

Original Article

Computed Tomographic Findings in Children with Cerebral Palsy in a Developing Country

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Abstract

Background: Cerebral palsy (CP) is one of the most common causes of chronic childhood disability. To know the aetiopathogenesis, severity and prognosis of CP, neuroimaging is an important modality of investigation. **Objective:** This study was done to observe the findings in CT scan of brain in children with CP. **Materials and Methods:** This is a cross-sectional descriptive study. One hundred and ten patients who were clinically diagnosed as cerebral palsy were enrolled in the study. After selection of the subjects, demographic and clinical characteristics were recorded. All other comorbidities including visual and hearing impairments were identified. CT scan of brain was done in all children and reporting had been done by a single qualified radiologist. **Results:** The mean age of the studied children was 2.6 ± 2.2 years (1 to 14 years). Seven types of CP were found in the study group. Among them quadriplegic CP were the most common (39.1%). History of perinatal asphyxia was found in 81.8% children. Cognitive delay was found in 90% children, speech delay was found in 88.2% children, visual impairment was found in 35.5% children and hearing impairment in 31.8% cases. Epilepsy was found in 44.4% among studied subjects. Most common finding on CT scan of brain was cerebral atrophy (62.7%), followed by encephalomalacia (15.5%), calcification (13.6%), and brain malformations (11.8%). Abnormal CT scan findings were found in 88.2% of study population. **Conclusion:** This study showed that most common type of CP was quadriplegic CP. Maximum children had abnormal CT scan findings. Most common CT scan finding was cerebral atrophy.

Key words: Cerebral palsy; Computed tomography; Encephalomalacia

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Introduction

Cerebral palsy (CP) describes a group of permanent disorders of the development of movement and posture, causing activity limitation, that are attributed to non-progressive disturbances that occurred in the developing fetal or infant brain.¹ The motor disorders of

cerebral palsy are often accompanied by disturbances of sensation, perception, cognition, communication and behavior by epilepsy and by secondary musculoskeletal problems.²⁻⁴ It is one of the most common causes of chronic childhood disability.⁵ The

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prevalence of CP in the world is about 2–2.5/1000 live births.⁶⁻⁸ In the developed world the prevalence of CP remains very stable for many years at this percentage.³ In Bangladesh the prevalence is about 6.1/1000 live births.^{9,10} CP is known to be associated with a host of proven etiologic factors. Prenatal causes are maternal hyperthyroidism, intrauterine infections, malnutrition etc. Perinatal causes are prematurity, VLBW, birth asphyxia, brain malformation, intrauterine growth retardation, hypoglycemia, dyselectrolytemias, sepsis, being a twin, TORCH infections, kernicterus etc. Postnatal risk factors are meningitis, encephalitis, head injury, seizures etc.¹¹⁻¹³ Different etiologies occurring at different developmental stages can result in the same clinical pattern of cerebral palsy.¹⁴ Alternatively, a similar etiology may produce variable outcomes.¹⁵ The American Academy of Neurology, in 2004, published a practice parameter that advocated for the first time the routine neuroimaging of children with suspected cerebral palsy.^{15,16} A practice parameter regarding the value and indications for obtaining neuroimaging in preterm and term infants has recently been published.⁶ The current parameter addresses the role of neuroimaging in the infant or child who has been diagnosed with or is suspected of having CP based upon a motor deficit.^{6,17}

Materials and Methods

This cross sectional descriptive study has been carried out in the Department of Paediatric Neurology and Institute of Paediatric Neurodisorder and Autism (IPNA), Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka over a period of 1 year and 6 months from March 2016 to August 2017. Purposive sampling was done and sample size was calculated. Total 200 CP patients had done CT scan of brain, among them 90 patients were excluded, because 30 patients had neurometabolic disease, 20 patients had neurodegenerative disease, 25 cases did not give consent, 15 patients were < 1 year old. Patients were eligible if they had chronological age 1 to 18 years. Child clinically diagnosed as a case of cerebral palsy and CT scan of brain was done following standard method as practiced in different centers but was reported by a single expert radiologist from the department of Radiology and Imaging at BSMMU. Informed written consent was taken from

the parents. Demographic and clinical characteristics were recorded, physical examination (mainly detailed neurological examination) was done to identify the type of CP and associated co-morbid conditions. The psychologists of pediatric neurology unit did the psychological tests by using appropriate tools. Cognitive level was designated as normal or impaired with cut-off IQ of 70. All the children had a formal visual and hearing assessment. Brainstem Auditory-Evoked Responses/Auditory Brainstem Responses (BAER/ABR) or Otoacoustic Emissions (OAEs) test were done to assess hearing. CT scan was done by 64 slice spiral CT machine.

Results

Out of 110 patients with CP 69 (62.7%) were male and 41 (37.3%) were female. Most of them (77, 70.0%) were socioeconomically poor. Most of the patients (67, 60.9%) lived in rural areas. Table I shows the demographic and socioeconomic characteristics of children with cerebral palsy

Table I: Demographic and socioeconomic characteristics of children with cerebral palsy (N=110)

Demographic variables	Frequency	Percentage
Age		
1–5 years	99	90.0
5–12 years	10	9.1
12–18 years	1	0.9
Sex		
Male	69	62.7
Female	41	37.3
Place of birth		
Rural	67	60.9
Urban	43	39.1
Socioeconomic condition		
Poor	77	70.0
Middle class	33	30.0
Rich	0	0.0
Birth order of the child		
First born	75	68.1
Second child	28	25.5
Third or later born	7	6.4
Twin	8	7.3

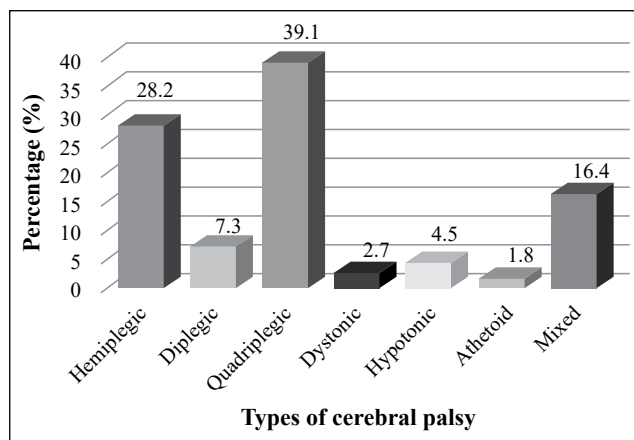


Fig 1. Bar diagram showing the types of cerebral palsy (N=110)

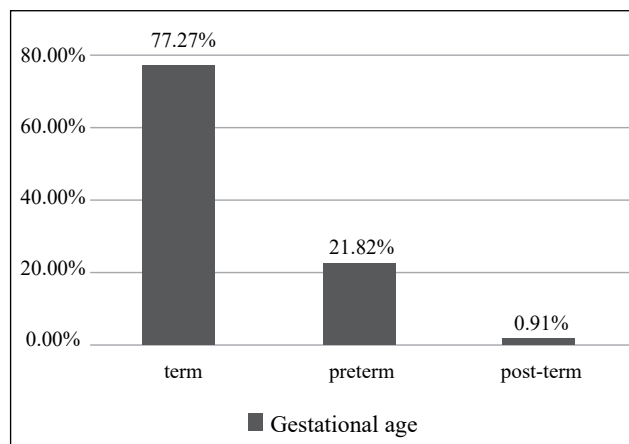


Fig 2. Bar diagram showing the gestational age at birth (N=110)

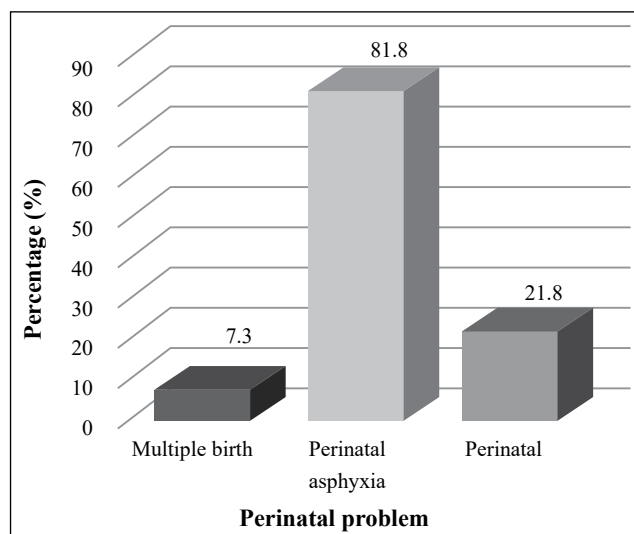


Fig 3. Bar diagram showing the extent of perinatal problems (N=110)

This study found most of the patients had perinatal asphyxia (81.8%). Most of the patients had cognitive delay (90.9%), 2nd most common finding was speech delay (88.2%), seizure was present among 49 patients (44.4%).

Seven types of CP were found in the study group (Fig 1). Among them, quadriplegic CP were the most common (39.1%), followed by cases of hemiplegic CP (28.2%) and mixed type was 16.4%. Most of the patients (77.27%) were born at term.

Table II shows the distribution of the findings of CT scan of brain (N=110). Some patients had multiple findings.

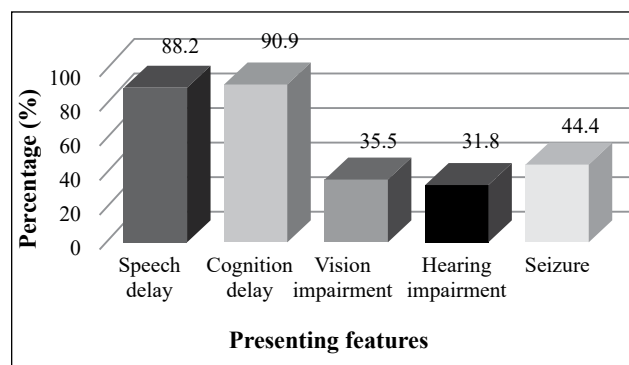


Fig 4. Bar diagram showing the frequency of associated co-morbidities (N= 110)

Table II: Distribution of patients according to the findings of CT scan of brain (N=110)

CT scan findings	Number	Percentage
Brain atrophy (Fig 5)	69	62.7
Encephalomalacia (Fig 6)	17	15.5
Brian malformation (Fig 7, 8, 9)	13	11.8
Periventricular Leukomalacia (PVL)	2	1.8
Calcification due to TORCH infection	15	13.6
Delayed myelination	1	0.9
Focal arterial infarction	1	0.9
Normal	13	11.8



Fig 5. CT scan of brain showing moderate generalized cerebral atrophy



Fig 8. CT scan of brain showing Arachnoid cyst

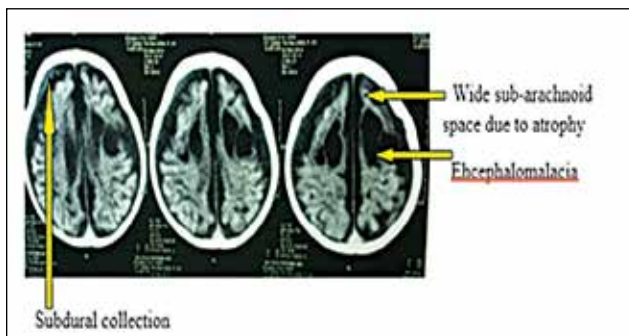


Fig 6. CT scan of brain showing diffuse cerebral atrophy with encephalomalatic change and mild subdural collection

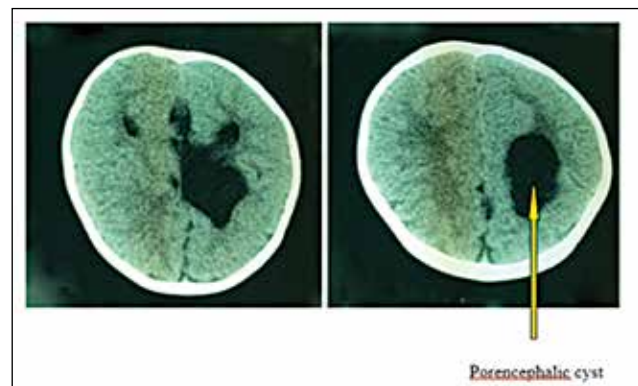


Fig 9. CT scan of brain showing porencephalic cyst in left fronto-parietal region

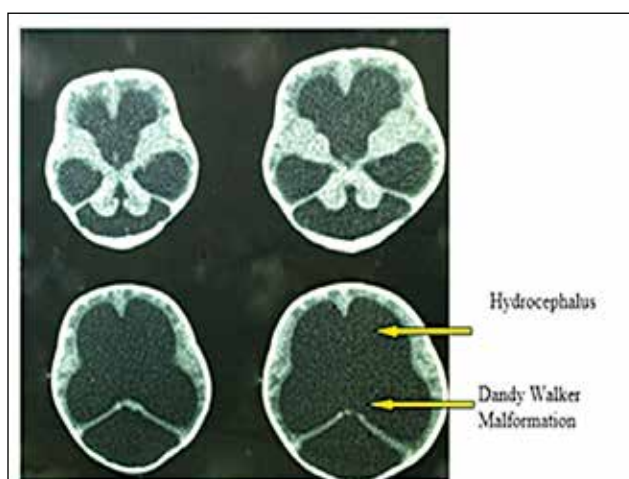


Fig 7. CT scan of brain showing Dandy Walker Malformation with hydrocephalus

Discussion

Computerized tomography is a useful tool for demonstrating the anatomical lesions responsible for CP patient’s clinical findings, useful in predicting prognosis and functional outcomes and to diagnose lesions which are correctable by neurosurgery.¹⁸⁻²⁰ In Bangladesh perspective, mostly CT scan of brain is done as MRI of brain is costly and needs general anesthesia. According to several literatures CT scan is considered to be a proven useful method of correlating morphology with clinical features in CP.²¹⁻²³ Kolawole et al²¹ reported that 72.5% of children with cerebral palsy had positive CT scan findings while Taudorf et al²³ found that 67% of children with CP had pathological CT scan findings. In this study it was

found that 88.18% of children with CP had abnormal CT scan findings, most frequent (62.7%) pathological CT finding was cerebral atrophy which was similar to Moifo et al²⁴, Taudorf et al²³ and Kolawole et al²¹ studies. Moifo et al²⁴ found atrophy in 52.7% cases, Kolawole et al²¹ found atrophy in 30.8% cases and Taudorf et al²³ found presence of brain atrophy in 44 children among 56 pathological CT scan findings. Again in this study it was found that 2nd most common finding was encephalomalacia which was present in 15.5% cases followed by calcification due to infections (13.6%) and brain malformations were in 11.8% of children with CP. Brain malformations found in this study were hydrocephalus with Dandy Walker malformation (1 children with CP), corpus callosal agenesis (3 children with CP), cortical dysplasia and arachnoid cyst in left temporo-parietal regions (1 children with CP), poor myelination (1 children with CP), Giant cisterna magna (2 children with CP), open lip schizencephaly with corpus callosal agenesis (1 children with CP), porencephaly (2 children with CP), holoporencephaly with hypoplastic cerebellar vermis and posterior fossa cyst (1 children with CP), cortical dysplasia (1 children with CP). Korzeniewski¹⁵ also found about 10% of children with cerebral palsy was attributable to brain malformations. Martin , Clare & Olof found in their study there was 9.1% of children with CP had brain malformation.¹⁷ Moifo et al²⁴ was also found brain malformations in 7.4% of children with CP. Multiple findings in CT scan of brain is common in children with CP. In this study it was found that significant number of studied population (**26**) had two/more findings at a time which included-atrophy with calcification (3), atrophy with encephalomalacia (7), atrophy with infarct (4), atrophy with encephalomalacia with calcification (2), hydrocephalus with encephalomalacia (2), atrophy with calcification with subdural hematoma (1), atrophy with calcification with infarct (2), atrophy with encephalomalacia with subdural hematoma (1), atrophy with malformation (1), atrophy with encephalopathy (1), atrophy with calcification with malformation (1) and infective encephalopathy (1). Encephalomalacia was found in 15.5% of children with CP, calcification was found in 13.6% of children with CP and periventricular leukomalacia was found

in 1.8% of children with CP. Taudorf et al²³ found the frequency of pathological CT findings increased with increasing severity of the motor handicap. There were significantly more children with pathological CT findings among CP children suffering from epilepsy than among CP children without epilepsy. This study had also same results. Most of the children who had pathological CT findings suffered from epilepsy and had other co-morbid conditions like cognitive disorder, visual, hearing impairment, and feeding difficulty.

This study showed that most common types of CP were quadriplegic CP and hemiplegic CP. A significant number of patients had mixed type CP. In this study 88.2% children with CP showed abnormality in CT scan. Most common findings of this study were cerebral atrophy followed by encephalomalacia, calcifications and brain malformation. Epilepsy and other co-morbid conditions were found in many children with abnormal CT scan findings, but no relation was investigated.

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