Original Research Article

Evaluation of electroencephalographic changes in patients with the new onset suspicious seizure movements

Ghasem Fattahzadeh, Abolfazl Atalu, Zahra Hamed*, Anahita Abdolzadeh

Department of Neurology, Ardabil University of Medical Science, Ardabil, Iran

*Correspondence:
Dr. Zahra Hamed,
E-mail: Z127hamed@gmail.com

ABSTRACT

Background: Abnormal EEG is a predictor of seizure relapse. Obtaining data related to the diagnosis and outcome of the first seizures is necessary for improving care for these patients, whereas data for these studies is scarce and is limited to a few a few centres. The aim was evaluation of the EEG changes in patients with first suspicious movements of seizure.

Methods: All of the patients with first suspicious movements of seizure referred to Alavi hospital of Ardabil from March 2019 to March 2020 enrolled in this study. Data including age, gender, etiology of the seizure, seizure type and EEG changes gathered. Collected data were analyzed by statistical methods in SPSS version 21.

Results: 71 patients were studied. Based on the seizure type, 50 (70.4%) patients had motor, 10 (14.1%) patients had nonmotor and 11 (15.5%) patients had focal seizures type impaired awareness. EEG findings were normal in 46 patients (64.8%). There were slowing waves and epileptic discharge in 12 (16.9%) and 13 (18.3%) patients, respectively. Abnormal EEGs recorded in routine modality in 16 patients (64%), H. V. modality in 2 patients (8%), Ph. S. modality in 2 patients (8%) and both routine and excitatory modalities in 5 (20%) patients.

Conclusions: There was not a significant relationship between EEG findings and age, gender, seizure etiology and seizure type. Also there was not a significant relationship between abnormal waves in different modalities and type and etiology of the seizures.

Keywords: Electroencephalography, Seizure, Excitatory, Modalities, Seizure, Etiology

INTRODUCTION

Seizure is defined as excessive or concurrent simulation and abnormal activity of neurons in the brain and is classified into three general categories of focal seizures, generalized seizures and non-classified seizures.[1]

The incidence rate of seizures in high-income countries is between 40 and 70 cases per 100,000 people per year and in less developed countries it is estimated to be about twice that rate which is usually higher among young children and older people.[2] The new onset seizure can range from a fleeting experience such as twitch to a tonic-colonic seizure.

Seizure attack may occur due to a predisposing factor or without predisposing factor with unknown cause.[3] Differential diagnosis of the new onset seizure is widespread and the most important ones include syncope, apnea, transient ischemic attacks, metabolic encephalopathies (e.g. hypoglycemia or electrolyte disorders), sleep disorders (e.g. narcolepsy), migraine complex, cardiac arrhythmias and pseudo seizures.[4] Seizure is characterized by uncontrolled electrical activity episodes in the brain and it is diagnosed by observation,

neurologic physical examination and EEG and in some cases advanced brain imaging. Primary EEG (within first 48 hours) and MRI are the accurate diagnostic methods for the new onset seizure.[5] EEG shows a variety of physiologic and pathologic patterns of the brain that are classified for diagnostic purposes. In order to identify abnormal patterns, different types of normal patterns must be clearly identified. Standard EEG report should include description, classification and clinical interpretation. EEG interpretation requires patient demographic information, past medical and drug history, clinical conditions during EEG, details of their level of consciousness and reaction level.[6,7] The first seizure is an unforgettable event for the patients and their family members. The new onset seizure might be the first important disease for young and previous healthy patients and for older patients, the new onset seizure might represent an unexpected period of loss of autonomy. Social exclusion around the world is intimately associated with the first occurred seizure, and usually the first seizures due to fear of social stigma, fear of losing driver's license, concerns about employment and has often been concealed and therefore information about the first occurred seizures is limited to only a few centers worldwide.[9,8]

Therefore, evaluation of patients with the new onset seizure is an important and common issue in neurology.[10] Therefore, obtaining data of the diagnosis and outcome of the new onset seizures is necessary to develop and improve the services provided to these patients. Therefore, the aim of this study was to evaluate the electroencephalographic changes in patients with the new onset suspicious seizure movements referred to Alavi hospital of Ardabil city.

METHODS

Study design

This descriptive cross-sectional study was conducted on 71 patients with the new onset suspected seizure movements referred to Alavi hospital in Ardabil city from March 2019 to March 2020.

Data collection

All patients firstly referred to the electroencephalography (EEG) and all the required data were obtained through a two-part checklist including demographic and clinical information such as age, gender, etiology of seizures and type of seizure and findings of EEG.

Statistical analysis

The collected data were analyzed using SPSS statistical software version 26. Fisher and square Pearson tests were used to investigate the relationship between variables and p value less than 0.05 was considered significant.

RESULTS

71 patients enrolled in this study of them, 57.7% were male and the rest were female with an average age of 37 years old which, 45.1% were under 30 years old and 4.2% were over 70 years old. Electroencephalographic findings showed that 46 (64.8%) of patients had normal EEG and 25 (35.2%) had abnormal EEG, of which 12 (48%) had slowing waves and 13 (52%) had epileptic discharges.

Table 1: Relation between EEG findings with demographic information of patients.

Demographic variables		EEG findings								P value
		Normal		Epileptic discharges		Slowing waves		Total		
		N	%	N	%	N	%	N	%	
Gender	Male	27	66	5	12	9	22	41	57.7	0.19
	Female	19	63.3	8	16.7	3	10	30	42.3	
	Total	46	64.8	13	18.3	12	16.9	71	100	
Age groups (in years)	<30	19	59.3	10	31.3	3	9.4	32	45.1	0.15
	40-30	8	66.7	2	16.7	2	16.7	12	16.9	
	40-50	11	84.5	0	0	2	15.4	13	18.3	
	>50	8	57.1	1	7.2	5	35.7	14	19.7	
	Total	46	64.8	13	18.3	12	16.9	71	100	

Table 2: Relation between EEG finding and seizure etiology.

Seizure etiology	Normal		Epileptic discharge		Slowing waves		Total		P value
	N	%	N	%	N	%	N	%	
Idiopathic	21	65.6	7	21.9	4	12.5	32	45.1	
Hypokalemia	7	70	3	30	0	0	10	14.1	
Tramadol use	0	0	0	0	1	100	1	1.4	

Continued.

Seizure etiology	Normal		Epileptic discharge		Slowing waves		Total		P value
Head trauma	4	66.7	1	16.7	1	16.7	6	8.5	
CNS infection	1	100	0	0	0	0	1	1.4	
Stroke	5	55.6	1	16.7	3	33.3	9	12.6	
Uremia	1	100	0	0	0	0	1	1.4	
Vascular malformation	2	67	0	0	1	33	3	4.2	0.69
Hyponatermia	2	100	0	0	0	0	2	2.8	
Brain tumor	2	50	0	0	2	50	4	5.6	
MS	0	0	1	100	0	0	1	1.4	
Hypocalsemia	1	100	0	0	0	0	1	1.4	
Total	46	64.8	13	18.3	12	16.9	71	100	

Table 3: Relation between type of seizure with EEG and modality findings in patients.

EEG and modality findings		Type of siezures								P value
		Motor		Impaired awareness		Non-motor		Total		
		N	%	N	%	N	%	N	%	
EEG (N=71)	Normal	32	69.5	5	11	9	19.5	46	64.8	
	Slowing waves	8	66.7	4	33.3	0	0	12	16.9	0.2
	Epileptic discharge	10	77	2	15.4	1	7.6	13	18.3	
	Total	50	70.4	11	15.4	10	14.1	71	100	
Modality (N=25)	Routine	12	75	4	25	0	0	16	64	
	H. V.	2	100	0	0	0	0	2	8	
	Routine and excitatory stage waves	1	50	0	0	1	50	2	8	0.29
	Ph. S.	3	60	2	40	0	0	5	20	
	Total	18	72	6	24	1	4	25	100	

27 (66%) of male and 19 (63.3%) of female patients had normal EEG and the relationship between EEG and gender and age groups was not statistically significant (Table 1).

The most common etiologies were idiopathic seizure, hypoglycemia and stroke with incidence of 45.1%, 14.1% and 12.6%, respectivelye and among idiopathic seizure patients, EEG findings were normal in 65.6% of them and 21%. 9% had epileptic discharges. Among patients with hypoglycemia-induced seizures, EEG findings were normal in 70% of them and 30% had epileptic discharges and no significant relationship was found between the etiology of seizures and EEG findings (Table 2). Evaluation of seizure types showed that 50 cases (70.4%) had motor seizures, 10 cases (14.1%) had nonmotor type seizure and 11 cases (15.4%) had impaired awareness type. The most amount of epileptic discharges and slowing waves were found in motor type seizures with incidence of 77% and 66.7%, respectively, but there was no significant relationship between the type of seizure and EEG findings (Table 3).

In interpretation of EEG findings of 25 patients with abnormal electroencephalography, 16 patients (64%) had routine modality waves, 5 patients (20%) had routine and excitatory stage waves, 2 patients (8%) had H. V. modality and two patients (8%) had Ph. S. modality and there was no significant relationship between modality type and EEG of patients (Table 3).

DISCUSSION

In this study, 71 patients with the new onset suspected seizure movements were enrolled in the study, of which 41 were male (57.7%) and 30 women (42.3%) with an average age of 37 years, which is indicating a higher prevalence of the disease in men. In study of Bahrami et al among 221 patients, 54% were male and 46% were female.[11] In Ahangar et al study, of 213 patients, 138 were male and 75 were female, which result of both studies were in line with the present study. In the present study, the most common type of seizure was generalized motor seizure with prevalence of 70.4%. Also, it was mentioned in Merritt's book that the most common type of seizure is generalized type.[12,13]

In the present study, as the Merritt's book mentioned, the most common type of seizure was generalized motor seizure with prevalence of 70.4%.[13] Evaluation of

etiologies of seizures showed that most cases were idiopathic seizures (32 cases with 45.1%). Among sympathetic etiologies, hypoglycemia (10 cases with 14.1%) and stroke (9 cases with 12.6%) were most common reasons, respectively.

In Aynesher et al study, etiology of seizures included 77 cases (36.1%) of epilepsy, 45 cases (21.1%) were idiopathic and the rest cases were due to poisonings and cerebrovascular lesions.[12] In general, the known causes of seizure etiology which were mentioned in Merritt's book included idiopathic epilepsy (65.5%), infections (2.5%), degenerative diseases (3.5%), malignancies (4.1%) and vascular diseases (10.9%), which is in line with the present study.[13]

Perhaps the reason is that the culture of follow up of the disease until full treatment had not yet been established among the people of the society and some people, whenever they or their relatives have seizures, go to the doctor and temporarily continue the treatment for a while and then leave and sometimes the costly treatment prevents patients from visiting the doctor.

EEG findings in the present study included normal in 46 cases (64.8%) and abnormal in 25 cases (35.2%) and abnormal EEG findings included slowing waves in 12 cases (48%) and epileptic discharges in 13 cases (52%) and in 16 patients (64%) these waves were in routine modality and in 5 patients (20%) in routine-excitatory stage. Yenjun et al studied 87 patients with symptoms and EEG findings in favor of generalized idiopathic epilepsy and divided the patients into two groups including 56 adolescent patients aged 11-20 years old and 31 adult patients aged 20 years and older. The results of this study showed that there was no difference in EEG findings between these two groups of patients.[14]

Similarly, in the present study, there was no significant difference between EEG of patients with age and etiology and type of seizure. In another study, 500 epileptic patients were studied. The results showed that 386 patients (77.2%) had abnormal EEG and 114 patients had normal EEG despite history of epilepsy.

Likely the results of this study showed that activation was effective in positive findings of EEG, but the rate of positive findings in activation groups was not statistically significant. In the present study, despite different excitatory modalities, no relationship was found between modalities and type and etiology of seizures.[15] Contrary to our study, in an analytical study conducted over two years on 111 children with complex febrile convulsion, the results showed that EEG was abnormal in 37.8% of patients, which 9% of them had epileptic waves and 28.8% had nonspecific abnormal waves. They found a significant relationship among focal seizure, familial history of the disease, febrile convulsion and neurological disorder after seizure.[16] Due to nature of the study based on changes in EEG results, we had no limitation in this study.

CONCLUSION

Most of the EEG findings of the patients in this study were normal but not definitively ruled out the seizures and it seems that the diagnostic value of EEG is less likely in patients with the new onset suspected seizure movements. Therefore, regular control of this disease and follow up of patients for repeating the EEG can be effective in reducing the costs and incidence of seizures. On the other hand, a small number of samples and short duration of study can affect the results so further studies with larger number of samples and longer period of time is recommended. It is also important to understand the secondary causes of seizures, considering that it is preventable and treatable in most cases.

REFERENCES

1. Palka D, Yogarajah M, Cock HR, Mula M. Diagnoses and referral pattern at a first seizure clinic in London. J Epileptol. 2017;25(1-2):31-6.
2. Aminoff MJ. Aminoff's electrodiagnosis in clinical neurology e-book. 6th ed. Philadelphia: Elsevier Health Sciences; 2012.
3. Angus-Leppan H. First seizures in adults. BMJ. 2014;348:2470.
4. Pohlmann-Eden B, Beghi E, Camfield C, Camfield P. The first seizure and its management in adults and children. BMJ. 2006;332(7537):339-42.
5. Pohlmann-Eden B, Newton M. First seizure: EEG and neuroimaging following an epileptic seizure. Epilepsia. 2008;49(1):19-25.
6. Noachter S. A glossary of terms most commonly used by clinical electroencephalographers and proposal for the report form for the EEG findings. Electroencephalogr Clin Neurophysiol Suppl. 1999;52:21-41.
7. Kane N, Acharya J, Beniczky S, Caboclo L, Finnigan S, Kaplan PW, et al. A revised glossary of terms most commonly used by clinical electroencephalographers and updated proposal for the report format of the EEG findings. Revision 2017. Clin Neurophysiol Pract. 2017;2:170-185.
8. Pressler R, Beniczky S, Aurlien H, Fuglsang-Frederiksen A, Martins-da-Silva A, Trinka E, et al. W8.4 SCORE: specific features of the neonatal EEG. Clin Neurophysiol. 2011;122(1):S26.
9. Nowacki TA, Jirsch JD. Evaluation of the first seizure patient: key points in the history and physical examination. Seizure. 2017;49:54-63.
10. Bergey GK. Management of a first seizure. Contin Lifelong Learn Neurol. 2016;22(1):38-50.

11. Bahrami P, Farhadi A, Movahedi Y. Frequency of seizure causes in patients referred to neurology clinic in Khorramabad city. Yafte. 2014;16(2):24-31.

12. Ahangar AA, Izadpanah F, Aghajanipour A, Baay MR. Etiology of sirzure disorder in cases admitted to emergency department of Ayatollah Roohani Hospital in Babol, Iran (2009-2011). J Babol Univ Med Sci. 2013;15(2):102-8.

13. Rowland LP, Pedley TA, Merritt Neurology. 10th ed. Philadelphia, PA: Lippincott Williams and Wilkins; 2010.

14. Yenjun S, Harvey AS, Marini C, Newton MR, King MA, Berkovic SF. EEG in adult-onset idiopathic generalized epilepsy. Epilepsia. 2003;44(2):252-6.

15. Gholamreza-Mirzaei M. Comparing the validity of EEG in epileptic patients with and without activation methods. J Shahrekord Univ Med Sci. 2009;10(4):22-7.

16. Mitra H, Nazanin R, Ali ATS. EEG disorder in patients with complex febrile convulsion and underlying risk factors. J Kermanshah Univ Med Sci (Behbood). 2014;18(5):298-302.