

Behavioral problems in children with epilepsy

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Abstract

Background Epilepsy is a neurological disorder that most often affects children. Most cases of epilepsy are found in developing countries. Children with epilepsy are at risk of behavioral disorders that can affect their quality of life. Studies on behavioral problems in children with epilepsy have been limited in Indonesia.

Objective To compare behavioral disorders in children with epilepsy to those in normal children, and to assess for possible factors associated with the occurrence of behavioral disorders.

Methods We conducted a cross-sectional study involving 47 children with epilepsy and 46 children without epilepsy, aged 3-16 years. Behavioral problems were screened with the *Strength and Difficulty Questionnaire* (SDQ), Indonesian version. Information about EEG description, medication, onset, and duration of epilepsy were obtained from medical records.

Results Behavioral problems were found in 19.1% of children with epilepsy and only in 2.2 % of children without epilepsy (PR 8.8; 95%CI 1.16 to 66.77; P= 0.015). Significant differences were also found in the percentage of conduct problems and emotional disorders. Multivariate analysis with logistic regression revealed that the factors associated with behavioral disorders in children with epilepsy were uncontrolled epilepsy (PR 13.9; 95%CI 1.45 to 132.4; P=0.023) and focal EEG appearance (PR 19; 95%CI 1.71 to 214.43; P=0.017). We also found that uncontrolled epilepsy was a factor related to emotional (PR 6.7; 95%CI 1.66 to 26.76; P=0.007) and conduct problems (PR 6.1; 95%CI 1.35 to 27.29; P=0.019).

Conclusion Uncontrolled epilepsy and focal EEG results are factors associated with increased risk of behavioral problems in children with epilepsy. Children with epilepsy should undergo behavioral disorder screening, followed by diagnosis confirmation and treatment. [Paediatr Indones. 2014;54:324-9].

Keywords: epilepsy, behavioral problems, SDQ, risk factors

Children with epilepsy are at greater risk of psychiatric and behavioral disorders, such as attention deficit/hyperactivity disorder (AD/HD), conduct disorder, autism spectrum disorder (ASD), as well as affective and aggressive disorders that affect their quality of life.¹⁻³ Children with seizures have a 4.7 times higher risk of behavioral problems than those without seizures.⁴ The prevalences of behavioral disorders in childhood epilepsy were 54% in Thailand in 2007 and 52.8% in India in 2004.^{5,6}

Causes of behavioral disorders in epilepsy are multifactorial, involving both neurobiologic and psychosocial factors. The neurobiologic factors may include age at onset, duration of illness, frequency and severity of seizures, type of the seizures, as well as the type and number of anti-epileptic drugs taken. The contributing psychosocial factors may include the stigma attached to having epilepsy, low adaptation to the illness, financial stress, family and parent dynamics, as well as children's characteristics, such as basic temperament and intelligence level.⁷

There have been few studies on behavioral

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disorders in childhood epilepsy in Indonesia.⁸ A study found that although 60% of epileptic children were diagnosed with psychiatric and behavior disorders, only 33% of them had a history of receiving mental health services before the study.⁹ As such, screening for behavioral problems followed by diagnosis and treatment needs to be performed in all children with epilepsy.

The aim of this study was to compare behavioral disorders in children with epilepsy to those in normal children, and to assess for possible factors associated with the occurrence of behavioral disorders.

Methods

We conducted a cross-sectional study at the Pediatric Outpatient Clinic of Dr. Sardjito Hospital, Yogyakarta from June to July 2013. Subjects consisted of 2 groups: children with and without epilepsy. Using a power of 80%, $Z\alpha$: 1.96, $Z\beta$: 0.842, and proportion of effect in the epilepsy group of 0.24¹⁰, the minimum required sample size for each group was 46 subjects.

Inclusion criteria for the epilepsy group were children aged 3 to 16 years who had been diagnosed with epilepsy and treated in the Pediatric Neurology Clinic at DR. Sardjito Hospital. The inclusion criteria for the non-epilepsy group were children aged 3 to 16 years who did not have epilepsy, a history of febrile seizures or other chronic diseases. Diagnosis of epilepsy was established by history of seizures without provocation or more than once fever supported by EEG examination. For both groups, parents consented to participate in this study by signing a proxy consent. Exclusion criteria for both groups were children with severe physical or mental disabilities (e.g., unable to walk without the aid of tools or unable to communicate), had been previously diagnosed with AD/HD, autism, or other psychiatric disorders, had other chronic diseases or did not live with their parents. This study was approved by the Medical and Health Research Ethics Committee of the Gadjah Mada University Medical School.

Behavioral problems were assessed using SDQ Indonesian version that had been validated and may be downloaded at www.sdqinfo.com. The SDQ was divided into two sections: one completed by parents/teachers for children aged 3 to 10 years, and one

completed by the children themselves for those aged 11 to 16 years. The questionnaires contained identity information and statements about the behavior of children to be answered as untrue, somewhat true or true. Secondary data, such as number of anti-epileptic drugs (AEDs) and EEG descriptions were taken from medical records. Completeness of the data was examined by the researcher.

The primary outcome was the occurrence of behavioral disorders as measured by the SDQ for both groups. The independent variable was epilepsy; the dependent variable was behavioral disorders based on SDQ scores. External variables studied were age, gender, maternal education, age at onset of epilepsy, duration of epilepsy, type of epilepsy (controlled vs. uncontrolled epilepsy), the number of AEDs, and EEG description. Behavioral disorders were based on SDQ results, in terms of total and subset scores. The SDQ score consisted of 6 subsets of behavior assessment: total difficulties, hyperactivity, conduct problems, emotional problems, peer problems, and prosocial scores. Behavioral disorders in this study were determined based on the results of the examination using SDQ in terms of the total score and were considered to be abnormal for total difficulty scores of 17 to 40 for children aged 3-10 years, and scores of 20 to 40 for children aged 11-16 years. The hyperactivity subset was considered abnormal for scores of 7 to 10 for all groups of age. The conduct problems subset was considered abnormal for scores of 4 to 10 for children aged 3-10 years, and 5 to 10 for children aged 11-16 years. The emotional problems subset was considered abnormal for scores of 5 to 10 for children aged 3-10 years, and 7 to 10 for children aged 11-16 years. The peer problem subset was considered abnormal for scores of 4 to 10 for children aged 3-10 years, and 6 to 10 for children aged 11-16 years. Prosocial behavior was considered to be abnormal for scores of 0 to 4 for all age groups.

Controlled epilepsy was defined as active epilepsy without seizure symptoms within the one year prior to the study period. Age at onset was defined as the child's age in years when the diagnosis of epilepsy was confirmed, and classified into two categories: <3 years and ≥ 3 years. The duration of epilepsy in years was defined as the duration between the time at diagnosis confirmation and the time of questionnaire completion, grouped into <3 years and ≥ 3 years.

The number of AEDs was defined as the number of AED types taken by the patient at the present time, and classified into monotherapy and polytherapy. The EEG description was obtained from medical records in the form of EEG examination results, and classified into focal and non-focal.

Children's ages were classified into 3-10 years and 11-16 years. Maternal educational background was defined as the level of formal education completed by the mother, and classified into low education background (elementary/junior high school) and high education background (high school/higher education).

We conducted bivariate analysis using Chi square test to compare SDQ scores between the epilepsy and non-epilepsy groups, as well as to compare SDQ

scores to each variable in the epilepsy group. Logistic regression was used to assess the most significant factors related to the occurrence of behavioral problems in children with epilepsy. Statistical significance was confirmed by P values <0.05 and 95% confidence intervals. Data were analyzed using SPSS version 17 (Chicago, IL, USA).

Results

Baseline characteristics of the children are shown in **Table 1**.

Behavioral disorders were found in 19.1% of children with epilepsy but only in 2.2% of children without epilepsy. The occurrence of total difficulties, emotional disorders and conduct problems was also significantly higher in children with epilepsy than in the non-epilepsy group (**Table 2**). However, no significant differences were observed in the other subsets of hyperactive, peer problems, or prosocial scores between the two groups.

Table 3 shows the prevalence ratios of factors associated with behavioral disorders in children with epilepsy that we obtained from bivariate analysis.

After conducting multivariate analysis using logistic regression, we found that the factors significantly associated with behavioral disorders in children with epilepsy were uncontrolled epilepsy

Table 1. Baseline characteristics of subjects in the epilepsy and non-epilepsy groups

| | Epilepsy (n=47) | Non-epilepsy (n=46) |
|---------------------------|--------------------|------------------------|
| Mean age (SD), years | 9.9 (4.21) | 7.7 (3.15) |
| Age, n (%) | | |
| 3-10 years | 26 (55) | 36 (78) |
| 11-16 years | 21 (45) | 10 (22) |
| Gender, n (%) | | |
| Female | 27 (57) | 17 (37) |
| Male | 20 (45) | 29 (63) |
| Maternal education, n (%) | | |
| Low | 16 (34) | 8 (17) |
| High | 31 (66) | 38 (83) |

Table 2. Behavioral scores classification between the epilepsy and non-epilepsy groups

| Behavioral scores | Epilepsy (n= 47) | Non-epilepsy (n= 46) | PR* | 95% CI | P value |
|---------------------------------|---------------------|-------------------------|-------|---------------|---------|
| Total difficulties score, n (%) | | | | | |
| Abnormal | 9 (19.1) | 1 (2.2) | 8.8 | 1.16 to 66.77 | 0.015 |
| Normal | 38 (80.9) | 45 (97.8) | | | |
| Hyperactive score, n (%) | | | | | |
| Abnormal | 6 (12.8) | 1 (2.2) | 5.87 | 0.74 to 46.89 | 0.111 |
| Normal | 41 (87.2) | 45 (97.8) | | | |
| Conduct problems score, n (%) | | | | | |
| Abnormal | 11 (23.4) | 1 (2.2) | 10.77 | 1.45 to 80.06 | 0.002 |
| Normal | 36 (76.6) | 45 (97.8) | | | |
| Emotional problems score, n (%) | | | | | |
| Abnormal | 14 (29.8) | 0 (0) | 2.39 | 1.85 to 3.11 | 0.000 |
| Normal | 33 (70.2) | 46 (100) | | | |
| Peer problems score, n (%) | | | | | |
| Abnormal | 5 (10.6) | 3 (6.5) | 1.63 | 0.41 to 6.44 | 0.714 |
| Normal | 42 (83.4) | 43 (94.5) | | | |
| Prosocial score, n (%) | | | | | |
| Abnormal | 2 (4.3) | 0 (0) | 0.96 | 0.9 to 1.01 | 0.495 |
| Normal | 45 (95.7) | 46 (100) | | | |

*PR=prevalence ratio

Table 3. Prevalence ratios of factors related to behavior problems in children with epilepsy

| | Total score PR (95% CI) P value | Hyperactive PR (95% CI) P value | Conduct problems PR (95% CI) P value | Emotional problems PR (95% CI) P value | Peer problems PR (95% CI) P value | Abnormal pro- social score PR (95% CI) P value |
|---------------------------------------|--|--|--|--|--|--|
| Age 3-10 years (children) | 1.01 0.31 to 3.29 0.987 | 1.73 0.33 to 7.98 0.549 | 1.57 0.48 to 4.18 0.526 | 0.74 0.34 to 1.94 0.732 | 1.24 0.22 to 6.59 1.000 | 1.10 0.92 to 1.27 0.108 |
| Male | 2.59 0.6 to 11.17 0.170 | 4.32 0.46 to 9.28 0.170 | 1.40 0.44 to 3.83 0.635 | 0.65 0.31 to 1.77 0.535 | 3.30 0.35 to 4.52 0.281 | 0.73 0.04 to 11.14 0.828 |
| Low maternal education | 0.96 0.28 to 3.37 0.950 | 0.35 0.04 to 1.39 0.336 | 0.66 0.22 to 2.37 0.588 | 0.70 0.28 to 2.08 0.606 | 0.45 0.05 to 3.98 0.483 | 1.07 0.96 to 1.17 0.299 |
| Age at onset < 3 years | 0.40 0.06 to 2.92 0.333 | 1.20 1.04 to 1.39 0.147 | 0.67 0.18 to 2.88 0.640 | 0.44 0.14 to 2.07 0.336 | 0.80 0.10 to 6.58 0.849 | 1.06 0.98 to 1.15 0.424 |
| Duration of epilepsy for ≥ 3 years | 0.65 0.19 to 2.11 0.466 | 0.35 0.08 to 1.99 0.246 | 0.96 0.34 to 2.74 0.953 | 1.11 1.35 to 10.04 1.000 | 1.24 0.22 to 6.59 0.842 | 1.08 0.96 to 1.27 0.108 |
| Uncontrolled epilepsy | 5.16* 1.19 to 2.19 0.011 | 9.64* 0.93 to 58.19 0.022 | 5.06* 1.19 to 12.94 0.013 | 6.68* 1.35 to 10.04 0.009 | 7.2 0.71 to 48.74 0.056 | 1.08 0.97 to 1.19 0.234 |
| Polytherapy | 2.86 0.92 to 8.84 0.084 | 1.17 0.16 to 8.37 0.896 | 1.38 0.34 to 2.68 0.726 | 1.98 0.58 to 4.20 0.412 | 1.5 0.18 to 10.97 0.734 | 1.05 0.97 to 1.13 0.545 |
| Focal EEG | 4.57* 1.61 to 12.95 0.006 | 3.60 0.64 to 12.75 0.174 | 0.50 0.08 to 3.79 0.537 | 4.00 0.99 to 5.28 0.173 | 4.93 0.77 to 18.85 0.095 | 6.5 0.40 to 81.12 0.154 |

* statistically significant

(PR 13.9; 95%CI 1.45 to 132.42; P= 0.023) and focal EEG (PR 19; 95%CI 1.71 to 214.43; P=0.017). In children with uncontrolled epilepsy, the prevalence of conduct problems was 6.1 times higher than in those with controlled epilepsy (PR 6.1; 95%CI 1.35 to 27.29; P=0.019). We also found that children with uncontrolled epilepsy had 6.7 times higher prevalence of emotional disorders compared to those with controlled epilepsy (95%CI 1.66 to 26.76; P=0.007).

Discussion

We found that behavioral problems were more common in children with epilepsy than in children without epilepsy (19.1% vs 2.2%, respectively). Multivariate analysis using logistic regression revealed that the factors associated with behavioral disorders in children with epilepsy were uncontrolled epilepsy and focal EEG. We also found that uncontrolled

epilepsy was a factor related to emotional and conduct problems.

A limitation of our study was that we did not use multiple informants to fill out the SDQs, which could be completed by both parents and teachers. Multiple informants would provide better SDQ sensitivity for detecting behavioral disorders in children than a single informant, either a parent or a teacher. The use of multiple informants has been shown to be a better predictor than self-completion by children.¹⁰ In addition, there is a significant association between cognitive impairment and behavioral problems. However, we did not measure IQ to analyze cognitive factors in our study. Cognitive impairment is more prevalent in children with epilepsy than normal children.¹¹ The loss of cognitive skills may manifest as behavioral problems because cognitive ability may influence learning adaptive behaviors (age-appropriate behaviors necessary for children to live independently in new situations). Cognitive impairments also apply to children with epilepsy. Furthermore, the nature of the underlying

brain disease that gives rise to epilepsy is a cause of both cognitive impairment and behavioral problems in children with epilepsy.¹²

Since our study design was cross-sectional, we were not able to infer a causal relationship between epilepsy and behavioral disorders. Psychiatric disorders in children with epilepsy are assumed to be triggered by psychosocial factors due to the lack of adaptation to chronic illness, including the presence of a significant stigma.¹³ However, studies have found that epilepsy and psychiatric disorders were concurrent phenomena rather than a causal factor.¹⁴⁻¹⁶ A study reported that one-third of children with new onset of epilepsy displayed behavioral problems prior to the onset of seizures.¹⁷

Another study using the same instrument found greater proportions of subjects having disorders with 56.3% for the category of total behavioral scores, 50% for emotional disorders, 34.4% for conduct problems, 40.6% for hyperactivity disorders, and 65.6% for peer problems.¹⁸ The differences from our results are due to different socio-demographic conditions, including target population, as well as inclusion and exclusion criteria. Their study subjects were hospitalized, pediatric patients with more complex diseases than our outpatients and their subjects had been referred to national epilepsy centers in Norway. In addition, children with mental retardation and developmental disorders were not excluded as in our study. Tanabe *et al.* found that epileptic children had higher total difficulty, hyperactivity disorder, and peer problem scores of 23.7%, 32.9% and 15.8%, respectively, compared to non-epileptic children.¹⁹

McDermott *et al.* evaluated 121 epileptic children in 1995 using the *Behavior Problem Index* (BPI). They found that epileptic children had higher percentages of the following disorders compared to those of non-epileptic children: behavioral disorders (31.4% vs. 8.5%, respectively), hyperactivity disorders (28.1% vs. 4.9%, respectively), peer problems (14.9% vs. 4.1%, respectively), and anxiety disorders (24% vs. 7.5%, respectively).⁴ Kariuki *et al.* evaluated 108 epileptic children in 2010 using the *Child Behavior Questionnaire for Parents* (CBQFP). They found that epileptic children had significantly higher percentages of behavioral disorders compared to controls (49% vs. 26%, respectively; $P < 0.001$).²⁰ Datta *et al.* reported that 53.8% of behavioral disorders occurred

in 132 children with epilepsy using the *Child Behaviour Checklist* (CBCL).⁶ Langunju *et al.* (2012) reported that out of 84 epileptic children, behavioral disorders, conduct problems, emotional disorders, and hyperactivity disorders occurred in 46.4%, 27.3%, 11.9% and 20.2% of the children, respectively, using the *Rutter A2* scale.²¹

We found that uncontrolled epilepsy and focal EEG were factors significantly associated with abnormal total difficulty score. Gender, child's age, duration of epilepsy, age at onset, maternal educational background, and the number of AEDs were not significantly related to the occurrence of behavioral disorders in epileptic children. These results are similar to those of Kariuki *et al.* which concluded that active/uncontrolled epilepsy was significantly associated with behavioral disorders (OR 7.89; 95%CI 1.23 to 50.06; $P = 0.029$).²⁰ The higher prevalence of behavioral disorders in epileptic children with focal EEG in our study was also observed by Tanabe *et al.*¹⁹ In a previous study, male children, uncontrolled seizures, a focus on the frontal or temporal of EEG, as well as polytherapy showed higher prevalence of ADHD.²² However, our study did not confirm these results. The percentage of hyperactivity disorders in our study was 6.5%, and not significantly different from the non-epilepsy group. Bauer *et al.* reported that 40.6% of children had hyperactivity disorders.¹⁸ However, as in our study, they did not find significant factors associated with hyperactivity disorders. McDermott *et al.* reported that 28.1% of children with epilepsy experienced hyperactivity, and poverty elevated the risk of hyperactivity by 5.7 times.⁴

We found that 29.8% of children in the epilepsy group had emotional disorders, and was significantly associated with uncontrolled epilepsy (PR 6.7; 95%CI 1.66 to 26.76; $P = 0.007$). Psychological factors such as fear of the occurrence of seizures that could not be predicted and controlled in addition to the perceived stigma, lead to anxiety in children with epilepsy. Seizure frequency, duration of epilepsy, teen age, and polytherapy were found to be risk factors for emotional disorders, especially anxiety, in epilepsy.²³ However, in our study uncontrolled epilepsy was the only factor associated with this emotional problem.

Our study supported the previous study about behavior problems assessed using SDQ in children with epilepsy.^{19,24} Since children with epilepsy are at risk for behavioral problems, screening followed

by diagnosis confirmation and treatment should be performed in all children with epilepsy. Further studies on behavioral problems in Indonesian children with epilepsy with an assessment of other risk factors are needed.

In conclusion, behavioral problems are more common in children with epilepsy than in normal children, especially conduct and emotional disorders. Uncontrolled epilepsy and focal EEG appearance are significant factors related to behavioral problems in children with epilepsy.

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