

## ARTIKEL PENELITIAN

# GROSS MOTOR FUNCTION AND EPILEPSY IN CHILDREN WITH CEREBRAL PALSY

## FUNGSI MOTORIK KASAR DAN EPILEPSI PADA ANAK DENGAN PALSI SEREBRAL

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### ABSTRAK

**Pendahuluan:** Epilepsi merupakan komorbiditas yang sering menyertai palsy serebral. Anak dengan palsy serebral memiliki variasi derajat fungsi motorik yang berdampak signifikan terhadap luaran fungsionalnya. Penelitian ini bertujuan untuk mengetahui hubungan antara derajat fungsi motorik kasar dengan epilepsi pada anak dengan palsy serebral.

**Metode:** Penelitian dengan metode potong lintang dilakukan di ruang rawat inap anak, poliklinik, dan unit rehabilitasi medik RSUD Ulin Banjarmasin sejak bulan Juli hingga September 2024. Sampel merupakan anak berusia 2-18 tahun yang didiagnosis palsy serebral. Fungsi motorik kasar dinilai menggunakan Gross Motor Function Classification System (GMFCS) dan dibagi menjadi dua kategori yaitu disfungsi motorik ringan-sedang (GMFCS I-III) dan berat (GMFCS IV-V). Data dianalisis dengan uji Chi-square.

**Hasil:** Sebanyak 42 subjek memenuhi kriteria inklusi. Dua puluh delapan (66,7%) subjek menderita palsy serebral dengan epilepsi. Mayoritas mengalami kejang umum sebanyak 23 subjek (82,1%) dan kuadriplegia sebanyak 18 subjek (64,3%). Disfungsi motorik ringan-sedang terdapat pada 17 subjek (40,5%) sedangkan disfungsi motorik berat terdapat pada 25 subjek (59,5%). Sebanyak 20 subjek memiliki disfungsi motorik berat disertai dengan epilepsi (71,4%). Terdapat hubungan yang signifikan antara derajat fungsi motorik kasar yang berat dengan epilepsi pada anak dengan palsy serebral ( $p=0,026$ ).

**Simpulan:** Epilepsi ditemukan secara signifikan pada anak palsy serebral dengan disfungsi motorik kasar yang berat.

**Kata Kunci:** epilepsi, GMFCS, komorbiditas, palsy serebral

### ABSTRACT

**Introduction:** Epilepsy is a common comorbidity of cerebral palsy (CP). Variations in gross motor function affect functional outcomes in CP children significantly. This study aims to analyze the association between gross motor function and epilepsy in children with CP.

**Methods:** A cross-sectional study was performed at the Pediatric Inpatient Ward, Outpatient Clinic, and Medical Rehabilitation Installation at Ulin General Hospital in Banjarmasin from July to September 2024. The subjects of the study were children between the ages of 2 and 18 who had been diagnosed with CP. We evaluated gross motor function utilizing the Gross Motor Function Classification System (GMFCS), categorizing the results into two groups: mild-moderate (GMFCS I-III) and severe (GMFCS IV-V) motor dysfunction. Chi-Square test was used for statistical analysis.

**Results:** The study involved a total of 42 subjects diagnosed with CP. Twenty-eight subjects (66.7%) had epilepsy as a comorbidity. Twenty-three subjects experienced generalized seizures (82.1%), and 18 subjects were quadriplegic (64.3%). There were 17 subjects (40.5%) with mild-moderate motor dysfunction and 25 subjects (59.5%) with severe motor dysfunction. Twenty subjects with epilepsy showed severe motor dysfunction (71.4%). A significant association was identified between severe gross motor function and epilepsy in children with CP ( $p=0.026$ ).

**Conclusion:** Epilepsy was found to be significantly associated with cerebral palsy in children with severe gross motor dysfunction.

**Key Words:** cerebral palsy, comorbidity, epilepsy, GMFCS

## INTRODUCTION

Cerebral palsy (CP) is a non-progressive motor disorder caused by abnormal brain development or injury, impacting muscle tone, movement, and coordination, with different degrees of severity and related problems.<sup>1</sup> In Asia, the prevalence of CP is 2.19 per 1,000 live births.<sup>2</sup> Patients with CP might come with other neurological comorbidities, including problems of perception, sensation, cognition, communication, behavior, and epilepsy.<sup>3</sup>

Epilepsy is a condition characterized by unprovoked recurring seizures that occur at intervals greater than 24 hours.<sup>4</sup> The incidence of epilepsy in children is quite high. Approximately 40-50% of epilepsy cases occur in children.<sup>5</sup> Several studies indicate that the number of cases of epilepsy in pediatric patients with CP varies from 15% to 90%, with the majority of results falling between 35% and 41%. Patients with CP have a fivefold higher incidence of epilepsy compared to healthy children.<sup>3</sup> According to a meta-analysis by Gong, et al., epilepsy was present in 38% of children diagnosed with CP.<sup>3</sup> These findings indicate that almost one-third of children with CP have epilepsy.

The Gross Motor Function Classification System (GMFCS) can be used to evaluate the level of gross motor function in children with CP. The GMFCS consists of five levels (I–V). Increasing the GMFCS level indicates more severe gross motor impairment.<sup>6</sup> Study by Fujianti, et al.<sup>6</sup> revealed that pediatric patients with CP and epilepsy had poorer GMFCS levels. As many as 80% of children with CP

and epilepsy exhibited severe gross motor impairment. According to Rufino et al., patients with CP and epilepsy accounted for 24% with GMFCS I, 29% with GMFCS II, 60% with GMFCS III, 57% with GMFCS IV, and 89% with GMFCS V.<sup>7</sup> This suggests that children with CP and epilepsy demonstrate a worse degree of gross motor function. Therefore, the researchers want to find out the association between gross motor function and epilepsy in children with CP in Ulin General Hospital Banjarmasin.

## METHODS

This cross-sectional research was performed in Pediatric Inpatient Ward, Outpatient Clinic, and Medical Rehabilitation Installation at Ulin General Hospital in Banjarmasin. We used total sampling method with study period from July to September 2024. All children between the ages of 2 and 18 who have been diagnosed with CP and had complete medical records were included. Children whose parents refused to participate in the study and those with incomplete data were excluded. The assessment of gross motor dysfunction was conducted utilizing the Gross Motor Function Classification System (GMFCS), which categorizes individuals based on age into mild-moderate (GMFCS I-III) and severe (GMFCS IV-V) motor dysfunction.

The diagnosis of CP and epilepsy was made based on assessment by a pediatrician, including clinical assessment and the result from electroencephalography (EEG). Epilepsy was defined as at least two unprovoked seizures that occurred more than 24 hours

apart. We also collected the demographical data, incidence of epilepsy, type of seizure, and topographical patterns.

Data analysis was conducted using IBM SPSS Statistics for Windows 25. We used the Chi-Square for statistical analysis. A p-value <0.05 shows statistical significance. The Ethics Committee of Ulin General Hospital Banjarmasin approved this study (No: 115/VIII-Reg Riset/RSUDU/24).

## RESULTS

This study included 42 children. Cerebral palsy accompanied by epilepsy was found in 28 children (66.7%), with boys predominantly (53.6%). (Table 1). Most of the children were aged 5 years or younger. (Table 1). The study showed that 17 subjects (40.5%) had mild to moderate gross motor dysfunction, whereas 25 subjects (59.5%) had severe motor dysfunction. (Table 1).

**Table 1.** Characteristic of the Subjects

Variable	Epilepsy (n = 28)	No Epilepsy (n = 14)	Total (n = 42)
<b>Sex, n (%)</b>			
Boy	15 (53.6)	9 (64.3)	24 (57.1)
Girl	13 (46.4)	5 (35.7)	18 (42.9)
<b>Age, n (%)</b>			
≤5 years old	18 (64.3)	12 (85.7)	30 (71.4)
>5 years old	10 (35.7)	2 (14.3)	12 (28.6)
<b>Gross motor dysfunction, n (%)</b>			
Mild to moderate (GMFCS I-III)	8 (28.6)	9 (64.3)	17 (40.5)
Severe (GMFCS IV-V)	20 (71.4)	5 (35.7)	25 (59.5)

Epilepsy affects 66.7% of children with CP. Generalized seizures were found in 23 subjects (82.1%), while focal seizures were found in 5 subjects (17.9%). (Table 2). The evaluation of gross motor through the GMFCS revealed that 6 subjects (14.3%) were classified to GMFCS I, 2 subjects (4.8%) were GMFCS II, 8 subjects (19%) were GMFCS III, 2 subjects (4.8%) were GMFCS IV, and 24

subjects (57.1%) were GMFCS V. (Table 3). The topographical patterns of children with CP mainly affected all of the extremities (quadriplegia) (54.8%), followed by diplegia (28.6%), hemiplegia (14.3%), and monoplegia (2.4%) (Table 3). It was found that there was a significant association identified between severe gross motor dysfunction and epilepsy in children with CP (p=0.026) (Table 4).

**Table 2.** Prevalence of Epilepsy and Type of Seizure

Variable	n (%)
<b>Epilepsy</b>	
Yes	28 (66.7)
<b>Type of seizure</b>	
Generalized	23 (82.1)
Focal	5 (17.9)
No	14 (33.3)

**Table 3.** Gross Motor Function in Children with CP

Variable	Epilepsy (n = 28)	No Epilepsy (n = 14)	Total (n = 42)
<b>GMFCS Classification, n (%)</b>			
I	4 (14.3)	2 (14.3)	6 (14.3)
II	2 (7.1)	0 (0.0)	2 (4.8)
III	2 (7.1)	6 (42.9)	8 (19.0)
IV	1 (3.6)	1 (7.1)	2 (4.8)
V	19 (67.9)	5 (35.7)	24 (57.1)
<b>Topographical pattern, n (%)</b>			
Monoplegia	1 (3.6)	0 (0.0)	1 (2.4)
Diplegia	7 (25.0)	5 (35.7)	12 (28.6)
Hemiplegia	2 (7.1)	4 (28.6)	6 (14.3)
Quadriplegia	18 (64.3)	5 (35.7)	23 (54.8)

**Table 4.** Association Between Gross Motor Dysfunction and Epilepsy in Children with CP

Gross Motor Dysfunction	Epilepsy n (%)	No Epilepsy n (%)	p-value
Mild to moderate (GMFCS I-III)	8 (28.6)	9 (64.3)	0.026
Severe (GMFCS IV-V)	20 (71.4)	5 (35.7)	

## DISCUSSION

The study found that the prevalence of CP is greater among boys. This finding aligns with the study by Romeo, et al., which discovered that CP was more frequent in boys. It may be due to the higher physiologic susceptibility, the influence of protective hormones, and genetic polymorphism.<sup>8</sup> Boys had greater biological susceptibility, reflected by a higher frequency of preterm births, death, and intra-ventricular hemorrhage compared to girls. A retrospective study by Elmagid, et al. showed the ratio of males to females is 1.8:1.<sup>9</sup> Several studies demonstrated that mild to moderate and severe motor dysfunction were more prevalent in boys than in girls; nevertheless, no significant differences in values were noted. Gender is not a predictor of changes in motor dysfunction. Comorbidities like epilepsy frequently occur in children with CP; however, studies examining potential gender differ-

ences are still limited. Research by Chiang, et al showed that girls had higher risk of CP with epilepsy.<sup>10</sup> However, a different study found that there was no correlation between gender and incidence of epilepsy based on electro-encephalography examination.<sup>11</sup>

The majority of the children's ages were 5 years or less. Most of the subjects had previously been diagnosed with CP and had visited the outpatient clinic for routine check-ups or received physiotherapy in the medical rehabilitation installation. In addition, some of them were hospitalized due to other accompanying illnesses.

In this study, 66.7% of children with CP also had epilepsy, predominantly exhibiting generalized seizures. Several studies have indicated that the percentage of CP with epilepsy ranges from 15% to 90%.<sup>12</sup> Fujianti, et al. discovered that children with CP and epilepsy exhibited significant motor dysfuncti-

on.<sup>6</sup> Seizures were reported in around 49.5% of children with CP. Seizures were found higher among those with spastic quadriplegia, particularly in those having severe motor dysfunction.<sup>13</sup>

Pediatric patients with CP and epilepsy had a greater prevalence of generalized seizures (82.1%). Hastuti, et al. revealed that 83% of children with CP and epilepsy experienced generalized seizures compared to focal seizures.<sup>14</sup> This is also supported by study from Archana, et al. in 300 children with CP.<sup>15</sup> Approximately 26% had epilepsy, with 57% having generalized seizures, 38% having focal seizures, and 5% categorized as unclassified. Children with spastic quadriplegic and epilepsy were more likely to have focal to generalized seizures. In the case of hemiplegia, focal seizures usually occur more frequently on the side of motor dysfunction.<sup>13</sup>

This study revealed that the subjects predominantly had severe motor dysfunction that was classified as GMFCS V (57.1%). A research by Pujasari, et al. involving 60 children with spastic cerebral palsy supports this finding.<sup>16</sup> This study's results contrast with a study from Aydin, et al in Turkey on 197 children with CP, which showed that the majority of the subjects were classified to GMFCS I.<sup>17</sup> This could be related to variances in research populations across regions. In this study, the majority of subjects are patients with severe motor function dysfunction or various comorbidities because data were collected at Ulin Regional Hospital Banjarmasin as a tertiary referral hospital in South Kalimantan. This hospital has more comprehensive

diagnostic and treatment modalities such as neuropsychiatric and facilities for pediatric rehabilitation than other hospital in South Kalimantan.

Quadriplegia (54.8%) became the most common type of topographical pattern among the subjects in this study. Study by Salfi, et al. in Surabaya, which included 107 patients with CP, found that quadriplegia was the most prevalent type.<sup>18</sup> It reached 64% of the cases.

This study discovered a significant association between the level of gross motor function and epilepsy among children with CP (RR: 1.7; 95%CI: 0.990 to 2.920;  $p=0.002$ ). Compared to other neurological disorders, epilepsy often manifests as a comorbidity accompanying CP at an early age.<sup>7</sup> In children with CP, epilepsy frequently associated with disease severity due to its association with underlying brain lesions. The likelihood of seizures is higher in patients with CP with more extensive involvement of the gray matter. Most children with hemiplegic cerebral palsy exhibit focal cortical lesions or infarcts that lead to seizures. Patients with quadriplegic CP may exhibit widespread cortical lesions or secondary lesions as a result of hypoxic-ischemic injury at birth. According to the findings of this study, 64.3% of patients with quadriplegic CP had epilepsy. Numerous studies indicate that the occurrence of seizures in pediatric patients with quadriplegic CP is notably high, varying between 50% and 94%, which suggests significant brain injury.<sup>16</sup>

A study by Rufino, et al. including 140 pediatric patients with CP showed an association between severe motor dysfunction

and epilepsy.<sup>7</sup> Archana, et al. revealed a significant correlation between GMFCS levels and seizure occurrence.<sup>15</sup> Significant motor dysfunction tends to appear in children with CP and epilepsy.<sup>19,20</sup> Bearden, et al. stated that the incidence of seizures was commonly found in children with severe motor dysfunction, but no significant relationship was found.<sup>21</sup>

Our study was conducted at Ulin General Hospital, Banjarmasin, an educational and referral hospital, which presented a wide variety of cases. The study's limitations included a small sample size and its conduct at a single center. Further study should be performed on larger populations and sample sizes.

## CONCLUSION

Cerebral palsy was more common in boys aged five years or less. Epilepsy was found in 66.7% of children with CP. A significant association is found between the level of gross motor dysfunction and epilepsy in children with CP in Ulin General Hospital Banjarmasin. Moreover, it is important to prevent the incidence of CP to reduce the health morbidity among children.

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