The effect of seizures on functional status of people with spastic forms of cerebral palsy

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SUMMARY

Background. Cerebral palsy (CP) is the most common childhood motor impairment. Epilepsy affects approximately one third of patients with CP. It is characterized by earlier disclosure, it is more severe and shows greater resistance than that of the general epilepsy treatment, associated with necessity for polytherapy. Its presence can result in gradual loss of function, loss of posture in non-ambulant individuals with severe disabilities and cognitive impairment risk, behavioural disorders and reducing probability of walking.

Aim. The aim of the study was to evaluate the functioning of people with CP with and without epilepsy.

Material and Methods. The study included 210 patients with a diagnosis of CP, aged 0–18 years. The study was conducted among the patients using the physiotherapy services in centres in southern Poland. The study used the Paediatric Evaluation of Disability Inventory (PEDI) and the classification systems: GMFCS, MACS, and CFCS.

Results. There were significant differences with regards to social functioning (53.7/67.4; W = 179, p = 0.006) and support in the social functioning (65.4/89.9; W = 185.5, p = 0.007) in patients with diplegia. However, mobility (19.55/29.00; W = 392, p = 0.018) and the social functioning (36.95/44.1; W = 418.5, p = 0.042) were lower in epileptic patients with tetraplegia. In patients with hemiplegia, there were no significant differences, although each domain with epilepsy subgroup had a lower rating than the subgroup without epilepsy.

Conclusion. The presence of epilepsy is associated with lower levels of social function in patients with cerebral palsy; particularly, with regard to mobility and selfservice.

Assessment of epilepsy impact on the level of social functioning of people with CP (diplegia, tetraplegia, hemiplegia) is difficult because ambiguous relationship with mental retardation. The assessment should be undertaken separately for each group of spastic CP.

Key words: cerebral palsy • epilepsy • functional assessment

BACKGROUND

Cerebral palsy (CP) is the most common childhood motor impairment. The term CP describes a group of permanent disorders of the development of movement and posture and is not attributed to any progressive disturbances in fetal development or of the infant brain (Rosenbaum et al., 2007). Epilepsy frequently coexists with CP. Its occurrence in the population of developmental age is assessed to be approximately 1% (Hauser 1995; Panayiotopoulos et al., 2007). However, in the population of children with CP, higher occurrence rates are reported, between 15–60% (Sellier et al., 2012) and 90% (Aksu, 1990), which depend on the distribution of the form of CP in the studied groups. We can assume that epilepsy occurs in approximately one third of patients with CP. Odding et al. (2006), on the basis of a review of studies on epilepsy, determined the frequency

of its occurrence to be at the level of 22–40%. In the European study population the prevalence of epilepsy in people with CP was at the level of 35% (Sellier et al., 2012), in the Swedish study at the level of 38% (Carlsson et al., 2008), in the Brazilian study at the level of 62% (Bruck et al., 2001), and in the Indonesian study at the level of 37.3% (Sianturi et al., 2002). Comparable occurrence data are provided by the Polish authors: Kułak (41%) (2003), Mieszczanek (33%) (2003) and Zgorzalewicz (27%) (2001). If cognitive impairment coexists, the risk of epilepsy rising to 71% (Hadjipanayis et al., 1997).

In the case of CP, epilepsy is characterized by earlier disclosure, it is more severe and shows greater resistance than that of the general epilepsy treatment, associated with necessity for polytherapy (Wallace, 2001; Pakula et al., 2009). The treatment of epilepsy in people with CP includes antiepileptic drugs, ketogenic diet and neurosurgical treatment. Epilepsy is a negative phenomenon, which can lead to secondary changes in the central nervous system (CNS), occurring due to cerebral hypoxia or trauma. It is associated with gradual loss of function, loss of posture in non-ambulant individuals with severe disabilities and mental disorder risk, behavioural disorders and decreased ability to walk (Wallace, 2001; Kułak and Sobaniec, 2003; Marszał, 2006; Sellier et al., 2012).

AIM

The aim of the study was to assess and compare the level of functioning of people with CP with and without epilepsy.

MATERIAL AND METHODS

The study included 210 patients with a diagnosis of CP, aged 0–18 years. The study was conducted among the patients at the rehabilitation centers in southern Poland (Busko-Zdrój, Czarniecka Góra, Kielce, Rusinowice, Rzeszów). Patients were included in the study regardless of their functional status and any coexisting dysfunctions. The study inclusion criteria were: a confirmed diagnosis of CP, age between 1 and 18 years old and consent of the parents. Epilepsy was defined as a separate occurrence of two or more unprovoked seizures apparently reported by the parents and confirmed by the medical records. Data were collected by use of questionnaires.

Study tools

The study used tools designed to conduct functional assessment: Paediatric Evaluation of Disability Inventory (PEDI), and the classification systems for people with CP: Gross Motor Function Classification System (GMFCS), Manual Ability Classification System (MACS), and Communication Function Classification System (CFCS).

PEDI is the assessment tool used to monitor progress of the patients in treatment programs. PEDI has been designed to measure the level of functioning and functional independence (caregiver assistance) with regards to self-care (S), mobility (M), and social functioning (SF). Additionally, it can be used to assess modifications of the environment to facilitate functioning in the aforementioned areas. PEDI is used in children and adolescents with disabilities of different origins, including CP (Haley et al., 1998). The study measured the level of functioning and functional independence. The results are presented as scaled scores taking values in the range from 0 to 100, where 0 represents the lowest level of functioning and the highest level of support, and 100 represents the highest level of functioning and functional independence.

GMFCS is the classification system for gross motor functioning. Locomotion skills are classified based on functional limitations of movement and the need for use of an assistance device (Palisano et al., 1997; Palisano et al., 2008). MACS describes how children with CP use their hands to handle objects in daily activities (Eliasson et al., 2006). The purpose of the CFCS is to classify everyday communication performance (Hidecker et al., 2011). In each of these instruments, level I includes children with minor limitations, while children with severe functional limitations will usually be found at levels IV and V.

Statistical analysis

Data are presented by distribution parameters: arithmetic average (mean), standard deviation (SD), median (Me), minimum value (Min) and maximum value (Max) and quartiles. The distribution of all tested variables did not have a normal distribution, hence the analysis used medians and quartiles, and non-parametric tests were used: chi-square, Mann-Whitney and Kruskal-Wallis. In this study, statistical significant was considered to occur at $p < 0,05$.

Ethics

The study was approved by the Ethics Committee of the Institute of Polish Mother's Health Centre in Łódź.

RESULTS

Complete information was available from all patients, hence 210 questionnaires were analysed. The preliminary assessment of the gathered material revealed the presence of 5 patients with rare types of CP and therefore they were excluded from further analysis. Thus only data from 205 individuals were used. Due to the low number of patients with extrapyramidal type of CP, this type was excluded from the detailed assessment of impact of epilepsy on functional status. Therefore in this study only patients with the spastic type of CP was investigated. The clinical characteristics of the study group (tab. 1) was based on the analysis of the medical records and functional assessment (GMFCS, MACS, CFCS). The degree of intellectual disability was determined by the analysis of the documentation releasing the appropriate system of education (the assessment provided on the basis of a psychology test).

Table 1. Patient demographic data (n = 205)

Characteristics	n	(%)
Gender		
Male	124	(60.5)
Female	81	(39.5)
Age		
1–6 years	54	(26.3)
7–12 years	83	(40.49)
13–18 years	68	(33.17)
Type of cerebral palsy		
Diplegia	78	(38.0)
Hemiplegia	38	(18.5)
Tetraplegia	70	(34.1)
Extrapyramidal	19	(9.3)
Intellectual disability		
None (IQ > 70)	58	(28.3)
Mild (IQ 69–55)	30	(14.6)
Moderate (IQ 54–35)	42	(20.5)
Significant (IQ 34–20)	33	(16.1)
Deep (IQ < 20)	29	(14.1)
Not tested	13	(6.3)
GMFCS level		
I	33	(16.1)
II	41	(20.0)
III	32	(15.6)
IV	51	(24.9)
V	48	(23.4)
MACS level		
I	19	(9.3)
II	86	(42.0)
III	29	(14.1)
IV	37	(18.0)
V	34	(16.6)
CFCS level		
I	56	(27.3)
II	45	(22.0)
III	25	(12.2)
IV	30	(14.6)
V	49	(23.9)

Presence of associated impairments, excluding intellectual disability, were found in 79% of people. Presence of one disability was shown in 34% of patients, two in 25% and three in 17%. The disorders reported the most frequently included vision impairment (51%), communication impairment (44%) and epilepsy (35%) seen in 71 patients (tab. 2). There were significant differences in prevalence of epilepsy and with various forms of CP. The highest proportions were observed in the case of tetraplegia and hemiplegia and in the patients classified at the lower levels (IV, V) of GMFCS, MACS and CFCS. In the case of the classification systems, the percentage of people with epilepsy increased with decreasing level of functioning (I to V), although the relationship was not statistically significant (data not presented).

In group of patients without epilepsy mental retardation occurred in 72% and in group with epilepsy in 97%. Apart from the group with tetraplegia, significant correlations between the presence of epilepsy and intellectual disability were not observed (tab. 3). In this form, the percentage of people with epilepsy increased with decreasing IQ. It should be noted that in the case of the mild form of both diplegia and hemiplegia, the cases of epilepsy without accompanying cognitive impairment were observed.

Mean scaled PEDI scores for the whole group were significantly correlated with the presence of epilepsy (tab. 4). The patients with epilepsy revealed a lower level of functioning and higher level of support compared to those without epilepsy. However, the detailed analysis conducted with division into the forms of CP did not confirm presence of differences significant for the average results of the group. Statistically significant differences were observed only for social functioning and support in social functioning in the patients with diplegia (lower in the subgroup with epilepsy), mobility and social functioning in the patients with tetraplegia (lower in the subgroup with epilepsy). In the patients with hemiplegia, there were no significant differences, although in each domain the subgroup with epilepsy obtained a lower rating than the subgroup without epilepsy.

In addition, the detailed analysis of the answers to the questions at the level of individual domain: self-care, mobility, social function and caregiver assistance, was undertaken. Because each domain of PEDI contains

Table 2. Details of coexisting disorders in the studied patient population

Associated impairments	Diplegia		Tetraplegia		Hemiplegia		Extrapyramidal type		Total		χ^2 test
	n	%*	n	%*	n	%*	n	%*	n	%*	
Vision impairment	39	50.0	45	64.3	12	31.6	8	42.1	104	50.7	$\chi^2=11.304$ $p=0.01$
Hearing impairment	3	3.8	4	5.7	5	13.2	0	0.0	12	5.9	$\chi^2=5.433$ $p=0.143$
Communication impairment	21	26.9	48	68.6	10	26.3	11	57.9	90	43.9	$\chi^2=32.71$ $p<0.001$
Epilepsy**	11	14.1	42	60.0	11	28.9	7	36.8	71	34.6	$\chi^2=35.003$ $p<0.001$
Behavioural problems	6	7.7	10	14.3	8	21.1	6	31.6	30	14.6	$\chi^2=8.636$ $p=0.035$

* Percentages do not add up to 100%, because it was a multiple choice question

** Including West syndrome

Table 3. The relationship between epilepsy and intellectual disability in the each form of CP

Form of CP	Presence of epilepsy	Normal cognitive function (IQ > 70)		Mild cognitive impairment (IQ 69–55)		Moderate cognitive impairment (IQ 54–35)		Severe cognitive impairment (IQ 34–20)		Profound cognitive impairment (IQ < 20)		χ^2 test	
		n	%	n	%	n	%	n	%	n	%		
Diplegia	No epilepsy	34	91.89	11	84.62	15	83.33	4	57.14	1	100.00	$\chi^2=6.015$	$p=0.198$
	Epilepsy	3	8.11	2	15.38	3	16.67	3	42.86	0	0.00		
Tetraplegia	No epilepsy	3	100.00	1	50.00	6	54.55	5	29.41	6	22.22	$\chi^2=9.787$	$p=0.044$
	Epilepsy	0	0.00	1	50.00	5	45.45	12	70.59	21	77.78		
Hemiplegia	No epilepsy	11	78.57	8	66.67	5	71.43	3	75.00	0	-	$\chi^2=0.481$	$p=0.923$
	Epilepsy	3	21.43	4	33.33	2	28.57	1	25.00	0	-		

a different number of items, for each of them the percentage of the activities, which were mastered by the studied, was calculated. These percentages were found not to have a normal distribution (as per Shapiro-Wilk test), and thus the analyses were conducted using the non-parametric test.

In the Self-Care Domain, significant differences in mastering the skills of hand washing and toileting tasks were observed in thse patients with tetraplegia and use of drinking containers in those patients with hemiplegia. For each of the assessed skills, and each form of CP, the medians of the percentage of the mastered activities were higher in the studied without epilepsy or equal to the medians in the subjected with epilepsy. In no instance were they lower than the results obtained from patients with epilepsy (tab. 5).

In the Mobility Domain, significant differences were found for outdoor locomotion and ability to climb stairs in patients with the mild forms – hemiplegia and diplegia and for car transfers, indoor locomotion and moving objects in patients with tetraplegia.

In Social Function Domain the percentage of the mastered skills in the patients with epilepsy in all forms of CP was at least equal to, and frequently lower than the percentage of those without epilepsy. According to table 7, significantly lower levels of skills in the patients with epilepsy were found in terms of:

- comprehension of word meanings, comprehension of sentence complexity, functional use of communication, issue resolution, social interactive play, play with objects, peer interactions, self-information,

Table 4. The scaled results for functional skills and caregiver assistance, taking into account presence of epilepsy

Type of CP	PEDI	Patients with epilepsy	Patients without epilepsy	Kruskal-Wallis test			
		Me	Scope	Me	Scope		
The whole group	Sa	39.60	11.8–100	64.25	11.8–100	W = 2407.5	p < 0.001
	Mb	29.00	0–100	61.90	0–100	W = 2721	p < 0.001
	SFc	43.10	3.1–100	63.65	6.6–100	W = 2051	p < 0.001
	Scad	20.10	0–100	61.65	0–100	W = 2641	p < 0.001
	Mcae	20.30	0–100	56.10	0–100	W = 3031	p < 0.001
	SFcaf	35.90	0–100	75.30	0–100	W = 2357	p < 0.001
Diplegia	S	61.80	30.7–85.1	66.00	36–100	W = 316	p = 0.451
	M	65.00	52.2–94.2	62.90	29–100	W = 453	p = 0.225
	SF	53.70	38.8–89.1	67.40	30–100	W = 179	p = 0.006
	Sca	63.40	0.0–89.7	66.90	0–100	W = 346.5	p = 0.752
	Mca	63.30	40.9–100	61.80	0–100	W = 454	p = 0.219
	SFca	65.40	11.3–100	89.90	0–100	W = 185.5	p = 0.007
Tetraplegia	S	32.45	11.8–50.3	36.00	11.8–61.8	W = 454.5	p = 0.109
	M	19.55	0–42.4	29.00	0–44.3	W = 392	p = 0.018
	SF	36.95	3.1–61.5	44.10	6.6–67.4	W = 418.5	p = 0.042
	Sca	0.00	0.0–100	11.60	0–54.6	W = 473	p = 0.126
	Mca	0.00	0.0–100	0.00	0–58.8	W = 547	p = 0.566
	SFca	0.00	0.0–100	20.40	0–100	W = 498.5	p = 0.259
Hemiplegia	S	68.30	48.9–100	70.80	28–100	W = 120	p = 0.358
	M	77.30	34.7–100	94.20	15.2–100	W = 105	p = 0.156
	SF	56.00	39.6–100	66.20	30–100	W = 106	p = 0.171
	Sca	56.80	37.2–100	71.10	0–100	W = 100.5	p = 0.119
	Mca	75.20	25.4–100	89.40	0–100	W = 95	p = 0.076
	SFca	61.30	31.6–100	82.90	0–100	W = 103	p = 0.136

a – self-care **c** – social function **e** – mobility caregiver assistance
b – mobility **d** – self-care caregiver assistance **f** – social function caregiver assistance

time orientation, community function for diplegia;
- complexity of expressive communication, play with objects, self-protection in case of tetraplegia;
- comprehension of word meanings, complexity of expressive communication, play with objects, self-information in case hemiplegia.

DISCUSSION

Children with CP can suffer extensive brain injury including to the cortex, deep white matter, and central nuclei, and therefore they are liable to develop epilepsy (Andersen et al., 2008). Despite the prevalence of epilepsy in such patients its clinical course is not well-defined. In the present study we observed that 34.6% of our patients had epilepsy and this is comparable to that reported by other authors both non-Polish (Sianturi et al., 2002; Carlsson et al., 2003; Odding et al., 2006; Sellier et al., 2012) and Polish (Kulak and Sobaniec, 2003; Mieszczanek, 2003; Kołomyjska et al., 2004; Kulak et al., 2005; Gajewska et al., 2014). In the studied group epilepsy was observed to occur most frequently in the tetraplegic form (60%) and in the hemiplegic form (28.9%). According to the literature the frequency of disclosure of epilepsy depends on the form of the CP. It is frequently observed in the tetraplegic form (50–90%) and hemiplegic form (34–60%). It is less common in diplegia, especially in preterm infants (11–20%), because their pathology predominantly involves the periventicular white matter (Marszał, 2006; Odding et al., 2006). The dominant number in the group of the epileptic patients with tetraplegia and hemiplegia is confirmed by other studies (Bruck et al., 2001; Czochańska and Szczepanik, 2002; Sianturi et al., 2002; Kołomyjska et al., 2004; El-Tallawy et al., 2014).

Based on our data it can be concluded that the most common type of seizures were focal seizures with or

Table 5. The mastered skills of Self-care Domain in the studied, taking into account presence of epilepsy

Self-care Domain	Percentage of mastered activities [%] Diplegia		Kruskal-Wallis test	Percentage of mastered activities [%] Tetraplegia		Kruskal-Wallis test	Percentage of mastered activities [%] Hemiplegia			Kruskal-Wallis test					
	Without epilepsy		With epilepsy				Without epilepsy		With epilepsy						
	Me	Scope	Me	Scope		Me	Scope	Me	Scope		Me	Scope	Me	Scope	
Food textures	100	50–100	100	50–100	W = 396.5 p = 0.142	100	25–100	100	0–100	W = 568.5 p = 0.796	100	50–100	100	75–100	W = 156 p = 0.533
Use of utensils	80	0–100	80	0–100	W = 418.5 p = 0.439	10	0–80	0	0–80	W = 698.5 p = 0.137	80	0–100	80	40–100	W = 183.5 p = 0.228
Use of drinking containers	100	0–100	80	40–100	W = 457 p = 0.168	10	0–100	0	0–80	W = 639.5 p = 0.502	100	0–100	80	40–100	W = 205.5 p = 0.040
Tooth brushing	80	20–100	80	0–100	W = 445 p = 0.246	30	0–100	20	0–60	W = 705.5 p = 0.133	100	20–100	100	20–100	W = 164 p = 0.577
Hair brushing	75	25–100	75	25–100	W = 312.5 p = 0.388	25	0–75	25	0–75	W = 711.5 p = 0.115	100	25–100	75	25–100	W = 195 p = 0.109
Nose care	100	20–100	100	20–100	W = 386.5 p = 0.774	40	0–100	20	0–100	W = 701 p = 0.15	100	20–100	60	40–100	W = 180.5 p = 0.271
Hand washing	100	0–100	100	0–100	W = 400 p = 0.568	20	0–100	20	0–100	W = 761 p = 0.029	100	20–100	60	40–100	W = 183.5 p = 0.191
Washing body and face	80	0–100	60	0–100	W = 459.5 p = 0.172	0	0–60	0	0–60	W = 690 p = 0.136	80	0–100	40	0–100	W = 183 p = 0.242
Pullover/front-opening garments	80	20–100	80	20–100	W = 355 p = 0.842	20	0–80	0	0–40	W = 685 p = 0.194	80	0–100	80	20–100	W = 158 p = 0.749
Fasteners	60	0–100	40	0–100	W = 490.5 p = 0.072	0	0–60	0	0–60	W = 694 p = 0.09	80	0–100	60	20–100	W = 118.5 p = 0.324
Pants	60	0–100	60	20–100	W = 377.5 p = 0.893	0	0–60	0	0–40	W = 684.5 p = 0.165	80	0–100	80	20–100	W = 151 p = 0.934
Shoes/socks	80	0–100	80	0–100	W = 368 p = 0.994	0	0–40	0	0–20	W = 570 p = 0.71	80	0–100	60	20–100	W = 168.5 p = 0.489
Toileting tasks	80	0–100	80	0–100	W = 388 p = 0.774	0	0–40	0	0–20	W = 679.5 p = 0.024	100	0–100	60	20–100	W = 184 p = 0.229
Management of bladder	100	0–100	100	0–100	W = 407 p = 0.531	20	0–80	0	0–80	W = 645 p = 0.461	100	0–100	100	40–100	W = 188 p = 0.088
Management of bowel	100	0–100	100	0–100	W = 409.5 p = 0.47	40	0–80	20	0–80	W = 688 p = 0.212	100	0–100	100	40–100	W = 169 p = 0.298

Table 6. The mastered skills in Mobility Domain in the studied, taking into account presence of epilepsy

Mobility Domain	Percentage of mastered activities [%] Diplegia	Kruskal-Wallis test	Percentage of mastered activities [%] Tetraplegia	Kruskal-Wallis test	Percentage of mastered activities [%] Hemiplegia	Kruskal-Wallis test									
	Without epilepsy	With epilepsy		Without epilepsy	With epilepsy		Without epilepsy	With epilepsy							
	Me	Scope	Me	Scope		Me	Scope	Me	Scope		Me	Scope	Me	Scope	
Toilet transfers	80	0–100	80	40–100	W = 330 p = 0.566	20	0–80	0	0–40	W = 724.5 p = 0.071	100	0–100	80	40–100	W = 182.5 p = 0.203
Chair/wheelchair transfers	80	20–100	80	40–100	W = 264 p = 0.114	20	0–80	20	0–60	W = 677.5 p = 0.241	100	40–100	80	60–100	W = 174.5 p = 0.344
Car transfers	60	0–100	80	0–100	W = 347 p = 0.752	0	0–40	0	0–0	W = 693 p = 0.005	100	0–100	80	0–100	W = 163.5 p = 0.595
Bed mobility/ transfers	75	0–100	75	50–100	W = 308.5 p = 0.353	0	0–75	0	0–75	W = 701.5 p = 0.092	100	0–100	75	25–100	W = 183 p = 0.201
Tub transfers	60	0–100	100	20–100	W = 264 p = 0.123	20	0–40	20	0–40	W = 666 p = 0.289	100	20–100	80	40–100	W = 171 p = 0.41
Indoor locomotion methods	67	0–100	67	33–100	W = 357 p = 0.858	33	0–67	0	0–67	W = 714 p = 0.085	100	0–100	100	33–100	W = 153.5 p = 0.8
Indoor locomotion: distance/speed	100	0–100	100	40–100	W = 340 p = 0.655	0	0–80	0	0–100	W = 736 p = 0.033	100	0–100	100	0–100	W = 164.5 p = 0.333
Pulls/carries objects	80	0–100	100	60–100	W = 336.5 p = 0.619	60	0–100	0	0–80	W = 776 p = 0.016	100	0–100	80	60–100	W = 190.5 p = 0.116
Outdoor locomotion methods	50	0–100	50	50–100	W = 308.5 p = 0.343	0	0–50	0	0–50	W = 581 p = 0.901	100	0–100	100	50–100	W = 165.5 p = 0.416
Outdoor locomotion: distance/speed	60	0–100	80	20–100	W = 223.5 p = 0.034	0	0–40	0	0–20	W = 591 p = 0.953	100	0–100	100	0–100	W = 168.5 p = 0.341
Outdoor locomotion: surfaces	60	0–100	100	60–100	W = 192 p = 0.009	0	0–60	0	0–80	W = 650 p = 0.273	100	0–100	80	0–100	W = 210 p = 0.011
Upstairs	80	0–100	80	0–100	W = 351 p = 0.794	0	0–20	0	0–20	W = 595 p = 0.771	100	0–100	100	0–100	W = 203 p = 0.009
Downstairs	80	0–100	80	0–100	W = 353.5 p = 0.823	0	0–0	0	0–0	W = 588 p = 1	100	0–100	100	0–100	W = 193 p = 0.054

Table 7. The mastered skills in Social Function Domain in the studied, including presence of epilepsy

Social Function Domain	Percentage of mastered activities [%] Diplegia	Kruskal-Wallis Test	Percentage of mastered activities [%] Tetraplegia	Kruskal-Wallis Test	Percentage of mastered activities [%] Hemiplegia	Kruskal-Wallis Test									
	Without epilepsy	With epilepsy		Without epilepsy	With epilepsy		Without epilepsy	With epilepsy							
	Me	Scope	Me	Scope		Me	Scope	Me	Scope		Me	Scope	Me	Scope	
Comprehension of word meanings	100	40–100	80	40–100	W = 524 p = 0.001	80	20–100	80	0–100	W = 730.5 p = 0.077	100	40–100	80	60–100	W = 198 p = 0.045
Comprehension of sentence complexity	100	0–100	80	20–100	W = 509 p = 0.013	60	0–100	20	0–100	W = 707 p = 0.139	100	0–100	60	40–100	W = 180.5 p = 0.249
Functional use of communication	100	0–100	80	20–100	W = 523 p = 0.004	20	0–100	0	0–100	W = 760 p = 0.029	100	0–100	80	0–100	W = 186 p = 0.17
Complexity of expressive communication	100	0–100	80	40–100	W = 477.5 p = 0.052	40	0–100	0	0–100	W = 764.5 p = 0.026	100	0–100	80	20–100	W = 204 p = 0.034
Problem resolution	80	0–100	40	0–100	W = 531 p = 0.013	20	0–100	20	0–100	W = 726 p = 0.085	80	0–100	40	20–100	W = 180 p = 0.292
Social interactive play	100	20–100	80	60–100	W = 516 p = 0.016	40	0–100	20	0–100	W = 803 p = 0.008	100	0–100	80	20–100	W = 175.5 p = 0.345
Peer interactions	100	0–100	40	20–100	W = 513 p = 0.019	30	0–100	20	0–100	W = 681 p = 0.245	100	20–100	60	40–100	W = 195.5 p = 0.103
Play with objects	100	0–100	60	0–100	W = 520 p = 0.017	20	0–100	0	0–80	W = 779 p = 0.014	100	0–100	60	20–100	W = 206.5 p = 0.047
Self-information	100	0–100	80	20–100	W = 521 p = 0.008	40	0–100	30	0–100	W = 702 p = 0.163	100	0–100	80	0–100	W = 221 p = 0.009
Time orientation	80	0–100	40	0–100	W = 546 p = 0.008	40	0–100	20	0–80	W = 701 p = 0.161	80	0–100	60	0–100	W = 183.5 p = 0.245
Household chorus	80	0–100	60	0–100	W = 468.5 p = 0.138	0	0–80	0	0–60	W = 665 p = 0.209	80	0–100	80	0–100	W = 169 p = 0.493
Self-protection	60	0–100	60	0–100	W = 425 p = 0.409	0	0–60	0	0–40	W = 721 p = 0.012	80	0–100	40	0–100	W = 193.5 p = 0.137
Community function	60	0–100	40	0–80	W = 541 p = 0.012	0	0–80	0	0–40	W = 647 p = 0.406	60	0–100	40	0–100	W = 175.5 p = 0.376

without secondary generalization. However, the issue was not statistically developed, due to the nature of the study, based mainly on the analysis of questionnaires without personal examination conducted by the authors. These results are consistent with other references (Bruck et al., 2001; Sianturi et al., 2002; Kołomyjska et al., 2004).

Among the factors associated with occurrence of epilepsy are low birth weight and gestational age (there is a higher risk in children born more than 37 week of pregnancy), however, there is no general agreement between authors. Other cited factors include intellectual disability, presence of neonatal seizures and abnormal neuroimaging. Epilepsy is associated with an increased risk of cognitive problems and behavioural disorders and decreased probability of walking. Epilepsy is observed in over 90% of the patients with severe intellectual disabilities and thus is frequently used as a marker of severity of the CP (Kulak and Sobaniec, 2003; Marszał, 2006; Carlsson et al., 2008; Sellier et al., 2012).

Epilepsy and intellectual disability

The relationship between epilepsy and intellectual disability was and is still widely debated. It appears that in the case of CP, cognitive impairment can result from damage to the CNS independent of epilepsy, but coexisting with it, or it can be consequent to epilepsy. The high incidence of epilepsy and cognitive impairment among the patients with CP suggests that these disorders have common or related origins (Wendorff, 2010; Sellier et al., 2012). According to Kołomyjska et al. (2004), all of the factors leading to damage to the CNS, are also the factors predisposing to seizures. The study results confirm that children with cognitive impairment had higher frequency of epilepsy than those without cognitive impairment (Carlsson et al. 2003; Kulak et al., 2005).

In the present study a difference in the incidence of cognitive impairment in the patients without (72%) and with epilepsy (97%) was confirmed. In the study by El-Tallawy et al. (2014) the percentages were similar (66.7% and 84.6% respectively). Kołomyjska et al. (2004) reported that in the group of 52 children with CP, cognitive impairment was present in 75% of the respondents, 36.54% cases of which were profound, 26.92% cases were moderate, and 11.54% of cases were mild. Profound disorder was found significantly more frequent in the case of tetraplegia as reported by Gajewska et al. (2014). In the present study, profound disorder related to 28 patients, 96.4% of whom were children with tetraplegia. It was the only form of CP which revealed presence of a significant relationship between epilepsy and intellectual disability ($p = 0.044$). Other investigators have recently shown that chronic medication refractory temporal lobe epilepsy leads to cognitive impairment over time, with longer duration significantly related to decreases in memory, attention and executive function skills. These findings underscore the importance of early and effective intervention to control seizures (Kent et al., 2006; Black et al., 2010, Chapman et al., 2010).

Epilepsy and functional status

Results of the study revealed significant relation between occurrence of epilepsy and average scores in both subscales of PEDI. The patients with epilepsy revealed a lower level of functioning and a higher level of support compared to those without epilepsy. The analysis at the level of the CP form showed, however, difference only in social functioning of the patients with diplegia and social functioning and mobility of the patients with tetraplegia. The results are similar for the analysis conducted at the level of individual PEDI domains. Gajewska et al. (2014) using GMFCS, and MACS functional systems assessed the effects of epilepsy and cognitive impairment on locomotion and manual skills. Occurrence of epilepsy in children with CP was associated with worse manual function and general motor performance. However, these were not related to the specific type of CP. In children with epilepsy, MACS was on a higher level (i.e., hand function was poorer). The same relations for three classification systems (GMFCS, MACS and CFCS) were found in our study.

The detailed analysis of functioning of the study group showed significant differences in the minor number of Self-Care Domain and Mobility Domain items. The largest number of statistically significant differences were observed in the Social Function Domain.

It is stated that children with both CP and epilepsy have a poorer prognosis for ambulation than children with only CP (Trahan and Marcoux, 1994). Among the factors contributing to emergence of self-locomotion are the following: intellectual disability, presence of epilepsy and severe sensory dysfunction (Koman et al., 2004; Himmelmann et al., 2006; Beckung et al., 2008). In the studies of Kułak et al. (2005) the locomotion function was affected in similar proportions in the tetraplegic and diplegic CP children with or with-

out epilepsy. In many studies using PEDI regression analysis, epilepsy is not indicated as the main predictor in the Mobility Domain nor in the Self-Care Domain. The strongest predictor in the Mobility Domain is the level of GMFCS (Ostensjo et al., 2003; Smits et al., 2011; Tseng et al., 2011; Phipps and Roberts, 2012). MACS level is considered to be a strong predictor in the Self-Care Domain (Öhrvall et al., 2010; Ahn et al., 2011; Phipps and Roberts, 2012). In contrast, intellectual disability and epilepsy are factors closely associated with social functioning (Voorman et al. (2006); Wong et al. (2004)) and explain the results obtained in the field of Social Function Domain.

Decreased level of motivation and cognitive exploration activities and lower life expectancy of the acquired skills, contribute to the development of interdependence existing between cognitive deficits and the effects of rehabilitation. In children with moderate and severe levels of intellectual disability worse therapeutic results are observed compared to children with normal development or a slight delay (Zgorzalewicz et al., 2001). The studies of Karimzadeh et al. (2010) found that hemiparetic patients with epilepsy did not show a good outcome after rehabilitation. With regards to patients with severe drug resistant epilepsy, the performed skills or previously learned skills could be lost (Aicardi, 1990).

The results, i.e. a significantly lower level of social functioning especially in the group of patients with diplegia, can indicate a secondary negative effect of epilepsy on cognitive and functional status. These relationships, however, require verification by further studies.

The present study is, to our knowledge, the first in Poland, involving the attempt to specify the functional status of patients with CP and epilepsy. The limitations of the study are the questionnaire character of the study, and the absence of more detailed description of epilepsy.

CONCLUSIONS

The presence of epilepsy is associated with lower levels of social function in patients with cerebral palsy; particularly, with regard to mobility and selfservice.

Assessment of epilepsy impact on the level of social functioning of people with CP (diplegia, tetraplegia, hemiplegia) is difficult because ambiguous relationship with mental retardation.

The detailed assessment of the impact of epilepsy on the level of functioning of people with CP should be undertaken separately for each group.

CONFLICT OF INTEREREST DISCLOSURE

The authors have no conflict of interests to declare.

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