Short Communication

Associations between seizure management and sleep disorders in children with epilepsy: A cross-sectional study in Medan, Indonesia

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Abstract

Sleep disorders are prevalent in children, particularly those with chronic illnesses such as epilepsy, where they disrupt sleep quantity, quality, or timing. The aim of this study was to analyze factors associated with sleep disorder among epileptic children admitted to Haji Adam Malik General Hospital, Medan, Indonesia. The study employed cross sectional design, recruiting 49 children (4–10 years old) with epilepsy at Haji Adam Malik General Hospital from February to June 2024. Data collection was carried out using the Children's Sleep Habit Questionnaire (CSHQ). Further, data on anti-epileptic drugs (AED) intake, history and type of seizures were collected. Pearson's Chi-square test was employed to analyze the association of the demographic, seizure characteristics, and AED with sleeping disorder. The findings suggest that sleep disorders in children with epilepsy were prevalent (n=26, 53.1%), mostly occurring in boys (32.7%) and those receiving valproic acid (n=9, 34.6%) and its combination with levetiracetam (n=8, 30.8%). Chi-square test results showed that seizure history intake (p<0.001), AEDs intake (p<0.001), and type of AED (p=0.010) were significantly associated with sleep disorder. The study highlights that seizure management strategies and AED regimens can influence sleep disorders in children with epilepsy. Therefore, revisiting and modifying AED treatments may be necessary to improve both seizure control and sleep quality in affected patients.

Keywords: Sleep disorders, child, epilepsy, seizure history, anti-epileptic drugs (AED)

Introduction

Sleep is a fundamental biological necessity for all individuals, playing a critical role in maintaining physical, mental, and emotional health. It is characterized by a reversible state of reduced physical activity and diminished awareness of the environment, occurring in a cyclical pattern throughout life [1,2]. The amount of sleep required varies significantly across different age groups, with infants and children needing substantially more sleep than adults to support growth, brain development, and memory consolidation [3,4]. Adequate sleep is essential for cognitive function, emotional regulation, immune system efficiency, and overall well-being. Conversely, disruptions in sleep patterns can serve as early indicators of neurological or psychological abnormalities, such as epilepsy, depression, or anxiety [5,6]. Sleep disorders, which include disturbances in the amount, quality, or timing of sleep, can have profound negative effects on an individual's health, leading to growth impairments, cardiovascular issues, cognitive deficits, and behavioral problems [7].

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Sleep disorders in children are increasingly recognized as a significant public health concern, encompassing a range of conditions that affect the quality, duration, or timing of sleep, often accompanied by behavioral and physiological disturbances [8]. The prevalence of sleep disorders in children aged 0–18 years is estimated at 3.7%, with up to 25% of healthy children experiencing some form of sleep disturbance, including obstructive sleep apnea syndrome (OSAS) in 1–5% of cases [9,10]. These disorders are influenced by a combination of psychological, physical, environmental, and familial factors. Chronic illnesses, such as asthma, cerebral palsy, and neuropsychiatric disorders, are strongly associated with an increased risk of sleep disturbances [11]. Among these conditions, epilepsy—a chronic neurological disorder characterized by recurrent seizures due to abnormal electrical activity in the brain—stands out as a major contributor to sleep disorders in children [13,14].

Epilepsy affects approximately 65 million people worldwide, accounting for 0.75% of the global disease burden, with a higher incidence in children under 15 years of age [15,16]. In Indonesia, the highest incidence of childhood epilepsy occurs in the 1–5-year age group, representing 42% of cases [17,18]. Sleep disorders are highly prevalent in individuals with epilepsy, with complex etiologies involving seizures, anti-epileptic drugs (AEDs), and comorbid conditions. Seizures can disrupt sleep architecture, leading to fragmented sleep and reduced rapid eye movement sleep, which persist beyond the postictal period [19,20]. Additionally, certain AEDs, such as phenobarbital and valproate, can cause sedation or insomnia, further exacerbating sleep disturbances [21]. Studies have shown that sleep disorders are significantly more common in children with epilepsy compared to their healthy peers, with prevalence rates as high as 73.7% versus 31.5% in one study [22]. This bidirectional relationship between epilepsy and sleep creates a vicious cycle, where poor sleep quality can lower the seizure threshold, worsening both conditions [23].

The consequences of untreated sleep disorders in children with epilepsy are far-reaching, impacting academic performance, daily behavior, and long-term health outcomes [12]. Given the high prevalence of sleep disorders in children with epilepsy and their profound impact on quality of life, the aim of this study was to analyze the factors associated with sleep disturbances in this population. Specifically, we investigate the role of seizure frequency, AED use, comorbid conditions, and environmental factors in contributing to sleep disorders among children with epilepsy at Haji Adam Malik General Hospital in Medan, Indonesia.

Methods

Study design

This study employed an analytical cross-sectional design to investigate the factors associated with sleep disorders in children with epilepsy. A total of 49 outpatients aged 4—10 years were recruited from the Pediatric Department, Neurology Division, Haji Adam Malik General Hospital, Medan, Indonesia, from February to June 2024. Participants were recruited using consecutive sampling, and the minimum required sample size of 49 was calculated using a predetermined statistical formula. Signed informed consents were collected from the parent or guardian of the patient. Potential bias was minimized by excluding patients with chronic illnesses known to independently affect sleep patterns. Approval clearance was granted from the Research Ethics Committee of Universitas Sumatra Utara and Haji Adam Malik General Hospital, Medan, Indonesia (number: 272/KEPK/USU/2024).

Eligibility criteria

The inclusion criteria included children aged 4–10 years diagnosed with epilepsy. The diagnosis was confirmed through a review of the clinical history, combined with physical examination and electroencephalogram (EEG) findings. We excluded patients if they had primary sleep disorders, such as obstructive sleep apnea (OSA) or were unable to fully complete the Children's Sleep Habits Questionnaire (CSHQ). Additionally, we excluded those with comorbid chronic conditions, such as hypertension, diabetes mellitus, chronic obstructive pulmonary disease (COPD), stroke, liver disease, or other chronic illnesses.

Data collection

Data were collected through structured interviews with the parents or guardians of the study participants, using the validated CSHQ. The CSHQ is a widely used tool for assessing sleep disturbances in children and covers domains such as bedtime resistance, sleep duration, sleep anxiety, and daytime sleepiness. The collected data were then tabulated and analyzed to identify risk factors associated with sleep disorders in children with epilepsy. Validity of this questionnaire in the Indonesian population has been previously published with a Cronbach alpha coefficient of 0.80 for all items [30]. The collected demographic characteristics included age and sex. As for the clinical factors, we collected data on type of seizure and seizure history from medical records. In addition, we reviewed the medical records to retrieve the data on treatment regimen and AEDs intake.

Data analysis

Data were processed and analyzed using Statistical Package for Social Science (SPSS) version 20.0 (IBM, New York, US). The data were presented in frequency distribution for each variable, including demographic, clinical, and medication-related factors. Bivariate analysis was then carried out to examine the association between independent variables (such as age, sex, type of seizure, and number of AEDs) and the dependent variable (sleep disorders). Pearson's Chi-square test was used for categorical variables, with Yates' correction for continuity applied to address potential overestimation of statistical significance due to small sample sizes. A *p*-value of <0.05 was considered statistically significant.

Results

Characteristics of research subjects

Characteristics of patients recruited are presented in **Table 1**. Of all 49 children, most of them were boys (n=33, 67.3%) and aged ≥5 years (n=37, 75.5%). According to the medical record, 55.1% of the total patients (n=27) were recorded to have less than five times seizures per month. Thirty-three children (67.3%) received monotherapy AEDs, while 16 others (32.7%) received polytherapy. More than 50% of the total children (n=30, 61.3%) received valproic acid. A combination of valproic acid and levetiracetam was prescribed to eight children (16.4%).

Table 1. Characteristics of the outpatient epilepsy children in Medan, Indonesia

Subject characteristics	n (%)
Age	
<5 years	12 (24.5)
≥5 years	37 (75.5)
Sex	
Boys	33 (67.3)
Girls	16 (32.7)
Types of seizures	
Focal	5 (10.2)
General	44 (89.8)
Seizure frequency	
<5 times per month	27 (55.1)
≥5 times per month	22 (44.9)
Number of anti-epileptic drugs (AEDs)	
Monotherapy	33 (67.3)
Polytherapy	16 (32.7)
Types of AEDs	
Valproic acid	30 (61.3)
Levetiracetam	2 (4.1)
Ocarbamazepine	1 (2.0)
Valproic acid + phenobarbital	2 (4.1)
Valproic acid + levetiracetam	8 (16.4)
Valproic acid + oxcarbazepine	1 (2.0)
Valproic acid + topiramate	1 (2.0)
Levetiracetam + topiramate	1 (2.0)
Valproic acid + levetiracetam + oxcarbazepine	2 (4.1)
Valproic acid + carbamazepine + topiramate	1 (2.0)

Results of bivariate analysis

The summary of the bivariate analysis results on factors associated with sleep disorders among epileptic children is presented in **Table 2**. The prevalence of sleep disorders among children with epilepsy reached 53.1% (n=26). The prevalence was 19.2% (n=5) and 80.8% (n=21) in those aged <5 and ≥5 years, respectively. Sleep disorder was found to be more prevalent among boys (n=16, 61.5%) than among girls (n=10, 38.5%). However, no significant association was found between age (p=0.508) or sex (p=0.382) and sleep disorders. The type of seizures was not associated with the sleep disorder (p=0.052). Significant associations were found between seizure frequency (p<0.001), AEDs intake (p<0.001), and AEDs regimen (p=0.010) with sleep disorder. The prevalence of sleep disorder was 76.9% (n=20) in those with ≥5 seizures per month. The prevalence was 61.5% (n=16) for those receiving polytherapy, with the highest prevalence observed in those receiving a combination of valproic acid and levetiracetam (n=8, 30.8%). Among those receiving a single therapy of valproic acid, only nine children (34.6%) had sleep disorders.

Table 2. Results from the bivariate analysis on factors associated with sleep disorder among children with epilepsy in Medan, Indonesia

Variables	Sleep disorders		p-value
	Yes (n=26)	No (n=23)	
Age			
<5 years	5 (19.2)	7 (30.4)	0.508
≥5 years	21 (80.8)	16 (69.6)	
Sex			
Boys	16 (61.5)	17 (73.9)	0.382
Girls	10 (38.5)	6 (26.1)	
Types of seizures			
Focal	5 (19.2)	0 (0)	0.052
General	21 (80.8)	23 (100)	
Seizure frequency			
<5 times per month	6 (23.1)	21 (91.3)	<0.001**
≥5 times per month	20 (76.9)	2 (8.7)	
Number of AEDs			
Monotherapy	10 (38.5)	23 (100)	<0.001**
Polytherapy	16 (61.5)	0 (0)	
Types of AEDs			
Valproic acid	9 (34.6)	21 (91.4)	0.010*
Levetiracetam	1 (3.8)	1 (4.3)	
Oxcarbazepine	0 (0)	1 (4.3)	
Valproic acid + phenobarbital	2 (7.8)	0 (0)	
Valproic acid + levetiracetam	8 (30.8)	0 (0)	
Valproic acid + oxcarbazepine	1 (3.8)	0 (0)	
Valproic acid + topiramate	1 (3.8)	0 (0)	
Levetiracetam + topiramate	1 (3.8)	0 (0)	
Valproic acid + levetiracetam + oxcarbazepine	2 (7.8)	0 (0)	
Valproic acid + carbamazepine + topiramate	1 (3.8)	0 (0)	

*Significant at p<0.05 or **p<0.001 based on Chi-square test.

Discussion

In the present study, we found that the prevalence of sleep disorder was 53.1% (n=26), where the figure reached 80.8% (n=21) among those aged ≥5 years and 61.5% (n=16) among boys. In a previous study, the sleep disorder among this population reached a higher number (73.7%) [16]. The discrepancy could be attributed to the differences in age range and population characteristics. In the previous study, sleep disorders were most commonly found among school-aged children (6–12 years), likely due to school-related activities and external stressors [16]. The insignificant association between sex and sleep disorder among epileptic children was also reported in previous studies [31, 32]. However, the trend toward higher prevalence among boys in the present study may warrant further investigation, as some previous studies suggest that boys were more susceptible to sleep disturbances due to behavioral or biological factors [33, 34].

Herein, a history of frequent seizures (≥5 per month) was significantly associated with a higher prevalence of sleep disorders (n=20, 76.9%) compared to less frequent seizures (<5 per

month) (n=6, 23.1%). This finding contrasts with a previous study, which found no significant association between seizure history and sleep disorders [35]. The discrepancy may be due to differences in study populations or methodologies. Frequent seizures may disrupt sleep continuity and exacerbate sleep-related issues, highlighting the importance of effective seizure control in managing sleep disorders.

In the present study, polytherapy was associated with a higher prevalence of sleep disorders compared to monotherapy. This finding aligns with previous studies reporting that AEDs can alter sleep structure and contribute to sleep disturbances [35,36]. The use of multiple AEDs may increase the risk of side effects and drug interactions, leading to excessive daytime sleepiness and poor sleep quality. These results underscore the need for careful selection and monitoring of AED regimens to minimize sleep-related adverse effects. It is also worth noting that valproic acid was the most commonly used AED in this present study, with 18.4% of subjects experiencing sleep disorders. A previous study suggests that valproic acid can increase non-rapid eye movement phase 1 sleep, leading to excessive sleepiness [29]. The use of multiple AEDs further complicates the interpretation of these findings, as the combined effects of different drugs may contribute to sleep disturbances.

This study has several limitations that should be acknowledged. First, the cross-sectional design limits the ability to establish causal relationships between seizure management and sleep disorders. Longitudinal studies are needed to better understand the temporal dynamics of these associations. Second, the reliance on parent-reported data for sleep disorders (using the CSHQ) may introduce recall bias or subjectivity, as parents may not always accurately perceive their child's sleep patterns. Third, the study was conducted at a single tertiary care center (Haji Adam Malik General Hospital), which may limit the generalizability of the findings to other settings or populations. Additionally, the sample size, while adequate for initial analysis, may not fully capture the diversity of epilepsy types and sleep disorder presentations. Finally, the study did not account for potential confounding factors such as socioeconomic status, parental education, or environmental influences, which could also impact sleep quality in children with epilepsy. Future research should address these limitations by incorporating objective sleep measurements (such as polysomnography), expanding to multiple centers, and exploring the role of additional confounding variables.

Conclusion

The study revealed a high prevalence of sleeping disorders among children with epilepsy in Medan, Indonesia. Seizure management strategies and AED regimens can influence sleep disorders in children with epilepsy, as indicated by the significant associations observed between seizure history, AED use, and the type of AED with sleep disturbances. It is imperative to revisit and modify AED treatments to optimize seizure control while minimizing their potential impact on sleep quality. Further research with a larger sample size and a more robust statistical approach is recommended to elucidate the causal relationship between seizure management, AED use, and sleep disorders.

Ethics approval

The protocol of this study was approved by the Research Ethics Committee of Universitas Sumatra Utara and Haji Adam Malik General Hospital, Medan, Indonesia (number: 272/KEPK/USU/2024).

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Competing interests

Authors have no known conflict of interest in relation to the publication of this work.

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Underlying data

Data underlying this study can be requested from the corresponding authors upon reasonable requests.

Declaration of artificial intelligence use

We hereby confirm that no artificial intelligence (AI) tools or methodologies were utilized at any stage of this study, including during data collection, analysis, visualization, or manuscript preparation. All work presented in this study was conducted manually by the authors without the assistance of AI-based tools or systems.

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