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Original Article

Clinical use of Electroencephalography in the Diagnosis of Partial Seizures

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Abstract

Introduction: Electroencephalography (EEG) remains the most important investigative modality in the diagnostic evaluation individuals with epilepsy. Although the diagnosis of epilepsy is clinical, EEG helps establish the diagnosis of epilepsy, distinguish epileptic seizures from other non-epileptic events, determine the site of seizure origin and the classification of epilepsy and epilepsy syndromes.

Aim: The aim was to study the role of EEG in localizing the lesion in partial seizure and to identify clinical clues which predict a structural lesion in partial seizure.

Materials and Methods: Prospective observational study was conducted in Department of Neurology, Government Rajaji Hospital, Madurai. Detailed history and clinical examination are carried out to ensure the organic nature of epilepsy. EEG and computed tomography (CT) were done; results are critically analyzed for the presence of focal, localized, or generalized changes by montage-wise analysis.

Conclusion: Even though yield of EEG in making a diagnosis in epilepsy is low-lateralizing changes and localizing if present gives more idea of the presence of a structural lesion in the brain.

Key words: Electroencephalography, Management, Partial seizures

INTRODUCTION

Partial seizures are those in which in general the first clinical and electroencephalographies (EEG) changes indicate initial activation of a system of neurons limited to part of one cerebral hemisphere.[1] Many investigations have suggested that people with partial seizures are more likely to have recurrence than generalized seizures. In the evaluation of partial seizure, we the physician utilize various tools.[2] First and foremost is the history of illness and then EEG and neuroimaging. The incidence of structural abnormality in partial seizure is relatively high when compared to generalized seizure, and it is about 78% in a study by Misra *et al.* EEG helps us to identify the functional site of epileptogenesis even though the yield is low and also helps us to identify the mirror focus.[3] In the era of epilepsy surgery, a clinical approach which mixes the skillful history elicitation, EEG, neuroimaging together helps us to localize the site of origin of seizure and thereby helps us to have a better cure rate.

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Aim

The aim was to study the role of EEG in localizing the lesion in partial seizure and to identify clinical clues which predict a structural lesion in partial seizure.

MATERIALS AND METHODS

Prospective observational study was conducted in Department of Neurology, Government Rajaji Hospital, Madurai. Detailed history and clinical examination are carried out to ensure the organic nature of epilepsy. EEG was done; results are critically analyzed for the presence of

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focal, localized, or generalized changes by montage-wise analysis. Individual abnormalities are recorded in the pro forma. Radiologist's opinion obtained, abnormalities noted.

RESULTS

In our study, 76 patients of which 3 did not turn up for EEG, so a drop out of 3 cases. Finally, the study included 73 cases, in them detailed history, clinical examination, and investigations were completed. In our study population, children under 13 years were 28 in number. Adults <45 years were 38 in number. Adults more than 45 years were 7 in number. Among the total 73 cases, 29 patients had simple partial seizures, 42 patients had complex partial seizure, and 2 patients had both simple and complex partial attacks. Duration of illness before reporting for medical advice was <1 week - 18, <1 month - 33, and more than 1 month - 22. Right focal seizure was noted as 43 patients and left focal seizure is 30 patients. When we analyzed the symptomatology, patient's headache was the most frequent symptom and it was reported in 25 cases. Thirty-one patients out of the 73 cases had clinical signs of deficit (42.5%).

EEG was abnormal in 40 cases (54.79%). Among these, generalized changes were present in 14 patients (19%) and lateralizing changes were present in 26 cases (35.6%) (Table 1). Among the patients with granuloma, EEG was positive in 16 cases. Sixteen patients had EEG abnormality (61.5%). Interestingly, 15 patients had shown lateralizing EEG abnormalities (93.75%). Predominantly, granulomas were seen in younger population. Among the 26 cases, 23 cases were at or under 18 years of age, 3 were in their 20-35 years of age group. Infarct was seen in 10 cases here to parietal lobe was the most common site. 8/10 cases shown die infarct in the parietal lobe (Figure 1). EEG was abnormal in 4 cases (40%), of which 3 had lateralizing EEG changes and one showed generalized changes. Among the 4 cases with mass lesion, EEG was abnormal in 2 cases both of them showed generalized changes. Patient with tuberous sclerosis also showed generalized EEG changes. Patient with arteriovenous malformations showed lateralizing EEG changes. Patient with calcification and gliosis did not show any EEG abnormality. Postictal edema is reported in 2 cases, both in young age group. Both did not show any EEG abnormality.

EEG was abnormal in 40 cases (56.2%). Lateralizing EEG changes were noted in 26 cases; among the patients, CT brain was abnormal in 20 cases (76.92%). Bilateral changes were noted in 14 cases; among these, CT was abnormal in 4 cases (35.7%) (Table 2).

DISCUSSION

Overall, we have studied 73 cases. Clinical history is taken as the tool for the diagnosis. Strictly conversion and other seizure mimics have been excluded from the study. EEG which is available in our department was utilized in the study. Generalized EEG epileptiform activity and lateralizing EEG abnormalities were particularly scrutinized. Among the lateralizing changes, phase reversal is defined as abnormal waveforms of opposite polarity in adjacent bipolar montages. Focal spikes and sharp waves are defined by the duration <70 m/s and 70-200 m/s, respectively. Slow waves as defined by frequency <8/s were taken into consideration while interpreting the abnormality. CT of the brain was done in all 73 cases. Both plain and contrast CT brain axial section with normal window length/breadth with 10 mm anterior and 5 mm posterior cuts were taken. Rajashekhar[4] criteria for NCC utilized. Ring-enhancing lesion is defined as peripheral thin rim of enhancement with central hypodensity and disc-enhancing lesion is defined as uniform enhancing lesion in entirety. Mass lesions are not categorized into individual tumor. The incidence of partial seizures is almost equally distributed

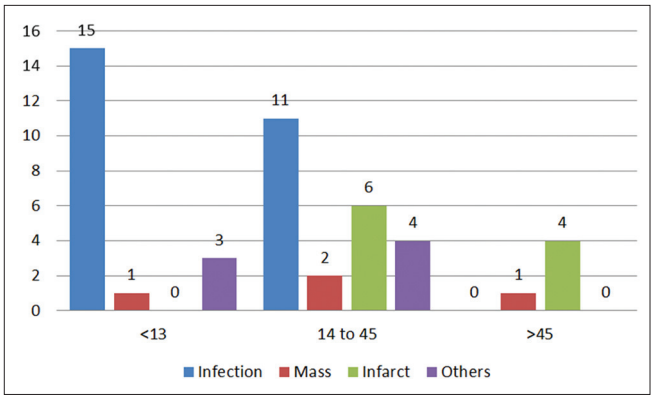

Figure 1: Etiologies of partial seizure in various age groups

Table 1: EEG abnormalities

EEG abnormalities	Number of patients
Phase reversal	11
Bilateral spike, sharp waves	14
Focal or unilateral sharp waves	8
Focal slow waves	7

EEG: Electroencephalography

Table 2: Lateralizing EEG changes in predicting CT brain lesions

Lateralizing EEG changes	CT brain lesions		Total
	Present	Absent	
Present	20	6	26
Absent	27	20	47

EEG: Electroencephalography, CT: Computed tomography

Table 3: Generalized EEG changes in predicting CT brain lesions

Generalized EEG changes	CT brain lesions		Total
	Present	Absent	
Present	5	9	14
Absent	42	17	59

EEG: Electroencephalography, CT: Computed tomography

Table 4: Distribution of EEG abnormalities

Lesion	EEG abnormality (%)
Contrast-enhancing granuloma	62
Infarct	40
Mass	50
Others	43

among male and female population. Complex partial motor seizure was the most common entity. Incidence of partial seizure is more common in younger population than in older. More frequent in young adults and children. Among the 73 cases studied, EEG was abnormal in 40 cases (56.2%). 25 out of 40 patients with EEG abnormality had CT brain lesions (62.5%). This is almost comparable to an Indian study done in 2003 by Baheti *et al.*[5] In their study, 57.9% of cases with EEG abnormality had abnormal CT brain. Generalized EEG changes were noticed in 14 cases and lateralizing EEG changes in 26 cases (Table 3). We have analyzed the statistical significance of both these changes independently in predicting structural lesion in the CT brain.[6] Analysis showed that EEG showing lateralizing changes are more specific in picking up structural lesion than EEG with generalized changes. Patients with generalized EEG changes have a sensitivity of 10.6% and specificity of 65.3% in predicting a structural lesion.[7] Hence, in general, patients with EEG changes in partial seizure are more likely to have structural lesion than those who do not. However, in specific patient with lateralizing changes have more chance of having structural lesion than generalized changes. Among the localized EEG changes, phase reversal is more predictive of structural lesion (81%) followed by focal spike, sharp, and slow waves accounting for about 70%. In the etiological aspect, contrast-enhancing granuloma was the most frequent lesion. We have observed that patients with granulomatous contrast-enhancing lesions have more chance of their EEG being abnormal when compared to other patients with structural lesions. Incidence of lateralizing EEG abnormality was also more in patients with granulomatous lesions (Table 4).[8]

Overall, 34 cases out of the 47 cases with structural lesion had their lesion in the parietal lobe (72.3%). Hence, it shows that parietal lobe lesions are the most common cause of partial motor seizure.

CONCLUSION

Majority of the epilepsy patients give normal EEG recording and routine EEG has little role in the diagnosis and management of partial seizure due to its low sensitivity. Although EEG is an essential tool for investigating epilepsy, diagnosis does not completely rely exclusively on its reading. Even though yield of EEG in making a diagnosis in epilepsy is low-lateralizing changes and localizing if present gives more idea of the presence of a structural lesion in the brain.

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