

# The EEG and Epilepsy in Kelantan — A Hospital/Laboratory-Based Study

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## Summary

Five hundred and ninety three cases of clinically diagnosed and suspected epilepsy were analysed as regards to the EEG (standard scalp electrode recording) features for confirmation and typing. Fifty-five per cent of all clinically diagnosed adult epileptics were confirmed by the EEG with the initial record, and the EEG confirmatory rate in children was higher at 92%. The frequency of generalised epilepsy as confirmed by the EEG was found to be 86% in adults and 92% in children, reflecting a higher proportion of generalised epilepsy in the population than reported elsewhere. Clinical diagnosis of partial epilepsy was often subsequently shown to be of generalised type on EEG.

**Key words:** Electroencephalography (EEG), epilepsy type.

## Introduction

Epilepsy is a paroxysmal disorder of brain function. It is usually manifested clinically as fits, convulsions or seizures, but in a minority may present only as transient loss of consciousness or "absences".

The standard scalp electroencephalogram (EEG) is usually the first electrographic test ordered in the investigation of patients with presumed or suspected epilepsy. It is useful for:

1. confirming the diagnosis in clinically doubtful cases;
2. characterization or classification of type of seizure (i.e., generalised or partial);
3. quantification of epileptiform discharges (e.g., in monitoring the effects of anticonvulsant therapy);
4. localisation of the epileptiform focus.

The short duration (i.e., 30-40 mins) of a standard EEG may, however, not detect infrequent paroxysmal discharges. Various workers have shown that the relative positivity rate, whether it is in the form of inter-ictal epileptiform activity (IEA) or the spike and wave form of an epileptic discharge on an initial EEG recording, is about 50% in those who have been clinically diagnosed as epilepsy. However, with repeated recordings and the inclusion of a sleep record, the yield increases to 90%<sup>1</sup>. Ajmone and Zioin have identified factors related to occurrence of epileptic discharges in EEG which include:

- a. multiple recordings;
- b. age of the patient — the younger the patient the better the chances of recording epileptic activity;
- c. type of seizure observed — temporal lobe seizures more often demonstrating epileptic discharges;

- d. frequency of seizures — the patients with more frequency seizures being more likely to show positive EEG confirmation; and
- e. medication effect<sup>2</sup>.

In cases in which the history and a standard scalp EEG do not give a firm diagnosis, a prolonged record may be obtained, thus allowing a larger temporal sample in which IEA and symptomatic episodes may be documented. These require expensive portable instruments or closed circuit videomonitoring (CCTV-EEG) which are usually only available in centres for epilepsy.

The objectives of this study are:

1. To detail the EEG findings with the initial recording for clinically diagnosed or suspected epileptics.
2. To look into the degree of clinical and EEG correlation as regards the 2 main types of epilepsy (i.e., generalised and partial).

### Materials and Methods

A prospective analysis was made of the initial EEG records of all patients referred to the EEG laboratory of the University Hospital Universiti Sains Malaysia, Kubang Kerian, Kelantan, within a 2 year period (1st January, 1990 to 31st December, 1991), for clinically diagnosed and suspected epilepsy as the main diagnosis. This hospital offers the only EEG service in the state. The criteria for clinical diagnosis or suspicion includes 2 or more seizures and/or loss of consciousness. Patients clinically diagnosed as generalised epilepsy comprise of those with grand-mal, petit-mal, tonic-clonic, tonic, clonic, myoclonic, absence seizures and drop attacks, whereas those clinically diagnosed as partial epilepsy include simple partial, simple partial with secondary generalisation, complex partial (including temporal lobe) and complex partial with secondary generalisation. For obvious reasons, patients with first-time seizures, those clinically diagnosed as febrile fits and acute meningoencephalitis were excluded from the study. Initial clinical assessments were made by multiple clinicians. All requests for the EEG were made by a consultant physician, consultant neurosurgeon, paediatrician or psychiatrist.

All recordings were performed on a 14 channel standard scalp electrode EEG machine using the International 10-20 system. The standard duration of recording time was 35 mins with the paper speed at 30 mm per second. Hyperventilation for 3 mins and photic stimulation were routinely employed as activation procedures. No sleep recordings were performed due to logistic problems. The presence of IEA (i.e., spikes or sharpwaves) and/or spike and wave complexes was taken as documented evidence of epilepsy and the typing (i.e., generalised or partial) made according to the site and timing of appearance of the aforementioned features. Both the technical report and the diagnostic interpretation were done by a single person in all the records.

Details of age, sex, clinical diagnosis of type of epilepsy were extracted from the request form and the EEG findings grouped into:

1. normal EEG (i.e., no IEA) (Fig 1);
2. generalised epilepsy (Fig 2);
3. partial (focal) epilepsy (Fig 3).

## Results

**Table I**  
Age range and sex of patients clinically diagnosed and suspected of epilepsy

Age range	=	3 months to 76 years
Adult (>12 years)	=	354 cases (M=183, F=171)
Paediatric (<12 years)	=	239 cases (M=139, F=100)
Total		593 cases

**Table II**  
Table showing EEG confirmatory rate with the initial recording of patients clinically diagnosed as epilepsy

	No of patients clinically diagnosed as epilepsy	EEG confirmed for epilepsy	Normal EEG
Adults	260	143 (55%)	117 (45%)
Children	154	142 (92%)	12 (8%)

**Table III**  
Table showing EEG confirmatory rate with the initial recording of patients clinically suspected of epilepsy

	No of patients with clinically suspected epilepsy	EEG confirmed epilepsy	Normal EEG
Adults	94	31 (31%)	63 (68%)
Children	85	77 (91%)	8 (9%)

**Table IV**  
Correlation between clinical and EEG seizure types (adults)

Clinical seizure type	EEG seizure type		
	Normal	Generalised epilepsy	Partial epilepsy
Epilepsy suspected n=94	63 (68%)	27 (28%)	4 (4%)
Generalised epilepsy n=193	81 (42%)	103 (53%)	9 (5%)
Partial epilepsy n=67	36 (54%)	20 (29%)	11 (17%)
Total n=354	180	150	24

**Table V**  
Correlation between clinical and EEG seizure types (children)

Clinical seizure type	EEG seizure type		
	Normal	Generalised epilepsy	Partial epilepsy
Epilepsy suspected n=85	8 (9%)	75 (88%)	2 (3%)
Generalised epilepsy n=122	8 (6%)	109 (90%)	5 (4%)
Partial epilepsy n=32	4 (12%)	19 (59%)	9 (29%)
Total n=239	20	203	16

**Table VI**  
Table showing different EEG seizure types from total no of patients with EEG confirmed for epilepsy with the initial recording

	Total no of patients with EEG confirmed for epilepsy	(EEG) generalised epilepsy	(EEG) partial epilepsy
Adults	174	150 (86%)	24 (14%)
Children	219	203 (92%)	16 (8%)

## Discussion

The age range from 3 months to 76 years (Table I), shows that no age is exempt from epilepsy. There were 354 adults (183 males) and 239 (139 males) in the paediatric age group (i.e., <12 years). There appears to be a slight dominance of males in this study. This supports the general view that epilepsy is slightly commoner in males<sup>3</sup>.

Among the 260 adults clinically diagnosed as epilepsy (Table II), 143 (55%) were confirmed on EEG and 117 (45%) were normal. This is comparable with the results of other workers which showed a confirmatory rate of about 50% with the initial recording<sup>1</sup>. However, of the 154 paediatric patients clinically diagnosed as epilepsy, 142 (92%) were EEG confirmed for epilepsy and only 12 (8%) were normal. Thus, this supports the general contention that the EEG confirmatory rate is definitely higher in children<sup>2</sup>.

Of the 94 adults with suspected epilepsy (Table III), 31 (30%) were EEG confirmed for epilepsy and 63 (68%) normal. However, of the 85 paediatric cases with suspected epilepsy, 77 (91%) were EEG confirmed for epilepsy and only 8 (9%) normal. This again implies that in children with clinically suspected epilepsy, the chances that the EEG would be confirmed was increased by threefold (91% vs 30%) compared to adults. This might reflect the fact that epilepsy is associated with a greater number of differential diagnoses in adults compared to epilepsy of childhood.

Tables IV and V show that in adult epileptics, 53% of those clinically diagnosed as generalised epilepsy have EEG confirmation of generalisation. Thus, the accuracy of clinical typing for generalised epilepsy is relatively high. On the other hand, only 17% of adult epileptics clinically diagnosed as partial epilepsy had EEG evidence of focalisation. Likewise, in epileptic children, 90% of those clinically diagnosed as generalised epilepsy were supported by the EEG confirmation of generalisation, again reflecting the high accuracy of clinical typing to EEG confirmation for generalised epilepsy, whereas only 29% of children clinically diagnosed as partial epilepsy

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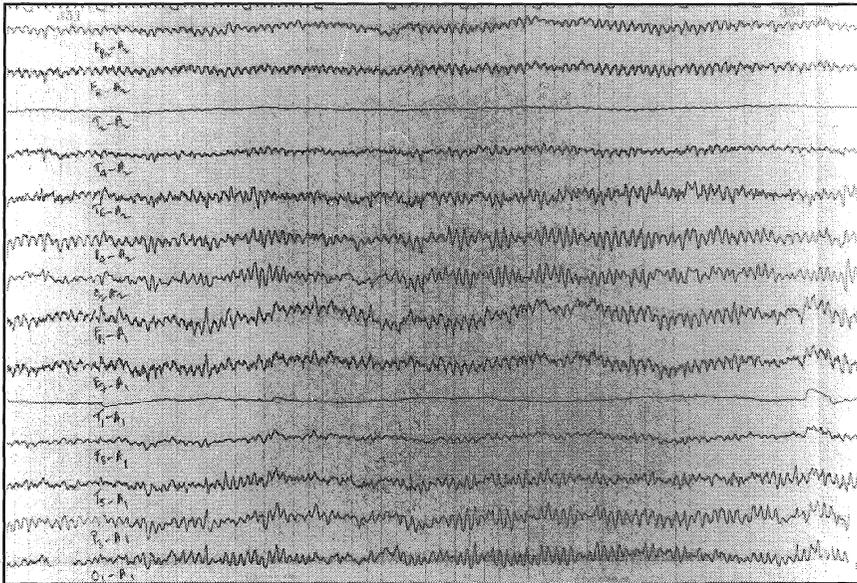


Fig 1: A normal EEG.



Fig 2: EEG in generalised epilepsy.



**Fig 3: EEG in partial (focal) epilepsy.**

had EEG confirmation of focalisation. Thus, it appears that in both adult and in paediatric medical practice, clinical diagnosis of partial epilepsy was often subsequently shown to be of generalised type on EEG. This may be due to the fact that since the clinical typing in most cases depended upon the history obtained from the patient or an observer, undue emphasis was placed on the possibility of a partial nature during history-taking, as the clinicians were aware that the presence of a partial nature would have important aetiological and investigative implications.

On scrutinising the EEG typing of epilepsy in all patients with EEG findings positive for epilepsy (Table IV), generalised epilepsy was found in 86% of adults and 92% of epileptic children, whereas partial epilepsy was noted in 14% of adults and 8% of childhood epileptics. These figures are higher than the 30% to 35% of generalised epilepsy rate reported elsewhere<sup>3,4,5</sup>. This might be due to the fact that with the short duration (30 mins) of the standard scalp electrode EEG, one or few episodes of generalised discharges only might have been seen and the partial ones missed. The partial discharges might also have their origin in the deep structures in the brain and thus not be picked up at all by the scalp electrode, or only the secondary generalised component might have been recorded. This again reflects the limitations of the standard scalp electrode EEG in typing of epilepsy electrophysiologically.

### Conclusion

This study reemphasises the generally accepted view that, using the standard scalp electrode EEG recording in adults, only half (50%) of all clinically diagnosed epileptics are further confirmed by the EEG with the initial record. It also follows the dictum that the EEG confirmatory rate is higher in children. This age factor was further exemplified by the fact that the EEG confirmatory rate is increased 4 times in children suspected of epilepsy when compared to adults in a similar clinical situation. There is a higher proportion of generalised epilepsy as confirmed by the EEG in the initial record in this study when compared to other published data. Clinical diagnosis of partial epilepsy was often subsequently shown to be of generalised type on EEG.

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