

Prevalence and Risk Factors of Worsened Seizure Control in Pediatric Patients with Epilepsy during COVID-19 Pandemic in Tertiary Care Hospital

Kotchakorn Rangsimontakul, MD¹, Siriluk Assawabumrungrkul, MD¹, Thitiporn Fangsa-ad, MD¹

¹ Department of Pediatrics, Bhumibol Adulyadej Hospital, Medical Services, Royal Thai Air Force, Bangkok, Thailand

Background: Epilepsy can achieve remission through accessible medications and regular follow-up. However, maintaining remission became challenging due to the barriers to care that emerged during the COVID-19 pandemic.

Objective: To assess the prevalence of worsened seizure control in pediatric patients with epilepsy during the COVID-19 pandemic. Associated factors would be defined and investigated.

Materials and Methods: A cross-sectional study was conducted on patients with epilepsy at the Pediatric Outpatient Unit of Bhumibol Adulyadej Hospital in Bangkok, Thailand, between January and February 2022. The present study included patients aged 1 month to 18 years at the time of diagnosis, with epilepsy diagnosed at least six months before the COVID-19 pandemic, making the diagnosis between January 2012 and October 2019, and treated with at least one antiseizure medication. Guardians were interviewed via telephone to assess demographic data, epilepsy characteristics, and their views on changes in care.

Results: Among the 509 patients, 128 were included. Forty percent of guardians reported facing challenges in scheduling follow-up doctor's appointments, primarily due to the fear of COVID-19 infection for 61.9%. The prevalence of worsened seizure control during the COVID-19 pandemic was 4.7%. Uncontrolled seizures at baseline were identified as a significant factor influencing worsened seizure control ($p=0.001$).

Conclusion: Approximately five percent of pediatric patients with epilepsy experienced worsened seizure control during the COVID-19 pandemic. This highlights the importance of continuous care for this vulnerable group, even between limitations in travel and access to medical services. Forty percent of guardians reported difficulty in scheduling follow-up physician appointments. These findings suggest the importance of establishing efficient medication delivery and that telemedicine services for epilepsy care be considered in future planning, especially in anticipation of potential future waves of COVID-19 or other disease outbreaks.

Keywords: COVID-19; Epilepsy; Seizure control; Pediatric patients

Received 15 July 2024 | Revised 18 October 2024 | Accepted 28 October 2024

J Med Assoc Thai 2024; 107(12): 945-9

Website: <http://www.jmatonline.com>

The coronavirus disease 2019 (COVID-19) was a newly emerging disease caused by SARS-CoV-2. It was first detected in Wuhan, China, in December 2019. In Thailand, the first case was reported on January 13, 2020. Subsequently, the number of new cases rapidly escalated. The Thai government implemented a lockdown policy, along with social

distancing and work-from-home measures, on April 3, 2020⁽¹⁾.

Epilepsy is defined as experiencing at least two unprovoked seizures occurring more than 24 hours apart, or one unprovoked seizure with a likelihood of further seizures comparable to the general recurrence risk, which is at least 60%, after two unprovoked seizures or diagnosis of an epilepsy syndrome⁽²⁾. It stands as one of the most prevalent chronic neurological disorders in children. In Thailand, the estimated prevalence of epilepsy is 7.2 per 1,000, with peaks observed in two age groups, 5 to 9 and 25 to 34 years⁽³⁾. Epilepsy in children has various consequences, including impacts on academic achievement, behavioral and emotional adjustment, and social competence⁽⁴⁾. Approximately 70% of children undergoing optimal epilepsy treatment could achieve remission by consistently adhering to their medications and regular follow-ups. However,

Correspondence to:

Rangsimontakul K.
Department of Pediatrics, Bhumibol Adulyadej Hospital, Medical Services, Royal Thai Air Force, Paholyothin Road, Saimai, Bangkok 10220, Thailand.
Phone: +66-81-8016064
Email: mild.kot@gmail.com

How to cite this article:

Rangsimontakul K, Assawabumrungrkul S, Fangsa-ad T. Prevalence and Risk Factors of Worsened Seizure Control in Pediatric Patients with Epilepsy during COVID-19 Pandemic in Tertiary Care Hospital. *J Med Assoc Thai* 2024;107:945-9.
DOI: 10.35755/jmedassocthai.2024.12.945-949-01386

sustaining remission becomes challenging when faced with barriers to healthcare⁽⁵⁾.

The present study investigating the impact of the COVID-19 pandemic on patients with epilepsy revealed that timely access to seizure medication and concerns about the adverse effects of the outbreak exacerbated seizure control issues among patients. Additionally, the number of antiseizure medications (ASMs) prescribed to patients and their baseline seizure frequency were identified as risk factors^(6,7).

The objective of the present study was to evaluate the prevalence of worsened seizure control among pediatric patients with epilepsy during the COVID-19 pandemic at Bhumibol Adulyadej Hospital (BAH), a tertiary center in Thailand. Furthermore, associated factors would be defined and investigated.

Materials and Methods

A cross-sectional study was conducted using data obtained from telephone interviews of pediatric patients with epilepsy between January and February 2022, at BAH. Ethical approval for the study was obtained from the Ethics Committee of BAH (IRB No. 58/65).

Information on pediatric patients diagnosed with epilepsy between 2012 and 2021 was extracted from the BAH computerized hospital database using the International Classification of Diseases, Tenth Revision (ICD-10) codes G400-409 and G410-419. The inclusion criteria encompassed patients aged one month to 18 years at the time of epilepsy diagnosis, with the diagnosis occurring at least six months before the onset of the COVID-19 pandemic, thus a diagnosis spanning between 2012 and October 2019. Specifically, patients treated at the Pediatric outpatient unit of BAH and receiving at least one ASM were included in the present study.

Guardians were interviewed over the phone using a questionnaire developed by the researcher. The questionnaire had been previously reviewed by three independent physicians and was pretested with 10 patients with epilepsy for validation and reliability. Prior to initiating the interview process, informed consent was obtained.

The questionnaire comprised three sections. The first section gathered demographic data on the patient such as age at diagnosis, gender, and history of family members contacted or diagnosed with COVID-19, and guardians such as socioeconomic status, education, and occupational status. The second section focused on epilepsy characteristics, including the number of ASMs and seizure frequency during the

COVID-19 pandemic, between April and December 2020, during the first wave, and after the lifting of lockdown measures, or after November 2021. The third section explored the views of guardians regarding changes in care before and during the COVID-19 pandemic, assessing factors such as the difficulty in administering ASMs on time and access to medical services. Participants were allowed to select only one option for the reasons of barriers.

Sample size calculation

The sample size calculation was based on the prevalence of worsened seizure control at 22.7%⁽⁶⁾. The sample size estimation utilized the infinite population proportion formula, considering an acceptable sampling error of 0.07 and a significance level of 0.05. The anticipated number of patients was 138.

Statistical analysis

The data were analyzed using the IBM SPSS Statistics, version 27.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics for categorical data were expressed as numbers and percentages. Univariate analyses were performed using the chi-square test to evaluate the association between the variables and seizure control.

Results

Demographics

Five hundred nine patients were enrolled in the present study. Three hundred sixty-eight patients were excluded either because they were not on ASM or had been diagnosed with epilepsy less than six months before the COVID-19 pandemic. Additionally, two patients died, and 11 patients did not respond to the questionnaire. Consequently, 128 patients, with 63% male, were included in the analysis. Sixty-eight patients (53%) received an epilepsy diagnosis before the age of 5. Eighty-one patients (63%) were male. Eighty-nine patients (70%) had a family income of less than 30,000 baht monthly, and a decrease in income was reported by 81 participants (63%). Furthermore, four-fifths of guardians (105 out of 128), had education below a bachelor's degree. Unclassified seizures were identified in 53.1% of cases (68 out of 128). About ASMs used, 79.7% of patients effectively controlled their seizures with only 1 to 2 ASMs. Additionally, 91.4% and 76.5% of subjects did not require ASM adjustments both during the COVID-19 outbreak and after the lifting of the lockdown respectively as shown in Table 1.

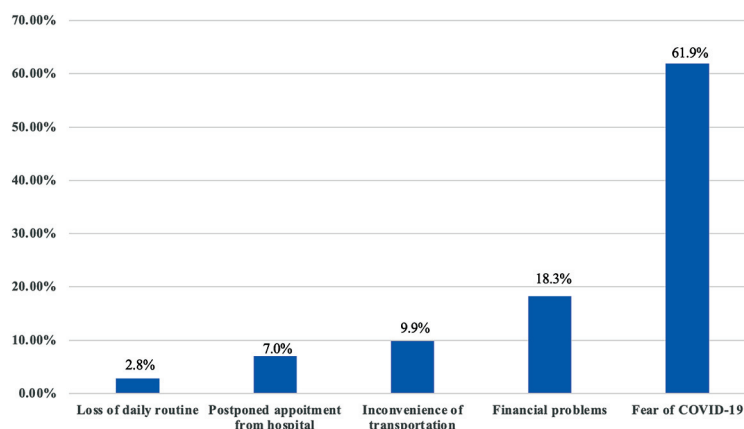


Figure 1. Reasons behind the reported difficulty having a follow-up doctor's appointment.

Table 1. Demographics and clinical data of patients with epilepsy

Characteristics	n=128; n (%)
Age at diagnosis (years)	
<1	26 (20.3)
1 to 5	42 (32.8)
6 to 10	28 (21.9)
11 to 18	32 (25.0)
Male	81 (63.3)
History of family COVID-19	18 (14.1)
Income >30,000 THB	39 (30.5)
Decreased income	81 (63.3)
Below bachelor guardians	105 (82.0)
Employed guardians	100 (78.1)
Type of epilepsy	
Focal	44 (34.6)
Generalized	16 (12.6)
Unclassified	68 (53.1)
Controlled seizure	104 (81.3)
Number of ASMs >2 medications	26 (20.3)
Duration >5 years*	66 (51.6)
ASMs change: outbreak**	
No change	117 (91.4)
Increased	7 (5.5)
Decreased	4 (3.1)
ASMs change: after lifting***	
No change	98 (76.5)
Increased	6 (4.7)
Decreased	24 (18.8)

ASMs=antiseizure medications

* Duration of diagnosed disease, ** Change of ASMs during the outbreak (dose/number), *** Change of ASMs after lifting lockdown (dose/number)

Views of guardians on change of care

During the COVID-19 outbreak, 40% of guardians (53 out of 128) reported difficulties in

attending doctor's appointments. Only 10% (13 out of 128) of guardians encountered problems visiting the emergency department (ED). The primary reasons for difficulty in following up with physician appointments were fear of COVID-19 infection in 61.9%, financial problems in 18.3%, and transportation inconvenience in 9.9%, as shown in Figure 1.

Prevalence of worsened seizure control

The prevalence of worsened seizure control during the COVID-19 pandemic was 4.7%, and after the lifting of the lockdown, it was 3.9%.

Associated factors of worsened seizure control

As presented in Table 2, the results of the univariate analysis revealed that patients with uncontrolled seizures at baseline (83.3%) experienced significantly worsened seizure control compared to those with controlled seizures at baseline (16.7%) during the outbreak. Similarly, after the lifting of the lockdown, patients with uncontrolled seizures at baseline demonstrated worsened seizure control in comparison to those with controlled seizures at 80% and 20%, respectively ($p=0.004$). However, the socioeconomic status of the family, the number of ASMs, the change in ASMs, and the difficulties in care according to the views of the guardian were not identified as affecting factors on seizure control.

Discussion

The findings from the present study showed that the prevalence of worsened seizure control during the COVID-19 pandemic and after lifting the lockdown were 4.7% and 3.9%, respectively. These rates were lower than those reported in previous studies, which exhibited a range between 8% and 30%⁽⁶⁻¹⁰⁾. A study

Table 2. Univariate analysis of factors affecting seizure control

	During & before; n (%)			AFL & before; n (%)		
	Worse (n=6)	Stable/better (n=122)	p-value	Worse (n=5)	Stable/better (n=123)	p-value
Age (years)#			0.417			0.8
<1	1 (16.7)	25 (20.5)		0 (0.0)	26 (21.1)	
1 to 5	3 (50.0)	39 (32.0)		3 (60.0)	39 (31.8)	
6 to 18	2 (33.3)	58 (47.5)		2 (40.0)	58 (47.1)	
Male	4 (66.7)	77 (63.1)	1	5 (100)	76 (61.8)	0.517
History COVID-19*	2 (33.3)	16 (13.3)	0.172	2 (40.0)	16 (13.2)	0.149
Type of epilepsy			0.394			0.306
Focal	1 (16.7)	43 (35.2)		1 (20.0)	43 (35.0)	
Generalized	1 (16.7)	15 (12.3)		0 (0.0)	16 (13.0)	
Unclassified	4 (66.6)	64 (52.5)		4 (80.0)	64 (52.0)	
Uncontrolled seizure	5 (83.3)	19 (15.6)	0.001	4 (80.0)	20 (16.3)	0.004
ASMs >2	3 (50.0)	23 (18.9)	0.098	1 (20.0)	25 (20.3)	1
Change of ASMs			0.761			0.522
No	5 (83.3)	112 (91.8)		4 (80.0)	94 (76.4)	
Increased	1 (16.7)	6 (4.9)		1 (20.0)	5 (4.1)	
Decreased	0 (0.0)	4 (3.3)		0 (0.0)	24 (19.5)	
Duration >5 years**	4 (66.7)	62 (50.8)	0.681	2 (40.0)	64 (52.0)	0.673
Income >30,000 THB	1 (16.7)	38 (31.7)	0.4	0 (0.0)	39 (32.2)	0.136
Decreased income***	5 (83.3)	76 (63.3)	0.42	5 (100)	76 (62.8)	0.159
Bachelor or higher****	1 (16.7)	20 (16.7)	1	0 (0.0)	21 (17.4)	0.589
Difficulty						
Give ASMs on time	0 (0.0)	2 (1.6)	1	0 (0.0)	1 (0.8)	1
Follow-up	3 (50.0)	50 (41.0)	0.691	1 (20.0)	32 (26.0)	1
Visiting ED	1 (16.7)	12 (9.8)	0.589	0 (0.0)	7 (5.7)	1

AFL=after lifting lockdown; ASMs=antiseizure medications; ED=emergency department

Age at diagnosis, * Family contacted/diagnosed COVID-19, ** Duration of diagnosed disease, *** Decrease income by 10% from the original income, **** Education of guardian

in China reported an 8.56% worsening of seizure control in patients with epilepsy⁽⁹⁾, while in Jordan, caregivers reported a higher rate of 22.7% for their children⁽⁶⁾. In Saudi Arabia, the reported rate was even higher at 29.5%⁽⁷⁾. These variations may be attributed to differences in the severity of the pandemics, characteristics of epilepsy, and the effectiveness of lockdown measures implemented in each respective location.

Factors influencing seizure worsening included uncontrolled seizures at baseline ($p=0.001$), consistent with findings from previous studies. Having two or more ASMs was identified as a factor associated with worsened seizure control in studies conducted in Jordan and Saudi Arabia^(6,7). In the present study, fifty percent of patients with worsened seizure control had more than two ASMs, although this did not reach statistical significance ($p=0.098$). These findings may be explained by the inherently unpredictable nature of epilepsy. Additionally, the study highlighted that 41.4% of caregivers reported difficulty securing a

follow-up doctor's appointment, with more than half (61.9%) citing fear of COVID-19 as the primary reason.

The prevalence of worsened seizure control during the COVID-19 pandemic was 4.7%, which did not differ significantly from the rate after lifting the lockdown, which was 3.9%. Despite 41.4% of guardians reporting difficulty in securing a follow-up, only 0.9% of guardians faced challenges in administering ASMs on time during the outbreak.

For instance, the present study could explore whether the challenges faced by patients with uncontrolled seizures were primarily due to internal factors, such as drug-resistant epilepsy, rather than external factors like COVID-19 infection or the inability to access medication refills. Patients with uncontrolled seizures typically require close monitoring, but during the pandemic, limited healthcare access may have exacerbated their condition. Telemedicine could offer a structured approach to ensure consistent follow-up and care

for these epilepsy patients, especially in preparation for future waves of COVID-19 or other disease outbreaks.

The present study has limitations. Firstly, the small sample size may have limited the power of the study to detect significant associations. Additionally, being a cross-sectional and retrospective survey, it can introduce recall bias. However, to the best of the authors' knowledge, this is the only study that examines two distinct points in time, during the lockdown and after the lifting of the lockdown, making it a long-term study.

Conclusion

The COVID-19 pandemic has adversely affected epilepsy care in pediatric patients. Factors associated with worsened seizures included uncontrolled seizures at baseline. Notably, 41.4% of caregivers reported difficulties attending follow-up doctor's appointments, emphasizing the necessity for efficient telemedicine in epilepsy care. This is particularly crucial in addressing the findings of the present study, especially for patients with uncontrolled seizures. The present study highlights the necessity of ensuring consistent monitoring and management, which could help mitigate the risk of worsening seizure control during the periods when in-person visits are limited during future waves of COVID-19 or outbreaks of other diseases.

What is already known on this topic?

Previous studies reported prevalence of worsened seizure control during the COVID-19 pandemic ranging between 8% and 30%. However, severity of the pandemics, lockdown measurement, and health care system are different in each country.

What does this study add?

The present study found that the prevalence of worsened seizure control during the COVID-19 pandemic in pediatric patients with epilepsy was 4.7%. About forty percent of caregivers reported difficulty in attending follow-up physician appointments, emphasizing the need to establish efficient telemedicine in epilepsy care.

Acknowledgement

The authors express their gratitude to Gp. Capt. Napaporn Jiraphongsa, MD, MSc, Gp. Capt. Sasawan

Chinratanapisit, MD, PhD, Gp. Capt. Supaporn Kritsaneepaiboon, and Flt. Lt. Suwittra Huanraluck for their valuable assistance in research methodology and statistical analysis. The authors also extend their appreciation to Assoc. Prof. Wg. Cdr. Komsun Suwannarurk, MD, and Assoc. Prof. Dr. Kornkarn Bhamarapratatana, PhD, for their contributions to manuscript preparation.

Conflicts of interest

The authors declare that they have no conflict of interest.

References

1. COVID-19: WHO's action in countries [Internet]. September 2020 [cited 2024 Jul 24]. Available from: https://www.who.int/docs/default-source/coronaviruse/country-case-studies/thailand-c19-case-study-20-september.pdf?sfvrsn=d5534183_2.
2. Fisher RS, Acevedo C, Arzimanoglou A, Bogacz A, Cross JH, Elger CE, et al. ILAE official report: a practical clinical definition of epilepsy. *Epilepsia* 2014;55:475-82.
3. Asawavichienjinda T, Sitthi-Amorn C, Tanyanont W. Prevalence of epilepsy in rural Thailand: a population-based study. *J Med Assoc Thai* 2002;85:1066-73.
4. Kwan P, Brodie MJ. Neuropsychological effects of epilepsy and antiepileptic drugs. *Lancet* 2001;357:216-22.
5. Neubauer BA, Gross S, Hahn A. Epilepsy in childhood and adolescence. *Dtsch Arztebl Int* 2008;105:319-27.
6. Al Momani M, Almomani BA, Sweidan P, Al-Qudah A, Aburahma S, Arafah Y. Impact of COVID-19 pandemic on pediatric patients with epilepsy in Jordan: The caregiver perspective. *Seizure* 2021;92:100-5.
7. Alkhotani A, Siddiqui MI, Almuntashri F, Baothman R. The effect of COVID-19 pandemic on seizure control and self-reported stress on patient with epilepsy. *Epilepsy Behav* 2020;112:107323. doi: 10.1016/j.yebeh.2020.107323.
8. Rosengard JL, Donato J, Ferastraoaru V, Zhao D, Molinero I, Boro A, et al. Seizure control, stress, and access to care during the COVID-19 pandemic in New York City: The patient perspective. *Epilepsia* 2021;62:41-50.
9. Huang S, Wu C, Jia Y, Li G, Zhu Z, Lu K, et al. COVID-19 outbreak: The impact of stress on seizures in patients with epilepsy. *Epilepsia* 2020;61:1884-93.
10. Trivisano M, Specchio N, Pietrafusa N, Calabrese C, Ferretti A, Ricci R, et al. Impact of COVID-19 pandemic on pediatric patients with epilepsy - The caregiver perspective. *Epilepsy Behav* 2020;113:107527. doi: 10.1016/j.yebeh.2020.107527.