

Is Interictal EEG Correlated with the Seizure Type in Idiopathic (Genetic) Generalized Epilepsies?

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Abstract

Objective

We investigated the correlation between different interictal EEG abnormalities observed in patients with idiopathic (genetic) generalized epilepsies (IGEs) and their seizure types.

Material & Methods

In this cross-sectional study, all patients with the diagnosis of IGE, were recruited in the outpatient epilepsy clinic at Shiraz University of Medical Sciences, Iran, from 2008 through 2010. Demographic variables and relevant clinical and EEG variables were summarized descriptively. Statistical analyses were performed using independent samples T-test, Chi square and Fisher's Exact tests to determine potentially significant differences.

Results

Three-hundred thirty-six patients were diagnosed as having IGE. Interictal EEG findings in patients with generalized tonic-clonic seizure (GTCS) compared to patients without GTCS were not different. Abnormal EEG findings in patients with myoclonic seizures compared to patients without these were not different either. However, normal EEGs were more frequently observed in patients with history of myoclonic seizures ($P = 0.0001$). EEG findings in patients with absences compared to patients without absences were not different.

Conclusion

Interictal EEG cannot differentiate the seizure types and therefore different syndromes of IGEs. Polyspikes, 3-Hz generalized spike-wave (GSW) complexes and 3.5-6 Hz GSW complexes, alone or in combinations, could be observed in various seizure types and syndromes of IGE. The key element in making the correct diagnosis is a detailed clinical history.

Keywords: Idiopathic generalized epilepsy; EEG; Seizure type

Introduction

Idiopathic (genetic) generalized epilepsies (IGEs) are epilepsy syndromes diagnosed by strict clinical and electroencephalographic (EEG) features proposed by the International League Against Epilepsy (ILAE) (1). EEG provides information concerning the presence or absence of abnormal electrical activity as well as information that aids in the classification of epilepsy syndromes and location of the seizure focus [2]. EEG is particularly valuable in making the diagnosis of idiopathic (genetic) generalized epilepsies (IGEs). Presence of generalized spike-wave

complexes and / or polyspikes adds to the probability of a correct diagnosis (i.e., IGE) and supports this diagnosis (1). However, EEG has its own limitations. For example, it could be normal in some patients (3). Besides, there are reports revealing no significant differences in EEG features of various syndromes of IGE (4). In this study, we investigated the correlation between different interictal EEG abnormalities observed in patients with IGE and their seizure types.

Methods & Material

In this cross-sectional chart review single-center retrospective study, all patients with an electro-clinical diagnosis of IGE, who had at least one EEG available, were recruited in the outpatient epilepsy clinic at Shiraz University of Medical Sciences, from 2008 through 2010. The diagnosis of epilepsy was made based on the clinical grounds and EEG findings and all patients had to be under the care of the epileptologist at our institution. Study time for EEG was 10 minutes and we performed intermittent photic stimulation at 4, 8, 12, 16 and 20 Hz (10 seconds IPS and 10 seconds rest) in all patients. Hyperventilation was typically performed in children above five years of age. The high frequency filter was set to 70 Hz and the low filter was at 0.16 Hz. The EEG machine was analog (Nihon-Kohden). All EEGs were analyzed and reported by the epileptologist.

We differentiated the IGE syndromes on the basis of their predominant seizure type and age of onset (for further studies refer to references 5-7). There was no age limit to enter the study. Age, gender, age at seizure onset, seizure type(s) and interictal EEG findings of all patients were registered routinely. Demographic variables and relevant clinical and EEG variables were summarized descriptively to characterize the study population. Statistical analyses were performed using independent samples T-test, Chi square and Fisher's exact tests to determine potentially significant differences and a P value less than 0.05 was considered significant. This study was conducted with the approval of Shiraz University of Medical Sciences review board.

Results

During the study period, 336 patients were diagnosed as having IGE and had EEG(s) available. Of these, 199

patients were female (59%) and 137 (41%) were male. Age of seizure onset was 12 ± 7 years (minimum = 1 and maximum = 47 years). One hundred thirty four patients had new-onset IGE and the rest were on therapy at the time of referral.

1. Generalized tonic-clonic seizures: The most common seizure type among our patients was generalized tonic-clonic seizures (GTCS), which were reported in 297 (88%) patients. Among these, 75 patients had only GTCSs (without other seizure types). The sex ratio (female to male) among patients with a history of GTCSs was 1.5 (177: 120) and in patients without GTCS was 1.3 (22: 17). The difference was not statistically significant ($P = 0.7$). The mean (\pm standard deviation) age of onset in patients with a history of GTCS was 13 years (± 7) and 8 years (± 5) in patients without GTCS. The difference was statistically significant ($P < 0.001$). Interictal EEG findings in patients with GTCS compared to patients without GTCS were not different. These are summarized in table 1. EEG findings in patients with pure GTCS (75 patients) compared to patients without GTCS (39 patients) were not different either. We did the same analysis in patients with new-onset IGE [patients not taking any antiepileptic drug (AED)] in order to eliminate any possible confounding effects of AEDs on EEG findings (8). Similar to previous analyses, there was no significant difference between patients with new-onset IGE and GTCS (110 patients) compared to new-onset patients without GTCS (24 patients) regarding EEG findings. The rate of photoparoxysmal response (PPR) in patients with GTCS was 7.7% (23:297) and in patients without GTCS was 2.6% (1:39) demonstrating no significant difference, statistically ($P = 0.2$).

2. Myoclonic seizures: Myoclonic seizures were reported in 197 (59%) patients of whom 10 patients had myoclonic seizures only. The sex ratio (female to male) among patients with history of myoclonic seizure was 1.9 (128:69) and 1 (71:68) in patients without myoclonic seizures showing a significant difference, statistically ($P = 0.01$). The mean (\pm standard deviation) age of onset in patients with history of myoclonic seizures was 14 years (± 5) and 10 years (± 8) in patients without myoclonic seizures pointing to a significant difference, statistically ($P < 0.001$). There was no significant difference between patients with myoclonic seizures and patients without

myoclonic seizures regarding abnormal interictal EEG findings. However, normal EEGs were more frequently observed in patients with history of myoclonic seizures compared to patients without jerks ($P = 0.0001$). EEG findings in patients with myoclonic seizures compared to patients without myoclonic seizures are summarized in table 2. Abnormal EEG findings in patients with pure myoclonic seizures (10 patients) compared to patients without myoclonic seizures (139 patients) were not different either. Similarly, abnormal EEG findings in patients with new-onset IGE and myoclonic seizures (63 patients) compared to new-onset patients without myoclonic seizures (71 patients) were not different. The rate of photoparoxysmal response in patients with myoclonic seizures was 9.1% (18:197) and in patients without myoclonic seizures was 4.3% (6: 139). The difference was not statistically significant ($P = 0.09$).

3. Absence seizures: Absence seizures were reported in 153 (46%) patients of whom 13 had absences only. The sex ratio (female to male) among patients with history of absences was 1.9 (88: 65) and in patients without absences was 1.5 (111: 72). The difference was not statistically significant ($P = 0.5$). The mean (\pm standard deviation) age of onset in patients with history of absences was 13 years (± 7) and 12 years (± 7) in patients without absences. The difference was not statistically significant ($P = 0.3$) either. Interictal EEG findings in patients with absences compared to patients without absences were not different. These are summarized in table 3. EEG findings in patients with pure absences (13 patients) compared to patients without absences (183 patients) were not different either. Similarly, there were no significant differences between patients with new-onset IGE and absences (65 patients), and new-onset patients without absences (69 patients) regarding EEG findings. The rate of photoparoxysmal response in patients with absences was 6.5% (10:153) and in patients without absences was 7.7% (14:183); not showing a statistically significant difference ($P = 0.6$).

Discussion

EEG is a valuable tool in making the diagnosis of IGE. Presence of generalized spike-wave complexes and / or polyspikes adds to the probability of a correct diagnosis of IGE and supports this diagnosis (1). However, EEG

has its own limitations. First, it could be normal in some patients (about 15% in our study). In our study, a normal EEG was particularly common in patients with myoclonic seizures (27%) compared to patients without this seizure type (12%). In contrast, the frequency of normal EEGs in patients with absences was lower compared to patients without absences (16% vs. 24%; $P = 0.1$). The latest difference was not statistically significant. These findings were similar to the findings in a previous study by Betting and colleagues (3). Second, interictal EEG cannot differentiate the seizure types and therefore different syndromes of IGEs. Polyspikes, 3-Hz GSW complexes and 3.5 - 6 Hz GSW complexes, alone or in combinations, could be observed in various seizure types and IGE syndromes. This is in contrast to the general perception that 3-Hz GSW complexes mean absences and polyspikes mean myoclonic seizures. In a previous report, there was no EEG difference between classic adolescent-onset IGEs and adult-onset IGEs (4). In another recently published study on the same population, we did not observe any significant differences between early-onset and typical childhood absence epilepsies with respect to the demographic, clinical and electroencephalographic characteristics (9). Lack of significant differences in EEG features of various syndromes of IGEs supports the hypothesis that they share common biologic (probably genetic) determinants (4).

In conclusion, IGEs are syndromes diagnosed by strict clinical and electroencephalographic features (10, 11). However, interictal EEG cannot differentiate the seizure types and therefore different IGE syndromes and the key element in making the correct diagnosis is clinical history. The essential issue here is that making a diagnosis of IGE, as opposed to other epilepsy syndromes (e.g., localization-related epilepsy), has critical implications for patient care, whereas differentiation between the specific syndromes of IGE is relatively less important (12).

Limitations of the study

1. This was a clinic-based series and may not represent the full spectrum of idiopathic (genetic) generalized epilepsies, because the mildest disease varieties may not be referred to a university clinic.

2. The method of performing EEG at our center, particularly the duration of the test (10 minutes), is not well standard. However, this could have had an effect on observing more normal EEGs in the patients, which was not the case in this study.

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