Journal of Society Medicine
Research & Review Articles on Diseases
Journal of Society Medicine. 2026; 5 (7)

The Impact of Recurrent Seizures on Cognitive Functions in Epilepsy: A Literature Review

Ainaya Az Zahra [1*], Yudhisman Imran [2]

[1] Medical Doctor Profession Program, Faculty of Medicine, Trisakti University, Jakarta, Indonesia
[2] Department of Neurology, Faculty of Medicine, Trisakti University, Jakarta, Indonesia

***Corresponding Author**: Yudhisman Imran, E-mail: yudhisman.imran@trisakti.ac.id

ARTICLE INFO

Article history:
Received
18 June 2026

Revised
04 July 2026

Accepted
31 July 2026

Manuscript ID:
JSOCMED-18062026-57-4

Checked for Plagiarism: Yes

Language Editor:
Rebecca

Editor-Chief:
Prof. Aznan Lelo, PhD

ABSTRACT

Epilepsy is among the most prevalent chronic neurological disorders, affecting more than 50 million people worldwide and contributing substantially to the global burden of neurological disease. Beyond the seizures themselves, recurrent epileptic activity is increasingly recognized as a driver of progressive cognitive decline; however, cognitive comorbidity remains under-addressed in routine clinical management. This literature review synthesizes current evidence on the mechanisms, clinical manifestations, and assessment of cognitive impairment associated with recurrent seizures. Recurrent seizures arise from an imbalance between excitatory (glutamate) and inhibitory (GABA) neurotransmission, producing neuronal hyperexcitability and hypersynchronization. During and after seizure episodes, cyclooxygenase-2–dependent cerebral vasoconstriction induces localized hypoperfusion and hypoxia; when repeated, these events accumulate, causing structural and functional brain injury. The hippocampus, essential for memory, is particularly vulnerable to hypoxic-ischemic damage, whereas temporal- and frontal-lobe involvement disrupts memory, language, attention, and executive function. Approximately 60–70% of patients with chronic epilepsy experience cognitive impairment, the severity of which is modulated by age at onset, seizure frequency, duration, and antiepileptic drug use. Practical screening tools such as the Montreal Cognitive Assessment (MoCA), including its validated Indonesian version (MoCA-Ina), demonstrate higher sensitivity than the Mini-Mental State Examination for detecting mild impairment, while brain-derived neurotrophic factor represents a promising biomolecular marker of cognitive dysfunction. Collectively, the evidence indicates that epilepsy management should extend beyond seizure control to incorporate routine cognitive surveillance. Early detection through sensitive screening instruments enables comprehensive, individualized treatment planning and may ultimately improve the long-term quality of life for people living with epilepsy.

Keywords: Epilepsy, Recurrent Seizures, Cognitive Impairment, Hippocampus, Montreal Cognitive Assessment, Brain-Derived Neurotrophic Factor

How to cite: Zahra AA, Imran Y. The Impact of Recurrent Seizures on Cognitive Functions in Epilepsy: A Literature Review. *Journal of Society Medicine*. 2026; 5 (7): 259-263. **DOI: https://doi.org/10.71197/jsocmed.v5i7.309**

INTRODUCTION

The Global Burden of Disease study has identified epilepsy as one of the leading contributors to the global burden of neurological disorders, with more than 50 million people living with epilepsy worldwide. As a chronic brain disorder caused by abnormal neuronal electrical activity, epilepsy is characterized by an enduring predisposition to generate unprovoked seizures, which frequently manifest as recurrent episodes. Recurrent seizures contribute substantially to disability-adjusted life years (DALYs), reflecting the considerable disability and reduced quality of life associated with the disease [1].

Increased seizure frequency has been identified as a significant negative predictor of health-related quality of life (HRQL), with a higher seizure frequency consistently associated with a poorer quality of life among patients with epilepsy [2]. This relationship is thought to be linked, at least in part, to cerebral hypoxia occurring during seizure episodes; when such events recur, their cumulative effects may precipitate brain dysfunction, including cognitive impairment [3,4]. Cognitive impairment is increasingly recognized as one of the most disabling and frequently overlooked comorbidities of epilepsy, affecting a large proportion of individuals with chronic diseases and representing a major determinant of long-term functional outcomes [5]. Nevertheless, clinical management continues to emphasize seizure control, whereas the cognitive consequences of recurrent seizures are often under-recognized and under-assessed. Therefore, this review synthesizes the current evidence on the relationship between recurrent seizures and cognitive function, encompassing the underlying pathophysiological mechanisms, the cognitive domains most affected, and the screening instruments and biomarkers available for the early detection of cognitive decline in epilepsy.

DISCUSSION

Definition and Classification of Epilepsy

Epilepsy is a chronic neurological disorder that can occur at any age. The International League Against Epilepsy (ILAE) defines epilepsy as a disease of the brain characterized by any of the following conditions: (1) at least two unprovoked seizures occurring more than 24 h apart; (2) one unprovoked seizure with a probability of further seizures similar to the general recurrence risk (at least 60%) over the next 10 years; or (3) a diagnosis of an epilepsy syndrome, established on the basis of clinical characteristics and electroencephalography (EEG) findings supported by specific etiologies, including structural, genetic, metabolic, immune, and infectious factors [6].

Pathophysiology and Impact of Recurrent Seizures on the Brain

In terms of pathophysiology, epileptic seizures are associated with neuronal hyperexcitability and hypersynchronization of brain activity, which are governed by the balance between excitatory and inhibitory neurotransmitters, namely, glutamate and gamma-aminobutyric acid (GABA). An imbalance between these neurotransmitters, characterized by excessive excitatory activity, leads to increased sodium and calcium ion influx and decreased chloride ion influx. These changes trigger excessive neuronal depolarization, increase the frequency of action potentials, and enhance the propagation of abnormal electrical activity in the brain, ultimately resulting in seizures [7]. Based on this pathophysiology, antiepileptic drugs primarily aim to stabilize neuronal action potentials and electrical activity to prevent seizure occurrence. However, under certain conditions, seizures may still recur, particularly when patients are unable to avoid triggering factors. In addition to non-adherence to antiepileptic drugs (AEDs), several other factors may precipitate recurrent seizures, including smoking, sleep deprivation (less than eight hours), fatigue, and severe emotional stress. Large surveys of people with epilepsy have consistently identified stress, sleep deprivation, and fatigue as the most frequently reported seizure precipitants [8].

Patients with epilepsy who experience seizures frequently have a greater impact on their quality of life. This is supported by a study by Tran et al., which demonstrated cyclooxygenase-2–dependent vasoconstriction during and after seizures, potentially causing cerebral hypoperfusion, hypoxia, and even ischemia [9]. When recurrent, this may cause cumulative structural and functional brain damage. Among brain regions, lesions are most frequently observed in the hippocampus, a structure crucial for memory, one of the key domains of cognition [10,11]. The hippocampus is particularly sensitive to hypoxic and ischemic conditions, rendering it more vulnerable to damage from recurrent seizures. Damage to this region can disrupt memory formation, storage, and retrieval and affect other cognitive functions, such as attention and learning ability [12]. Consequently, individuals with epilepsy, particularly those experiencing recurrent seizures, are at an increased risk of cognitive decline.

Impact of Recurrent Seizures on Cognitive Function

Cognitive function refers to an individual's ability to recognize objects or situations and is associated with skills, learning experiences, and intellectual capacity. This function encompasses multiple domains, including perception, memory, learning, attention, language, executive function, and orientation [13]. Approximately 60–70% of individuals with chronic epilepsy experience cognitive impairment, which is closely associated with several interrelated factors, including earlier age at epilepsy onset, higher seizure frequency, intensity, and duration of seizures, and the use of antiepileptic drugs [5].

In adults, temporal lobe epilepsy is the most common cause of focal-onset impaired awareness seizures [5]. The temporal lobe plays a crucial role in language (speech), learning, memory, and affective behavior. Temporal lobe epilepsy can affect various domains of cognitive function, including working memory, autobiographical memory, executive function, naming ability, hemispheric lateralization, and language function [14]. Another common form of epilepsy in adults is frontal lobe epilepsy (FLE) [5]. The frontal lobe is essential for higher-order cognitive processes, particularly executive functioning and working memory, and is involved in motor function, emotional regulation, and inhibitory control. Structural and functional disturbances in the frontal lobe, such as focal seizures originating from this region, may lead to cognitive and behavioral impairment. In adults with frontal lobe epilepsy, these impairments commonly manifest as decreased attention and difficulty in performing complex behaviors, particularly those related to executive functions, such as planning, anticipation, organization, initiation, working memory, and task execution [15].

Cognitive Assessment in Epilepsy

In assessing cognitive function in patients with epilepsy, the use of cognitive screening tools is important for the early identification of impairment. The gold standard for cognitive assessment is comprehensive neuropsychological testing; however, this approach is time-consuming and requires specialized resources. More practical screening instruments, such as the Mini-Mental State Examination (MMSE) and Montreal Cognitive Assessment (MoCA), can be used as alternatives. The MMSE is the most used tool, particularly for assessing cognitive function related to Alzheimer's disease. However, it has limitations owing to its relatively low sensitivity in detecting mild cognitive impairment and its susceptibility to the influence of age, socioeconomic status, and educational level [16].

In Indonesia, the MoCA was validated in 2010 by Husein et al., resulting in the Indonesian version, the MoCA-Ina [17]. The MoCA was developed as a brief cognitive screening tool to detect mild-to-moderate cognitive impairment and has demonstrated high sensitivity and specificity, particularly for mild cognitive impairment [18]. Furthermore, several studies suggest that the MoCA is more suitable for patients with epilepsy owing to its broader and more comprehensive assessment than the MMSE. One study reported that the MoCA has a sensitivity of 90% and that 87.5% of patients with normal MMSE scores were found to have cognitive impairment when assessed using the MoCA; no patient with a low MMSE score had a normal MoCA result. A strong correlation was observed between the two instruments ($r = 0.80$), and significant associations were found between memory function and both immediate and delayed recall—and seizure type ($p < 0.03$) and educational level ($p < 0.001$) [19]. A study involving 150 subjects (50 patients with temporal lobe epilepsy, 50 patients with other types of epilepsy, and 50 healthy controls) demonstrated a significant difference in mean MoCA scores. Both epilepsy groups had lower scores than the healthy control group ($p < 0.05$). Cognitive impairment is more severe in temporal lobe epilepsy, particularly in the visuospatial, attention, memory, language, and abstraction domains. Significant risk factors associated with cognitive decline include age, lower educational level, higher seizure frequency, and longer duration of epilepsy [20].

Brain-Derived Neurotrophic Factor as a Biomolecular Marker

In addition to cognitive screening instruments, cognitive function can also be assessed using biomolecular approaches, one of which is the measurement of brain-derived neurotrophic factor (BDNF) levels. BDNF is an essential protein that plays a critical role in promoting neuronal survival and synaptic plasticity, processes involved in memory and learning [21]. Basic and clinical studies have demonstrated that BDNF exerts broad effects on the nervous system, including neuroprotective roles in various neurological disorders, and is strongly associated with the development of cognitive function. In the context of epilepsy, recurrent seizures are thought to influence the expression and levels of BDNF in the brain, particularly in regions involved in memory function, such as the hippocampus. These alterations in BDNF levels may contribute to the cognitive impairment frequently observed in patients with epilepsy, suggesting that BDNF has potential as a biological marker reflecting the severity of cognitive dysfunction associated with recurrent epileptic activity [22].

Taken together, recurrent seizures contribute to impairments across multiple domains of cognitive function, with varying severity depending on the clinical characteristics and location of the epileptogenic foci. The involvement of brain structures, such as the temporal and frontal lobes, highlights the complex and multidimensional nature of cognitive impairment in patients with epilepsy. This underscores the importance of addressing the cognitive aspects of the management of patients with epilepsy rather than focusing solely on seizure control.

CONCLUSION

Recurrent seizures contribute to cognitive decline, especially when prolonged or uncontrolled. Impairments are influenced by seizure characteristics, age, education, and treatment regimens. Temporal and frontal lobe involvement shows that epilepsy affects domains including memory, delayed recall, executive functions, attention, language, especially naming, and visuospatial function. Early detection using instruments such as the Montreal Cognitive Assessment (MoCA) and routine assessment supports treatment planning and improves patients' quality of life.

DECLARATIONS

None

CONSENT FOR PUBLICATION

The authors agree to the publication of this article in the Journal of Society Medicine.

FUNDING

This work did not receive any specific grant from any funding agency.

COMPETING INTERESTS

All authors have reviewed and approved the final version of the manuscript and have agreed to its publication in the Journal of Society Medicine.

AUTHORS' CONTRIBUTIONS

All authors have read, critically revised, and approved the final manuscript and have agreed to be accountable for all aspects of the work.

ACKNOWLEDGMENTS

The authors would like to thank the Faculty of Medicine, Universitas Trisakti for their support during the preparation of this literature review. The authors also thank all the colleagues who provided valuable input and constructive feedback on the manuscript.

REFERENCE

1. Feigin VL, Vos T, Nair BS, Hay SI, Abate YH, Abd Al Magied AHA, et al. Global, regional, and national burden of epilepsy, 1990-2021: a systematic analysis for the Global Burden of Disease Study 2021. Lancet Public Health. 2025;10:27-e203.
2. Leidy NK, Elixhauser A, Vickrey B, Means E, Willian MK. Seizure frequency and the health-related quality of life of adults with epilepsy. Neurology. 1999;53:162.
3. Oommen K, Kopel J. Cerebral blood flow dynamics before, during, and after seizures from epilepsy and the periictal state. Baylor University Medical Center Proceedings. 2022;35.

4. Dingledine R, Varvel NH, Dudek FE. When and how do seizures kill neurons, and is cell death relevant to epileptogenesis? Adv Exp Med Biol. 2014;813.
5. Novak A, Vizjak K, Rakusa M. Cognitive impairment in people with epilepsy. J Clin Med. 2022;11:267.
6. Fisher RS, Cross JH, French JA, Higurashi N, Hirsch E, Jansen FE, et al. Operational classification of seizure types by the International League Against Epilepsy: Position Paper of the ILAE Commission for Classification and Terminology. Epilepsia. 2017;58:30-522.
7. Gulia S, Kumar V, Thakur M, Kumar DA. Pathophysiology of epileptogenesis: a comprehensive review. Journal of Population Therapeutics and Clinical Pharmacology. 2022;29(4).
8. Nakken KO, Solaas MH, Kjeldsen MJ, Friis ML, Pellock JM, Corey LA. Which seizure-precipitating factors do patients with epilepsy most frequently report? Epilepsy Behav. 2005;6(1):9-85.
9. Tran CHT, George AG, Teskey GC, Gordon GR. Seizures elevate gliovascular unit Ca2+ and cause sustained vasoconstriction. JCI Insight. 2020;5(21):e136469.
10. Lucchi C, Vinet J, Meletti S, Biagini G. Ischemic-hypoxic mechanisms leading to hippocampal dysfunction because of status epilepticus. Epilepsy Behav. 2015;49:47-54.
11. Opitz B. Memory function and the hippocampus. In: The Hippocampus in Clinical Neuroscience. Front Neurol Neurosci. 2014;34:51-59.
12. Lu G, Rili G, Shuang M. Impact of hypoxia on the hippocampus: a review. Medicine (Baltimore). 2025;104:e41479.
13. Harvey PD. Domains of cognition and their assessment. Dialogues Clin Neurosci. 2019;21(3):37-227.
14. Zhao F, Kang H, You L, Rastogi P, Venkatesh D, Chandra M. Neuropsychological deficits in temporal lobe epilepsy: a comprehensive review. Ann Indian Acad Neurol. 2014;17:82-374.
15. Zhu Q, Zhang J, Wang X, Fang Y. Influencing factors for cognitive impairment in patients with dorsolateral frontal lobe epilepsy. Neurol Asia. 2022;27:8-301.
16. Luthfiana A, Harliansyah H. Examination of memory index, MMSE (Mini Mental State Examination) and MoCA-Ina (Montreal Cognitive Assessment Indonesian version) on Yarsi University employees. YARSI Medical Journal. 2019;27(2).
17. Husein N, Lumempouw SF, Ramli Y. Indonesian version of Montreal Cognitive Assessment (MoCA-Ina) for screening cognitive dysfunction. Neurona. 2010;27(4).
18. Panentu D, Irfan M. Testing the validity and reliability of examination items using the Indonesian version of the Montreal Cognitive Assessment (MoCA-Ina) in post-stroke individuals in the recovery phase. Journal of Physiotherapy. 2013;13(1).
19. Souza MC de, Paulo CO de, Miyashiro L, Twardowschy CA. Comparison of screening tests in the evaluation of cognitive status of patients with epilepsy. Dement Neuropsychol. 2021;15:52-145.
20. Sodov U, Zuunnast K, Stefan H, Avirmed T. Can MoCA be applied for rough cognitive assessment in patients with epilepsy in Mongolia? J Clin Med. 2025;14:3372.
21. Adriani D, Amani P, Putri MA, Imran Y, Rachmiyani I, Fauzi A, et al. Memorizing Al-Quran increases serum BDNF levels. Journal of Medicinal and Chemical Sciences. 2025;8:44-339.
22. Wang X, Hu Z, Zhong K. The role of brain-derived neurotrophic factor in epileptogenesis: an update. Front Pharmacol. 2021;12:758232.
23. Imran Y, Naulla R. Risk Factors for Recurrence in Epilepsy Patients. Journal of Society Medicine. 2026;5(6):220-225.
24. Yani IF, Rachmiyani I, Imran Y, Khusfiani T, Nasution DP, Yousif E. Polycystic ovary syndrome (PCOS) as a risk factor for preeclampsia and cognitive dysfunction. Journal of Society Medicine. 2026;5(5):194-199.
25. Imran Y, Putri DM. Relationship between addiction to online video games and cognitive function in adolescents. Journal of Society Medicine. 2024;3(9):259-265.