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A CROSS-SECTIONAL STUDY ON EEG IN DIAGNOSING SEIZURES IN THE CHILDREN OF AGE GROUP 1 MONTH TO 12 YEARS

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ABSTRACT: BACKGROUND: Although the relationship between EEG and seizures is well established, role of EEG in Early Diagnosis of Seizures is poorly understood. The aim of this study is to assess EEG in diagnosing seizures in the children of age group 1 month to 12 years. **METHODS:** This cross-sectional study was carried out during a 2 month period in the seizure patients admitted in Government General Hospital, Guntur. A total of 40 patients took part in this study. **RESULTS:** Among the 40 patients 6 patients were diagnosed with partial seizures {15%}, 23 patients were diagnosed with generalized seizures {57.5%}, 4 patients each were diagnosed with status epilepticus, unclassified seizures {10%} and 3 patients were seen with febrile seizures. **CONCLUSIONS:** The results highlight the need for EEG as the Diagnostic tool for seizure activity in the tested age groups.

KEYWORDS: EEG, Seizure.

INTRODUCTION: A seizure is the physical findings or changes in behavior that occur after an episode of abnormal electrical activity in the brain.

The term "seizure" is often used interchangeably with "convulsion." Convulsions are when a person's body shakes rapidly and uncontrollably. During convulsions, the person's muscles contract and relax repeatedly.

SEIZURES CLASSIFICATION: There are lots of different types of epileptic seizure – about 40 in fact. What happens to the person having the seizure varies from one seizure to another and from one person to another. Although seizures vary, it is often useful to classify or group seizures together by similar features. Here we look at the different types of seizures and how they are classified.

ILAE CLASSIFICATION: When we classify seizures, we usually follow the International League against Epilepsy (ILAE) classification, which groups seizures together by what they look like and what happens to the person. There are also other types of classification that group seizures together by the cause of the epilepsy.

What happens to someone when they have a seizure varies depending on which part of the brain is affected by the seizure, and what that part of the brain normally does. This is why seizures vary, and cause different "symptoms".

The descriptions of seizures that follow give the 'typical' features of the seizure, but everyone's seizures can be different, and may not exactly fit the descriptions. To start with, seizures are usually classified into partial or generalised seizures.

PARTIAL SEIZURES: In partial seizures the seizure happens in, and affects, just one part of the brain. This could be any part of the brain, and what happens to the person depends on which part of the brain is affected and how big the affected area is.

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SIMPLE PARTIAL SEIZURES: If the area of the brain affected by the seizure is small, this is called a simple partial seizure (SPS). The person will be awake and aware during the seizure and will remember what happened to them.

Temporal lobe SPS are the most common type of SPS Frontal lobe SPS can be harder to put into words.

SPS ARE AGAIN DIVIDED INTO:

1. Motor.
2. Sensory.
3. Autonomic.
4. Physiological.

COMPLEX PARTIAL SEIZURES: If the area of the brain affected by the seizure is larger than in an SPS, this causes a complex partial seizure (CPS). These seizures affect three things – the person's awareness, their accessibility and their memory

Temporal lobe CPS is the most common CPS. Frontal lobe CPS is often much shorter than temporal lobe CPS, usually lasting about 15–30 seconds. Afterwards the person will usually recover quite quickly.

GENERALISED SEIZURES: In generalized seizures the seizure affects all of the brain all at once. Generalized seizures affect the person's consciousness so that they lose consciousness, even just for a few seconds. Because of this, after the seizure, they will have no memory of the seizure.

TONIC CLONIC SEIZURES: These are the seizures that we usually think of as epilepsy. There are two parts to this seizure. In the tonic part, all the muscles in the person's body 'contract' and go stiff. If they are standing up they will fall down. Because the muscles around the chest go stiff, this pushes air out of the lungs and the person may cry out. Also they might bite their tongue as the seizure starts.

The next part of the seizure is the clonic, jerking or convulsing part. This might last for a couple of minutes. The muscles go stiff and then relax, stiff and relax repeatedly. This makes the person's arms and legs jerk. Often the person's breathing is affected.

TONIC SEIZURES: Tonic seizures happen when all the muscles in the person's body go stiff.

ATONIC SEIZURES: Atonic seizures are the opposite of tonic seizures and all the muscles in the body suddenly go floppy. When this happens the person will fall down, usually forwards. These seizures are also called 'drop attacks' as they cause the person to suddenly drop to the ground. Like tonic seizures the person usually recovers quickly, but they may hurt themselves when they fall.

MYOCLONIC SEIZURES: 'Myoclonic' means 'muscle jerk', which describes what happens during these seizures. Usually the arms or leg will briefly jerk, although it can be the head or trunk (Top half of the body).

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ABSENCE SEIZURES: Absences are brief seizures where the person is 'absent' for a couple of seconds, going blank and staring. The seizures can be quite subtle and hard to see, as there may be no obvious movement. Absences can be confused with daydreaming. If you talk to someone who is daydreaming, they will usually respond to you but this is not so with absences

STATUS EPILEPTICUS: Status epilepticus (SE) is defined as a seizure that lasts more than 30 minutes, constituting a neurological emergency. The seizure may be continuous or may be intermittent without recovery of consciousness between seizures.

SECONDARILY GENERALISED SEIZURES: Sometimes a partial seizure can become a generalized seizure and is called a secondarily generalized seizure. The most common type of generalized seizure to happen in this case is a tonic clonic seizure.

As the seizure starts as a simple or complex partial seizure, the person might be aware that the seizure has started, but as it becomes generalized, they will lose consciousness.

UNCLASSIFIED SEIZURES: Some seizures do not easily fit into one of the categories here; they might have different parts of different seizures, or they can be unique to the person having them. These seizures are sometimes called 'unclassified'. As more is known about what happens during the seizure, it might be possible to classify them later on.

ASLEEP SEIZURES: If someone has seizures while they are asleep, they may be called 'asleep' or 'nocturnal' seizures. The seizures could also happen during the day if the person falls asleep. Asleep seizures do not describe what type of seizure the person has, it only tells you when the seizures happen.

ELECTROENCEPHALOGRAPHY (EEG): The electroencephalogram (EEG) is a measure of brain waves. It is a readily available test that provides evidence of how the brain functions over time.

The EEG is used in the evaluation of brain disorders. Most commonly it is used to show the type and location of the activity in the brain during a seizure¹. It also is used to evaluate people who are having problems associated with brain function². An EEG is also used to determine brain death. It may be used to prove that someone on life-support equipment has no chance of recovery.

Scientists first captured and recorded brain waves in dogs in 1912. By the 1950s the EEG was used commonly throughout the United States.

RELATIVE ADVANTAGES: Several other methods to study brain function exist, including functional magnetic resonance imaging, positron emission tomography, magneto-encephalography, Nuclear magnetic resonance spectroscopy, Electrocorticography, and Single-photon emission computed tomography. Despite the relatively poor spatial sensitivity of EEG, it possesses multiple advantages over these techniques:

Hardware costs are significantly lower than those of all other techniques

EEG sensors can be used in more places than fMRI, SPECT, PET, MRS, or MEG, as these techniques require bulky and immobile equipment

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EEG has very high temporal resolution, on the order of milliseconds rather than seconds. EEG is commonly recorded at sampling rates between 250 and 2000 Hz in clinical and research settings, but modern EEG data collection systems are capable of recording at sampling rates above 20,000 Hz if desired

EEG is relatively tolerant of subject movement, unlike all other neuroimaging techniques.

RELATIVE DISADVANTAGES: Significantly lower spatial resolution. FMRI, for example, can directly display areas of the brain that are active, while EEG requires intense interpretation just to hypothesize what areas are activated by a particular response.

EEG determines neural activity that occurs below the upper layers of the brain (the cortex) very poorly.

Unlike PET and MRS, cannot identify specific locations in the brain at which various neurotransmitters, drugs, etc. can be found.

Often takes a long time to connect a subject to EEG, as it requires precise placement of dozens of electrodes around the head and the use of various gels, saline solutions, and/or pastes to keep them in place.

A normal EEG and primary generalized epilepsy.

AIMS AND OBJECTIVES:

1. To study the sensitivity of EEG in diagnosing seizures in children.
2. To classify seizures.

MATERIALS AND METHODS:

STUDY DESIGN: cross-sectional study.

PERIOD OF STUDY: 2 MONTHS.

STUDY PERIOD: 1st May 2012 to 30th June 2012. The study was started from 1st may and continued till the end of June.

STUDY POPULATION: patients admitted in the department of pediatrics with the complaint of seizures in government general hospital Guntur during the study period.

INCLUSION CRITERIA: All types of seizures which include head trauma, infections of central nervous system and ICSOL as per CT brain.

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EXCLUSION CRITERIA:

1. Seizures due to electrolyte imbalance.
2. Children above twelve years.

RESULTS:

Graph 1: TYPE OF SEIZURE

Among the 40 patients 6 patients were diagnosed with partial seizures {15%}, 23 patients were diagnosed with generalised seizures{57.5%}, 4 patients each were diagnosed with status epilepticus, unclassified seizures{10%} and 3 patients were seen with febrile seizures.

Graph 2

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Among the total number of cases the majority are generalised tonic clonic seizures i.e., 35%(15 out of 40) followed by status epilepticus and complex partial seizures each of 10%(4 out of 40).7.5% of febrile and tonic seizures.5% each of absence and atonic seizures.2.5% of clonic,myoclonic and secondary generalized partial seizures and lastly 10% are unclassified seizures.

Graph 3: SEX OF THE PATIENTS

Most of the patients are female i.e., 25 out of 40 (62.5%) followed by male 15 out of 40 (32.5%).

Graph 4: AGE OF THE PATIENTS

Majority of patients are of age group below 4 years and between 8 to 12 years. Majority of the patients of age group 4 to 8 are females.

Fig. 1: EEG FINDINGS

87% of the cases showed abnormal EEG whereas 13% of the cases showed normal EEG.

DISCUSSION:

TYPE OF SEIZURE: The majority of the cases are generalized seizures type which accounted for 57.5%.

Among the generalized seizures the various types are:

- 1 Generalized tonic clonic seizures-35%.
- 2 Tonic seizures-7.5%.
- 3 Clonic seizures-2.5%.
- 4 Myoclonic seizures-2.5%.
- 5 Atonic seizures-5%.
- 6 Absence seizures-5%.

The second majority of cases are seen in partial seizures which are about 15%:

1. Simple partial seizures 2.5%.
2. Complex partial seizures 10%.
3. Partial seizures with secondary generalization 2.5%.

Febrile seizures accounted for 7.5%.

Status epilepticus is seen in 10% of the patients.

Unclassified seizures are also seen in 10% of the patients.

SEX OF THE PATIENTS: The majority of the patients are female patients they accounted for 62.5% whereas the male patients are only 32.5%.

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AGE OF THE PATIENTS: The patients were divided into three classes based on their age (0-4,4-8,8-12).

The majority of the patients were seen in the age group of 0-4 and 4-8 in equal number. The age group between 4-8 showed less number of patients. This age group is predominantly dominated by female patients.

EEG FINDINGS: Generally 87% of the EEG reports were abnormal and 13% of the EEG reports were normal although the patients were diagnosed to have seizures by physical examination.

The abnormal EEG findings found are:

- Periodic lateralized epileptiform discharges.³
- Bilateral independent periodic lateralized epileptiform discharges.
- Ipsarrythmias.
- Benign childhood epilepsy with centrotemporal spikes{bects}.⁴
- Generalized sharp wave discharges. {Seen in generalized tonic clonic seizures}.
- High amplitude slow wave discharges. {Seen in status epilepticus}.⁵
- 2-3 spikes per second. {Seen in absence seizures}.hyperventilation may precipitate absence seizures with characteristic EEG abnormalities.⁶
- Bi temporo parietal discharges {seen in atonic seizures}.⁷
- Biparietal epileptiform occipital peroxyms.^{8,9}

EEG findings are more reliable and diagnostic in continuous monitoring over a period of time.

CONCLUSION:

- Clinical history and EEG are the main Diagnostic weapons for seizures.
- The sensitivity of the Diagnosis of the EEG is 70-90%.

SUGESSTION: When history is unclear EEG helps determine seizure type and epilepsy syndrome in patients with epilepsy and thereby and thereby, antiepileptic medication and prediction of prognosis.

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