

## Visual impairments in children with cerebral palsy

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### ABSTRACT

**Background:** Visual impairments are associated with cerebral palsy (CP). They enhance functional limitations in children with CP.

**Objective:** The objective of the study was to determine the types of visual impairments in children with CP, and thus the importance of early evaluation and intervention to improve the quality of life. **Materials and Methods:** Children with CP (n=775) attending the child development clinic from 2012 to 2017 were included in the study. Thorough antenatal, natal, postnatal, and developmental history were recorded. Complete demographic data, anthropometry and general physical, and neurological examination findings were recorded. All patients were advised neuroimaging (computed tomography/magnetic resonance imaging) and hearing and ophthalmological assessment. **Results:** Of the 775 patients, 270 (34.8%) patients had squint (including convergent and divergent). Detailed fundoscopic and visual evoked potentials (VEP) examination was done in 382 patients. Non-apparent abnormalities (VEP and fundus changes) were seen in 121 patients (31.7%) among 382 tested. Of those 121 patients, VEP changes and fundus changes were seen in 62 and 41 patients, respectively. Refractive errors were detected in 25 patients. Of the total patients assessed for ophthalmological ailments, 129 (33.7%) patients were completely normal. **Conclusion:** Visual impairments are associated in large percentage of CP patients. Early evaluation and intervention are emphasized to improve the quality of life in these patients.

**Key words:** Cerebral palsy, Children, Quadriparetic cerebral palsy, Squint, Visual impairments

Cerebral palsy (CP) is a diagnostic term used to describe a group of permanent disorders of movement and posture, causing activity limitation that is attributed to non-progressive disturbance in the developing fetal or infant brain. Motor disorders are often accompanied by disturbances of sensation, perception, cognition, communication, and behavior [1]. CP is the commonest form of chronic motor disability that begins in childhood; the incidence being 2-2.5/1000 live births [2]. It is accompanied with various handicaps and intellectual disability is the most common among them. The associated abnormalities are epilepsy, visual, hearing, and speech impairment [3].

Visual impairments are well known to be associated with CP; causing functional limitation and thus affecting the quality of life. Various studies have been done to consider visual ailments in CP globally [4]. However, there is paucity of Indian studies of such patients. This study was planned to determine the types of visual impairments in children with CP and thus the importance of early evaluation and intervention to improve the quality of life.

### MATERIALS AND METHODS

This retrospective study was conducted in the Department of Pediatrics of a tertiary care teaching hospital of North India. Data of 775 patients with CP attending the child development clinic

from 2012 to 2017 belonging to the age group of 1-12 years were included. Clinical examination was done and complete history was recorded and those patients fitting to the definition of CP were included. Patients with neurodegenerative disorders, developmental delay without, and evolving CP were excluded from the study.

Complete demographic profile was recorded including age, sex, maternal and paternal age, and education. Prenatal, natal, and postnatal history was recorded using a structured pro forma. Developmental and neurological examination was done. Comprehensive ophthalmological and auditory evaluation, neuroimaging, and IQ assessment were advised to all patients.

CP was classified by topographical classification based on limb involvement as quadriparetic/diplegic/hemiparetic/monoplegic/triplegic. Risk factors for the development of CP were identified on the basis of history. Complete visual assessment was advised to all the patients. The visual assessment included evaluation for apparent abnormalities (squint, ocular mobility, and cataract) and non-apparent abnormalities (optic atrophy, papilloedema, and visual evoked potential [VEP] changes). Non-apparent ophthalmological abnormalities were assessed by fundoscopy (normal fundus/disc pallor/papilloedema). VEP provide a non-invasive, objective measure of visual function which reflects the activity of the visual pathway from the retina to the visual cortex.

VEP was measured and the findings were classified as normal or abnormal (increased interpeak latencies, decreased amplitude of waveforms, and non-recordable waves). Data were entered and analyzed using SPSS version 2.0. Frequencies were calculated and association of type of CP with visual impairments was done by using Chi-square test.

## RESULTS

The mean age at the time of presentation to the clinic was 20.8±6.54 months. Among 775 patients, 488 (63%) were males and 287 (37%) were females. Table 1 shows the clinical profile of patients with CP in our study. Overall assessment revealed that 313 patients had visual problems. Among the total CP patients visiting the development clinic, detailed fundoscopy and VEP measurement were undertaken in 382 (49.2%) patients. Of 382 patients, VEP was measured in 122 (33.1%) patients. Others underwent only fundoscopy and visual acuity assessment. Fundus changes were found in 62 patients, VEP changes in 41 and refractive error in 25 patients. The number of patients with both apparent and inapparent impairments amounted to 89.

Table 2 shows the distribution of different visual impairments in spastic quadriparetic non-spastic quadriparetic CP patients. Of 62 patients with fundus changes (disc pallor/optic atrophy) 55 patients (88.7%) were spastic quadriparetic type of CP and 11.7% included rest types of CP, the difference being significant ( $p=0.002^*$ ).

## DISCUSSION

CP is a common developmental disability first described by William Little in the 1840s. The condition poses a considerable diagnostic and therapeutic challenge to the physician with degree of involvement ranging from mild with minimal disability to severe associated with severe comorbid condition. CP is defined as an umbrella term covering a group of non-progressive but often changing, motor impairment, syndromes secondary to lesions, or anomalies of the brain occurring in the early stages of its development [5].

Our study revealed 542 (62.2%) patients to be spastic quadriparetic followed by 118 (15.2%) patients of spastic diplegic CP and rest of the cases was hemiplegic, monoplegic, or triplegic CP. According to a previous study by Singhi *et al.*, 61% of the study population had spastic quadriplegia and 22% were spastic diplegics [6]. A comparative study was done by Singhi *et al.* in 2002 revealed a decrease in spastic quadriplegic CP to 51.5% and increased in spastic diplegic CP to 34.5% [7]. This decrease in frequency of spastic quadriplegic CP is attributed to improvement in perinatal services and thus decreasing the incidence of perinatal asphyxia. Western literature reveals spastic diplegia as the most common form of CP due to better perinatal services and improved premature neonatal survival [8].

Visual assessment (fundoscopy, VEP measurement, and visual acuity testing) for non-apparent ophthalmological abnormalities was done in 382 patients of total 775 patients advised for the same.

**Table 1: Clinical profile of patients and visual abnormalities among CP patients in our study (n=775)**

Type of CP	Number (%)
Spastic quadriparetic	542 (69.9)
Spastic diplegic	118 (14.2)
Spastic hemiparetic	93 (12.0)
Spastic monoplegic	2 (0.25)
Spastic triplegic	2 (0.25)
Dyskinetic	18 (2.3)
Visual abnormality	
Squint	270 (34.8)
Disc changes/optic atrophy	62
VEP changes	41
Cataract	11 (1.4)
Papilloedema	3

CP: Cerebral palsy, VEP: Visual evoked potential

**Table 2: Distribution of types of visual impairments in spastic quadriparetic versus non-quadruparetic CP**

Abnormality (n)	Spastic quadriparetic number (%)	Non-spastic quadriparetic number (%)	p-value
Squint (n=775)			
Yes	196 (72.6)	74 (27.4)	0.238
No	346 (68.5)	159 (31.5)	
Fundus changes (n=382)			
Yes	55 (88.7)	7 (11.3)	0.002*
No	201 (62.8)	119 (37.1)	
VEP changes (n=122)			
Yes	29 (70.7)	12 (29.3)	0.310
No	64 (79)	17 (21)	
Refractive error (n=38)			
Yes	18 (72)	7 (28)	0.744
No	10 (76.9)	3 (23.1)	

Chi-square test, \* $p<0.05$ . CP: Cerebral palsy, VEP: Visual evoked potential

Of these 382 patients, only 122 undertook VEP measurement. Very few patients underwent detailed ophthalmological examination. This shows lack of awareness about visual assessment and its implications in child's overall performance. Parents should be counseled about the clues to early suspicion of visual ailments. The early clues to visual handicaps might be covering of eyes in bright light by child, tilting of head while gaze fixation, excessive ocular mobility, deviation of eyes, and not able to fix gaze.

Of total 382 patients evaluated for non-apparent abnormalities, 121 (31.6%) were revealed to have VEP changes, fundus changes and refractive errors. This reveals high burden of visual problems in CP patients which are inapparent and thus leading to delay in corrective measures. This high percentage might be due to less number of patients being evaluated for ophthalmological issues (382 of 775 patients attending the clinic). This reveals lack of awareness among Indian population for visual handicaps as a cause of poor quality of life in CP patients. A total number of patients with visual problems were 313 (40.3%). This data were similar to previous study by Singhi *et al.* in 2002 which

depicted that 41% CP patients had visual impairments among total 1000 patients studied [6]. Another study by Singhi *et al.* in 2013 showed 46.7% prevalence of visual handicaps in patients with CP [7].

A large spectrum of visual ailments is prevalent in children with CP and has been described in the literature globally [9-11]. In our study, very few patients underwent detailed ophthalmological examination which emphasizes the role of counseling about the role of detailed examination and its implications in child's overall performance. Our study revealed a very low percentage of children with refractive errors which is in disagreement with most of the studies done previously. A study done by Alimović and Mejaski-Bosnjak in 2011 showed that more than 50% of their study population had refractive errors [12]. Similarly, studies by Katoch *et al.* in 2007 and Elmenshawy *et al.* in 2010 revealed 33.5% and 67.2% cases with refractive errors [13,14].

Of 121 patients with non-apparent visual impairments, 96 (79.3%) were spastic quadriparetic and rest (20.7%) were rest forms of CP ( $p=0.029$ ), association being significant. Fundus changes were seen in 62 patients and 55 (88.7%) of them were quadriparetic ( $p=0.002^*$ ). Majority of the patients having visual problems were spastic quadriparetic CP. Thus, this group of CP needs early evaluation for inapparent visual problems. This can facilitate early intervention and thus limit deterioration in vision. VEP changes help in diagnosis of cerebral visual impairment. There are no medicines or surgical treatments that will fix or improve brain damage. There are, however, lots of things that can be done to help children with cerebral visual impairment and make the most of their vision. These children should be encouraged to wear spectacles, contact lenses, or low visual aids as prescribed to them. Cerebral visual impairment commonly occurs in children who have difficulty controlling both head and eye movements. Careful positioning of the head to prevent it falling to the side or falling forward could help a lot.

Squint (divergent and convergent) was found in 270 patients (34.8%) of 775 patients. This result was comparable to the results of a study conducted by Marasani *et al.* in 2011 in Kathmandu, Nepal, which revealed 36% cases of squints in their study population including exotropia and esotropia [15]. These visual ailments could affect the development of brain and even cause amblyopia if left untreated. Visuospatial difficulties are exaggerated by squint. The cosmetic aspect of squint should also be given importance. Development of amblyopia could further add on to the poor functional abilities of children with CP. The treatment of amblyopia is mandatory for optimum functioning of both eyes. Thus, its early diagnosis is necessary.

Visual impairments often result in concentration issues and problems with eye-hand coordination. It is very important that an eye care specialist be consulted regularly for possible intervention, including glasses, eye patching, and surgery. There is a growing body of literature reporting the relationship between vision impairments and various aspects of functioning for children with CP, including gross motor, communication, cognition, self-care, and daily functioning skills. Visual perception has a remarkable influence on overall development of children. Visual objects

stimulate children to move toward them during their initial period of development. Children learn through visual imitation. Therefore, it is necessary to have a good visual perception to facilitate the development of children with CP [12].

Although ocular assessment is very difficult in CP patients due to their physical and mental disability, examination with patience and adequate clinical attention can help reach diagnosis of visual ailments. Timely referral and appropriate interventions including corrective surgeries, spectacles, visual stimulation [16], and rehabilitative counseling might facilitate overall development of CP children. The study was limited by the small number of patients undergoing thorough ophthalmological assessment. The study with larger population size is needed to have a better viewpoint on prevalence of visual problems in CP patients.

## CONCLUSION

Visual ailments are an associated handicap in CP. Visual perception is important for the functioning and development of brain. A large percentage of CP patients suffer from visual defects. Hence, it becomes mandatory to initiate early assessment and intervention to minimize the effects on functional abilities of children with CP. As soon as the diagnosis of CP is made, complete ophthalmological examination should be sought for. It is believed that this study would facilitate in creating awareness regarding early visual assessment to have a better quality of life in CP children.

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