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% (Haus-...
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: Kulak (41%) (2003), Mieszczanek (33%) (2003) and Zgorzelwicz (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; Kulak 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, Czarnecka 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).

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 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>
<thead>
<tr>
<th>Characteristics</th>
<th>n</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>124</td>
<td>(60.5)</td>
</tr>
<tr>
<td>Female</td>
<td>81</td>
<td>(39.5)</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1–6 years</td>
<td>54</td>
<td>(26.3)</td>
</tr>
<tr>
<td>7–12 years</td>
<td>83</td>
<td>(40.49)</td>
</tr>
<tr>
<td>13–18 years</td>
<td>68</td>
<td>(33.17)</td>
</tr>
<tr>
<td><strong>Type of cerebral palsy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diplegia</td>
<td>78</td>
<td>(38.0)</td>
</tr>
<tr>
<td>Hemiplegia</td>
<td>38</td>
<td>(18.5)</td>
</tr>
<tr>
<td>Tetraplegia</td>
<td>70</td>
<td>(34.1)</td>
</tr>
<tr>
<td>Extrapyramidal</td>
<td>19</td>
<td>(9.3)</td>
</tr>
<tr>
<td><strong>Intellectual disability</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None (IQ &gt; 70)</td>
<td>58</td>
<td>(28.3)</td>
</tr>
<tr>
<td>Mild (IQ 69–55)</td>
<td>30</td>
<td>(14.6)</td>
</tr>
<tr>
<td>Moderate (IQ 54–35)</td>
<td>42</td>
<td>(20.5)</td>
</tr>
<tr>
<td>Significant (IQ 34–20)</td>
<td>33</td>
<td>(16.1)</td>
</tr>
<tr>
<td>Deep (IQ &lt; 20)</td>
<td>29</td>
<td>(14.1)</td>
</tr>
<tr>
<td>Not tested</td>
<td>13</td>
<td>(6.3)</td>
</tr>
<tr>
<td><strong>GMFCS level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>33</td>
<td>(16.1)</td>
</tr>
<tr>
<td>II</td>
<td>41</td>
<td>(20.0)</td>
</tr>
<tr>
<td>III</td>
<td>32</td>
<td>(15.6)</td>
</tr>
<tr>
<td>IV</td>
<td>51</td>
<td>(24.9)</td>
</tr>
<tr>
<td>V</td>
<td>48</td>
<td>(23.4)</td>
</tr>
<tr>
<td><strong>MACS level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>19</td>
<td>(9.3)</td>
</tr>
<tr>
<td>II</td>
<td>86</td>
<td>(42.0)</td>
</tr>
<tr>
<td>III</td>
<td>29</td>
<td>(14.1)</td>
</tr>
<tr>
<td>IV</td>
<td>37</td>
<td>(18.0)</td>
</tr>
<tr>
<td>V</td>
<td>34</td>
<td>(16.6)</td>
</tr>
<tr>
<td><strong>CFCS level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>56</td>
<td>(27.3)</td>
</tr>
<tr>
<td>II</td>
<td>45</td>
<td>(22.0)</td>
</tr>
<tr>
<td>III</td>
<td>25</td>
<td>(12.2)</td>
</tr>
<tr>
<td>IV</td>
<td>30</td>
<td>(14.6)</td>
</tr>
<tr>
<td>V</td>
<td>49</td>
<td>(23.9)</td>
</tr>
</tbody>
</table>
Table 2. Details of coexisting disorders in the studied patient population

<table>
<thead>
<tr>
<th>Associated impairments</th>
<th>Diplegia</th>
<th>Tetraplegia</th>
<th>Hemiplegia</th>
<th>Extrapyramidal type</th>
<th>Total</th>
<th>χ² test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>% *</td>
<td>n</td>
<td>% *</td>
<td>n</td>
<td>% *</td>
</tr>
<tr>
<td>Vision impairment</td>
<td>39</td>
<td>50.0</td>
<td>45</td>
<td>64.3</td>
<td>12</td>
<td>31.6</td>
</tr>
<tr>
<td>Hearing impairment</td>
<td>3</td>
<td>3.8</td>
<td>4</td>
<td>5.7</td>
<td>5</td>
<td>13.2</td>
</tr>
<tr>
<td>Communication impairment</td>
<td>21</td>
<td>26.9</td>
<td>48</td>
<td>68.6</td>
<td>10</td>
<td>26.3</td>
</tr>
<tr>
<td>Epilepsy**</td>
<td>11</td>
<td>14.1</td>
<td>42</td>
<td>60.0</td>
<td>11</td>
<td>28.9</td>
</tr>
<tr>
<td>Behavioural problems</td>
<td>6</td>
<td>7.7</td>
<td>10</td>
<td>14.3</td>
<td>8</td>
<td>21.1</td>
</tr>
</tbody>
</table>

* 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

<table>
<thead>
<tr>
<th>Form of CP</th>
<th>Presence of epilepsy</th>
<th>Normal cognitive (IQ &gt; 70)</th>
<th>Mild cognitive (IQ 50–69)</th>
<th>Moderate cognitive (IQ 40–49)</th>
<th>Severe cognitive impairment (IQ 25–39)</th>
<th>Profound cognitive impairment (IQ &lt; 25)</th>
<th>χ² test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Diplegia</td>
<td>No epilepsy</td>
<td>34</td>
<td>91.89</td>
<td>11</td>
<td>84.62</td>
<td>15</td>
<td>83.33</td>
</tr>
<tr>
<td>Epilepsy</td>
<td>3</td>
<td>8.11</td>
<td>2</td>
<td>15.38</td>
<td>3</td>
<td>16.67</td>
<td>3</td>
</tr>
<tr>
<td>Tetraplegia</td>
<td>No epilepsy</td>
<td>3</td>
<td>100.00</td>
<td>2</td>
<td>50.00</td>
<td>6</td>
<td>54.55</td>
</tr>
<tr>
<td>Epilepsy</td>
<td>0</td>
<td>0.00</td>
<td>1</td>
<td>50.00</td>
<td>5</td>
<td>45.45</td>
<td>12</td>
</tr>
<tr>
<td>Hemiplegia</td>
<td>No epilepsy</td>
<td>11</td>
<td>78.57</td>
<td>8</td>
<td>66.67</td>
<td>5</td>
<td>71.43</td>
</tr>
<tr>
<td>Epilepsy</td>
<td>3</td>
<td>21.43</td>
<td>4</td>
<td>33.33</td>
<td>2</td>
<td>28.57</td>
<td>1</td>
</tr>
</tbody>
</table>

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,
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; Kolomyjska 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 periventricular 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

<table>
<thead>
<tr>
<th>Self-care Domain</th>
<th>Percentage of mastered activities [%]</th>
<th>Kruskal-Wallis test</th>
<th>Percentage of mastered activities [%]</th>
<th>Kruskal-Wallis test</th>
<th>Percentage of mastered activities [%]</th>
<th>Kruskal-Wallis test</th>
<th>Percentage of mastered activities [%]</th>
<th>Kruskal-Wallis test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Without epilepsy</td>
<td>Me Scope</td>
<td>With epilepsy</td>
<td>Me Scope</td>
<td>Without epilepsy</td>
<td>Me Scope</td>
<td>With epilepsy</td>
<td>Me Scope</td>
</tr>
<tr>
<td>Food textures</td>
<td>Without epilepsy</td>
<td>100</td>
<td>50–100</td>
<td>100</td>
<td>50–100</td>
<td>100</td>
<td>0–100</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>With epilepsy</td>
<td>25–100</td>
<td>100</td>
<td>0–100</td>
<td>100</td>
<td>75–100</td>
<td>156</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>W = 396.5</td>
<td>p = 0.142</td>
<td>W = 568.5</td>
<td>p = 0.796</td>
<td>W = 156</td>
<td>p = 0.533</td>
<td></td>
</tr>
<tr>
<td>Use of utensils</td>
<td>Without epilepsy</td>
<td>80</td>
<td>0–100</td>
<td>100</td>
<td>0–80</td>
<td>0–80</td>
<td>80</td>
<td>0–80</td>
</tr>
<tr>
<td></td>
<td>With epilepsy</td>
<td>0–80</td>
<td>0</td>
<td>80</td>
<td>0–100</td>
<td>80</td>
<td>40–100</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>W = 418.5</td>
<td>p = 0.043</td>
<td>W = 698.5</td>
<td>p = 0.137</td>
<td>W = 183.5</td>
<td>p = 0.228</td>
<td></td>
</tr>
<tr>
<td>Use of drinking containers</td>
<td>Without epilepsy</td>
<td>100</td>
<td>0–100</td>
<td>100</td>
<td>0–100</td>
<td>100</td>
<td>0–200</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>With epilepsy</td>
<td>80</td>
<td>0–100</td>
<td>100</td>
<td>0–100</td>
<td>100</td>
<td>0–200</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>W = 457</td>
<td>p = 0.168</td>
<td>W = 639.5</td>
<td>p = 0.502</td>
<td>W = 205.5</td>
<td>p = 0.040</td>
<td></td>
</tr>
<tr>
<td>Tooth brushing</td>
<td>Without epilepsy</td>
<td>80</td>
<td>20–100</td>
<td>100</td>
<td>0–60</td>
<td>100</td>
<td>20–100</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>With epilepsy</td>
<td>0–60</td>
<td>100</td>
<td>0–60</td>
<td>100</td>
<td>0–200</td>
<td>100</td>
<td>0–200</td>
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<tr>
<td></td>
<td></td>
<td>W = 445</td>
<td>p = 0.246</td>
<td>W = 705.5</td>
<td>p = 0.133</td>
<td>W = 164</td>
<td>p = 0.577</td>
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<tr>
<td>Hair brushing</td>
<td>Without epilepsy</td>
<td>75</td>
<td>25–100</td>
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<td>0–75</td>
<td>25</td>
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<td>25</td>
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<tr>
<td></td>
<td>With epilepsy</td>
<td>25</td>
<td>0</td>
<td>75</td>
<td>0</td>
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<td>75</td>
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<tr>
<td></td>
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<td>W = 312.5</td>
<td>p = 0.388</td>
<td>W = 711.5</td>
<td>p = 0.115</td>
<td>W = 195</td>
<td>p = 0.109</td>
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<tr>
<td>Nose care</td>
<td>Without epilepsy</td>
<td>100</td>
<td>20–100</td>
<td>100</td>
<td>0–100</td>
<td>100</td>
<td>0–100</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>With epilepsy</td>
<td>20–100</td>
<td>100</td>
<td>0–100</td>
<td>100</td>
<td>100</td>
<td>0–100</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>W = 386.5</td>
<td>p = 0.784</td>
<td>W = 701</td>
<td>p = 0.15</td>
<td>W = 180.5</td>
<td>p = 0.271</td>
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<tr>
<td>Hand washing</td>
<td>Without epilepsy</td>
<td>100</td>
<td>0–100</td>
<td>100</td>
<td>0–100</td>
<td>100</td>
<td>0–100</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>With epilepsy</td>
<td>0–100</td>
<td>100</td>
<td>0–100</td>
<td>100</td>
<td>100</td>
<td>0–100</td>
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<td></td>
<td></td>
<td>W = 400</td>
<td>p = 0.568</td>
<td>W = 761</td>
<td>p = 0.029</td>
<td>W = 183.5</td>
<td>p = 0.191</td>
<td></td>
</tr>
<tr>
<td>Washing body and face</td>
<td>Without epilepsy</td>
<td>80</td>
<td>0–100</td>
<td>100</td>
<td>0–60</td>
<td>100</td>
<td>0–60</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>With epilepsy</td>
<td>0–60</td>
<td>80</td>
<td>0–60</td>
<td>80</td>
<td>0–100</td>
<td>80</td>
<td>0–100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>W = 459.5</td>
<td>p = 0.172</td>
<td>W = 690</td>
<td>p = 0.136</td>
<td>W = 183</td>
<td>p = 0.242</td>
<td></td>
</tr>
<tr>
<td>Pullover/front-opening garments</td>
<td>Without epilepsy</td>
<td>80</td>
<td>20–100</td>
<td>80</td>
<td>0–40</td>
<td>80</td>
<td>0–40</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>With epilepsy</td>
<td>0–40</td>
<td>80</td>
<td>0–40</td>
<td>80</td>
<td>20–100</td>
<td>80</td>
<td>20–100</td>
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<tr>
<td></td>
<td></td>
<td>W = 355</td>
<td>p = 0.842</td>
<td>W = 685</td>
<td>p = 0.194</td>
<td>W = 158</td>
<td>p = 0.749</td>
<td></td>
</tr>
<tr>
<td>Fasteners</td>
<td>Without epilepsy</td>
<td>60</td>
<td>0–100</td>
<td>60</td>
<td>0–60</td>
<td>60</td>
<td>0–60</td>
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<tr>
<td></td>
<td>With epilepsy</td>
<td>0–60</td>
<td>60</td>
<td>0–60</td>
<td>60</td>
<td>20–100</td>
<td>60</td>
<td>20–100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>W = 490.5</td>
<td>p = 0.072</td>
<td>W = 694</td>
<td>p = 0.09</td>
<td>W = 118.5</td>
<td>p = 0.324</td>
<td></td>
</tr>
<tr>
<td>Pants</td>
<td>Without epilepsy</td>
<td>60</td>
<td>0–100</td>
<td>60</td>
<td>0–60</td>
<td>60</td>
<td>0–60</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>With epilepsy</td>
<td>0–60</td>
<td>60</td>
<td>0–60</td>
<td>60</td>
<td>20–100</td>
<td>60</td>
<td>20–100</td>
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<tr>
<td></td>
<td></td>
<td>W = 377.5</td>
<td>p = 0.893</td>
<td>W = 684.5</td>
<td>p = 0.165</td>
<td>W = 151</td>
<td>p = 0.934</td>
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<tr>
<td>Shoes/socks</td>
<td>Without epilepsy</td>
<td>80</td>
<td>0–100</td>
<td>80</td>
<td>0–60</td>
<td>80</td>
<td>0–60</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>With epilepsy</td>
<td>0–60</td>
<td>80</td>
<td>0–60</td>
<td>80</td>
<td>20–100</td>
<td>80</td>
<td>20–100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>W = 368</td>
<td>p = 0.994</td>
<td>W = 570</td>
<td>p = 0.71</td>
<td>W = 168.5</td>
<td>p = 0.489</td>
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<tr>
<td>Toileting tasks</td>
<td>Without epilepsy</td>
<td>80</td>
<td>0–100</td>
<td>80</td>
<td>0–20</td>
<td>80</td>
<td>0–20</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>With epilepsy</td>
<td>0–20</td>
<td>80</td>
<td>0–20</td>
<td>80</td>
<td>100</td>
<td>0–100</td>
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<tr>
<td></td>
<td></td>
<td>W = 388</td>
<td>p = 0.774</td>
<td>W = 679.5</td>
<td>p = 0.024</td>
<td>W = 184</td>
<td>p = 0.229</td>
<td></td>
</tr>
<tr>
<td>Management of bladder</td>
<td>Without epilepsy</td>
<td>100</td>
<td>0–100</td>
<td>100</td>
<td>0–80</td>
<td>100</td>
<td>0–80</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>With epilepsy</td>
<td>0–80</td>
<td>100</td>
<td>0–80</td>
<td>100</td>
<td>40–100</td>
<td>100</td>
<td>40–100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>W = 407</td>
<td>p = 0.531</td>
<td>W = 64.5</td>
<td>p = 0.461</td>
<td>W = 188</td>
<td>p = 0.088</td>
<td></td>
</tr>
<tr>
<td>Management of bowel</td>
<td>Without epilepsy</td>
<td>100</td>
<td>0–100</td>
<td>100</td>
<td>0–80</td>
<td>100</td>
<td>0–80</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>With epilepsy</td>
<td>0–80</td>
<td>100</td>
<td>0–80</td>
<td>100</td>
<td>40–100</td>
<td>100</td>
<td>40–100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>W = 409.5</td>
<td>p = 0.47</td>
<td>W = 688</td>
<td>p = 0.212</td>
<td>W = 169</td>
<td>p = 0.298</td>
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</table>
Table 6. The mastered skills in Mobility Domain in the studied, taking into account presence of epilepsy

<table>
<thead>
<tr>
<th>Mobility Domain</th>
<th>Percentage of mastered activities [%] Diplegia</th>
<th>Kruskal-Wallis test</th>
<th>Percentage of mastered activities [%] Tetraplegia</th>
<th>Kruskal-Wallis test</th>
<th>Percentage of mastered activities [%] Hemiplegia</th>
<th>Kruskal-Wallis test</th>
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<tbody>
<tr>
<td></td>
<td>Without epilepsy</td>
<td>With epilepsy</td>
<td>Without epilepsy</td>
<td>With epilepsy</td>
<td>Without epilepsy</td>
<td>With epilepsy</td>
</tr>
<tr>
<td>Toilet transfers</td>
<td>80</td>
<td>0–100</td>
<td>80</td>
<td>40–100</td>
<td>W = 330</td>
<td>p = 0.566</td>
</tr>
<tr>
<td>Chair/wheelchair transfers</td>
<td>80</td>
<td>20–100</td>
<td>80</td>
<td>40–100</td>
<td>W = 264</td>
<td>p = 0.114</td>
</tr>
<tr>
<td>Car transfers</td>
<td>60</td>
<td>0–100</td>
<td>80</td>
<td>0–100</td>
<td>W = 347</td>
<td>p = 0.752</td>
</tr>
<tr>
<td>Bed mobility/ transfers</td>
<td>75</td>
<td>0–100</td>
<td>75</td>
<td>50–100</td>
<td>W = 308.5</td>
<td>p = 0.353</td>
</tr>
<tr>
<td>Tub transfers</td>
<td>60</td>
<td>0–100</td>
<td>100</td>
<td>20–100</td>
<td>W = 264</td>
<td>p = 0.123</td>
</tr>
<tr>
<td>Indoor locomotion methods</td>
<td>67</td>
<td>0–100</td>
<td>67</td>
<td>33–100</td>
<td>W = 357</td>
<td>p = 0.858</td>
</tr>
<tr>
<td>Indoor locomotion: distance/speed</td>
<td>100</td>
<td>0–100</td>
<td>100</td>
<td>40–100</td>
<td>W = 340</td>
<td>p = 0.655</td>
</tr>
<tr>
<td>Pulls/carries objects</td>
<td>80</td>
<td>0–100</td>
<td>100</td>
<td>60–100</td>
<td>W = 336.5</td>
<td>p = 0.619</td>
</tr>
<tr>
<td>Outdoor locomotion methods</td>
<td>50</td>
<td>0–100</td>
<td>50</td>
<td>50–100</td>
<td>W = 308.5</td>
<td>p = 0.343</td>
</tr>
<tr>
<td>Outdoor locomotion: distance/speed</td>
<td>60</td>
<td>0–100</td>
<td>80</td>
<td>20–100</td>
<td>W = 223.5</td>
<td>p = 0.034</td>
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<tr>
<td>Outdoor locomotion: surfaces</td>
<td>60</td>
<td>0–100</td>
<td>100</td>
<td>60–100</td>
<td>W = 192</td>
<td>p = 0.009</td>
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<tr>
<td>Upstairs</td>
<td>80</td>
<td>0–100</td>
<td>80</td>
<td>0–100</td>
<td>W = 351</td>
<td>p = 0.794</td>
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<tr>
<td>Downstairs</td>
<td>80</td>
<td>0–100</td>
<td>80</td>
<td>0–100</td>
<td>W = 353.5</td>
<td>p = 0.823</td>
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</table>
Table 7. The mastered skills in Social Function Domain in the studied, including presence of epilepsy

<table>
<thead>
<tr>
<th>Social Function Domain</th>
<th>Percentage of mastered activities [%]</th>
<th>Kruskal-Wallis Test</th>
<th>Percentage of mastered activities [%]</th>
<th>Kruskal-Wallis Test</th>
<th>Percentage of mastered activities [%]</th>
<th>Kruskal-Wallis Test</th>
<th>Percentage of mastered activities [%]</th>
<th>Kruskal-Wallis Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Without epilepsy</td>
<td>With epilepsy</td>
<td>Without epilepsy</td>
<td>With epilepsy</td>
<td>Without epilepsy</td>
<td>With epilepsy</td>
<td>Without epilepsy</td>
<td>With epilepsy</td>
</tr>
<tr>
<td></td>
<td>Me</td>
<td>Scope</td>
<td>Me</td>
<td>Scope</td>
<td>Me</td>
<td>Scope</td>
<td>Me</td>
<td>Scope</td>
</tr>
<tr>
<td>Comprehension of word meanings</td>
<td>100</td>
<td>40–100</td>
<td>80</td>
<td>40–100</td>
<td>W = 524</td>
<td>p = 0.001</td>
<td>80</td>
<td>20–100</td>
</tr>
<tr>
<td>Comprehension of sentence complexity</td>
<td>100</td>
<td>0–100</td>
<td>80</td>
<td>20–100</td>
<td>W = 509</td>
<td>p = 0.013</td>
<td>60</td>
<td>0–100</td>
</tr>
<tr>
<td>Functional use of communication</td>
<td>100</td>
<td>0–100</td>
<td>80</td>
<td>20–100</td>
<td>W = 523</td>
<td>p = 0.004</td>
<td>20</td>
<td>0–100</td>
</tr>
<tr>
<td>Complexity of expressive communication</td>
<td>100</td>
<td>0–100</td>
<td>80</td>
<td>40–100</td>
<td>W = 477.5</td>
<td>p = 0.052</td>
<td>40</td>
<td>0–100</td>
</tr>
<tr>
<td>Problem resolution</td>
<td>80</td>
<td>0–100</td>
<td>40</td>
<td>0–100</td>
<td>W = 531</td>
<td>p = 0.013</td>
<td>20</td>
<td>0–100</td>
</tr>
<tr>
<td>Social interactive play</td>
<td>100</td>
<td>20–100</td>
<td>80</td>
<td>60–100</td>
<td>W = 516</td>
<td>p = 0.016</td>
<td>40</td>
<td>0–100</td>
</tr>
<tr>
<td>Peer interactions</td>
<td>100</td>
<td>0–100</td>
<td>40</td>
<td>20–100</td>
<td>W = 513</td>
<td>p = 0.019</td>
<td>30</td>
<td>0–100</td>
</tr>
<tr>
<td>Play with objects</td>
<td>100</td>
<td>0–100</td>
<td>60</td>
<td>0–100</td>
<td>W = 520</td>
<td>p = 0.017</td>
<td>20</td>
<td>0–100</td>
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<tr>
<td>Self-information</td>
<td>100</td>
<td>0–100</td>
<td>80</td>
<td>20–100</td>
<td>W = 521</td>
<td>p = 0.008</td>
<td>40</td>
<td>0–100</td>
</tr>
<tr>
<td>Time orientation</td>
<td>80</td>
<td>0–100</td>
<td>40</td>
<td>0–100</td>
<td>W = 546</td>
<td>p = 0.008</td>
<td>40</td>
<td>0–100</td>
</tr>
<tr>
<td>Household chorus</td>
<td>80</td>
<td>0–100</td>
<td>60</td>
<td>0–100</td>
<td>W = 468.5</td>
<td>p = 0.138</td>
<td>0</td>
<td>0–80</td>
</tr>
<tr>
<td>Self-protection</td>
<td>60</td>
<td>0–100</td>
<td>60</td>
<td>0–100</td>
<td>W = 425</td>
<td>p = 0.409</td>
<td>0</td>
<td>0–60</td>
</tr>
<tr>
<td>Community function</td>
<td>60</td>
<td>0–100</td>
<td>40</td>
<td>0–80</td>
<td>W = 541</td>
<td>p = 0.012</td>
<td>0</td>
<td>0–80</td>
</tr>
</tbody>
</table>
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; Kolomyjska 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; Marszal, 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 co-existing 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 Kolomyjska 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). Kolomyjska 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 Gajewksa 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 Kulak 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 (Ostensjø 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 INTEREST DISCLOSURE
The authors have no conflict of interests to declare.

REFERENCES


