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Electroencephalogram (EEG) features and clinical presentation in the elderly patient at neurologic polyclinic Sanglah General Hospital between July 2015-2017 period

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ABSTRACT

Background: Epilepsy has the highest prevalence and many diagnostic process challenges in the elderly population. Research about clinical, type of seizure, and electroencephalogram (EEG) features is very limited in Indonesia, including in Bali. This study aims to know clinical, type of seizure and electroencephalogram (EEG) features in elderly patients.

Methods: Cross-sectional descriptive study was conducted among 76 elderly-patients consecutively at Neurologic Polyclinic of Sanglah General Hospital Denpasar Bali between July 2015-2017. The clinical aspect, age, gender, and type of seizure were analyzed. Digital electroencephalogram (EEG) was obtained from all patients by 30 minutes of routine EEG recording. Data were analyzed using univariate analysis to determine the frequency distribution of

each variable and showed as a percentage in SPSS version 17 for Windows.

Results: There were 43 (56,57%) males and 33 (43,43%) females enrolled. Most of the epilepsy in elderly are symptomatic epilepsy which consists of post-stroke epilepsy (30,26%), post-traumatic epilepsy (1,32%), epilepsy-related to brain tumor (10,53%), and post encephalitis epilepsy (6,58%). The type of seizure dominated by partial seizure (57,9%) compared with others. EEG result of 76% of patients was classified as normal EEG, and 24% were abnormal EEG.

Conclusion: Most of epilepsy in the elderly are symptomatic epilepsy, and the most cause is post-stroke epilepsy. The partial seizure is the most frequent type of seizure in the elderly.

Keywords: Electroencephalogram, elderly, clinical presentation

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INTRODUCTION

Increasing the health degrees and well-being of the population will increase life expectancy. The Central Bureau of Statistics reports the increase of life expectancy in Indonesia, which in 2000 was 64.5 years (with the percentage of the elderly population was 7.18%). This number increased to 69.65 years in 2011 (with the percentage of the elderly population being 7.58%).¹

The increase of the elderly population will increase morbidity rates of degenerative disease². Epidemiological study shows that the incidence and prevalence of epilepsy are highest in the elderly population, which one-third of all epilepsy diagnosis is made in people over the age of 60 years.³ The incidence of epilepsy that occurs at the age of 70 is twice as high as children and at the age of 80 as much as three times higher than children. The majority of elderly patients also have other comorbid diseases which are increasing health

care system burdens. The death rate from epilepsy also increases when epilepsy is combined with cardiovascular disease or senile dementia.⁴

Epilepsy in the elderly has a challenge in diagnostic because it is inhibited by several factors such as unable to provide detailed seizure history, seizures are often not observed by others, misdiagnose as changes in mental status, confusion, transient ischemic attack (TIA), or late-life migraine. The elderly population also has differences in etiology compared with young age, have disease comorbidities, cognitive difficulties, and physiological changes that affect the management of epilepsy.^{3,5} Hence, needed careful clinical examination and more than one investigation. Electroencephalography (EEG) is a technique to help diagnose in the elderly population, specifically establishing a diagnosis of epilepsy.⁶ EEG is essential in evaluating brain aging and recognizing of structural or functional changes in the brain. EEG signals have a large amount of

information that is important for the diagnosis of neurological diseases, especially epilepsy. EEG can be used as a preliminary test to distinguish between epilepsy and normal aging before using expensive and invasive tests.⁷ Unfortunately, there are only a few data regarding the clinical characteristics of elderly patients undergoing EEG in Indonesia, especially Bali.

Based on the aforementioned, the objective of the present study was to evaluate the clinical, type of seizure, and electroencephalogram (EEG) features in elderly patients at Sanglah General Hospital Bali, Indonesia

METHODS

A cross sectional descriptive study was conducted used seventy-six elderly patients with seizure, ≥ 60 years of age consecutively attended at Neurologic polyclinic Sanglah General Hospital Denpasar Bali between July 2015 and July 2017. The clinical neurological assessment evaluated clinical aspect, age, gender, and type of seizure. Digital electroencephalogram (EEG) was obtained for all patient by 30 minutes of routine EEG recording. The patients were noted according to the diagnosis when they were referred to the hospital. The type of seizure was evaluated and divided into three types such as generalized seizure, partial seizure, and others (syncope differential diagnosed with seizure).⁸

All patients who met the inclusion criteria were analyzed. Inclusion criteria consist of aged over 60 years, both men and women. Patient with open sepsis, hepatic encephalopathy, alcohol

withdrawal seizures, and gross metabolic disorders which trigger seizure such as hypoglycemia, hyperglycemia (serum level < 60 mg/dl, or > 600 mg/dl), hypocalcemia (serum level < 2.2 mmol/lit), or hyponatremia (serum level < 125 mg/dl) excluded.

EEG features were classified as normal EEG and abnormal EEG type I, II, III. Referred to as normal EEG if there is no abnormality in the electroencephalogram features. The degree of EEG abnormalities is divided as abnormal I, II, and III. EEG categories depend on the clinical significance of the finding and correlate with either the severity of the cerebral dysfunction or the specificity of the EEG abnormality.^{9,10}

Data analysis was conducted descriptively to see the frequency distribution of variable ratios that had been categorized and categorical variables. During data collection, researchers used codes to maintain the confidentiality of patient identities. All of data were analyzed using SPSS version 17 for Windows.

RESULTS

Seventy-six patients (43 male and 33 female) with more than or equal to 60 years of age were evaluated. The most EEG referral diagnosis in elderly was symptomatic epilepsy (48.69%) which consist of post-stroke epilepsy (30.26%), post-traumatic epilepsy (1.32%), epilepsy-related to brain tumor (10.53%), and post encephalitis epilepsy (6.58%). Suspected idiopathic epilepsy founded in 34.21%, which include temporal lobe epilepsy (10.53%) and late-onset epilepsy (23.68%). Epilepsy related to specific syndrome reached 9.21%, which the etiology were electrolyte disturbance, hypoglycemia, and kidney failure. Syncope differentiated diagnosed with seizure reached 7.89% (Table 1).

The most seizure type were partial seizures (57.9%). The partial seizure consists of the simple partial seizure (19.7%), complex partial seizure (15.8%), and partial seizure evolving in secondarily generalized seizures (22.4%). The percentage of generalized tonic-clonic seizure was 34.2%, and others (syncope differential diagnosed with seizure) was 7.9%. (Table 2)

Normal EEG was found in 76% of patients and abnormal EEG was found in 24%. Abnormal EEG type I were obtained in 8% EEG which 5 EEG showed diffuse general intermittent slow activity and suggested as mild encephalopathies diffuse general. One of abnormal EEG type I showed excessive fast activity and suggested because of diazepam intoxication. Abnormal EEG type II were obtained in 12% EEG, which showed intermittent slow activity focal related to the location of cerebral encephalopathies. Abnormal EEG type III were obtained from 4% cases. (Table 3)

Table 1. Clinical characteristics of an elderly patient who underwent EEG at Neurologic Polyclinic Sanglah Hospital between July 2015 and July 2017

Clinical Characteristic	N (%)
Symptomatic epilepsy	37 (48.69)
Post-stroke epilepsy	23 (30.26)
Post-traumatic epilepsy	1 (1.32)
Epilepsy-related to a brain tumor	8 (10.53)
Post encephalitis epilepsy	5 (6.58)
Epilepsy late-onset	18 (23.68)
Temporal lobe epilepsy	8 (10.53)
Epilepsy-related to a specific syndrome	7 (9.21)
Syncope	6 (7.89)

Table 2. Seizures type of elderly patient who underwent EEG at Neurologic Polyclinic Sanglah Hospital between July 2015 and July 2017.

Type of seizure	N (%)
Partial seizure	44 (57.9)
Simple partial seizure	15 (19.7)
Complex partial seizure	12 (15.8)
Partial seizure evolving in secondary generalized seizures	17 (22.4)
Generalized tonic clonic seizure	26 (34.2)
Others (syncope differential diagnosed with seizure)	6 (7.9)

Table 3. Encephalogram features of an elderly patient who underwent EEG at Neurologic Polyclinic Sanglah Hospital between July 2015 and July 2017.

EEG feature	N (%)
Normal EEG	58 (76)
Abnormal EEG	18 (24)
Abnormal I	6 (8)
Abnormal II	9 (12)
Abnormal III	3 (4)

EEG: electroencephalogram

DISCUSSION

Seizures and epilepsy are an important and common clinical problem in the elderly. The main known causes of seizures in the elderly population are the cerebrovascular disease, brain tumors, CNS infections, head trauma, Alzheimer's disease, and various metabolic-toxic syndromes such as non-ketotic hyperglycemia and drug toxicity. The recognition of seizures in the elderly may be complicated because of many clinical presentations and differential diagnoses. Management of epilepsy in the elderly also can be difficult because of many factors, including disease comorbidity, drug interactions, changes of pharmacokinetic, and pharmacodynamic. Side effects of antiepileptic drugs and seizure-related deaths were also high in the elderly.¹¹

Most of the epilepsy in the elderly are symptomatic epilepsy, and the most cause is post-stroke epilepsy. Symptomatic epilepsy was found in 55% of patients, and cryptogenic or idiopathic was found in 45%.¹¹ Other studies show that 30% to 40% of all epileptic seizures in the elderly are in people who have experienced a stroke. Hemorrhagic stroke has twice the risk of seizures higher than ischemic

stroke. The risk of experiencing seizures after suffering stroke is probably 20%¹²

Stroke can also be associated with immediate and delayed epilepsy attacks, which can increase the risk of epilepsy as much as 5.7% in the first year and 11.5% in 5 years.^{3,13} Cerebrovascular disorders may cause impaired integrity of neurovascular units, irregular metabolism, and perfusion of the brain, blood-brain barrier dysfunction; and inflammation.⁴

There is a limited understanding of the pathophysiological mechanisms underlying post-stroke seizures. In human studies, the presence of several comorbidities such as hypertension, hyperlipidemia, and diabetes can alter the homeostatic mechanism in the ischemic penumbra. An immediate seizure may be associated with acute changes such as metabolic disorders (increased penumbral sodium and intracellular calcium), excessive glutamate, downregulation of gamma-aminobutyric acid (GABA) inhibition, hypoxia, and hypoperfusion. Delayed seizures may be caused by chronic abnormalities such as a scar, changes in nerve stimulation, and hemosiderin deposition.^{3,14} During stroke or myocardial infarction, the brain lacks oxygen which can trigger seizures.

Seizures in the elderly have prolonged post-ictal state that can last more than 24 hours. It is essential to understand because it increases the risk of injury due to prolonged confusion and/or temporary paralysis that can cause falls or severe injury.

Elderly patients present with a unique presentation, suggestive of many different differential diagnoses. Elderly patients are at high risk for not just diseases like Alzheimer's, but also stroke and brain tumor. The natural course of acquired epilepsy in human follows a progression from insult (stroke) to a latent period when no seizures are observed to the state of chronic epilepsy defined as two or more spontaneous seizures.⁵ The elderly patient also is at high risk for metabolic disturbance like electrolyte disturbance, hypoglycemia, so elderly patients are more susceptible to seizures related to the specific syndrome. Elderly patients also are at high risk for cardiovascular event and syncope, and the clinical presentation is mimic as seizure.⁵

In the present study, the most seizure type were partial seizures. These finding supported by other studies which focal epileptic seizures were found in 67.3% of epilepsy with onset at over 50 years of age.⁶ In contrast, secondary general tonic-clonic seizures were found in only 26% of elderly patients compared to younger adults by 65%. Clinical differences may be related to the origin of the seizure anatomy, which is more likely at mesial temporal in young age and extratemporal, especially frontal or parietal

in the elderly. Extratemporal lobe localization often occurs because the most common seizure etiology is a stroke. But in some cases, new-onset temporal lobe epilepsy can also occur in the elderly population.³

Abnormal EEG is founding in 18 EEG (24%). Generalized EEG abnormalities are founding in 6 (8%) EEG, but the most EEG abnormalities are focal and founding in 12 EEG (16 %). The type of EEG abnormalities is slowing activity in 20% EEG and epileptiform discharges in 3% EEG, others in 1% EEG. Generalized intermittent slow activity and excessive fast activity are classified as abnormal I. These abnormal I classification are suggesting as mild diffuse generalized encephalopathies. Focal Intermittent slow activity is classifying as Abnormal II (in 12% EEG) because the abnormalities not specific and are suggesting as focalized medium encephalopathies in a certain region of the brain. All of abnormal III cases are a cerebral tumor and showed lateralized on the EEG features. One of the abnormal III EEG showed continuous slow activity at the left frontotemporal region suggested severe encephalopathies in that region. The other one showed periodic lateralized epileptiform discharges (PLEDs) at right parietocentral suggested destructive lesion at that region. The other case showed sharp wave at right frontal suggested potential epileptogenicity at right frontal (Table 3). Lateralized on EEG abnormalities indicate that in elderly most of encephalopathies or epileptogenesis in the brain are focal and due to symptomatic epilepsy/seizure.

Although EEG is the most common investigation in patients with seizures, EEG analysis is less specific and sensitive than neuroimaging. As many as 12-38% of healthy individuals have abnormalities in EEG in the elderly population. Therefore, the diagnosis of seizure disorders in the elderly is not only based on single EEG findings, although EEG can be useful for identifying the type of seizure.¹¹ The limitation of this study is that only patients from tertiary care hospitals undergo the analysis process, so the patient has a higher percentage of comorbidity.

CONCLUSION

Elderly patients present with a unique clinical presentation, suggestive of many different differential diagnoses and are at high risk for many diseases. Most of the epilepsy in the elderly are symptomatic epilepsy, and the most cause is post-stroke epilepsy. The partial seizure is the most frequent type of seizure in the elderly. The type of EEG abnormalities in elderly are consisting of slowing activity, epileptiform discharges, and the

most type of EEG abnormalities are slowing activity. Lateralized on EEG abnormalities indicate that most of encephalopathies or epileptogenesis in the brain are focal and due to symptomatic epilepsy/seizure. In this present study, all Abnormal III EEG, which showing severe and specific abnormalities are obtaining from cerebral tumor cases.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interests.

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Not applicable to this research.

AUTHOR CONTRIBUTIONS

All of the authors are equally contributed to the study from a conceptual framework, data gathering, data analysis, until results interpretation of is.

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