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RESEARCH PAPER

A STUDY OF ETIOLOGICAL FACTORS AND CO-MORBIDITIES ASSOCIATED WITH CEREBRAL PALSY

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ABSTRACT

INTRODUCTION: Cerebral palsy is a diagnostic term used to describe a group of permanent disorders of movement and posture which cause activity limitation, that are attributed to non-progressive disturbances in the developing fetal or infant brain. For India, the estimated incidence was about 3 per 1000 live births; however, being a developing country, the estimated actual figure might be much higher. causes of CP such as prematurity, perinatal asphyxia and prematurity.

RESULTS: Mean age of the patients was 5.2 ± 3.2 years (Range 2 to 12 years). 56.2% patients were 2 –5 years old, 28.8% were 5.1 – 9 years old and 15% were 9.1 – 12 years old. Majority of the patients were males (63%) with male to female ratio of 1.7:1. Antenatal history of patients' mothers had found that 10.9% had PIH, 5.4% had GDM, 2.7% had toxoplasmosis, 1.4% had CMV infection and 1.4% had Twin gestation. Perinatal history of the patients had found that 31.5% had perinatal asphyxia, 24.6% were premature, 10.9% had neonatal sepsis, 4.1% had prematurity with neonatal sepsis, 2.7% had neonatal seizure, 2.7% had anomalies of brain and 1.4% had neonatal hyperbilirubinemia. Postnatally 1.4% patients had developed CP as post meningitis sequelae. Most common co-morbidity in CP patients was epilepsy (57.5%), while other co-morbidities were visual impairment (49.3%), dental caries (32.9%), mental retardation (26%), bowel or bladder incontinence (24.7%), feeding difficulties (20.6%), auditory impairment (20.6%), malnutrition (19.2%) and language-speech disorder (5.5%).

CONCLUSION: Retrospective study helps in the diagnosis of the probable cause and early intervention prevents in the development of co-morbidities in cerebral palsy

KEY WORDS : cerebral palsy, hyperbilirubinemia, perinatal asphyxia, neonatal encephalopathy

INTRODUCTION

Cerebral palsy is a diagnostic term used to describe a group of permanent disorders of movement and posture which cause activity limitation, that are attributed to non-progressive disturbances in the developing fetal or infant brain[1]. It is the most common childhood physical disability representing a group of conditions with heterogenous symptoms that are characterized by deficient motor control, spasticity, paralysis and other neurological disturbances that emerge before, during, or in a short time after birth[2].

In India, nearly 3.8% of the population have some form of disability. For India, the estimated incidence was about 3 per 1000 live births; however, being a developing country, the estimated actual figure might be much higher[3]. Cerebral palsy is the second most prevalent neurological disorder in rural population in India[4]. Along with motor abnormality, children who suffer from CP experience cognitive and sensory impairments, epilepsy and nutritional deficiencies.

Previous epidemiologic studies highlight the scope of the problem. CP occurs in 1.5 to 2.5/1000 live births; neonatal encephalopathy in 1.8 to 7.7/1000 live births and intrapartum asphyxia in 1.5 to 3/1000 live births.

Previous studies have found causes of CP such as prematurity, perinatal asphyxia and deficiency in maternal iodine. Placental abruption, cord prolapse and uterine rupture also raise the risk of CP. Other prenatal factors responsible for CP were intrauterine exposure to infection or maternal fever during labor, ischemic stroke, congenital malformations and atypical intrauterine growth (restricted or excessive for gestational age) and as a complication of multiple gestation. Acquired conditions in the postnatal period that are responsible for CP are central nervous system infection, trauma, strokes and severe hypoxic events such as near drowning. Neurologically, deep gray matter and mostly white matter injuries are most probable causes of CP.

The classification of CP depends on the predominant motor alteration and encompasses three main types; spastic (unusual tightness in muscles of limbs), athetoid (involuntary movements) and ataxic (difficulties in motor coordination). Depending on the impairment of the arms relative to the spastic legs, CP is further classified into hemiplegic CP (unilateral disorder), diplegic CP (greater impairment of the legs than of the arms), quadriplegic CP (all four limbs equally affected), monoplegic CP(one limb affected) and triplegic(three limbs affected). Children with quadriplegic CP also have mental retardation, while the intellect function is often spared in diplegic and hemiplegic CP[5].

Clinical diagnosis of CP is mainly dependent on parents' observations after the child has attained motor milestones, such as sitting, pull to stand, walking; and on examiner's evaluation of posture, deep tendon reflexes and muscle tone.

Risk factors for CP varies in different patients that depend on the type of underlying brain abnormality[6]

METHODOLOGY

A tertiary hospital based descriptive cross sectional study was done among 73 subjects diagnosed as cerebral palsy. The study was carried to find the probable causes and to study the co-morbidities associated with cerebral palsy.

Study Site: Department of Paediatrics, Dr. D. Y. Patil Medical College

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Data was collected from **October 2016 to September 2018**
Statistical package used was WinPepi.

Qualitative data was summarised in terms of proportions and percentages along with a 95% confidence interval.

Sampling Technique: Convenient sampling methods

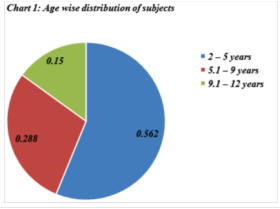
- **Inclusion criteria:**
- Children in the age group of 2-12 years.
- Children with moderate to severe impairment defined by gross motor functional classification system[7,8,9] who had been clinically diagnosed as cerebral palsy.

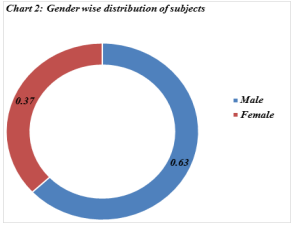
- **Exclusion criteria:**
- Children below the age of 2 years and above 12 years.
- Children who had history of regression of milestones.
- Children investigated or known to have genetic, metabolic or other medical illnesses known to influence the growth were excluded.

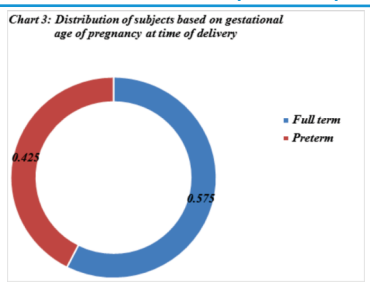
- After obtaining the written and informed consent form the parents or guardians of patients, the patients were examined in detail and assessed clinically and then classified according to the clinical type. Cerebral Palsy was diagnosed according to a standard clinical definition.

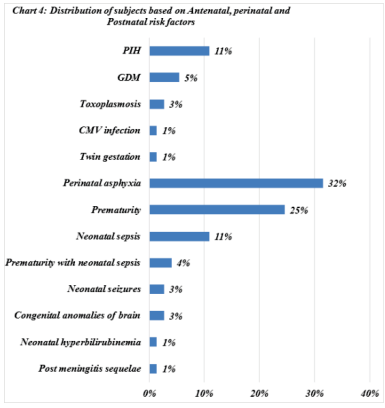
Data analysis:
- Data was entered in MS Excel spreadsheet.
- It was analyzed with the help of software SPSS Statistics version 20.0
- Qualitative data such as age group of the patients, sex, antenatal, perinatal and postnatal history, comorbidity, classification of CP topographically.
- Chi square test wherever pertinent was applied to check the statistical association in cross tabulation that was made between two qualitative data. P value less than 0.05 was considered as statistically significant.

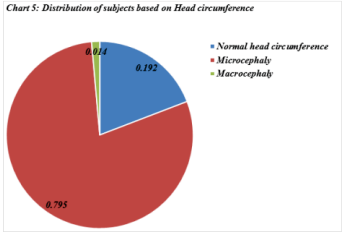
OBSERVATION

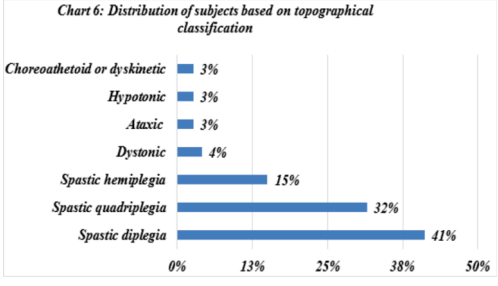


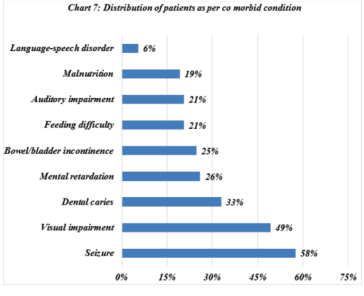












8.Distribution according to type of CP and co-morbid conditions

Type of CP	*Epilepsy*	*Visualimpairment*	*Dental caries*	*MR*	*Bowel or bladder incontinence*	*Feeding difficulty*	*Auditory impairment*	*Malnutrition*	*Language disorder*
Spastic quadriplegia	21	9	18	14	9	7	11	8	0
Spastic diplegia	10	26	6	3	9	5	2	3	0
Spastic hemiplegia	5	1	0	2	0	2	1	1	0
Dystonic	3	0	0	0	0	0	0	0	2
Ataxia	2	0	0	0	0	0	0	0	1
Hypotonic	1	0	0	0	0	1	0	1	0
Choreoathetoid or dyskinetic	0	0	0	0	0	1	1	1	1
Total	***42***	***36***	***24***	***19***	***18***	***15***	***15***	***14***	***4***

DISCUSSION

Age and gender of patients (Table no. 1, 2)

In present study, Mean age of the patients was 5.2 ± 3.2 years (range 2 to 12 years), while 56.2% patients were 2 –5 years old, 28.8% were 5.1 – 9 years and 15% were 9.1 – 12 years old. Singhi et al[10] had found that mean age was 3.1 ± 2.6 years (range 2 months to 16 years), while about half of the patients (50.2%) were less than 2 years age, 34.2% were 2 – 5 years age, 15.6% were more than 5 years age. A Japanese study by Yoshida et al[11] had found that mean age in athetotic CP was 4.14 years, while mean age in spastic CP was 4.72 years. A study by Nazar et al[12] had found commonest age group was 2 – 5 years age (78.9%).

In the present study, majority of the patients were males (63%) with male -female ratio of 1.7:1. Similarly male predominance was found in a study conducted by Agarwal et al[13] (4.1:1), Singhi et al[10] (2.1:1), Bax et al[14] (1.6:1), Yoshida et al[80] (2.5:1) and Nazar et al[81] (1.85:1).

Antenatal, perinatal and postnatal risk factors (Table no. 3 & 4)

In present study, majority of the patients (57.5%) were delivered at term gestation, while 42.5% patients were born preterm. Similarly, in Agarwal et al[82] study majority of the patients were delivered at term gestation (80.5%).

In present study, Antenatal history had found that 10.9% had PIH, 5.4% had GDM, 1.4% each had CMV infection and Twin pregnancy and 2.7% had toxoplasmosis. Perinatal history found that 31.5% had perinatal asphyxia, 24.6% were premature, 10.9% had neonatal sepsis, 4.1% had prematurity with neonatal sepsis, 2.7% had neonatal seizure, 2.7% had anomalies of brain and 1.4% had neonatal hyperbilirubinemia. While in the postnatal period, 1.4% patients had post meningitis sequelae. Wu et al[7] conducted a retrospective study in 377 cerebral palsy patients for where they found that independent risk factors responsible for CP were maternal age more than 35 years, black race, and IUGR. Bax et al[14] had found that antenatal risk factors responsible for CP were infection during pregnancy (39.5%), multiple pregnancy (12%), while perinatal findings were preterm (3.34%), low birth weight (10.9%). Robinson et al[17] had found that 40.1% patients were preterm and 10% had multiple gestation. Prematurity was most common (45.3%) neonatal factors that predispose to CP in a study conducted by Singhi et al[10]. While other risk factors were neonatal convulsion (25.2%), neonatal jaundice (21.6%), low birth weight (20.4%), prematurity (13.2%) and Twins delivery (1.2%). An observational study conducted by Nazar et al[12] had found that commonest risk factors for CP were prematurity (31.8%) and perinatal asphyxia (31.8%), PIH (29.4%), multiple gestations (29.4%), neonatal meningitis (18.2%), maternal hypothyroidism (17.6%), neonatal hyperbilirubinemia (13.6%), maternal rubella (11.8%), GDM (3.5%), toxoplasmosis (1.8%) and neonatal seizure (1.75%).

Head circumference (Table no.5)

In current study, 79.4% patients had Microcephaly, 1.4% had macrocephaly and 19.2% patients had normal head circumference. Agarwal et al[13] had found microcephaly in 60.5% CP patients. However, microcephaly did not differ significantly with sex, epilepsy, birth asphyxia and gestation ($p<0.05$). A study by Kurban et al[15] found that one third of children with microcephaly at age 2 had Cerebral palsy. However, study by Pharoah[16] had found that CP children had highly significant increases in risk for microcephaly, isolated hydrocephaly and other congenital anomalies.

Topographical classification (Table no. 6)

In the present study, based on topographical classification, it was found that 87.5% had spastic CP (41.1% had diplegia, 31.5% had quadriplegia, 15% had hemiplegia), 4.1% had dystonic type, 2.7% had ataxic type, 2.7% had hypotonic and 2.7% had choreoathetoid or dyskinetic type of CP. Similarly, a study by Agarwal et al[13] had found that spastic CP was the most common, found in 92.9% patients (where, 69.4% had quadriplegia, 12.2% had hemiplegia and 11.2% had diplegia), others were hypotonic (2.04%), dystonic (2.04%) and mixed types (3.1%). Spastic cerebral palsy was also the most common type in Singhi et al[10] study found in 70% of CP patients, followed by mixed type (13.9%), dyskinetic or athetoid type of CP (8.4%) and hypotonic or ataxic type (7.7%). Among Spastic CP type, 61% had quadriplegia, 22% had diplegia and 17% had hemiplegia. An Australian systemic review by Robinson et al[17] had found that spastic CP was found in 88% patients,where hemiplegia seen in 33.5%, diplegia in 28.5%, and quadriplegia in 37.6%, while 11.8% had non-spastic CP. In China, Hou et al[18] had found the most common type of CP was spastic (68.3%), 22.2% had athetosis and 10.6% had ataxia. However among Spastic CP patients (n=71), 66.2% had diplegia, 12.75 had tetraplegia and 21.1% had hemiplegia. A study by Howard et al[19] had found among CP patients, topographical distribution of hemiplegia (35%), diplegia (28%) and quadriplegia (37%) with a large majority of patients having spastic motor type (86%).

Other co morbid conditions (Table no. 7)

Present study had detected seizures as most common co-morbidity (57.5%) among CP patients. While other comorbidities were visual impairment (49.3%), dental caries (32.9%), mental retardation (26%), bowel or bladder incontinence (24.7%), feeding difficulties (20.6%), auditory impairment (20.6%), malnutrition (19.2%) and language-speech disorder (5.5%). Similarly, seizures was also the most common abnormality (47.9%) in CP patients in a study of Agarwal et al[13]. They also found that other comorbidities were high arched palate (24%), eye abnormalities (37%), hearing deficits (20%), and microcephaly (60.5%). Associated problems in CP patients of Singhi et al[75] study were mental retardation (72.5%), malnutrition (50.6%), visual disorder (41%), convulsions (32%), hearing disorder (14%), speech disorder (7.8%) and behavior problems (7.2%).

Type of CP AND comorbid conditions (Table no. 8)

In current study, among spastic diplegia patients (n=30), problems encountered were visual impairment (n=26), seizures (n=10), bowel or bladder incontinence (n=9), dental caries (n=6), feeding difficulties (n=5), malnutrion(n=3), mental retardation (n=3) auditory impairment(n=2). In Singhi et al[75]study, among spastic diplegia patients, commonest comorbidities were MR (61.7%), visual defects (44.8%), seizures (42%), malnutrition (42.9%), hearing defects (10.4%), speech defect (6.5%) and behavior problem (6.5%).
In present study, among spastic quadriplegia patients (n=23), complains were seizures (n=21), dental caries (n=18), MR (n=14), auditory impairment (n=11), visual impairment (n=9), bowel or bladder incontinence (n=9), and malnutrition (n=8) and feeding difficulty(n=7). Singhi et al[10] had found that among spastic quadriplegia patients, commonest comorbidities were MR (64.6%), visual defects (42.4%), seizures (31.6%), malnutrition (49.7%), hearing defects (13.6%), speech defects (7.3%).

In present study, among spastic hemiplegic CP patients (n=11), seizures (n=5), MR (n=2), feeding difficulties (n=2), auditory impairment (n=1) and malnutrition (n=1) were seen. However, Singhi et al[10] had found that among spastic Hemiplegia patients, commonest comorbidities were MR (61.3%), malnutrition (49.7%), seizures (32.5%), visual defects (26.9%), and hearing defects (13.6%).
In present study, seizures and language-speech disorder were seen in dystonic type and ataxic type of CP patients. Singhi et al[10] had found commonest morbidity in hypotonic or ataxic CP were MR (75.3%), malnutrition (52%), seizures (25.9%) and visual defects (20.9%) and Behaviors problems (9.1%).

CONCLUSION

A current cross-sectional study conducted in 73 patients of Cerebral palsy, found to have male dominance. Based on topographical classification, spastic type was the most common out of which diplegia was the commonest followed by spastic quadriplegia. Common co-morbidities were microcephaly, seizures, visual impairment, dental caries, malnutrition and mental retardation. Perinatal asphyxia and prematurity were the commonly seen risk factors in CP patients. Also other antenatal and perinatal risk factors

were observed. So, early identification of these factors and early intervention & counselling of the parents can help prevent development of cerebral palsy.

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