

Original Research Article

Ocular defect in children with cerebral palsy and its correlation with the types of cerebral palsy

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ABSTRACT

Background: Cerebral palsy (CP) describes a group of permanent disorder of the development of movement and posture, causing activity limitation, that are attributed to non-progressive disturbance that occurred in the developing fetal or infant brain. The motor disorders of cerebral palsy are often accompanied by disturbances of sensation, perception, cognition, communication and behavior, by epilepsy, and secondary musculoskeletal problem. However, no known study has been found on this aspect. Objective of this study was to evaluate the ocular defect in children with cerebral palsy and to correlate with the types of CP.

Methods: Study was done in the Paediatric Neurology unit of BSMMU from January 2012 to July 2012. One hundred thirty children with cerebral palsy were studied. The patients were randomly selected who full filled the inclusion criteria and ophthalmological examination was done.

Results: Sixty four (64%) of CP patients had pathological finding and 36% percent had normal finding. Most of the abnormalities were squint (strabismus) (40%) and refractive error (36.9%). Most of the ocular defects were found in spastic cerebral palsy, mainly in spastic quadriplegia (34.6%) and spastic diplegia (29.2%).

Conclusions: Ocular defect like squint and refractive error common associations of cerebral palsy. Spastic quadriplegic and diplegic children had more ocular defects.

Keywords: Ocular defect, Cerebral palsy, Children

INTRODUCTION

Cerebral palsy (CP) describes a group of permanent disorder of the development of movement and posture, causing activity limitation, that are attributed to non-progressive disturbance that occurred in the developing fetal or infant brain. The motor disorders of cerebral palsy are often accompanied by disturbances of sensation, perception, cognition, communication and behavior, by epilepsy, and secondary musculoskeletal problems.¹ CP are grouped into four main categories: spastic, athetoid, ataxic, and mixed type. Spastic CP occurs in about 70% of cases. The spasticity is due to upper motor neuron involvement and mildly or severely affect motor function.

This may be hemiplegic, quadriplegic, or diplegic. A study reported that hemiplegia occurred in about 30-40% of cases, quadriplegia about 15-20% cases, paraplegia about 10-20% cases, diplegia in about 10-20% cases. Athetoid CP occur in about 20% of cases. Slow, writhing, involuntary movement may affect the extremities (athetoid) or the proximal part of the limbs and the trunk (dystonic). Ataxic CP occurs in about 10% of cases. Weakness, incoordination, and intention tremor produce unsteadiness, a wide-based gait, and difficulty with rapid or fine movements. Mixed CP is a combination of the above types but is most often a mixture of spasticity and athetoid movement, with tight muscle tone and involuntary reflex.² Ocular problems in children with CP is a major

issue. Over 40-75% of children with CP have some form of a visual problem or impairment. They may have an acuity loss, field loss, oculomotor problem and/or a processing problem. The literature on visual anomalies in CP indicates a high prevalence- where strabismus 15-69%, amblyopia 6-32%, oculomotor dysfunction 92%, accommodative insufficiency 100%, visual perceptual deficits 78%, significant refractive errors 40-76%.³

Among the eye problems squint (strabismus), refractive error, low vision, amblyopia, nystagmus are commonly found in children with CP. These problems are more often in spastic variety of CP. One study was conducted among 117 patient with CP and showed that in spastic diplegia- refractive error (67.5%), concomitant squint (48.6%), paralytic squint (10.8%), nystagmus (18.9%), and field defect (5.4%) were common. In spastic tetra/quadruplegia, Main ocular problems were- refractive error (54.3%), concomitant squint (34.2%), paralytic squint (17.1%), nystagmus (17.1%), field defect (17.1%), but in spastic hemiplegia, refractive error (41.7%), concomitant squint (25%), paralytic squint (25%), nystagmus (16.7%), field defect (25%) were main ocular problems. In athetoid variety of CP- refractive error (37.5%), concomitant squint (25%). In athetoid with spasticity- refractive error (27.2%), concomitant squint (18.2%), paralytic squint (18.2%). In ataxic variety of CP- refractive error (50%), concomitant squint (33%), paralytic squint (16.7%), nystagmus (50%), field defect (16.7%). In ataxic with spasticity- concomitant squint (33%).⁴ Spastic children are more likely to have ocular defect than athetoid and ataxic children. The pathology in spastic children is more extensive and diffuse, with periventricular haemorrhage, sub-cortical haemorrhage, and cortical atrophy. In athetoid children it is centred on, although not confined to, the basal ganglia and in ataxic children on the cerebellum. This perhaps explains why spastic children have a higher incidence of ocular defect.⁵ Another study showed 24 (20%) children had normal eyes or ocular adnexae, squint was found in 52.5% of children and significant refractive errors in 50%. There was also a higher incidence of strabismic and anisometropic amblyopia (15%) and visual field defects (11%).⁵ A study showed higher percentages of hyperopia, tendency toward hyperopia, and other refractive anomalies in all the pathological groups of children than in the non-pathological control group.⁶ A number of other ocular abnormalities were found, the majority of which were not amenable to any form of treatment. Early identification of treatable ocular defects and their treatment along conventional lines is emphasized. It is also important to identify untreatable defects that may have a bearing on the child's education. These children need all the help available, and visual function should be at its best. A diagnosis of cerebral palsy has unusually been made by the time such a child reaches 18 months of age. In view of the high incidence of ocular defects a full ophthalmological assessment should be part of the routine assessment of the child.⁶ With this background information, this study was done to evaluate the ocular defect in children with cerebral palsy and its

correlation with the types of cerebral palsy.

Ocular defect in children with CP is one of the major problems. The study aims at finding the eye problems in children with CP and their correlation with the types of CP. This study also focuses the proportion and pattern of ocular problems in children with cerebral palsy, attending a tertiary care hospital. This study helps to counsel the parents and provide early intervention. Thus minimize ophthalmic error. This help in early diagnosis and treatment of ocular problem in children with CP. Thus ameliorate the complication associated with visual problems in CP and save the children from long term complication. This study was done with this background of ideas.

General objective

The present study was planned to evaluate the ocular defect in children with cerebral palsy and their correlation with the different types of cerebral palsy.

Specific objectives

The specific objectives included: to find out different types of ocular defect in children with cerebral palsy; and to correlate these defects with the types of cerebral palsy.

METHODS

It was a cross sectional study conducted in the Paediatric Neurology outpatient department of Bangabandhu Sheikh Mujib Medical University during the period from January 2012 to June 2012.

One hundred and thirty (130) patients were selected as a study population of this study. Children with progressive neurological disability were excluded clinically after taking informed consent detailed history was taken. General, systemic and thorough neurological examination was done. Diagnosis of cerebral palsy was clinical, based on disorder of posture and movement with improving developmental trend and was put in the criteria of CP. Diagnosis was cross checked by the paediatric neurologist based on study definition. Patients or attendants were interviewed by a standard questionnaire with emphasis on risk factors. Ophthalmological evaluation was done by the help of ophthalmologist of the department of ophthalmology of BSMMU. Ophthalmological and motor disturbance were correlated. After collection of all the data, it is entered in the SPSS 17 statistical software. Use of student's t test was done for homogenous data and non-parametric test for non-homogenous data.

Student's t test to compare mean and non-parametric test to compare median. A probability of <0.05 is consider statistically significant. To calculate the strength of association between different types of CP, evaluation of odds ratio was done and 95% confidence interval.

RESULTS

One hundred thirty children with cerebral palsy who were eligible for inclusion during study period were evaluated at paediatrics neurology OPD of BSMMU for their ocular defect and motor abnormalities. Their age was observed. Highest numbers of patients were 12 to 24 months (61.5%) (Table 1). Male were 55.4% and 44.6% patients were female (Table 1).

Table 1: Age and sex distribution of the studied patients with cerebral palsy (n=130).

Parameter	N	%
Sex		
Male	71	54.61
Female	59	45.39
Total	130	100
Age (month)		
12-24	80	61.5
25-36	17	13
37-48	16	12.3
49-60	7	5.3
>60	10	7.6
Total	130	100

Patients came with the complaints of poor neck control (29%), inability to sit (43%), stand (66%) and walk (70%). Seizure was found in 33% patients. Hearing impairment was found in 20% patients, speech abnormality was found in 52% patients (Table 2).

Table 2: Presenting feature of the studied patients with cerebral palsy (n=130).

Presenting complaints	N	%
Poor neck control	38	29.2
Unable to sit unsupported	56	43
Unable to stand	86	66.1
Unable to walk	92	70.7
Seizure	44	33.8
Vision impairment	20	15.3
Hearing impairment	26	20
Speech defect	68	52.3
Involuntary movement	10	7.6

Causal association of CP was observed. Birth asphyxia was the most common cause (50%), other causes were preterm (13%), maternal illness (3.8%), low birth weight (13%), neonatal seizure (10%), septicemia (13%), and jaundice (1.5%) (Table 3). Quadriplegia was found in 35% patients, other types were 29% diplegic CP, 9% hemiplegic CP, 3.8% hypotonic CP, 10% was mixed CP, 7% was athetoid and 4% was ataxic CP (Table 4). Among all, patient 47 patients (36%) had normal eye finding and 83 patients (64%) had abnormal eye finding (Figure 1). Squint (40%) and refractive error (37%) were most common ocular defect in studied patients (Table 5). Squint

was most commonly associated with spastic quadriplegia and spastic diplegia; 48% and 42% respectively (Table 6).

Table 3: Abnormal perinatal events among the studied patients with cerebral palsy (n=130).

Complaints	N	%
Preterm	18	13.8
Maternal illness	5	3.8
Perinatal asphyxia	65	50
Low birth weight	18	13.8
Neonatal seizure	13	10
Septicaemia	18	13.8
Jaundice	2	1.5
Unknown	15	11.5

Table 4: Type of cerebral palsy (classified by motor abnormality) (n=130).

Types of cerebral palsy	N	%
Spastic quadriplegia	45	34.6
Spastic diplegia	38	29.2
Spastic hemiplegia	12	9.2
Athetoid	10	7.6
Athetoid with spasticity	12	9.2
Hypotonic	5	3.8
Ataxic	5	3.8
Ataxic with spasticity	3	2.3

Table 5: Frequency of ocular defect in cerebral palsy (n=130).

Ocular defect	N	%
Squint	52	40
Refractive error	48	36.9
Nystagmus	12	10
Optic atrophy	12	9.2
Corneal opacity	4	3.07
Microphthalmia	4	3.07
Cataract	3	2.3
Optic hypoplasia	3	2.3
Pigmentary retinopathy	3	2.3
Retrolental fibroplasia	3	2.3
Ptosis	2	1.5
Normal eye finding	47	36.1

Squint in spastic quadriplegia and spastic diplegia was statistically significant (p<0.05) (Table 7). Refractive error was also commonly associated with spastic quadriplegia and spastic diplegia: 29% and 41% respectively (Table 8). Refractive error in spastic diplegia is statistically significant (p<0.05) (Table 9). Other ocular defects among studied patient were nystagmus (10%), optic atrophy (9%), optic hypoplasia (2.3%), cataract (2.3%), corneal opacity (3%), microphthalmia (3%), pigmentary retinopathy (2.3%), retrolental fibroplasias (2.3%), and ptosis (1.5%) (Figure 2). Among studied patients 10% patients had

nystagmus, among them one third was in ataxic and one third was in spastic quadriplegic type of cerebral palsy (Table 10). Nystagmus in ataxic type of cerebral palsy is statistically significant ($p < 0.05$) (Table 11). Among studied patients 9.2% had optic atrophy, mostly in spastic quadriplegia (58.3%) (Table 12). Other ocular defect was most commonly associated with spastic quadriplegic and spastic diplegic cerebral palsy.

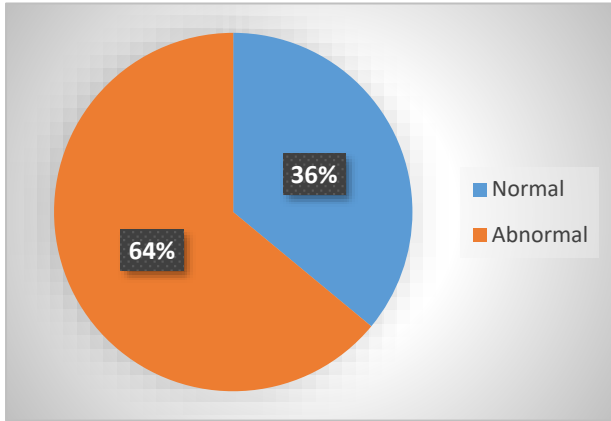


Figure 1: Distribution of abnormalities in eyes (n=130).

Table 6: Incidence of squint in different type of cerebral palsy (n=52).

Type of cerebral palsy	N	%
Spastic quadriplegia	25	48.0
Spastic diplegia	22	42.3
Spastic hemiplegia	02	3.8
Athetoid	01	1.9
Athetoid with spasticity	01	1.9
Ataxic	00	0.0
Ataxic with spasticity	01	1.9

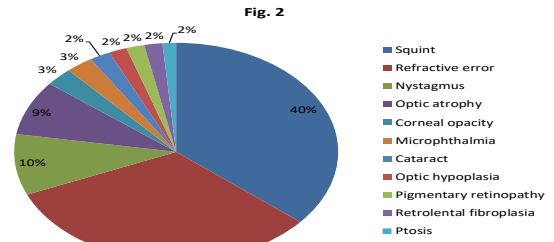


Figure 2: Frequency of ocular defect in cerebral palsy (n=130).

Table 7: Correlation between squint and different types of cerebral palsy.

Variables	No.	Squint	Non-squint	Odds ratio (95% CI)	P value
Spastic quadriplegia	45	25	20	2.69 (1.20-6.06)	0.014
Spastic diplegia	38	22	16	2.84(1.22-6.67)	0.013
Spastic hemiplegia	12	2	10	0.27 (0.04-1.41)	0.154
Athetoid	10	1	9	0.15 (0.01-1.22)	0.093
Athetoid with spasticity	12	1	11	0.12 (0.01-0.95)	0.041
Hypotonic	5	0	5	0.00 (0.00-1.72)	0.162
Ataxic	5	0	5	0.00 (0.00-1.72)	0.162
Ataxic with spasticity	3	1	2	0.75 (0.03-10.88)	0.72

Table 8: Incidence of refractive error in different type of cerebral palsy (n=48).

Types of cerebral palsy	N	%
Spastic quadriplegia	14	29.1
Spastic diplegia	20	41.6
Spastic hemiplegia	4	8.3
Athetoid	3	6.2
Athetoid with spasticity	4	8.3
Ataxic	2	4.1
Ataxic with spasticity	1	2

Table 9: Correlation between refractive error and different types of cerebral palsy.

Variables	No.	Refractive error cases	Non-refractive error cases	Odds ratio (95% CI)	P value
Spastic quadriplegia	45	14	31	0.68 (0.29-1.55)	0.419
Spastic diplegia	38	20	18	2.54 (1.09-5.95)	0.028
Spastic hemiplegia	12	4	8	0.84 (0.20-3.33)	0.965
Athetoid	10	2	8	0.40 (0.06-2.19)	0.416

Continued.

Variables	No.	Refractive error cases	Non-refractive error cases	Odds ratio (95% CI)	P value
Athetoid with spasticity	12	5	7	1.25 (0.32-4.74)	0.965
Hypotonic	5	0	5	0.00 (0.00-1.97)	0.203
Hypotonic	5	2	3	1.14 (0.13-8.86)	0.743
Ataxic with spasticity	3	1	2	0.85 (Cornfield limit invalid)	0.634

Table 10: Incidence of nystagmus in different type of cerebral palsy (n=12).

Types of cerebral palsy	N	%
Spastic quadriplegia	4	33.3
Spastic diplegia	2	16.6
Spastic hemiplegia	2	16.6
Athetoid	0	0
Athetoid with spasticity	0	0
Ataxic	4	33.3
Ataxic with spasticity	0	0

Table 11: Correlation between nystagmus and different types of cerebral palsy.

Variables	No.	Nystagmus cases	Non-nystagmus cases	Odds ratio (95% CI)	P value
Spastic quadriplegia	45	4	41	0.94 (0.30-2.97)	0.59
Spastic diplegia	38	2	36	0.48 (0.11-2.11)	0.25
Spastic hemiplegia	12	2	10	1.97 (0.49-7.95)	0.30
Athetoid	10	0	10	0.00 (0.00-5.43)	0.36
Athetoid with spasticity	12	0	12	0.00 (0.00-4.35)	0.29
Hypotonic	05	0	5	0.00 (0.00-12.71)	0.61
Ataxic	05	4	1	58.50 (5.04-1560)	0.0002
Ataxic with spasticity	03	0	3	0.00 (0.00-24.67)	0.74

Table 12: Incidence of optic atrophy in different type of cerebral palsy (n=12).

Types of cerebral palsy	N	%
Spastic quadriplegia	7	58.3
Spastic diplegia	2	16.6
Spastic hemiplegia	2	16.6
Athetoid	1	8.3
Athetoid with spasticity	0	0
Ataxic	0	0
Ataxic with spasticity	0	0

Table 13: Correlation between optic atrophy and different types of cerebral palsy.

Variables	NO.	Optic atrophy cases	Non-optic atrophy cases	Odds ratio (95% CI)	P value
Spastic quadriplegia	45	7	38	2.95 (0.77-11.59)	0.07
Spastic diplegia	38	2	36	0.46 (0.07-2.39)	0.25
Spastic hemiplegia	12	2	10	2.16 (0.28-13.03)	0.30
Athetoid	10	1	9	1.10 (Cornfield limit invalid)	0.63
Athetoid with spasticity	12	0	12	0.00 (0.00-4.35)	0.29
Hypotonic	05	0	5	0.00 (0.00-12.71)	0.61
Ataxic	05	0	5	0.00 (0.00-12.71)	0.61
Ataxic with spasticity	03	0	3	0.00 (0.00-24.67)	0.74

DISCUSSION

Ocular abnormalities are very common in children with cerebral palsy. Shafer reported over 40-75% of children with cerebral palsy have some form of visual problem or impairment.² In the present study 64% children with cerebral palsy have some sort of ocular abnormalities and 36% have normal eye finding. According to Black-out of 117 patient 55% were male and 45% were female. Main ocular defect were refractive error (49.6%), squint (50%).⁵ In the present study, where squint is found in 40% and refractive error found in 36.9% cases which was statistically significant. Black reported 48.6% squint in spastic diplegia and 34.2% were found in spastic quadriplegia.⁵ In the present study 48% squint was found in spastic quadriplegia and 42% found in spastic diplegia. So the finding of the present study correlate with the study of Black. According to Ettinger and Black-significant refractive error is found in spastic diplegia.⁴⁻⁶ According to Black and Black it was 68% and 67.5% respectively.^{5,6} In the present study 36.9% patient had significant refractive error and it is mostly in spastic diplegia (41.6%) and in spastic quadriplegia (29.1%). Refractive error in spastic diplegia is statistically significant. According to Black and Black other ocular abnormalities were also present in cerebral palsy patient. These were nystagmus, optic atrophy, optic hypoplasia, cataract, corneal opacity, microphthalmia, pigmentary retinopathy, retrolental fibroplasia, ptosis.^{5,6} According to Black nystagmus was in 16.2%, optic atrophy in 10.3%, optic hypoplasia in 2.6%, cataract in 2.6%, corneal opacity in 2.6%, microphthalmia in 3.4%, pigmentary retinopathy in 1.7%, retrolental fibroplasias in 2.6% and ptosis was in 2.6%.⁵ In the present study ocular abnormalities were nystagmus 10%, optic atrophy 9.2%, optic hypoplasia 2.3%, cataract 2.3%, corneal opacity 3.07%, microphthalmia 3.07%, pigmentary retinopathy 2.3%, retrolental fibroplasia 2.3%, ptosis 1.5%. So these ocular findings of the present study correlate with the study of Black.

According to Marasini et al total ocular abnormalities was found in 78% of 36 studied patient, among them squint was in 36%, refractive error was in 19% and nystagmus was in 14%. This finding was mostly in spastic quadriplegia and spastic diplegia.¹⁶ In the present study, squint was 40% and refractive error was 36.9% which were statistically significant with Marasini et al study.

Another study was done on 70 cerebral palsy children by Govinda and Lamba. Overall incidence of ocular abnormalities was 68.69%, the highest frequency being of squint (35.7%). Other abnormalities detected include refractive error (28.5%), optic atrophy (10%) and coloboma (2.9%). Most children were spastic quadriplegic which also match with present study.¹⁷ According to Lagunju and Oluleye - one hundred forty nine cerebral palsy children were studied over a period of 18 months. Authors found 9.5% cerebral palsy children had nystagmus, mostly in ataxic type of cerebral palsy. In the present study 10% patients had nystagmus mostly in ataxic

and spastic quadriplegic types of cerebral palsy. This finding correlate with the finding of Lagunju and Oluleye.¹⁸

Marasini et al studied 36 children with cerebral palsy, fourteen (14%) percent of the children had variant of nystagmus. Present study correlate with the Marasini et al study.¹⁹ Estela, Benitez-Nava and Garrido studied 110 cerebral palsy patients, among them 14.2% patients had optic atrophy. In the present study 9.2% patients had optic atrophy which was correlated with the finding of Estela et al.²⁰

In view of the high incidence of ocular defects a full ophthalmologic assessment should be part of the routine assessment of the children with cerebral palsy.

Limitations

This was a single centre study with small sample size. So, the study results may not reflect the scenarios of the whole country.

CONCLUSION

Ocular defect in children with CP was common and had correlation with the types of CP. Children with spastic quadriplegic and spastic diplegic CP had more ocular abnormalities, most commonly squint and refractive error. Nystagmus was also common in ataxic type of CP. This study provides data about the incidence and pattern of ocular problems in children with CP attending a tertiary care hospital. In turn this helps early diagnosis and treatment of ocular problem in children with CP and thus ameliorates the complication associated with visual problem in CP.

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