

Ocular Findings in Children with Cerebral Palsy.

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Abstract: Cerebral palsy (CP) is commonly associated with ocular abnormalities which often impact on their development and education. There is paucity of studies on this in Bangladesh. Cerebral palsy is one of the leading causes of childhood disability worldwide with the greatest burden found in developing countries. Motor impairments are the hallmarks of CP, but in many individuals, other impairments such as vision, hearing, speech, cognition, behavior, and epilepsy may at times produce even greater activity limitation in daily life. The aim of this study was to find out ocular findings in children with cerebral palsy attending a tertiary care hospital patients. A cross sectional survey of children with cerebral palsy presenting at Department of Pediatrics, Shaheed M Monsur Ali Medical College, Sirajganj, Bangladesh between January and December 2018 was done. Age appropriate visual acuities were checked, ocular examination was done with hand held Slit Lamp and Cycloplegic refraction and Fundoscopy done with indirect Ophthalmoscope. Thirty seven (42.5%) of 87 subjects seen within that period presented for ocular assessment. There were 24 males (64.9%) and 13 females (35.1%) with a male female ratio of 1.8:1. The age ranged between 0-60 months with a mean of 30.11± 26.51 months. Thirty three (89.2%) were delivered full term while 4(10.8%) were preterm. Spastic cerebral palsy accounted for 45.9% of all the cases seen. Strabismus was found in thirteen subjects (35.1%). In this study, esotropia was in 7(54%) and exotropia in 6 (46%) among subjects. Refractive error was found in 32(86.5%) subjects and Cortical Visual Impairment (CVI) in 28(75.7%) subjects. CVI, refractive errors and strabismus are the most common ocular findings in children with Cerebral Palsy in Bangladesh. Early detection and early intervention is important to achieve best developmental and educational attainment. Multidisciplinary approach involving Neurologists, Ophthalmologists, and Physiotherapist is paramount in managing these children from the time of diagnosis.

Keywords: Ocular Findings, Cerebral Palsy, Cortical Visual Impairment, Strabismus

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I. Introduction

Cerebral palsy (CP) is one of the leading causes of childhood disability worldwide with the greatest burden found in developing countries. Motor impairments are the hallmarks of CP, but in many individuals, other impairments such as vision, hearing, speech, cognition, behavior, and epilepsy may at times produce even greater activity limitation in daily life. Early diagnosis and comprehensive management with a multidisciplinary approach are required for satisfactory management of a child with CP. In low and middle-income countries, there are gaps in knowledge especially in spheres of epidemiological research, intervention, and service utilization. Cerebral palsy is a term used to describe a spectrum of deficits of muscle tone and posture resulting from damage to the developing nervous system (Arnoldi, Pendarvis and Jackson *et al* 2006:97-107) ^[7]. Though thought to be a motor disorder, it can be associated with disorders of the sensory pathway (Arnoldi *et al* 2006:97-

107) ^[2]. The damage to the motor control in the developing brain can occur during pregnancy, perinatal or postnatal life. The resultant limitation in movement and posture can be accompanied by seizure disorder, abnormal muscle tone, dysarthria, sensory impairment, mental retardation and learning disabilities (Rosenbaum, Paneth and Leviton *et al* 2006:8-14) ^[18]. There are four main types, spastic, ataxic, dyskinetic or athetoid and mixed cerebral palsy. The spastic type can be further classified into spastic hemiplegia, spastic diplegia and

spastic quadriplegia types. Beckung, Hagberg and Uldall (2008: e187-92) ^[4] classified them as Spastic unilateral cerebral palsy, Spastic bilateral cerebral palsy and dyskinetic cerebral palsy and ataxic cerebral palsy. In the

spastic type there is stiffness and movement difficulties, in ataxic form there is a disturbance of sense of balance and depth perception, while in the athetoid type there are involuntary and uncontrolled movements. Walking ability in children with cerebral palsy has been found to be significantly related to the type of cerebral palsy, IQ level, presence of active epilepsy and severe visual or hearing impairment (Beckunget *al* 2008: e187-92) ^[4]. Flagnagan, Jackson and Hill (2003:493- 9) ^[2] while studying seventy-six children with visual impairment recruited from multiple sources found that 79% of them had medical problems, 33% of this was from cerebral palsy. Also disorders of visual function are common findings in children with cerebral palsy (Ipata, Cioni and Bottai 1994:95-203; Lagunju and Oluleye 2007:71-5; Ghasia, Brunstrom, Gordon *et al* 2008:572-80) ^[12,13,8]. The ocular abnormalities include strabismus, refractive errors, visual impairment, nystagmus and optic atrophy. Lagunju *et al* (2007:71-5) ^[13] in Ibadan found that 50% of ocular abnormality in forty two cerebral palsy children with ocular abnormality was due to strabismus, 47.7% cortical visual impairment, 4.8% refractive error and 9.5% nystagmus. Other ocular features that have been reported include cicatricial retinopathy of prematurity and cortical blindness (Pennefather and Tin 2000:78-81) ^[17]. It has actually been found to be a risk factor for lack of development of object vision defined as ability to recognize faces or hand-held toys (Chen, Weinberg and Catalano 1992:575-8) ^[6]. Li, Yu and Zhang *et al* (2012:100) ^[14] found that 9-30% of his cerebral palsy patients had visual impairment.

Cerebral Disorders

Disorders of visual function in cerebral palsy is often due to damage to central visual pathway (Guzzetta, Mercuri and, Cioni 2001:115 -9; Sasmal, Maiti and Mandal 2011:318323) ^[11,19]. This is because chronic hypoxia to the brain usually causes damage to the visual cortex. Visual function is related to cognitive, motor and emotional development since children learn to move, talk and do many things they see others doing. Hence a child with cerebral palsy that is also blind/visually impaired pose a greater challenge in terms of management and rehabilitation. Early detection and treatment of ocular problems will therefore enhance management in this group of children. This research is therefore aimed at determining the prevalence and ocular abnormalities among children with cerebral palsy.

II. Objective

To find out Ocular findings in children with cerebral palsy attending a tertiary care hospital patients.

III. Materials AndMethods

A cross sectional survey of all children with cerebral palsy who attended at the Department of Pediatrics, Shaheed M Monsur Ali Medical College, Sirajganj, Bangladesh between January and December 2018 were recruited into the study. Informed consent was obtained from the parents/care givers of the children after explaining the purpose of the study/examination to them. Detailed history of their demographic data, pregnancy and birth history were obtained from parents or guardians to find the possible cause of cerebral palsy; type of cerebral palsy was obtained from their history and examination of hospital records and documented in a semi-structured questionnaire. Ageappropriate visual acuity assessment of respondents was carried out. Cover- Uncover test, Hirschberg and modified Krinsky test were used to check for strabismus. Extraocular muscle movements in the nine positions of gaze were assessed. The anterior segment was examined with the Keeler PSL classic hand held slit lamp. Cycloplegic (atropine) refraction was done using the retinoscope after which Posterior segment examination was done with indirect ophthalmoscope to check for optic atrophy and any other posterior segment lesions. Spectacles were prescribed for those with refractive errors and those with strabismus or other treatable conditions were offered treatment. Data was analyzed using SPSS 16 statistical package. Variables were generated. P-value was set at less than 0.05.

IV. Results

Thirty-seven (42.5%) subjects presented for ocular assessment out of a total of 87 children with cerebral palsy seen in 2018. There were 24 males (64.9%) and 13 females (35.1%) with a male female ratio of 1.8:1 (Table 1). Their ages ranged from 0-60 months with a mean of 30.11 ± 26.51 months. Thirty three (89.2%) were delivered full term while 4(10.8%) were preterm. The birth weight was known in 19 (51.4%) cases with low birth weight i.e. ≤ 2 kg found in 4(21.1%) children. Twenty one (56.8%) had birth asphyxia, 11(29.7%) did not while in 5(13.5%) it was unsure. Three (8.1%) had history of oxygen administration. History suggestive of encephalitis/meningitis was recorded in 4(10.8%) and hypoglycaemia in 2(5.4%) of subjects. Spastic cerebral palsy accounted for 45.94% cases seen (Table 2). Majority (91.9%) of the children had delayed developmental milestones. Vision assessment was CSM (Central Steady Maintained) in 24(64.9%) out of which 6(25%) on further assessment with LEA paddle appreciated 0.5 and 9.9cpm at 50mm. 13(35.1%) had visual acuity assessment by LEA symbols (Table 3). Cerebral visual impairment was found in 28(75.7%) of subjects. The

spastic type was the most common (65%), followed by ataxic (15%), dyskinetic (10%), and mixed (10%).

Among the spastic quadriplegic, subtype was seen in 69%, diplegia in 23%, and hemiplegia in 8% [Figures 1 and 2]. Imaging which includes computed tomography/ magnetic resonance imaging had been done in only 18% of the patients. Seven (18.9%) of respondent were able to do the draw a man test for IQ assessment. Of these, one with 73% score was a slow learner, one with 60% score had mild mental retardation, and one with 37% score was sub trainable while 4 had moderate mental retardation. Strabismus was found in thirteen (35.1%) subjects made up of esotropia in 7(54%) and exotropia in 6 (46%) subjects. Hirschberg and krimsky were ≤ 15 0/30 Prism Diopter (Table 4). Refractive error was found in 32(86.5%) subjects. Hypermetropia in 4(12.5%), Myopia 7(21.9%) and astigmatism 21(65.6%). Of the astigmatic subjects hypermetropic astigmatism was 14.3%, myopic astigmatism 14.3%, compound astigmatism 61.9% while simple astigmatism was 9.5%. The myopia was $\leq 3D$ in 7 (70%), $>3-5D$ in 1 (10%) and $>5D$ in 2(20%). Hypermetropia was $\leq +2D$ in 12(66.7%) subjects, $>+2D- +4D$ in 3(16.7%), and $>+4D$ in 2(11.0%) subjects while Anisometropia of $> +2D$ difference between the two eyes was found in 1(5.6%). Astigmatism was $\leq 1DCyl$ in 17 subjects and $> 1DCyl$ in 4 subjects (Table 5). Strabismus was found in 4 cases of Spastic Cerebral palsy, 1 in hypotonic, 1 mixed and 7 among the uncharacterized CP. Hypermetropia was more common in the spastic CP whereas myopia was more common with athetoid (hypotonic) CP, though this was not statistically significant. The pupil reacted briskly in 30(81.1%) and sluggishly in 4(10.8%) subjects while 3(8.1%) were not reactive. Other findings were in one patient each nystagmus, vernal conjunctivitis, and bilateral corneal scar with lower lid ectropion. Funduscopy revealed 02(5.4%) subjects with tilted disc while 03 (8.1%) had optic atrophy and 01 had bilateral chorioretina scar. The most common etiological factor being birth asphyxia (48%), central nervous system (CNS) infections (20%), hypoglycemia (18%), and bilirubin encephalopathy (14%) [Table 6]. The comorbid conditions affecting the patients were speech delay (80%), seizures (56%), feeding problems (46%), and contractures and deformities (20%) [Table 8]. There were significant socio economic issues noted during the study, as many parents had difficulties taking up care in form of correction of refractive errors and management of strabismus partly because of the need to pay out of pocket and fear of stigmatization.

Table 1: Age / Sex distribution (n=37).

Age (Months)	Sex		Number (%)
	Male	Female	
0-10	03	01	04 (10.8)
11-30	13	10	23 (62.2)
31-40	03	02	05 (13.5)
41-60	05	-	05 (13.5)
Total	24	13	37 (100)

Table 2: Types of Cerebral Palsy (n=37).

Type of CP	Frequency	Percentage
Spastic	17	45.95
Ataxic	10	27.02
Athetoid	8	21.63
Mixed	2	5.40
Total	37	100.0

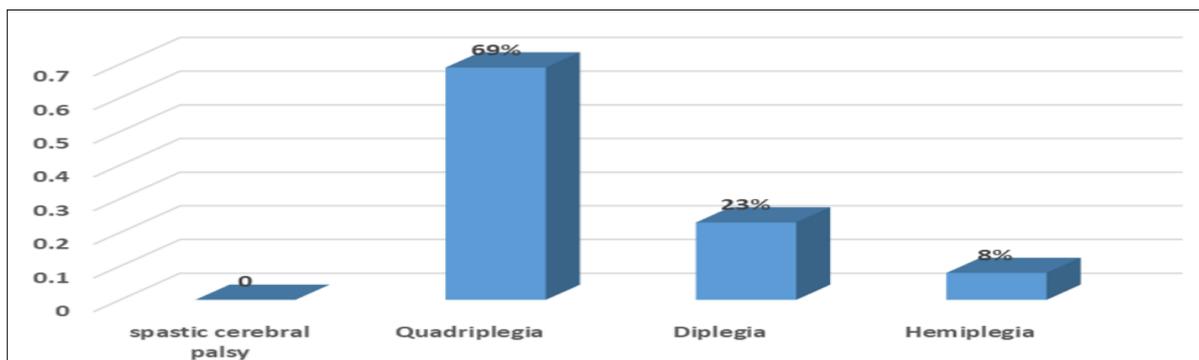


Fig 2: Types of spastic cerebral palsy.

Fig 3: Factors predisposition to cerebral palsy

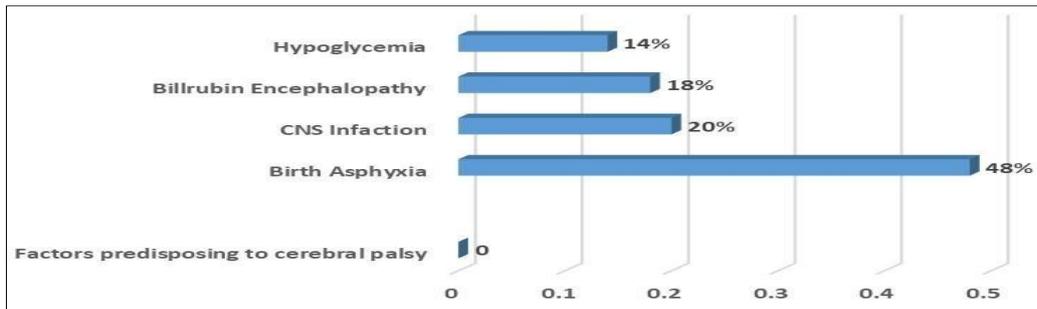


Table 3: Showing vision Assessment in patients with Cerebral Palsy (n=37).

VA	Number	Percentage
>6/18	2	5.4
< 6/18- 3/60	3	8.1
< 3/60-LP	3	8.1
NPL	5	13.5
CSM	24	64.9
CSM	37	100.0

Table 4: Degree of squint in 13 subjects (n=37).

Degree of squint	Number (%)
< 150/30PD	8(61.5)
>150- 30PD	4(30.8)
>30-45PD	1(7.7)
Total	13 (100.0)

Table 5: Refractive errors in 33 cerebral palsy patients (n=37).

Astigmatism 21(65.5 %)	Myopia 7(21.9%)	Hypermetropia 4(12.5%)
≤12(66.7%)+2DS)	≤+3DS7 (70%)	≤1DS 17

Table 6: Etiological factors (n=37).

Parameter	Parameter
Birth asphyxia	48%
CNS infection	20%
Bilirubin encephalopathy	18%
Hypoglycemia	14%

Table 7: Comparison of uncorrected visual acuity and best corrected visual in patients with spastic cerebral palsy (n=37).

Comparison	UCVA	BCVA	P Value*
Visual acuity, Right eye	0.33±0.22	0.55±0.23	0.003
Visual acuity, Left eye	0.26±0.18	0.46±0.25	0.001

*p value by paired T-test. Data are mean ± standard deviation. BCVA best corrected visual acuity, UCVA Uncorrected visual acuity.

Table 8: Comorbidities associated with cerebral palsy (n=37).

Parameter	Parameter
Speech problems	80%
Seizures	56%
Feeding problems	46%
Contractures and deformities	20%

V. Discussion

There was a low response rate in this study, as shown by only 42.5% responding to our call to present for ocular assessment. This could be related to the psychological challenge faced by parents as a result of their children's health condition. This could also explain the wrong addresses given by some respondents. In this study a large proportion of the subjects were between 1 and 5 years of age. This is comparable to other studies (Andersen, Irgens and Haagaas *et al* 2008:4-13; Sigurdardottir, Thorkelsson and Halidorsdottir *et al* 2009:356-

63) ^[1, 20] and due to the fact that the signs and symptoms are not usually present at birth, they commonly evolve as the child is developing. The most common risk factor found in this study was birth asphyxia. Only 4 (21.1%)

of subjects had history of prematurity despite the fact that increased prevalence has been reported in premature infants (Burja, Seme- Ciglenecki and Gajsek- Marchetti 2004:39-43) ^[5]. Premature infants are vulnerable, in part because their organs are not fully developed, increasing the risk of hypoxic injury to the brain that may later manifest as CP. Other risk factors for the development of CP found in this study include meningitis/ encephalitis and hypoglycaemia as have been observed in previous studies (Odding, Roebweck and Stam 2006:183-91) ^[16]. As reported by other workers (Beckung *et al* 2008: e187-92) ^[4], Spastic cerebral palsy was more common than other types of cerebral palsy. Further classifications in quadriplegic, diplegic was not done because they were not classified by neurologists. Ocular conditions found in these patients include refractive errors, strabismus, and optic atrophy. Majority (94.6%) of the patients had standard visual acuity. This is in conformity with the reports of other researchers that there is a high rate of vision /ocular defects among cerebral palsy patients (Lo Casio 1977:332-37; Govind and Lamba 1988:88-91) ^[15,10], thus confirming that early eye screening is essential in these groups of patients for early detection, diagnosis and treatment. Strabismus was diagnosed in thirty-five percent of subjects with exotropia being the most common type. This is the experience of various authors though to a varying degree (Arnold 1955:852-856; Lo Casio 1977:332-37; Lagunju, and Oluleye 2007:71-5) ^[3,15,13]. The degree of squint was mainly in the range of 30 prism dioptre which is quite significant and will require early treatment. Many of the parents were however not keen about getting this corrected by surgery because they were more interested in finding a solution to the delayed developmental milestone of their children. A child with a squint is likely to have a poorer level of binocular vision especially depth perception. Tasks requiring fine depth discrimination will be more difficult. About fifty percent of subjects had refractive error with astigmatism being the most common refractive error. This is unlike the findings of other authors (Govind *et al* 1988:8891; Sasma *et al* 2011:318-323) ^[10,19] and may be because of the low sample size in this study. Significant Myopia was more common in the hypotonic CP. Of note is the fact that majority of these refractive errors are not high errors except in two of the myopic subjects. However, early detection and correction of these errors are important as the correction can make a significant difference in the children's ability to see and improved academic performance. Correction of the refractive errors will also help to maximize any residual vision in these children (Groenvel, Jan and Leader 1990:11-5) and can also help correct or reduce the amount of strabismus in those children with hypermetropia. The finding of brisk papillary reaction in 80% of the subjects means the poor vision found in many of them was probably mainly due to cerebral visual impairment. Unfortunately, most of them did not do MRI /CT scan of the brain. In this study only 8.3% of subjects have optic atrophy and this is similar to Govind *et al* (1988:88-91) ^[10] who reported 10% prevalence of optic atrophy in their own series. Other ocular conditions were uncommon, which confirms Lo Casio' (1977:332-37) ^[15] report that ocular disorders are uncommon in these children, though a study with a larger sample size and probably a multicentre study will give better information. The socio economic issues noted during the study, as many parents had difficulty taking up care in form of correction of refractive errors and management of strabismus is partly because of the need to pay out of pocket and challenges of stigmatization. This makes it important to involve counselors and financial support facilities for children who have cerebral palsy. The strength of this study lies in the fact that it is the only study that looked at the degree of refractive error and strabismus in children with cerebral palsy. We therefore conclude that Strabismus, refractive errors and CVI are the most common ocular abnormalities in children with Cerebral palsy. Also that early detection and early intervention is important to achieve best results. Therefore, multidisciplinary approach involving neurologists, ophthalmologists, counselors and physiotherapist should be embarked upon in managing these children from the time of diagnosis. Parental/care givers education cannot be overemphasized. There is a limitation in our study. Our hospital is the tertiary one, and the patients visited our clinic with the recognition of the ophthalmologic problems or were recommended to visit our clinic by the orthopedic surgeons who fully recognize the necessity of the ophthalmologic examination. Therefore, our study may overestimate the prevalence of ophthalmologic problems in the general population of cerebral palsy.

VI. Conclusion And Recommendations

In conclusion, the prevalence of refractive errors and strabismus was considerably higher in patients with spastic type of cerebral palsy than in general population. Exotropia and hyperopia are the most common type of strabismus and refractive errors, respectively. There was no differences in clinical and ocular characteristics among subtypes of spastic cerebral palsy. Children with spastic type cerebral palsy have a high prevalence of strabismus and refractive errors. Exotropia and hyperopia are the most common ocular abnormalities.. Our results indicate that all children with spastic type of cerebral palsy may require a detailed ophthalmologic evaluation.

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