ISSN: 2581 – 3633
PubMed - National Library of Medicine - ID: 101745081

*International Journal of Medical Science and Advanced Clinical Research (IJMACR)*

*Available Online at:www.ijmacr.com*

*Volume – 6, Issue – 3, June - 2023, Page No. : 282 - 288*

# Correlation of seizure disorder as a comorbidity in children with Cerebral Palsy

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**How to citation this article**: Dr Vineet Dadegal, Dr Gayathri Devi C, Dr Chikkanarasa Reddy PS, Dr Ravichandra, Dr Shilpa Krishnapura Lakshminarayana, Dr Mallesh Kariyappa, Dr Shivaprakash Sosale, "Correlation of seizure disorder as a comorbidity in children with Cerebral Palsy", IJMACR- June - 2023, Volume – 6, Issue - 3, P. No. 282 – 288.



**Type of Publication:** Original Research Article

**Conflicts of Interest:** Nil

## Abstract

**Background:** Cerebral palsy refers to a heterogeneous group of disorders of movement and posture secondary to an insult to the developing brain which increases the chances of abnormal nerve activity resulting in seizures. They can aggravate the clinical course of cerebral palsy and can affect intellectual and motor functions.

**The aim** of the study was to describe the characteristics of seizures in children with cerebral palsy with associated EEG and MRI findings. The present study was a retrospective descriptive study of 66 children with cerebral palsy and seizures.

**Results:** Majority of the children had seizure onset within 1 year (68%), seizures were found to be predominant in children with preterm births (53) and spastic hemiplegia(48%). GTCS was the most common type of seizure noted (41%), majority of the children belonged to GMFCS level IV classification (44%), EEG showed epileptic foci in 64% and the most common neuroimaging finding was white matter alteration suggestive of hypoxic ischemic insult, 44 children (66%) were on monotherapy and 12 children (18%) were on polytherapy of antiepileptic drugs.

**Conclusion:** Correlation of seizure disorder in cerebral palsy helps us in understanding the nature of the disease

and formulate and individual approach depending on the type of seizure.

**Keywords:** Seizures, Epilepsy, Cerebral Palsy, MRI brain, EEG, Developmental Delay, Antiepileptic drugs.

## Introduction

Cerebral palsy (CP) refers to a group of non-progressive motor impairment syndromes secondary to lesions or anomalies of the brain arising in the early stages of development (1). Brain injuries increase the chance for abnormal nerve activity to occur within the brain which can result in seizures (2). Seizure disorders aggravate the clinical course of cerebral palsy, complicate the interventions planned, affects the prognosis of motor and intellectual functions, can be life threatening, hence epilepsy has been used as a marker for severity in this disorder (3). Epilepsy is known to have a higher association with cerebral palsy; 15–60% of children with cerebral palsy has been reported to have epilepsy. It has been observed that seizures in these children tend to have an earlier onset, necessitating the use of more than one anti-epileptic drug (AED) with the risk of seizure relapse after AED discontinuation (3). During the last decade several publications on the clinical features of children with both epilepsy and cerebral palsy (CP) reported the prevalence and the clinical characteristics of epilepsy in various forms of CP(4). It has also been consistently demonstrated that most of these epilepsies occur at an early age. The most commonly reported risk factor for later epilepsy was found to be neonatal seizures but additional data regarding birth history parameters that could increase the risk for the development of epilepsy in these children were less consistent (5). Hence the need for the study, as there is limited data on both trends in prevalence of CP and epilepsy, and trends in frequency of epilepsy among children with CP.

**Objectives:** To describe the characteristics of seizures in children with cerebral palsy, with associated EEG and MRI findings.

## Materials And Methods

**Source of Data:** Data was collected from children attending the District Early Intervention Centre (DEIC), Vani Vilas Hospital (VVH), Bangalore Medical College and Research Institute (BMCRI).

**Design of study:** Descriptive non-interventional study.

**Study Period:** January 2023-February 2023

**Place of Study:** OPD and IPD facilities, Department of Pediatrics, Vani Vilas Hospital, BMCRI, Bangalore.

**Sample Size:** In a descriptive hospital-based case control study done by A.K. Gururaj et al. a total of 56 children with CP and Seizures were studied based on the prevalence rate of 19% (15-25% among children with cerebral palsy)[6]

Sample size was determined using the following formula:

$$n = \frac{Z^2 * p * q}{d * d}$$

$$= \frac{(1.96)^2 * 19 * 78}{10 * 10}$$

n + 10% (61.4) (10% for the missing information)

=66 cases

Where , Z= 1.96 (constant)

p= Prevalence of seizures (19%)

q= 100-P

d=absolute precision (10)

n = Sample size

n= 67 Cerebral Palsy children with seizure disorder

**Inclusion Criteria**

- Children clinically diagnosed with Cerebral Palsy and seizure disorder in the age group 1 to 18yrs.
- Parents of children willing to give informed consent to participate in study.

**Exclusion Criteria**

- Children with Cerebral palsy without seizure disorder.
- Parents of children not willing to give informed consent to participate in study.

**Methodology**

After the Institutional Ethical Committee permission and written consent from care givers of children with CP and seizure disorder, the data of these children registered in DEIC register was recorded along with their descriptive data. Thus the children registered were analyzed based on their etiology, perinatal history, parity, gestational age, birth weight, functionality, antenatal history of risk factors, Neonatal history, head circumference, relation to Intellectual Disability if any etc were recorded for further analysis.

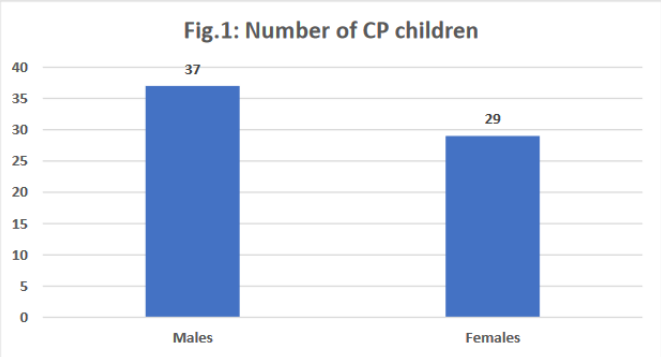
Type of CP, age at first seizure, seizure patterns, use of antiepileptic drugs and their response, developmental delay, Neuroimaging findings, EEG etc were correlated.

**Assessment Tools**

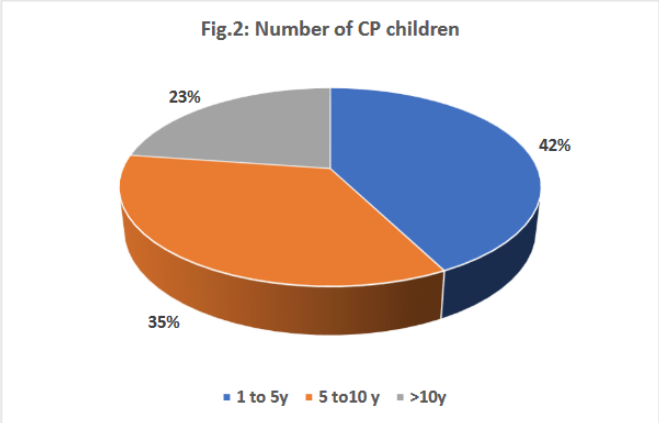
- Seizure patterns correlated with type of CP [(International League Against Epilepsy (ILAE) Classification of Seizures in Children)]
- EEG, MRI Brain findings
- Antiepileptic drugs usage

**Results**

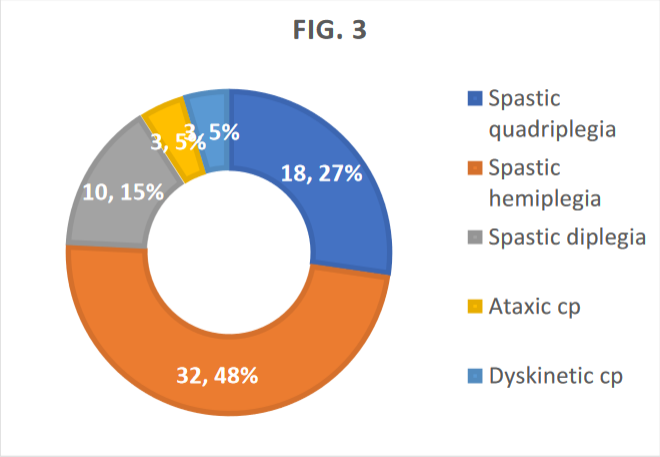
Out of 66 children who attended DEIC clinic during the year of 2023, 37 were male children and 29 were females.



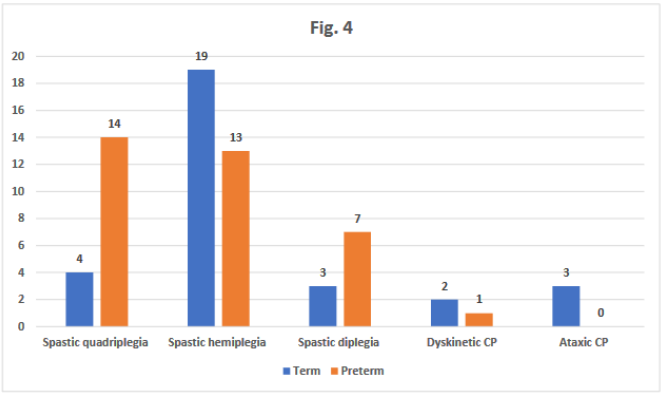

Majority of the children were in the age group of 1-5years-28 children (42%), 5 to 10y- 23 (35%) and more than 10 years- 15(23%), Mean age 4.7 +/- 2.2(SD).




9 children had microcephaly, Developmental delay was present in 59(90%) of cases. Cerebral palsy with seizures in majority of cases had its onset within one year in 41 children (62% Incidence of seizures was prominent in children with spastic hemiplegia (48%), followed by spastic quadriplegia (27%), spastic diplegia (15%), dyskinetic (5%) and ataxic cp (5%). Early onset of seizures within one year was seen in 45 patients (68%) – Fig.3

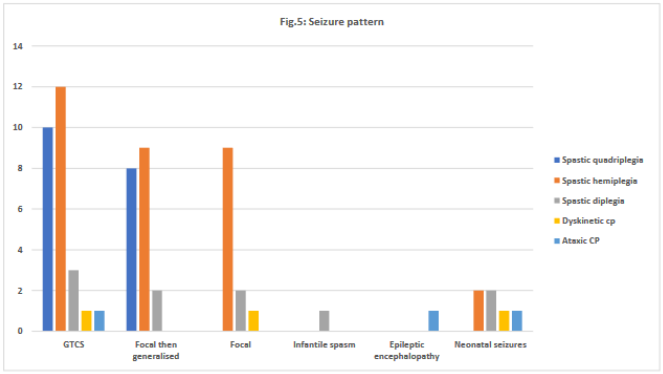



In this study, incidence of epilepsy in CP children was found to be more in preterm births than in term births -31 children (47%) and preterm births- 32 children (53%). Majority of the children born at term had spastic hemiplegia-19 children (61% of term births), while out of preterm births, 14 had spastic quadriplegia (40% of preterm births), 7 had spastic diplegia (20% of preterm births)- Fig.4

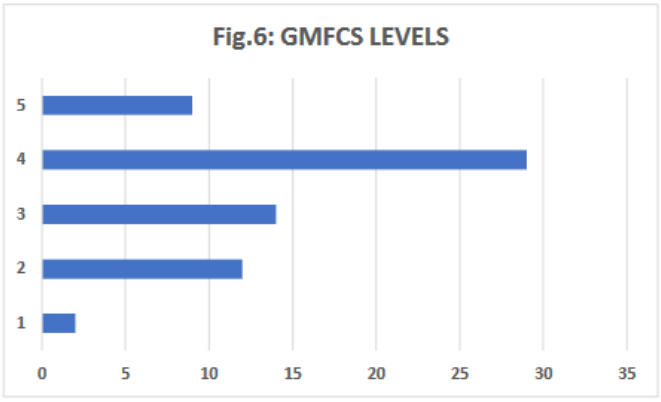



GTCS was noted in 46 children (69%), out of which 27 were focal then generalised, 12 children had focal seizures (18%), 7 children had neonatal seizure onset and 1 child had epileptic encephalopathy- Fig. 5

| | Spastic quadriplegia | Spastic hemiplegia | Spastic diplegia | Dyskinetic cp | Ataxic CP | Total |
|---|---|---|---|---|---|---|
| GTCS | 10 | 12 | 3 | 1 | 1 | 27 |
| Focal then generalised | 8 | 9 | 2 | 0 | 0 | 19 |
| Focal | 0 | 9 | 2 | 1 | 0 | 12 |
| Infantile spasm | 0 | 0 | 1 | 0 | 0 | 1 |
| Epileptic encephalopathy | 0 | 0 | 0 | 0 | 1 | 1 |
| Neonatal seizures | 0 | 2 | 2 | 1 | 1 | 6 |
| Total | 18 | 32 | 10 | 3 | 3 | |




Among the cerebral palsy children with seizures, majority of them belonged to GMFCS IV classification-29 children (44%), followed by Level III-14 (21%), Level II- 12 (18%), Level V- 9 (13%), Level I- 2 (3%)- Fig.6

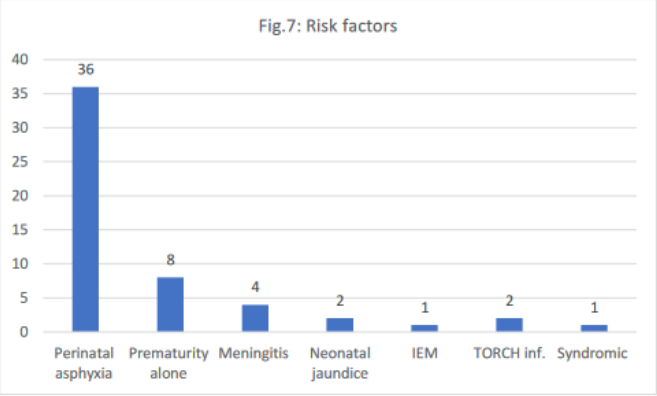



EEG was done in 37 children, out of which 24 children (64%) had an epileptic foci focal/multifocal, 13 children had normal EEG (36%) Spastic quadriplegic children had maximum abnormal mri findings with thinning of corpus callosum in 4 children, encephalomalacia in 5 and parasagittal hypointensities in 2 children. Thinning of corpus callosum along with white matter alterations seen in 4 children among 9 children who had microcephaly. Among 7 children with spastic diplegia who underwent neuroimaging, periventricukar leukomalacia was seen in 4 children. Most common neuroimaging finding among all groups was white matter alterations suggestive of hypoxic is ischemic

insult seen in 14 children.

56 children were on anti-epileptic drugs, out of which 44 children (66%) were on monotherapy and 12 children (18%) were on polytherapy. Among 12 children on polytherapy, 7 children had spastic quadriplegia.

Among the 66 children, 36 children (54%) had perinatal risk factor- birth asphyxia, 8 children had prematurity as a lone risk factor, Clearly defined post natal risk factors were found in 10 children- meningitis in 4 children, Neonatal jaundice in 2 out of which 1 child had undergone DVET, IEM in 1 child. Two children had antenatal risk factors one had TORCH infection and the other was a syndromic baby with microcephaly.




**Discussion**

In a study conducted by Pavone et al (7), This retrospective single-center study was performed with 93children affected by CP and distinguished according to the type of motor clinical presentation, with 46 showing epileptic seizures, compared to a control group of 136 children affected by epilepsy without other neurologic disorders , the type of epilepsy most frequently observed in CP were focal-generalised (37%), epileptic encephalopathy (15%) and seizures with neonatal onset (33%)-which were mainly found in children with spastic quadriplegia, whereas in the present study it was found that GTCS was the most common type of seizure amongst all and was found to be almost equal in both spastic hemiplegic and spastic quadriplegic children, In terms of neuroimaging, white matter lesions were more common. The frequency of epilepsy was higher in affected CP children who showed major motor dysfunction (GMFCS IV–V types) which was similar to the findings in the present study.

Sadowska et al.(8) investigated 181 children, seizure incidence was more in children with quadriplegia (75%), ataxia (83%), diplegia (32%) and hemiplegia (38%) whereas in our study spastic hemiplegic children had more seizures followed by spastic quadriplegia and diplegia. A higher incidence of epilepsy in CP children born at term compared to preterm children and in females compared to males was reported, whereas in our study children with prematurity had more seizures compared to term births. Quadriplegia and hemiplegia were mostly found in children born at term, while diplegia was found to be more prevalent in preterm children. The onset of epileptic seizures was found to be on average within the second year of life, this finding was similar to our study wherein majority of the children-68% had onset within one year of life.

The percentage of children on antiepileptic drugs (84%) in this study was similar to those found in other studies, between 75% and 95%. Kulak et al(9). reported that children with low birth weight had increased risk of epilepsy, whereas gestational age had no imapct. In contrast Zelnik et al.(10) reported that children born at term were at increased risk, however in the present study the incidence of seizures were found to be more in preterm births, than in term

births.

In a study done by Carlsson et al.(11) it was found that epilepsy was more common to have an earlier onset in children with quadriplegic CP than in those with diplegia or hemiplegia, similar results have been reported in the present study.Focal and secondary generalised seizures have been reported to be more common than primary generalised seizures in these children, in our study we also found that secondary generalized seizures was the common type (41%)

n a retrospective study conducted by Fatma et al(12) a total of 229 cerebral palsy children were studied, epileptic seizures were present in 120 children (52.4%) and drug resistant seizures in 64 (27.9%). The risk of epilepsy was significantly higher in patients with motor or speech impairment or undergoing first seizure during the neonatal period. The risk of epilepsy was also higher in patients with microcephaly or quadriplegic cerebral palsy and in patients with focal and generalized epileptiform abnormality on electroencephalograms (EEGs). The rate of Drug Resistant Epilepsy development was very low in patients with normal EEG findings or with only background rhythm abnormalities on first EEGs during neonatal seizures. This may be regarded as a good prognostic factor for non-development of drug resistant epilepsy. In the present majority of the children on polytherapy had spastic quadriplegia.

**Conclusion**

Correlation of seziure disorder in cerebral palsy children helps us in understanding the nature of the disease, its course and to formulate an individual approach depending on the type of CP, seizure type, requirement of MRI and EEG and Pharmacotherapy. Only a multidisciplinary collaborative individualised approach can be the management strategy for seizure disorder in cerebral palsy children.

**References**


1. Korzeniewski S.J., Slaughter J., Lenski M., Haak P., Paneth N. The complex aetiology of cerebral palsy. Nat. Rev. Neurol. 2018;14:528–543
2. Rosenbaum P, Paneth N, Leviton A, Goldstein M, Bax M, Damiano D. et al. A report: the definition and classification of cerebral palsy April 2006. Dev Med Child Neurol Suppl. 2007 Feb 1;109(suppl 109):8-14.
3. Zelnik N., Konopnicki M., Bennett-Back O., Castel-Deutsch T., Tirosh E. Risk factors for epilepsy in children with cerebral palsy. Eur. J. Paediatr. Neurol. 2010;14:67–72
4. Scheffer IE, Berkovic S, Capovilla G, Connolly MB, French J, Guilhoto L et al. ILAE classification of the epilepsies: Position paper of the ILAE Commission for Classification and Terminology. Epilepsia. 2017 Apr; 58(4):512-521.
5. Hollung S.J., Bakken I.J., Vik T., Lydersen S., Wiik R., Aaberg K.M. et al. Comorbidities in cerebral palsy: A patient registry study. Dev. Med. Child Neurol. 2019; 62:97–103.
6. Gururaj AK, Sztriha L, Bener A, Dawodu A, Eapen V. Epilepsy in children with cerebral palsy. Seizure. 2003 Mar; 12(2):110-4.
7. Pavone P, Gulizia C, Le Pira A, Greco F, Parisi P, Di Cara G.et al. Cerebral Palsy and Epilepsy in Children: Clinical Perspectives on a Common Comorbidity. Children. 2020 Dec 31; 8(1):16.
8. Sadowska M, Sarecka-Hujar B, Kopyta I. Cerebral Palsy: Current Opinions on Definition, Epidemiology, Risk Factors, Classification and

Treatment Options. Neuropsychiatr DisTreat. 2020 Jun 12; 16:1505-1518.

9. Wojciech Kułak, Wojciech Sobaniec, Risk factors and prognosis of epilepsy in children with cerebral palsy in north-eastern Poland,Brain and Development,Volume 25, Issue 7,2003
10. Nathanel Zelnik, Muriel Konopnicki, Odeya Bennett-Back, Tsofia Castel-Deutsch,
11. Emmanuel Tirosh,Risk factors for epilepsy in children with cerebral palsy,European
12. Journal of Paediatric Neurology,Volume 14, Issue 1,2010
13. Carlsson M, Hagberg G, Olsson I. Clinical and aetiological aspects of epilepsy in children with cerebral palsy. Dev Med Child Neurol. 2003 Jun;45(6):371-6
14. Hancı Fatma., Türay S., Dilek M., Kabakuş N. Epilepsy and drug-resistant epilepsy in children with cerebral palsy: A retrospective observational study. Epilepsy Behav. 2020;112