# Behavioral Problems in Children With Benign Childhood Epilepsy With Centrotemporal Spikes Treated and Untreated With Antiepileptic Drugs

**Rūta Samaitienė[1, 2], Jolita Norkūnienė[3], Giedrė Jurkevičienė[4], Jurgita Grikinienė[1, 2]**

*[1]Clinic of Children's Diseases, Vilnius University, [2]Children's Neurology Department, Children's Hospital, Affiliate of Vilnius University Hospital Santariškių Klinikos, [3]Department of Mathematical Statistics, Faculty of Fundamental Sciences, Vilnius Gediminas Technical University, [4]Department of Neurology, Lithuanian University of Health Sciences, Lithuania*

***Key words:*** *treatment; benign childhood epilepsy with centrotemporal spikes; epilepsy; behavioral problems; seizures.*

***Summary.*** *The aim of this study was to investigate behavioral problems in two groups of children with benign childhood epilepsy with centrotemporal spikes (BECTS), i.e., those treated with antiepileptic drugs and those not treated in order to identify the factors associated with behavioral problems.*

*Material and Methods. In total, 20 newly diagnosed untreated, 23 treated patients with BECTS, and 20 patients with acute/subacute peripheral nervous system disorders as a comparison group (aged 6–11 years) were examined. The evaluation was performed using the Lithuanian version of the Child Behavior Checklist (CBCL). Schooling parameters, clinical parameters, EEG parameters, and their relation to the results of the CBCL were also investigated.*

*Results. The treated patients with BECTS had significantly higher scores in the subscales of Social Problems, Anxious/Depressed, Aggressive Behavior, and Attention Problems compared with the scores of the patients with peripheral nervous system disorders. A significant relationship was established between the scores of native language grades and Attention Problems; grades in mathematics and treatment duration; and age when the first seizure occurred and Delinquent Behavior in the group of treated patients. The duration of epilepsy was positively correlated with the scores in the subscales of Withdrawn and Delinquent Behavior. The presence of additional extrarolandic focus and spread of focal specific discharges to the centrofrontotemporal and centroparietotemporal areas were related to higher scores in Social Problems, Attention Problems, and Delinquent Behavior in the group of the treated patients with BECTS.*

*Conclusions. Children with BECTS, especially those treated and with a longer epilepsy course, were found to be at risk of behavioral problems. Lower grades were associated with a longer disease course and medications. The presence of extrarolandic discharges was related to higher CBCL scores in the group of the treated patients with BECTS.*

## Introduction

Benign childhood epilepsy with centrotemporal spikes (BECTS) is the most common focal-onset epilepsy in childhood. It is characterized by brief, simple, partial orofacial motor and/or sensory seizures with or without secondary generalization. Seizures more often occur during sleep or upon awakening. Seizure frequency is usually low. The interictal electroencephalogram (EEG) usually shows centrotemporal spikes (other brain regions may also be involved) often followed by slow waves. Spikes are activated by sleep and tend to shift from side to side. The age at onset ranges from 1 to 14 years with the peak being at 7 to 10 years. The remission of seizures occurs before the age of 16 to 18 years in most patients (1, 2).

The term "benign" refers to a very good prognosis of the disorder regarding seizure control and long-term seizure and developmental outcome (3). However, patients with BECTS may develop cognitive and behavioral problems. Recent studies have raised the issue of subtle neurocognitive deficit, reading disability, speech sound disorder, and behavioral comorbidity in patients with benign epilepsy (4–9).

The aims and objectives of this study were as follows: 1) to investigate behavioral problems in treated and untreated children with BECTS and to compare the obtained results with the data of patients with peripheral nervous system disorders (PNSD); and 2) to estimate the relationship between age when the first seizure occurred, duration of epilepsy, duration of treatment, seizure frequency, seizure severity, EEG spiking parameters, schooling parameters, and behavioral problems.

Correspondence to R. Samaitienė, Children's Neurology Department, Children's Hospital, Affiliate of Vilnius University Hospital Santariškių Klinikos, Santariškių 4, 08406 Vilnius, Lithuania. E-mail: ruta.samaitiene@vuvl.lt

## Material and Methods

*Subjects.* For the purposes of research, 43 BECTS patients (20 girls and 23 boys) aged 6 to 11 years were included in this study. The study population comprised consecutive patients followed up at the Children's Neurology Department, Children's Hospital, Affiliate of Vilnius University Hospital Santariškių Klinikos, during 2010–2011. The diagnosis of BECTS was made according to the criteria of the International League Against Epilepsy (1989). The inclusion criteria were as follows: age 6–11 years; children attending normal schools; BECTS diagnosis based on clinical and EEG criteria; specific EEG characteristics observed at any time before the study or during the study period (2); no diagnosis of any other neurological or psychiatric disorders or somatic disorders; and no evidence of organic brain damage on clinical or structural brain imaging grounds. The diagnosis of attention deficit and hyperactivity disorder (ADHD) and inclusion in a full-time special education program were the exclusion criteria. Patients with a modified/adapted curriculum were included in the study. Patients with atypical BECTS and continuous spikes and waves during slow wave sleep were excluded from the study. The duration of epilepsy was calculated as the period from the first recognized unprovoked seizure until the beginning of the study.

According to the treatment and time of diagnosis, the patients with BECTS were divided into the group of the patients with newly diagnosed and previously untreated BECTS (BECTS-N) and the group of the patients with BECTS who were previously diagnosed and treated with antiepileptic drugs (BECTS-T). In total, 20 newly diagnosed untreated patients and 23 treated patients were included in the study.

The duration of treatment was not shorter than 3 months. All the patients in the BECTS-T group were treated with sufficient doses of an antiepileptic medication. All the treated patients were given monotherapy during the study. Table 1 shows the demographic, clinical, and EEG data of both study groups.

The comparison group consisted of 20 consecutive patients (9 girls and 11 boys) aged 6 to 11 years referred to our Children's Neurology Department due to acute/subacute peripheral nervous system diseases (PNSD patients). These patients met all the inclusion criteria except for epilepsy, which was not observed at any time of their lives.

*Ethics.* The study was approved by the Vilnius Regional Ethics Committee for Biomedical Research. All the parents gave written informed consent for the assessment. All the participants obtained information regarding the study.

*Methods.* The Lithuanian version of the Child Behavior Checklist was given to the parents of the

*Table 1.* Demographic, Clinical, and EEG Characteristics and Medications

| Characteristic | BECTS-N N=20 | BECTS-T N=23 |
|---|---|---|
| Demographic characteristic | | |
| Age, mean (SD), years | 8.3 (1.1) | 9.1 (1.7) |
| Boys, n (%) | 10 (50) | 13 (56.5) |
| Girls, n (%) | 10 (50) | 10 (43.5) |
| Clinical characteristic | | |
| Age when the first seizure occurred, mean (SD), years | 6.6 (1.6) | 6.7 (1.9) |
| Duration of epilepsy, mean (SD), months | 13.3 (16.8) | 27.6 (20.4) |
| Hague Seizure Severity Scale, mean (SD), score | 37.5 (5.7) | 39.5 (6.3) |
| Seizure frequency scale, mean (SD), score | 5.1 (1.0) | 5.0 (0.9) |
| Mainstream education, n (%) | 20 (100) | 18 (78.3) |
| Modified native language learning program, n (%) | – | 2 (8.7) |
| Adapted curriculum, n (%) | – | 2 (8.7) |
| Modified curriculum, n (%) | – | 1 (4.3) |
| Seizure characteristic | | |
| Focal seizures, nocturnal with/without generalization, n (%) | 17 (85) | 19 (82.6) |
| Diurnal focal seizures, with/without generalization, n (%) | 1 (5) | 2 (8.7) |
| Seizures with Todd's paresis, n (%) | 1 (5) | – |
| Prolonged seizures, n (%) | 1 (5) | 2 (8.7) |
| Medication | | |
| Monotherapy, n (%) | – | 14 (60.9) |
| Sequential monotherapy (>1 drug tried), n (%) | – | 9 (39.1) |
| EEG characteristic | | |
| Focal specific discharges CT only, n (%) | 18 (90) | 15 (65.2) |
| Focal specific discharges CT-CFT, n (%) | 1 (5) | 4 (17.4) |
| Focal specific discharges CT-CPT, n (%) | 1 (5) | 1 (4.3) |
| Additional extrarolandic focus (frontal spikes), n (%) | – | 3 (13.0) |
| Focal specific discharges and occasional sharp waves diffusing to one/both hemispheres, being present any time before the study or at the study period, n (%) | – | 2 (8.7) |
| Spike ratio per minute during wakefulness, mean (SD) | 11.1 (12.8) | 10.7 (15.1) |
| Spike ratio per minute during stage 1–2 slow wave sleep, mean (SD) | 27.3 (18.5) | 40.0 (26.6) |

BECTS, benign epilepsy with centrotemporal spikes; BECTS-T, treated patients; BECTS-N, untreated patients.

children with BECTS and PNSD patients who met the study inclusion criteria (Child Behavior Checklist, CBCL6/18, Achenbach and Resorla, 2001). The questionnaire used consisted of 112 items intended to assess the child's behavioral problems in the past 6 months, each of which was measured by means of a 3-point scale: 0, not true; 1, somewhat or sometimes true; and 2, very much true or often true. Achenbach (10) constructed 8 cross-informant narrow-band syndromes, labeled Anxious/Depressed, Withdrawn, Somatic Complaints, Social Problems, Thought Problems, Attention Problems, Delinquent Behavior, and Aggressive Behavior. Good reliability and discriminative validity established by Achenbach were confirmed for the Lithuanian version of the CBCL, supporting the cross-cultural validity of the instrument (11–13).

We also inquired about the duration of epilepsy, age when the first seizure occurred, seizure frequency, and seizure severity in children with BECTS. Seizure severity was estimated by using the Hague Seizure Severity Scale (14, 15). Seizure frequency during the last year was assessed by using a 1–6 point scale: 1, seizures recurring on a daily basis; 2, seizures recurring 3–5 times per week; 3, seizures recurring 1–2 times per week; 4, seizures recurring 1–2 times per month; 5, seizures recurring 1–2 times per year; and 6, seizures do not recur.

The schooling (the grade in native language of the last trimester and the grade in mathematics) was evaluated in 17 patients in the BECTS-N group, 15 patients in the BECTS-T group, and 18 patients in the PNSD group. The schooling was not evaluated in 8 children who were not enrolled in school yet: 2 patients in the PNSD group, 3 patients in the group of the untreated patients, and 3 patients in the group of the treated patients. The schooling was also not evaluated in 5 patients with underachievement and a modified/adapted curriculum in the group of the treated patients with BECTS (2 patients were educated according to a modified native language learning program, 1 patient according to a modified curriculum, and 2 patients had an adapted curriculum).

EEG was performed according to the 10–20 international system (Galileo NT Software). The EEG recordings in the BECTS group were carried out while the patients were awake and during the stages 1-2 of slow wave sleep. In the PNSD group, the EEG was performed mainly during the awake state and in some patients also during the stages 1–2 of slow wave sleep. The following EEG parameters were evaluated: spike localization, and spike index (number of spikes per minute) during the stages 1 and 2 of slow wave sleep and during wakefulness. The EEG recordings were analyzed manually.

*Statistical Analysis.* The statistical data processing was performed using SPSS 17.0 program. The data of different groups were compared using parametric and nonparametric statistical tests. For the numeric data satisfying the condition of normal distribution, the Student *t* test was performed, while the other groups of the data were compared using the Mann-Whitney *U*, Kruskal-Wallis, and other nonparametric tests. The correlation was evaluated using Pearson and Kendall $\tau$ coefficients. For statistical analysis, a *P* value of $<0.05$ was defined as statistically significant.

## Results

*Baseline Data.* The mean age of the untreated patients with BECTS was 8.3 years (SD, 1.1; median, 8.3; interquartile range [IQR], 1.6), and that of the treated ones was 9.1 years (SD, 1.7; median, 9.3; IQR, 2.4). There were 10 boys (50%) and 10 girls (50%) in the group of the untreated children with BECTS and 13 boys (57%) and 10 girls (43%) in the group of the treated children with BECTS.

The mean age of PNSD patients was 9.0 years (SD, 1.8; median 8.9; IQR, 3.2). There were 9 girls (45%) and 11 boys (55%) in the PNSD group. There were no significant age and gender differences between the groups of the untreated children and the PNSD patients, the treated children and the PNSD patients (age: 8.3 vs. 8.9, $P=0.148$, and 9.1 vs. 8.9, $P=0.779$, Student *t* test; gender: 50% girls vs. 50% boys and 45% girls vs. 55% boys, $P=0.755$, and 43.5% girls vs. 56.5% boys and 45% girls vs. 55% boys, $P=0.921$, Mann-Whitney *U* test).

The duration of epilepsy in the untreated patients with BECTS was 0.1–75 months (0.1–17 months in 16 patients and 18–75 months in 4 patients). The duration of epilepsy in the treated patients with BECTS was 4–87 months (4–17 months in 9 patients and 18–87 months in 14 patients).

The duration of treatment was 3–62 months (mean, 19.2; SD, 16.8; median, 13; IQR, 15). Nine patients (39.1%) received sequential monotherapy (>1 drug tried) because of recurring seizures. Medications used during the study period were as follows: 7 patients were treated with valproate, 11 with oxcarbazepine, and 5 with sulthiame.

Table 1 shows the demographic, clinical, and EEG data in both groups of the patients with BECTS. The PNSD patients had normal findings on EEG.

*Behavioral Profile.* The treated children with BECTS had significantly higher scores in the CBCL subscales of Anxious/Depressed (6.8 [SD, 3.3] vs. 4.0 [SD, 2.7]; $P=0.007$, Mann-Whitney *U* test), Social Problems (5.3 [SD, 3.4] vs. 3.1 [SD, 2.3]; $P=0.043$, Mann-Whitney *U* test), Attention Problems (7.6 [SD, 3.5] vs. 4.3 [SD, 3.1]; $P=0.003$, Mann-Whitney *U* test), and Aggressive Behavior (9.9 [SD, 5.6] vs. 5.3 [SD, 4.0]; $P=0.007$, Mann-

Whitney *U* test) as compared with the PNSD patients. The newly diagnosed untreated children with BECTS had higher scores in most subscales of the CBCL except in the Withdrawn and Somatic Complaints subscales in comparison with the PNSD patients, but the difference did not reach statistical significance (Table 2).

*Schooling Profile.* The treated children with BECTS (15 patients) had lower grades in mathematics as compared with the PNSD patients (18 patients) (8.3 [SD, 1.6] vs. 9.4 [SD, 1.0]; $P$=0.048, Mann-Whitney *U* test). The untreated patients with BECTS (17 patients) had lower grades in mathematics as compared with the PNSD patients (8.3 [SD, 1.3] vs. 9.4 [SD, 1.0]; $P$=0.013, Mann-Whitney *U* test). The schooling data of all the study groups are shown in Table 3.

*Correlations.* There was a significant relationship established between the grades in native language and the scores of Attention Problems in the group of the treated patients with BECTS. There were higher scores in the subscale of Attention Problems and lower grades in native language (Pearson, $r$=–0.560, $P$=0.03). In the group of the treated patients with BECTS, a relationship between the grades in mathematics and the duration of treatment was established. The longer the treatment, the lower the mathematics grades (Pearson, $r$=–0.581, $P$=0.023). The earlier the beginning of seizures of the BECTS-T patients, the greater the scores in the subscale of Delinquent Behavior (Pearson, $r$=–0.308, $P$=0.047).

The duration of epilepsy positively correlated with the scores in the Withdrawn (Pearson, $r$=0.355, $P$=0.019) and Delinquent Behavior subscales (Pearson, $r$=0.304, $P$=0.048) in the overall group of the patients with BECTS. The duration of epilepsy negatively correlated with mathematics grades (Pearson, $r$=–0.367, $P$=0.039) in the overall group of the patients with BECTS.

No significant relationships between the seizure frequency during the last year, seizure severity (Hague Scale), and behavioral problems were found in both groups of the treated and untreated patients.

*EEG Parameters.* All the patients had a normal EEG background activity. The presence of additional extrarolandic focus (frontal discharges additionally to centrotemporal discharges) and focal specific discharges spreading to the centrotemporal-centrofrontotemporal (CT-CFT) and centrotemporal-centroparietotemporal areas (CT-CPT) were related to higher scores in the subscales of Social Problems, Attention Problems, and Delinquent Behavior in the group of the treated patients with BECTS (Pearson, $r$=0.421, $P$=0.018; $r$=0.543, $P$=0.002; $r$=0.361, $P$=0.04).

No significant relationships between the spike ratio per minute during sleep, spike ratio per minute during wakefulness, and behavioral problems were found in both groups of the treated and untreated patients.

*Table 2.* Scores of Child Behavior Checklist Behavioral Problems

| CBCL Subscale | PNSD Patients (N=20) | BECTS-N (N=20) | BECTS-T (N=23) |
|---|---|---|---|
| Anxious/Depressed | 4.0 (2.7) | 5.0 (2.9) | 6.8 (3.3)* |
| Withdrawn | 2.6 (2.2) | 1.6 (1.7) | 3.7 (2.5) |
| Somatic Complaints | 3.5 (3.7) | 2.4 (2.4) | 4.2 (2.9) |
| Social Problems | 3.1 (2.3) | 3.9 (3.2) | 5.3 (3.4)* |
| Thought Problems | 1.8 (1.7) | 2.6 (2.0) | 4.3 (7.0) |
| Attention Problems | 4.3 (3.1) | 5.7 (3.0) | 7.6 (3.5)* |
| Delinquent Behavior | 2.1 (2.4) | 2.5 (1.8) | 3.1 (2.3) |
| Aggressive Behavior | 5.3 (4.0) | 6.8 (4.6) | 9.9 (5.6)* |

Values are mean (standard deviation).
CBCL, Child Behavior Checklist; PNSD, peripheral nervous system diseases; BECTS, benign epilepsy with centrotemporal spikes; BECTS-T, treated patients; BECTS-N, untreated patients.
*$P$<0.05 compared with PNSD patients (Mann-Whitney *U* test).

*Table 3.* Schooling Data

| Grade | PNSD Patients (N=18) | BECTS-N (N=17) | BECTS-T (N=15) |
|---|---|---|---|
| Math grade | 9.4 (1.0) | 8.3 (1.3)* | 8.3 (1.6)* |
| Native language grade | 9.1 (1.1) | 8.1 (1.4) | 8.3 (1.5) |

Values are mean (standard deviation).
PNSD, peripheral nervous system diseases; BECTS, benign epilepsy with centrotemporal spikes; BECTS-T, treated patients; BECTS-N, untreated patients.
*$P$<0.05 compared with PNSD patients (Mann-Whitney *U* test).

## Discussion

The current study revealed that the newly diagnosed untreated children with BECTS had higher scores in most subscales, except for Withdrawn and Somatic Complaints, compared with the PNSD patients, but without a statistical significance. This group was dominated by the patients with a short duration of epilepsy. Austin et al. in a sample of 224 children with the first recognized seizure found higher CBCL scores for behavioral problems compared with the controls with 32.1% being in the clinical or at-risk range. They found that children with seizures had significantly higher scores in the subscales of Attention Problems, Thought Problems, and Somatic Complaints compared with their nearest-in-age healthy siblings (16). In the longitudinal study of the same sample of 224 children with the first recognized seizure, Austin et al. found that recurrent seizures significantly predicted behavioral problems very early in the course of a seizure condition (17). The findings of Bhise et al. showed abnormalities in the domains of verbal intelligence, memory, motor skill, attention, and parent-identified behavioral issues in children with normal IQ

and with new-onset idiopathic epilepsies (18). In the study of 53 patients with recent-onset idiopathic epilepsies, Jones et al. found that 45.3% of the children met the criteria for a DSM-IV Axis I disorder before the diagnosis of epilepsy and the first recognized seizure (19). However, the aforementioned studies analyzed patients with new-onset seizures and new-onset idiopathic epilepsies, but were not restricted to patients with BECTS. Our findings showed that behavioral problems in the patients with BECTS in the early course of the disease were not as obvious as in other forms of epilepsy.

In our study, significantly higher scores in the subscales of behavioral problems in the cohort of the treated patients with BECTS compared with the scores of the patients with PNSD were found. This group was dominated by the patients with epilepsy of longer duration than 24 months. Persistent or growing behavioral problems in children with epilepsy over time have been shown in other studies. Oostrom et al. reported behavioral problems in children with new-onset epilepsy persisting at 3.5 years of follow-up (20). In the study by Austin et al., it was found that behavioral problems in girls with high seizure severity became substantially worse over the 4-year period (21). Hamiwka et al. summarized the data of long-term follow-up studies of children with epilepsy and concluded that behavioral and emotional problems did not disappear with age (22). Plioplys et al. concluded that attention, internalizing, and thought problems might be specific to epilepsy, but association of epilepsy-related variables, including antiepileptic drugs, with psychopathology was inconsistent in cognitively normal children with epilepsy (23). The findings of the present study related to higher scores for Social Problems, Anxious/Depressed, Aggressive Behavior, and Attention Problems in the group of the treated patients comply with findings in other studies. There was a complex association of epilepsy-related variables, including antiepileptic drugs, which could contribute to significantly higher scores for behavioral problems, found in the group of the treated patients with BECTS.

The influence of antiepileptic medication on cognition was studied by many authors. Worsening of reaction time and reaction time variability in the group of patients with focal seizure, treated with carbamazepine, were found in the longitudinal study of Mandelbaum et al. (24). Wesnes et al. confirmed the deterioration of information processing speed and attention after the treatment with carbamazepine in an international trial of 282 patients with newly diagnosed epilepsy, aged 12–75 years, comparing remacemide hydrochloride with carbamazepine (25). Piccinelli et al. demonstrated attention deficit at onset of the treatment with valproate or carbamazepine and after 12 months of therapy in the study of 43 children with idiopathic epilepsy. This attention deficit worsened after 12 months (26). Eddy et al. in the review of an cognitive impact of antiepileptic drugs in patients with epilepsy summarized that carbamazepine could lead to mild, but sometimes significant difficulties relating to motor speed and performance on attention-demanding tasks; minimal difficulties were also likely with low doses of sodium valproate. Topiramate was found to be associated with more consistent evidence of detrimental influences on cognition. Most studies have indicated no deterioration in learning memory or attention in patients treated with oxcarbazepine, and most consistent evidence of positive effects on cognition was in cases of treatment with levetiracetam (27). Donati et al. assessed mental information processing speed and attention in the multicenter, open-label, randomized, active-control, parallel-group study of 99 patients with newly diagnosed partial seizures treated with oxcarbazepine versus carbamazepine/valproate during 6 months and found an improvement in mental processing speed and no cognitive impairment in any treatment group. There were no statistically significant differences between oxcarbazepine and carbamazepine/valproate groups (28).

It is known that acquired cognitive changes can be found in the active phase of BECTS. In the longitudinal study of 9 patients with BECTS, Baglietto et al. found visuospatial short-term memory, attention, cognitive flexibility, picture naming, and fluency, visuoperceptual skill, and visuomotor coordination disorders. When these patients were evaluated after 2 years at the time of epileptic discharge remission, their performance did not differ from the controls (29). These cognitive changes during the active phase of epilepsy and also the impact of medication on cognition could both affect the behavior of a child. In our study, the duration of epilepsy positively correlated with the scores in the subscales of Withdrawn and Delinquent Behavior in the overall group of the patients with BECTS. The present study adds more evidence that a longer course of epilepsy is related to behavioral problems.

In our study, lower grades in mathematics in the group of the untreated children with BECTS were observed. These findings support the hypothesis of the impact of the active phase of epilepsy on cognition. Bhise et al. found evidence for an intrinsic weakness in attention associated with epilepsy (18). Kavros et al. in a systematic review of attention impairment in BECTS reported that attention systems were impaired in children with active centrotemporal spikes, but these impairments resolved on EEG remission (4). Our data showed that lower grades could be associated with attention problems and medication, i.e., we found lower grades in mathematics and the relationship between the grades in

mathematics and duration of the treatment as well as between the grades in native language and attention problems (BECTS-T group). The duration of epilepsy negatively correlated with the grades in mathematics in the overall group of the patients with BECTS.

Our study showed that the presence of additional extrarolandic focus (frontal area) and focal specific discharges spreading to the CT-CFT and CT-CPT areas were related to higher scores for Social Problems, Attention Problems, and Delinquent Behavior in the group of the treated patients with BECTS. In the review of cognitive and behavioral effects of nocturnal epileptiform discharges in children with BECTS, Nicolai et al. summarized that cognitive and behavioral problems were strongly related to the occurrence of specific atypical EEG characteristics (nondipole spike; intermittent slow wave focus; multiple asynchronous spike-wave foci; long spike-wave clusters; 3-Hz spike-wave discharges; abundance of interictal abnormalities in the awake state or sleep; atonia, myoclonia, or brief alteration of consciousness related to EEG discharges; and strong activation of interictal spikes during sleep). Patients with discharges and temporal-frontal dipole had fewer cognitive problems compared with patients with focal central, temporal, or centrotemporal discharges (5).

The findings of the current study indicated that behavioral problems in children with BECTS were not related to the seizure severity, seizure frequency during the last year, and spike frequency. However, it was found that the earlier the beginning of seizures in BECTS-T patients was, the greater the scores for Delinquent Behavior were.

## Conclusions

Children with BECTS, especially those treated and with a longer epilepsy course, had an increased risk of behavioral problems: social problems, attention problems, anxious/depressed, and aggressive behavior. The finding of lower grades in the group of the untreated children with BECTS supports the hypothesis that the active phase of epilepsy has an impact on cognition. The data of the current study also showed that lower grades could be associated with attention problems and medication in the treated patients with BECTS. A longer disease course was related to lower grades in mathematics in the overall group of the patients with BECTS. The presence of extrarolandic discharges was related to higher CBCL scores in the group of the treated patients with BECTS.

Based on our results and the data of other authors, conclusion can be drawn that comorbidity of epilepsy and behavioral problems exists, but the impact of antiepileptic medication could not be excluded. Our findings alert clinicians to the possibility of behavioral problems and highlight that attention to behavioral problems is important in clinical management of children with BECTS.

However, future studies, especially the longitudinal ones, are needed to evaluate deeper behavioral problems and associated factors in children with BECTS and to elucidate the influence of the disease and treatment on them.

## Acknowledgments

We are grateful to all the children and their parents who participated in our study. We also thank the staff of Children's Neurology Department, Children's Hospital, Affiliate of Vilnius University Hospital Santariškių Klinikos, and the EEG team for their contribution to the data collection.

## Statement of Conflicts of Interest

The authors state no conflict of interest.

## References

1. Panayiotopoulos CP, Michael M, Sanders S, Valeta T, Koutroumanidis M. Benign childhood focal epilepsies: assessment of established and newly recognized syndromes. Brain 2008;131:2264-86.
2. Proposal for revised classification of epilepsies and epileptic syndromes. Commission on Classification and Terminology of the International League Against Epilepsy. Epilepsia 1989;30:389-99.
3. Callenbach PM, Bouma PA, Geerts AT, Arts WF, Stroink H, Peeters EA, et al. Long term outcome of benign childhood epilepsy with centrotemporal spikes: Dutch Study of Epilepsy in Childhood. Seizure 2010;19:501-6.
4. Kavros PM, Clarke T, Strug LJ, Halperin JM, Dorta NJ, Pal DK. Attention impairment in rolandic epilepsy: systematic review. Epilepsia 2008;49:1570-80.
5. Nicolai J, van der Linden I, Arends JB, van Mil SG, Weber J W, Vles JS, et al. EEG characteristics related to educational impairments in children with benign childhood epilepsy with centrotemporal spikes. Epilepsia 2007;48:2093-100.
6. Nicolai J, Aldenkamp AP, Arends J, Weber JW, Vles JS. Cognitive and behavioral effects of nocturnal epileptiform discharges in children with benign childhood epilepsy with centrotemporal spikes. Epilepsy Behav 2006;8:56-70.
7. Chan SC, Lee WT. Benign epilepsy in children. J Formos Med Assoc 2011;110:134-44.
8. Vinayan KP, Biji V, Thomas SV. Educational problems with underlying neuropsychological impairment are common in children with Benign Epilepsy of Childhood with Centrotemporal Spikes (BECTS). Seizure 2005;14:207-12.
9. Clarke T, Baskurt Z, Strug LJ, Pal DK. High risk of reading disability and speech sound disorder in rolandic epilepsy families: case-control study. Epilepsia 2007;48:2258-65.
10. Achenbach TM. Manual for the Child Behavior Checklist/4–18 and 1991 profile. Burlington: Department of Psychiatry, University of Vermont, VT; 1991.
11. Žukauskienė R, Ignatavičienė K. Kai kurie lietuviškos CBCL 4/18 versijos psichometriniai rodikliai. (Lithuanian version of CBCL4/18: some psychometric properties.)

Psichologija 2001;24:38-47.
12. Zukauskiene R, Ignataviciene K, Daukantaite D. Subscales scores of the Lithuanian version of CBCL – preliminary data on the emotional and behavioural problems in childhood and adolescence. Eur Child Adolesc Psychiatry 2003;12:136-43.
13. Žukauskienė R, Kajokienė I. CBCL, TRF ir YSR metodikų standartizavimas naudojant 6-18 metų Lietuvos vaikų imties duomenis. (Standardization of CBCL, TRF and YSR in a sample of 6-18-year-old Lithuanian children.) Psichologija 2006;33:33-45.
14. Carpay JA, Vermuelen J, Stroink H, Brouwer OF, Peters AC, Aldenkamp AP, et al. Seizure severity in children with epilepsy: a parent-completed scale compared with clinical data. Epilepsia 1997;38:346-52.
15. Cramer JA, French J. Quantitative assessment of seizure severity for clinical trials: a review of approaches to seizure components. Epilepsia 2001;42:119-29.
16. Austin JK, Harezlak J, Dunn DW, Huster GA, Rose DF, Ambrosius WT. Behavior problems in children before first recognized seizures. Pediatrics 2001;107:115-22.
17. Austin JK, Dunn DW, Caffrey HM, Perkins SM, Harezlak J, Rose DF. Recurrent seizures and behavior problems in children with first recognized seizures: a prospective study. Epilepsia 2002;43:1564-73.
18. Bhise VV, Burack GD, Mandelbaum DE. Baseline cognition, behavior, and motor skills in children with new-onset, idiopathic epilepsy. Dev Med Child Neurol 2010;52:22-6.
19. Jones JE, Watson R, Sheth R, Caplan R, Koehn M, Seidenberg M, et al. Psychiatric comorbidity in children with new onset epilepsy. Dev Med Child Neurol 2007;49:493-7.
20. Oostrom KJ, van Teeseling H, Smeets-Schouten A, Peters AC, Jennekens-Schinkel A, et al. Three to four years after diagnosis: cognition and behaviour in children with 'epilepsy only'. A prospective, controlled study. Brain 2005;128:1546-55.
21. Austin JK, Dunn DW, Huster GA. Childhood epilepsy and asthma: changes in behavior problems related to gender and change in condition severity. Epilepsia 2000;41:615-23.
22. Hamiwka L, Jones JE, Salpekar J, Caplan R. Child psychiatry. Epilepsy Behav 2011;22:38-46.
23. Plioplys S, Dunn DW, Caplan R. 10-year research update review: psychiatric problems in children with epilepsy. J Am Acad Child Adolesc Psychiatry 2007;46:1389-402.
24. Mandelbaum DE, Burack GD, Bhise VV. Impact of antiepileptic drugs on cognition, behavior, and motor skills in children with new-onset, idiopathic epilepsy. Epilepsy Behav 2009;16:341-4.
25. Wesnes KA, Edgar C, Dean AD, Wroe SJ. The cognitive and psychomotor effects of remacemide and carbamazepine in newly diagnosed epilepsy. Epilepsy Behav 2009;14:522-8.
26. Piccinelli P, Beghi E, Borgatti R, Ferri M, Giordano L, Romeo A, et al. Neuropsychological and behavioural aspects in children and adolescents with idiopathic epilepsy at diagnosis and after 12 months of treatment. Seizure 2010;19:540-6.
27. Eddy CM, Rickards HE, Cavanna AE. The cognitive impact of antiepileptic drugs. Ther Adv Neurol Disord 2011;4:385-407.
28. Donati F, Gobbi G, Campistol J, Rapatz G, Daehler M, Sturm Y, et al. The cognitive effects of oxcarbazepine versus carbamazepine or valproate in newly diagnosed children with partial seizures. Seizure 2007;16:670-9.
29. Baglietto MG, Battaglia FM, Nobili L, Tortorelli S, De Negri E, Calevo MG, et al. Neuropsychological disorders related to interictal epileptic discharges during sleep in benign epilepsy of childhood with centrotemporal or Rolandic spikes. Dev Med Child Neurol 2001;43:407-12.

*Received 15 September 2011, accepted 24 July 2012*