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Original Research Article

Clinical and imaging correlation of cerebral palsy: a retrospective study in a tertiary care centre

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ABSTRACT

Background: Cerebral Palsy is the most common chronic motor disorder of childhood. Clinical spectrum is different in developing and developed countries. Aim of the study was to evaluate the clinical profile, co-morbidities and the imaging correlate of children with CP.
Methods: Data was collected retrospectively from individual case records from March 2016 to October 2018. All children aged 2 years and above with clinical signs of cerebral palsy were included in the study.
Results: A total of 78 children had the diagnosis of cerebral palsy, out of which 63 cases were included which satisfied the inclusion criteria. Most of the children were born out of singleton pregnancy (90.4%). The mean gestational age was 36.94±1.48 weeks. Most common type of cerebral palsy noted in present study was spastic quadriplegic type (n=34) followed by diplegic type (n=14). Epilepsy was associated in 36.5% (n=23) of children, and most commonly associated with spastic quadriplegic type of cerebral palsy(n=16). Other associated abnormalities included mental retardation, speech, hearing, cognitive, and behavioral abnormalities. Magnetic resonance imaging was normal in 60.3% (n=38) of children and abnormal in 39.68% (n=25) of children. Diffuse cerebral atrophy was the most common abnormal finding (n=9). Other abnormal findings included periventricular leucomalacia, basal ganglia lesions, cortical/subcortical lesion, focal infarcts and miscellaneous lesions.
Conclusions: MRI helps in knowing the pathological basis of the disease, but clinical findings carry utmost importance. MRI positivity was seen in only 39.68% of cases. Hearing abnormalities being the most common association, proper screening tests and regular follow up is very essential.

Keywords: Cerebral palsy, Magnetic resonance imaging

INTRODUCTION

Cerebral palsy (CP) is the commonest physical disability in childhood, being 2-2.5/1000 livebirths.[1] It is a disorder of development in which motor function abnormalities are a key feature. Severity varies from mild with minimal disability in which affected person leads almost normal life to severe, associated with several comorbid conditions. Originally reported by Little in 1861 as 'cerebral paresis', the term encompasses 'a group of disorders of development of movement and posture, causing activity limitation, that are attributed to non-progressive disturbances that occurred in the developing fetal or infant brain. The motor disorders of CP are often accompanied by disturbances of sensation, cognition, communication, perception, behaviour or seizure disorders'.[2]

Although the brain lesion is nonprogressive, the neurologic features change over a period of time and the clinical presentation may change accordingly due to growth and maturation of CNS. The type of morbidity

varies enormously with different clinical types of cerebral palsy. Clinical spectrum in developed and developing countries varies enormously. Increasing survival of preterms, advanced maternal and neonatal care has led to changes in trends of etiology of cerebral palsy.

METHODS

A retrospective study was done in AJ institute of medical sciences, Mangalore in the department of Paediatrics. Data was collected from March 2016 to October 2018 using the G-health software which is used in our hospital for data storage. Individual case records were searched after identifying the cerebral palsy patients who visited our weekly neurology clinic and included in the study. Cases in which MRI was not done and those cases in which complete information was not obtained were excluded from the study. Demographic data, detailed history with special regard to perinatal history, developmental assessment and examination findings were collected. Imaging reports were taken and analysed with a single radiologist to eliminate inter observer variation. Data was entered in excel sheet and then analysed using SPSS software version 7.0. p value <0.05 was considered as significant.

Case definition: The modified Swedish classification was used for classification which is based on tone, number and distribution of affected limbs.[1]

RESULTS

A total of 78 children had the diagnosis of cerebral palsy, out of which 63 cases were included which satisfied the inclusion criteria. Of the 11 excluded, 8 children didn't have the imaging studies done, 1 expired before the imaging and 2 children were less than 2 year old with history and clinical signs suggestive of cerebral palsy.

Table 1: Chief complaint at presentation.

Chief complaint at presentation	Number of cases	Percentage of cases
Delay in attainment of milestones	54	85.7%
Seizures	23	36.5%
Weakness of one half of body	2	3%
Speech delay	3	4%
Stiffness	19	30%
Floppiness	5	7%
Abnormal gait	2	3%

Of the children included in the study 37 were males and 26 were females. Most common chief complaint at presentation was delay in attainment of milestones which was present in 85.7% of patients (n=54), second being seizures (36.5%). Other complaints being stiffness of limbs, floppiness and weakness on one half of body. There was a significant overlap of more than one chief complaint. The chief complaint at presentation is being shown in Table 1.

Prenatal findings

Most of the children were born out of singleton pregnancy (90.4%). Only 6 were multiple gestations (9.5%). The mean maternal age was 24.13±3.27 years. History of infection was present in 5 mothers, out of which 3 had urinary tract infections. All 5 of them had received a course of antibiotics. The association with maternal history of urinary tract infection and cerebral palsy in the baby wasn't found to be statistically significant in the present study.

Perinatal findings

The mean gestational age was 36.94±1.48 weeks. Number of preterms were 21, constituting 33.3%, out of which early preterms were 3.1% (n=2), preterms 6.3% (n=4) and late preterms 23.8% (n=15). One baby was born post dated. The rest were term gestation constituting 65% (n=41). The number of early preterms was so low that statistically it didn't affect the study analysis. Figure 1 depicts the distribution of babies according to gestational age.

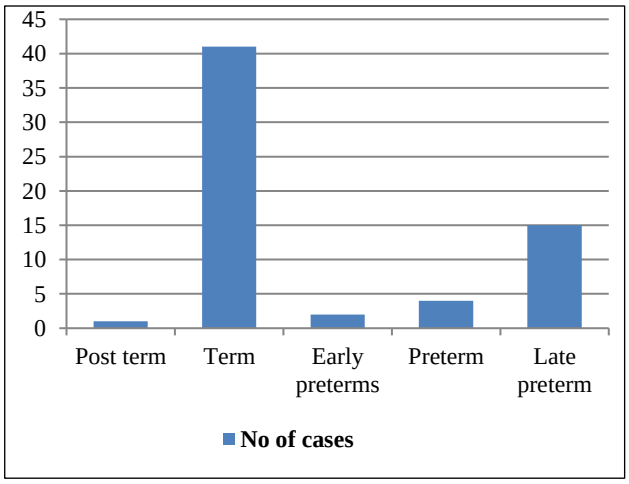

Figure 1: Distribution according to gestational age.

A 16 babies were small for gestation (<10th centile), 43 babies were appropriate for gestational age (between 10th and 90th centile) constituting the majority (68.2%). Against the predicted large number of large for gestation babies in cerebral palsy (>90th centile), in our study we found only 4 babies large for gestational age (6.3%). Weight-wise distribution according to gestational age is depicted in Figure 2.

A 71.4% children were born through normal vaginal delivery (n=45). 5 cases required instrumentation, out of which 1 case was forceps and 4 were vacuum assisted deliveries. A total of 31 children were admitted in neonatal intensive care units, out of which 22 had

seizures in neonatal period. Mean length of stay in Neonatal intensive care unit was 26.17 +/- 11.5 days. 28 cases had a significant history suggestive of perinatal asphyxia. 12 babies had required ventilatory support in the perinatal period and the mean duration of ventilatory support was 7.16 days +/- 1.32 days. Most commonly prescribed drug for neonatal seizures was phenobarbitone (41.2%), others being fosphenytoin and levetiracetam.

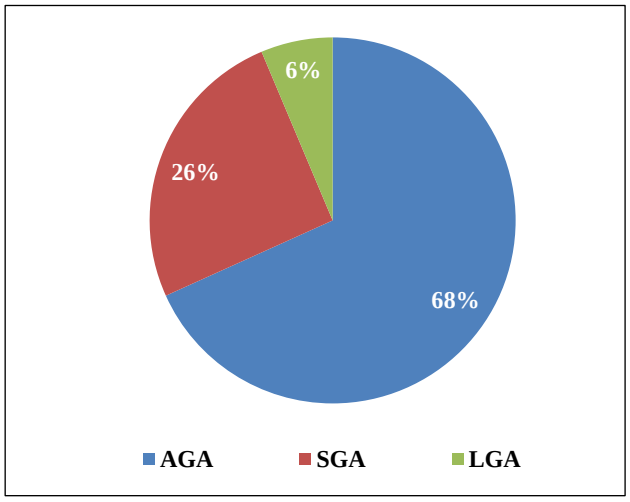

Figure 2: Weight-wise distribution according to gestational age.

Clinical findings

Topographical and functional classification was done according to the definitions as mentioned earlier. Most common type of cerebral palsy noted in our study was spastic quadriplegic type (n=34) followed by diplegic type (n=14). The number and percentage of different types of cerebral palsy has been explained in Table 2. Functional classification of the cases revealed that majority had grade II and III abnormalities being 42.8% and 36.5% respectively and the same has been depicted in Figure 3.

Table 2: Clinical type of cerebral palsy cases.

Clinical type	Percentage	Number
Spastic quadriplegic	53.9%	34
Hemiplegic	14.2%	9
Diplegic	22%	14
Dyskinetic	3%	2
Ataxic	6%	4

Epilepsy was associated in 36.5% (n=23) of children, and most commonly associated with spastic quadriplegic type of cerebral palsy (n=16). Other associated abnormalities included mental retardation, speech, hearing, cognitive, and behavioural abnormalities which are shown in Table 3. Visual abnormalities were associated in 14.2% of children, which is significantly lesser as compared to other studies. Congenital abnormalities not related to cerebral palsy included cleft lip, cleft palate, ankyloglossia, renal and cardiac anomalies, CTEV etc., and was seen in 17.4% of cases.

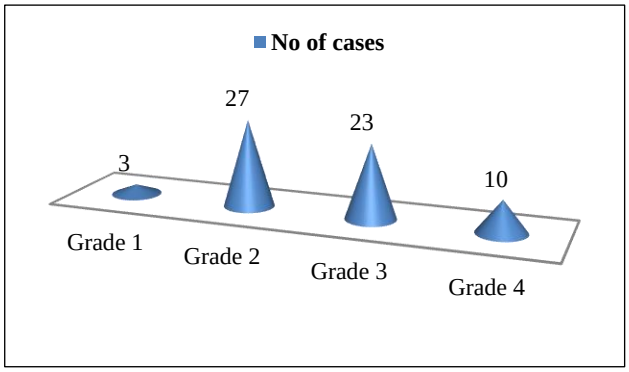

Figure 3: Functional grading of different cases of cerebral palsy.

Table 3: Associated abnormalities with cerebral palsy.

Abnormalities	Number of cases	Percentage of cases
Hearing defects	15	23.8%
Speech abnormalities	8	12.6%
Behavioural abnormalities	4	6.3%
Vision defects	9	14.2%
PEM	13	20.6%
Contractures	3	4.7%
Miscellaneous congenital abnormalities	11	17.4%

Family history of seizures was present in 4 cases which was statistically insignificant to comment. Unexplained sibling death in neonatal period was present in 2 cases. The mean developmental quotient noted in our study was 27.05. Global developmental delay was the universal finding.

Magnetic Resonance Imaging findings

Magnetic resonance imaging was normal in 60.3% (n=38) of children and abnormal in 39.68% (n=25) of children. Diffuse cerebral atrophy being the most common abnormal finding (n=9). Other findings were periventricular leucomalacia, basal ganglia lesions, cortical/subcortical lesion, focal infarcts and miscellaneous lesions. All 3 cases of periventricular leucomalacia were preterm births, 2 being early preterms and 1 being a late preterm.

The findings have been shown in Table 4. MRI findings in spastic quadriplegic cerebral palsy is analysed further and depicted in Figure 4. Fourteen cases of quadriplegic cerebral palsy had a normal MRI and 20 cases had abnormal findings. Out of the abnormal findings, the most common finding was diffuse cerebral atrophy.

Table 4: MRI patterns in cerebral palsy.

MRI pattern	Number of cases	%
Periventricular leukomalacia	3	4.7%
Diffuse cerebral atrophy	9	14.2%
Calcifications/infarcts	1	1.5%
Basal ganglia/subcortical lesions	3	4.7%
Cerebellar atrophy	3	4.7%
White matter atrophy	2	3.1%
Cystic encephalomalacia	2	3.1%
Miscellaneous	2	3.1%

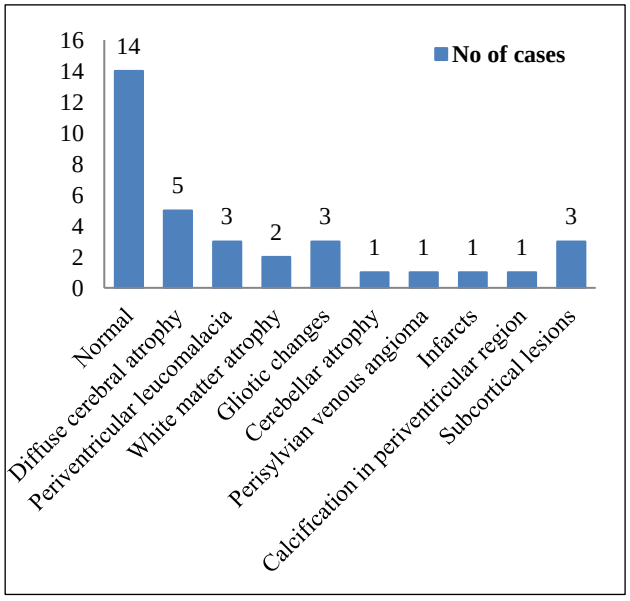

Figure 4: MRI findings in quadriplegic cerebral palsy.

Electroencephalogram findings

Out of 23 children having convulsion, EEG was performed in 17 cases. Among them, 8 cases had abnormal findings on EEG and 9 EEGs were normal. Most common finding in EEG was lateralised epileptiform discharges. The EEG findings have been depicted in Table 5.

Table 5: Electrencephalogram findings.

EEG	Number of cases	%
Lateralised epileptiform discharges	5	7.9%
Spike and wave pattern	2	3.1%
Generalised spikes	1	1.5%
Normal	9	14.2%
Total	17	26.9%

DISCUSSION

Spastic quadriplegic cerebral palsy has been shown to be the commonest form of cerebral palsy in various studies conducted in developing countries.[3] Spastic diplegic CP has been reported as the commonest type in developed countries.[4] In the present study, preponderance of spastic quadriplegic cerebral palsy was noted accounting for 53.9%. This decrease in spastic quadriplegia in developed countries has been attributed to reduction in perinatal mortality rate and also the increase in survival rates of extremely premature and low birth weight babies. Dyskinetic CP secondary to neonatal hyperbilirubinemia is virtually disappearing from the developed countries. Even in our study we had only 3% of cases with Dyskinetic CP reflecting improvement in the management of neonatal hyperbilirubinemia.

The role of perinatal asphyxia was found to be the major etiology in our study accounting for 44%. Even though perinatal asphyxia has been noted rarely in developed countries, in developing countries like India, it accounts for a major problem. This result was similar to the study done by Singhi PD et al.[3]

Many studies have reported the association of low birth weight and prematurity in the occurrence of CP.[5-7] In the present study, majority of the cases were term gestation and also, the weight was appropriate for gestational age. Most of the babies in our study were born through vaginal delivery. Instrument deliveries and multiple pregnancies has been attributed for the occurrence of CP, but in our study multiple pregnancies were only six in number.[8,9]

Global developmental delay was the most common associated feature in most of the cases. Next most common associated abnormality was epilepsy seen in 36.5% cases followed by hearing abnormalities seen in 23.8% of cases. These associated co morbidities were similar to other studies.[3,10] Malnutrition was present in 20% cases. The poor nutritional status is explained by feeding difficulties, gastroesophageal reflux, inability to independently access the food or communicate hunger and constipation.[11,12] The other associated co morbidities included vision impairment, dysarthria and behavioural problems.

As opposed to the studies done in developed countries[13] in which normal MRI was 11.4%, in our study, 60.3% cases had a normal MRI finding. Among the abnormal MRI, diffuse cerebral atrophy was the most common finding. Periventricular leukomalacia, cerebellar atrophy and subcortical white matter lesions were the other common findings. The variation in the MRI abnormalities in different studies is attributed to the varied etiologies in different populations.

CONCLUSION

With no doubt MRI helps in knowing the pathological basis of the disease, but clinical findings carries the utmost importance. MRI positivity was seen in only 39.68% of cases, but there was no statistically significant

clinical correlation with the type of cerebral palsy. Also, perinatal asphyxia being the most common etiology, improved obstetric care and neonatal care helps us to prevent the occurrence of CP cases. Hearing abnormalities being the most common association, proper screening tests and regular follow up is very essential.

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