).

Figure 1 shows that majority (84.1%) subjects belonged to diagnosis of CP ≤ 9 months. The mean age of diagnosis of CP was 10.88 ± 8.18 months with ranged from 4 to 48 months.

Table 1. Distribution of the study subjects by different ocular examination findings (n=340).

Eye history	Right Eye (n=170)		Left Eye (n=170)	
	n	%	n	%
Pupillary light reaction				
Brisk	162	95.3	162	95.3
Sluggish	7	4.1	0	0.0
Absent	1	0.6	8	4.7
RAPD				
Present	8	4.7	8	4.7
Absent	162	95.3	162	95.3
Ocular motility				
Full in all gaze	165	97.1	166	97.6
Restricted	5	2.9	4	2.4
Hirschberg reflex				
Central	136	80.0	146	85.9
Temporal Pupillary Margin	12	7.1	14	8.2
Nasal Pupillary Margin	22	12.9	10	5.9

Table 1 shows the distribution of the study subjects by different ocular examination findings. It was observed that in majority (95.3%) of subject pupillary light reaction was brisk in both eyes. Eight (4.7%) subjects had RAPD in both eye. Majority (97.1%) subjects had full ocular motility in all gaze in right eye and 166(97.6%) in left eye. Majority (80.0%) subjects had central Hirschberg reflex in right eye and 146(85.9%) in left eye.

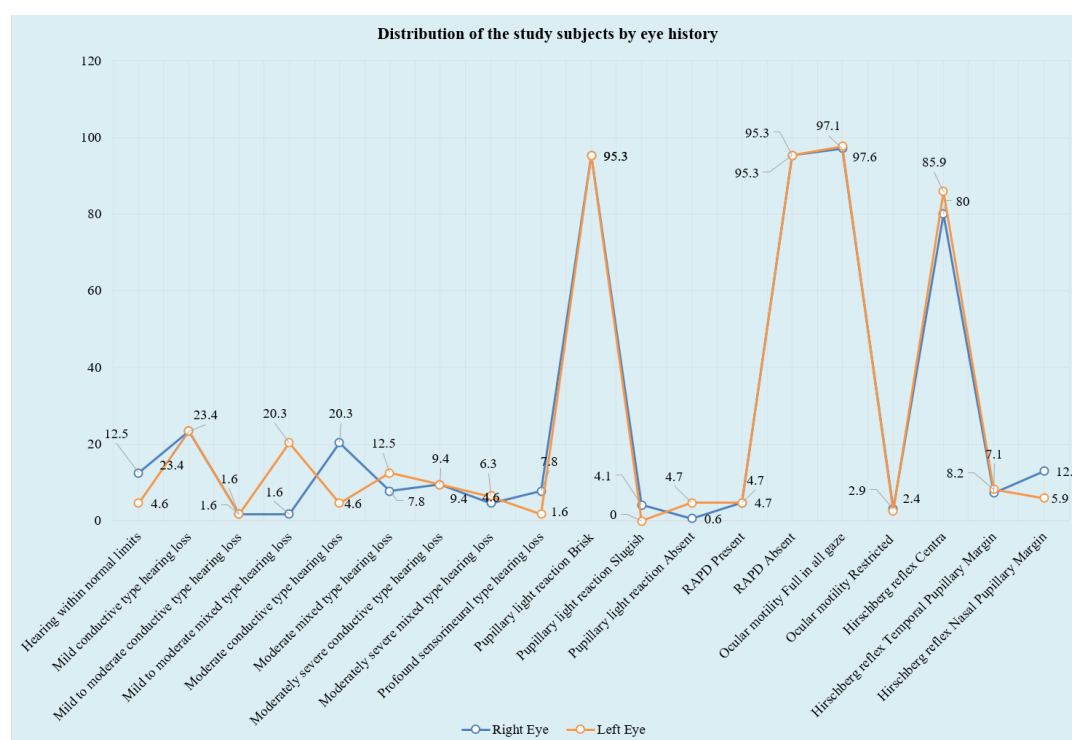
**Figure 2.** Line chart showed right and left eye history (n=340).

Table 2. Distribution of the study subjects by ocular alignment (N=170).

Ocular alignment	Number of Subjects	Percentage
Deviation	58	34.1
No Deviation	112	65.9

Table 2 shows the distribution of the study subjects by ocular alignment. It was observed that more than one-third (34.1%) of subjects' ocular alignment had deviation.

Table 3. Distribution of the study subjects by types strabismus (N=170).

Strabismus	Number of Subjects	Percentage
Exotropia	32	18.8
Esotropia	26	15.3
No Deviation	112	65.9

Table 3 shows the distribution of the study subjects by different types strabismus. It was observed that 32 (18.8%) subjects strabismus had exotropia and 26 (15.3%) esotropia.

Table 4. Distribution of the study subjects by refractive error (n=340).

Refractive error	Right Eye (n=170)		Left Eye (n=170)	
	n	%	n	%
Myopia	8	4.7	11	6.5
Hypermetropia	44	25.9	44	25.9
Astigmatism	76	44.7	72	42.3

Table 4 shows the distribution of the study subjects by refractive error. It was observed that almost half (44.7%) of subjects had astigmatism in the right eye and 72(42.3%) in the left eye.

Table 5. Distribution of the study subjects by fundus findings (N=170).

Fundus	Number of Subjects	Percentage
Normal	149	87.6

Fundus	Number of Subjects	Percentage
Deep Cupping	3	1.8
Pale disc	18	10.6

Table 5 shows the distribution of the study subjects by fundus. The majority (87.6%) of patients had normal fundus following 18(10.6%) had pale disc and 3(1.8%) had deep cupping.

Table 6. Distribution of the study subjects by ocular morbidity (N=170).

Ocular morbidity	Number of Subjects	Percentage
Refractive error	127	74.7
Strabismus	58	34.1
Refractive error and strabismus	58	34.1
Pale optic disc	18	10.6
Nystagmus	4	2.4
Cataract	2	1.2

Table 6 shows the distribution of the study subjects by ocular morbidity. It was observed that almost three fourth (74.7%) subjects had refractive error followed by 58(34.1%) had strabismus, 58(34.1%) had refractive error, and strabismus, 18(10.6%) had pale optic disc, 4(2.4%) had nystagmus and 2(1.2%) subjects had cataract.

6. Discussion

This study revolves around the ocular manifestation associated with cerebral palsy. It shows that the majority (84.1%) of participants diagnosed with CP at the age of ≤ 9 months and the mean age for diagnosis was 10.88 ± 8.18 months. In a similar study, Granild - Jensen et al., 2015 observed that the overall median corrected diagnostic age of CP was 11 months [11]. Brisk pupillary reactions were observed in 95.3% of the subjects while RAPD was present in 4.7%. Ocular motility showed all movements present in 97.1% (right eye) and 97.6% (left eye) of tested subjects. Right eye examination produced central Hirschberg reflex in 80.0% of cases and left eye examination showed it in 85.9%. According to Ozturk et al., 2013, the tetraplegia group reported abnormal ocular findings in 78.9% while displaying poor [12]. In this study, regarding the distribution of the study subjects by ocular alignment, it was observed that more than one-third (34.1%)

of subjects' ocular alignment had deviation. In our study, the prevalence of strabismus is 34.1%, which is similar to the study done by Sanjay Marasini in 2011, where the prevalence was 36% [13]. In the current study, the distribution of the study subjects by strabismus showed that 18.8% had exotropia and 15.3% had esotropia. Raj and Kotian, (2019) study agrees with the report of common ocular abnormality was strabismus (70.5 %) followed by refractive errors (53.3 %) [14]. Regarding the distribution of the study subjects by refractive error, it was observed that almost half (44.7%) of subjects had astigmatism in the right eye and 42.3% in the left eye. Park et al., 2016 reported that refractive errors were found in 53.3% of patients, with farsightedness being more common than nearsightedness [9]. The distribution of the study subjects by refractive status shows that a quarter (25.9%) of the subjects had hypermetropia in both eyes. Raj and Kotian, (2019) reported that among the refractive errors, hypermetropia was a more common incidence rate of 55% followed by astigmatism (17.5%) and myopia (5%) [14]. Shrestha, (2015) stated that children with cerebral palsy have ocular morbidities like refractive error and strabismus which need to be identified timely to prevent its long-term effects [15]. In this study, the distribution of the study subjects by fundus showed that the majority (87.6%) patients had normal fundus following 18(10.6%) pale and 3(1.8%) deep cupping fundus. In a study done by Taylan et al., 2013, disc pathologies were paleness, cupping, hypoplasia, and optic atrophy seen in 18.3%, 10.3%, 4.9%, and 5.7% respectively [12]. We recorded Refractive error (74.7%), strabismus (34.1%), and both (34.1%) are the major cause of ocular morbidity in this research project. A few researchers disagree with our findings by showing Spastics (60%) as the major ocular defects found in patients with CP [16]. Likewise, another researcher agrees with an evaluation of 4% to 100%, refractive error, strabismus, and nystagmus exhibiting the greatest overall prevalence at 52%, 48%, and 11%, respectively in this population in their studies [17].

7. Conclusion

The study showcases the substantial eye disorder prevalence rate among rural Bangladeshi children affected by cerebral palsy. The most frequently diagnosed visual impairments among children affect their refractive systems, their eye alignment and their optic disc structure. Vision-related quality of life requires prompt ophthalmologic examination and intervention since these disorders are very common within child populations. Routine eye examinations added to rehabilitation programs help patients achieve better functional outcomes and promote improved developmental advancement. Healthcare professionals should raise their awareness about visual impairments in children with CP while additional research must provide better management protocols for early detection.

Abbreviations

CP	Cerebral Palsy
VA	Visual Acuity
RAPD	Relative Afferent Pupillary Defect
CRP	Centre for the Rehabilitation of the Paralysed
SPSS	Statistical Package for Social Science

Author Contributions

Ashiqur Rahman Bhuiyan: Conceptualization, Data curation, Formal Analysis

Abir Bin Sajj: Writing – original draft, Writing – review & editing

Tohura Sharmin: Investigation, Methodology, Supervision

Conflicts of Interest

The authors declare no conflicts of interest.

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