

Pattern of EEG in Patients Suffering from Complex Partial Seizures

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ABSTRACT

A total of 65 patients (male = 34, female = 31) age-ranged from 3 years to 25 years were studied. All of them were clinically diagnosed as Complex Partial Seizures (CPS) patients. The subjects were divided on the basis of EEG-findings into six study groups as follows: (Group1) Focal Slowing; (Group 2) Generalized Slowing; (Group 3) Focal Sharp Waves/Spikes; (Group 4) Generalized Sharp Waves/Spikes; (Group 5) Generalized Slowing + Focal Spikes; and (Group 6) Normal.

Age-wise relationship of the patients with Complex partial seizures was established. As per EEG-findings, 44.44% of the patients in the range of 3 to 9 years were found to show the abnormality of Focal Sharp Waves/Spikes, while 22.22% patients were observed to show the Generalized Sharp Waves + Spikes. However, the patients in the range of > 9 years showed the epileptiform discharges in Focal Slowing + Spikes and Generalized Slowing/Spikes groups with the percentage of 25 and 14.28, respectively. The percentage of CPSz patients showing Normal EEG was 33.33% and 33.92% in both age groups (3-9 years, and > 9 years), respectively.

Our study shows that incidence of EEG-abnormality in Focal Sharp Waves/Spikes and Generalized Sharp Waves/Spikes (Groups 3 and 4), is almost double in patients of the first age level (3-9 years) as compared to the cases in the range of > 9 years. This observation may be due to birth hypoxia trauma or misdiagnosis of patients suffering from benign epileptic discharges with generalized tonic clonic seizures (GTCS).

(Key words: EEG, Focal Slowing, Generalized Slowing, Focal Sharp Waves/Spikes, Generalized Sharp Waves/Spikes, Generalized Slowing + Focal Spikes, Complex Partial seizures, Neurophysiology).

INTRODUCTION

Abnormal patterns of electrical activity in EEG are usually associated with seizures. The Complex Partial Seizures (CPSz) are most commonly due to the result of abnormal electrical activity in the temporal lobes of the brain. Therefore CPSz can be defined as "a brief, temporary alteration in brain function caused by abnormal electrical activity in the nerve cells of a discrete area of the brain, characterized by change in alertness or awareness with

behavioral or emotional symptoms and temporary loss of memory". The condition most commonly includes localized areas where damage may be caused by lack of oxygen, trauma, or by brain tumors or discrete brain lesions of any sort (Health News 2002).

The diagnosis of the seizures may include complete examination with detailed neuromuscular tests like EEG, CT-scan, and MRI. Brain cells communicate by producing tiny electrical impulses, and Electroencephalograph (EEG) is able to detect and record the electrical impulses in the brain. Certain abnormalities can be detected by observation of the patterns of the brain waves, which may be the changes confirming the type of seizures as partial (focal) seizures and may show location of the cause. While a brain CT-scan or a cranial MRI may show the location and the extent of structural lesion.

Many researchers have worked on the classification of the patterns of EEG and contributed much to this discipline. Paroxysmal EEG patterns are frequent and easily recognized. They often correlate with particular neurological or systemic conditions. Paroxysmal EEG activity is still classified by its localization - generalized or focal, and by its periodicity - long or short. Periodic lateralized epileptiform discharges have been classified according to their morphology and associated condition (epileptic seizures, subtle status, and vascular seizure) (Foldvary et al, (2001), Dunad et al, (2002)).

To further enhance the diagnostic use of the EEG and to determine how strongly EEG patterns are correlated with clinical seizures, Nowack et al. (2002) studied the EEG-pattern, lateralized bursts of theta, and found the rhythmicity of the pattern to be the most strongly correlated with seizures.

Work on EEG patterns has led to better diagnosis of the disease and its treatment, however, based on a review of the current literature, it was concluded that a comprehensive work with particular reference to EEG-patterns was still required to be done for complex partial seizures, in Saudi Arabia. Keeping in view the need to understand these aspects, the present study was designed to highlight the following objectives: 1) To establish the relationship of complex partial seizures to age in the epileptic patients and 2) To determine the role of EEG in the diagnosis of patients suffering from epileptic seizures.

MATERIALS AND METHODS

The research presented here is a hospital based study, from 1998-2002, and includes investigations on 65 patients (34 male, 31 female) suffering from epileptic seizures. The age range of patients was from 3 years to 25 years. The EEG test and neurological examinations were performed for the diagnosis of the patients. A digital EEG (Nicolet Voyageur) 10-20% system was used to obtain the electroencephalograph (EEG).

Keeping in view the clinical diagnosis on the basis of EEG, patients were divided into following six groups: Group 1) Focal Slowing, (n = 04); Group 2) Generalized Slowing, (n = 11); Group 3) Focal Sharp Waves/Spikes, (n = 18); Group 4) Generalized Sharp Waves/Spikes, (n = 10); Group 5) Generalized Slowing + Focal Spikes, (n = 0); and Group 6) Normal, (n = 22). The data was analyzed using a standard spreadsheet program.

RESULTS

The age-wise comparison of sharp waves/spikes in epileptic patients of different groups is shown in Table 1. The percentage of the patients in 3rd group in both of the age-wise categories is higher (44.44% and 25%) respectively, as compared to all other study groups. Similarly, the percentage of the patients in 4th group in both of the age-wise categories is high (22.22% and 14.28%) respectively. The first and second groups showed zero percentage in the first age-wise category, while the percentage of abnormality for the above mentioned groups in the second age-wise category was 7.14% and 19.64%, respectively. The percentage of the cases diagnosed as normal in both of the age-wise categories was 33.33% and 33.92%, respectively. However, group 5 did not show abnormality in either of the age categories.

Table1. Age-Wise Comparison of Sharp Waves/Spikes in Epileptic Patients.

SN	Age Category	Grp-1 (%)	Grp-2 (%)	Grp-3 (%)	Grp-4 (%)	Grp-5 (%)	Grp-6 (%)
1	3-9 Years (n = 9)	0 (n = 0)	0 (n = 0)	44.44 (n = 4)	22.22 (n = 2)	0 (n = 0)	33.33 (n = 3)
2	>9-25 Years (n = 56)	7.14 (n = 4)	19.64 (n = 11)	25 (n = 14)	14.28 (n = 8)	0 (n = 0)	33.92 (n = 19)
G. Total	3-25yrs (N = 65)	6.15 (n = 4)	16.92 (n = 11)	27.69 (n = 18)	15.38 (n = 10)	0 (n = 0)	33.84 (n = 22)

In the combined patients population (i.e., 3-25 years), it was observed that overall percentage values of Focal Sharp Waves/Spikes, Generalized Slowing, and Generalized Sharp Waves/Spikes in the patients were significantly higher (27.69%, 16.9, 15.38%), respectively, as compared to other study groups. The change observed in Focal Slowing group was 6.15%. However, the percentage of the cases found Normal was significantly higher (33.84%) as compared to all study groups. The abnormality observed in the group Generalized Slowing + Focal Spikes was zero percent (see Table1).

A comparison of the diagnosis based upon both neurological and EEG examinations is presented in Table 2. It was observed that (n = 33) 50.76% of the patients were found to show concordance (i.e., diagnosed as CPSz both in neurological and EEG-examinations). The rest of the cases (n = 32) 49.24% showed dis-concordance in neurological and EEG examinations. The detail of the dis-concordant cases is such that: (n = 19) the 29.24% cases indicating CPSz in Neurological tests were found normal in EEG-findings. Similarly, the other 20% of the patients had different neurological findings as compared to their EEG-diagnosis

(such as: seven patients suffering from Grand mal epilepsy, Focal seizures, Generalized tonic clonic seizures, and absence seizures, in Neurological examinations were found to show Partial Complex Seizures, in EEG-findings. Similarly one patient with PCSz-secondary generalized in Neurological examinations was found as Normal in EEG-findings); see Table 2.

Table 2. Comparison of the Diagnosis by Neurological Examination and EEG-Findings (N = 65).

No. of Pts.	Neurology Examination	EEG-Findings	Concordance/Dis-concordance %
33	PCS	CPS	50.76%, Concordance
19	PCS	Normal	29.24% Dis-concordance
3	Gen Sz	CPS	4.61% Dis-concordance
2	CPS	Un-Known	3.07% Dis-concordance
2	Grnd mal	CPS	3.07% Dis-concordance
2	Foc Sz	CPS	3.07% Dis-concordance
1	GTCS	CPS	1.53% Dis-concordance
1	GTCS	Symptomatic	1.53% Dis-concordance
1	CPS 2nd g	Normal	1.53% Dis-concordance
1	Absence	CPS	1.53% Dis-concordance

DISCUSSION AND CONCLUSIONS

The age-wise relationship of the patients with Complex partial seizures was established. As per EEG-findings, the 44.44% of the patients (Group-3) in the range of 3 to 9 years were found to show the abnormality of Focal Sharp Waves/Spikes. While 22.22% of patients (Group-4), were observed to show Generalized Sharp Waves/Spikes. However, the patients in the range of > 9 years were showing the above mentioned abnormalities (Groups 3 and 4) with frequencies of 25% and 14.28%, respectively. Our study indicates that incidence of EEG-abnormality in Focal Sharp Waves/Spikes and Generalized Sharp Waves/Spikes is almost double in 3-9 year old CPSz patients as compared to the cases in the range of >9 years. This may be due to birth hypoxia trauma or misdiagnosis of patients suffering from benign epileptic charges with GTCS (Generalized Tonic Clonic Seizures).

However, in the first age-wise category, the percentage of the cases showing abnormalities like Focal Slowing and Generalized Slowing, (Groups 1 and 2) was found to be zero, but in the second age-group category the percentage of these abnormalities in the groups mentioned above was 7.14% and 19.64%, respectively. No patients were found to indicate the abnormalities such as Focal Slowing + Focal Spikes (Group 5) in either of the age-levels in this study. The percentage of the CPSz patients showing Normal EEG in both of the age levels (Group 6) was 33.33% and 33.92%, respectively. The results show that the intensity of abnormalities observed in 3-9 years old CPSz-patients is greater as compared to the patients in >9 years age category.

In combined patients population, ranging from 3-25 years, the overall results indicated that the intensity of abnormality in study Group 3 (Focal Sharp Waves/Spikes), was significantly higher (27.69%) as compared to other study groups (Table 1). The previous study of Kutluay et. al, (2001), supported our findings that in the majority of patients, midline spikes represent focal epileptiform activity rather than fragments of generalized discharges, and are most commonly associated with seizures of partial onset.

In the present study, the abnormal percentage values observed in Group 2 (Generalized Slowing) and Group 4 (Generalized Sharp Waves/Spikes) were also significant (16.9% and 15.38%), respectively, as compared to other study groups. The change observed in Group 1 (Focal Slowing) was 6.15%. However, the percentage of the cases found to be Normal (Group 6), was significantly higher (33.84%) as compared to all study groups (Table 1). The abnormality observed in Group 5 (Generalized Slowing + Focal Spikes) was zero percent. The maximum incidence of EEG-abnormality in Groups 2, 3 and 4, may be due to Generalized Tonic Clonic Seizures or Focal Seizures Secondarily Generalized.

We compared the neurological examinations of our patients with their EEG-findings used to diagnose the seizures. In an earlier study performed by Jerger, et. al, (2001), the EEG-findings were compared to a neurologist's judgment to detect early seizures. Similarly Niedzielska et al, (2001) indicated that in patients with seizures, in the acute phase of stroke, the EEG examination is very helpful in making the proper therapeutic decision. Doose et al, (1997) indicated that clinical and EEG findings are in agreement with a multifactorial pathogenesis of epilepsies with benign focal epileptiform sharp waves.

The results of the comparison in present study showed that 50.76% of the cases showed concordance and were diagnosed as CPSz-patients both in EEG, and Neurological examinations. The 29.23% of the patients showed dis-concordance such that cases indicating CPSz in neurological examinations were found normal in EEG-findings. The remaining 20% of the cases also showed dis-concordance (such as: seven patients suffering from Grand mal epilepsy, Focal seizures, Generalized tonic clonic seizures, and absence seizures, in neurological examinations were found to show Complex Partial Seizures, in EEG-findings. Similarly one patient with CPSz-secondarily generalized in neurological examination was found as Normal in EEG-findings).

Overall, 49.24% cases showed different neurological findings as compared to the final diagnosis obtained by the EEG-examinations.

The results of the present study can be concluded that 51% of the cases were diagnosed as CPSz both by Neurological examination and EEG-findings. The remaining 49% of patients i.e, (29.24 + 20%) were finally diagnosed with the EEG-test only.

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