

Electro-encephalogram and the Diagnosis of Epilepsy

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Electro-encephalogram

The electro-encephalogram is a record of electric potentials originating in the brain and recorded by means of electrodes placed upon the scalp or nearby surfaces (mastoid process, ear lobes).

Branch of Neurologic Diagnosis

Electro-encephalography has become a diagnostic method of permanent value. During the last twenty years, its application has made tremendous strides. Facilities for electro-encephalography are available in almost all the larger hospitals on the United States today. The usefulness of diagnostic electro-encephalography in the clinical study of nerves and mental diseases is being progressively felt in our country too.

History of Development

The wonderful story of the human intellect probing into the functions as well as the disorders of the human brain, is really fascinating. Caton, Von Marxow and Beck are the three pioneers in this field of knowledge. The presence of changes in electric potentials in the brain; the possibility of recording them from electrodes outside the skull, and the existence of continuous changes of potentials, not due to extraneous stimulation, were the three fundamental discoveries by these three great pioneers.

It took Berger 27 years to convince himself that the electrical oscillations that he recorded from the surface of a living human head, originated from the underlying brain. It was Berger who introduced the terms *alpha* and *beta* waves for waves of the first and second order. While some attention was paid in Germany to Berger's results, his observations did not attract much attention out-

side Germany until Adrian, in 1934, confirmed the existence of the electro-encephalogram. This started a tremendous amount of research work in many countries. The significance of electro-encephalography in understanding brain physiology, was recognised. The use of this new method of investigation as a routine tool in the clinical study of nervous and mental disease inevitably followed.

In 1947, the American Electro-encephalographic Society was founded and in the same year the first International Congress of Electro-encephalography was held in London. In this way electro-encephalography had developed into an established diagnostic method practically applied everyday in numerous places in different parts of the globe.

Equipment

Most stationary machines constructed now have four to eight channels. The American Electro-encephalographic Society approves no fewer than four channels for laboratory use and no fewer than two portable instruments. I am privileged to work with an E.E.G. Grass Machine, Model III (eight channels). The most important characteristic of a machine is that it gives a true and undistorted record of the potentials originating in the brain.

Arrangement of the Recording Room

The same room can be used to house the electro-encephalograph and to accommodate the patient. A room should be chosen which is relatively quiet and through which nobody has to pass. Sudden loud noises and talking should be avoided during the recording. The room should be sufficiently darkened so that bright light does not disturb the patient.

Preparation for the Recording

Medications having influence upon the electro-encephalogram should be discontinued long enough before the recording. This is particularly important where the electro-encephalogram is used for the diagnosis of epilepsy. It is advisable to discontinue medications at least 48 hours before the recording. As in the case of the treatment of epilepsy where the influence of the medication on the electro-encephalogram is to be studied, the medication should not be withdrawn. The patient and all others concerned should be cautioned when the medication is discontinued. Patients should be advised to avoid the use of greasy hair applications before the examination. The patient should be instructed to appear for electro-encephalogram within one and one-half hours after the last meal so as to avoid low blood sugar levels at the time of recording.

Points of application of electrodes are determined and marked with a skin-writing pencil. To avoid high electric resistance, these sites are cleaned with ether or acetone so as to remove as far as possible fatty substances in the skin.

Recording

The patient is placed in a reclining position after the application of the electrodes. In such a relaxed position muscle action potentials are less likely to appear. The patient is "earthed" by connecting the extra scalp electrode, placed over the middle of the forehead to the ground socket on the panel. The rest of the electrodes are connected to the sockets with the corresponding numbers.

The patient should be assured before the recording that the process is entirely harmless and pain-

less. The patient is advised to keep the eyes closed and to relax. Hyperventilation is often used at the end of the recording, particularly in epilepsy cases, as a provocative test.

Wave forms and Artefacts

An electro-encephalogram consists of waves of various frequencies, voltages and forms. To distinguish them they have been given specific names viz. Alpha, Beta, Delta waves ; Spikes, Sharp waves and some mixed Spike and Wave patterns also come out in the recording. Potentials arising from sources outside the brain due to muscle actions, eye movements, gross movements, etc. often appear in many records. All these potentials are classified as artefacts.

For correct diagnosis it is necessary to distinguish between artefacts and true brain potentials.

E.E.G. in the diagnosis of Epilepsy

Electro-encephalography has become the most important diagnostic aid in the understanding of epileptic disorders. In epileptic disorders *grand mal* attacks are observed in fully developed convulsions. Other forms of transitory disturbances are called *petit mal* and psychomotor attacks. There are patients showing convulsive movements constituting a part of the generalised convulsion. The types of epilepsy eluded diagnosis on clinical grounds so far, are at present being correctly diagnosed with the help of electro-encephalography.

Idiopathic epilepsy is generally postulated on a hereditary predisposition. In contrast to it, symptomatic epilepsy is traceable to some known primary disturbance as for example, toxic or metabolic disorder, or organic brain diseases. E.E.G. record is of immense help in distinguishing the different types of epilepsy.

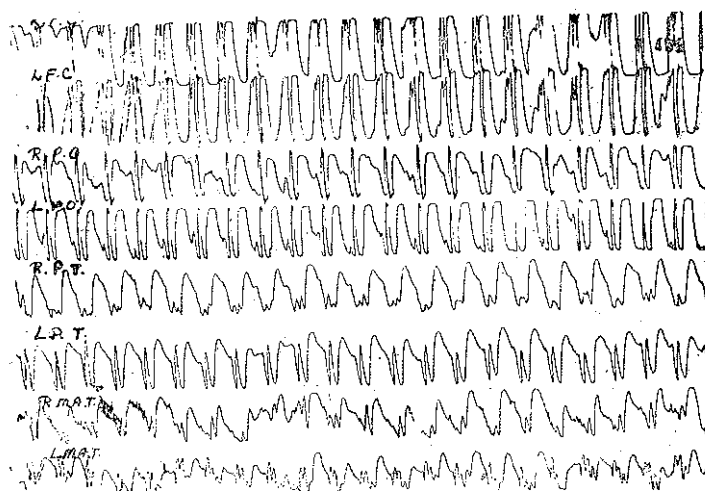
During the *petit mal* attack the electro-encephalogram shows a spike and wave pattern with a frequency of from 2 to 3 a second. In young children the pattern may appear with a still lower frequency. The frequency of a wave means the number of times this wave would appear in a second if it were continuously repeated. Continuous high voltage fast activity (Delta waves) appear during a

grand mal seizure. The voltage of wave is represented in the record by the height of the deflection.

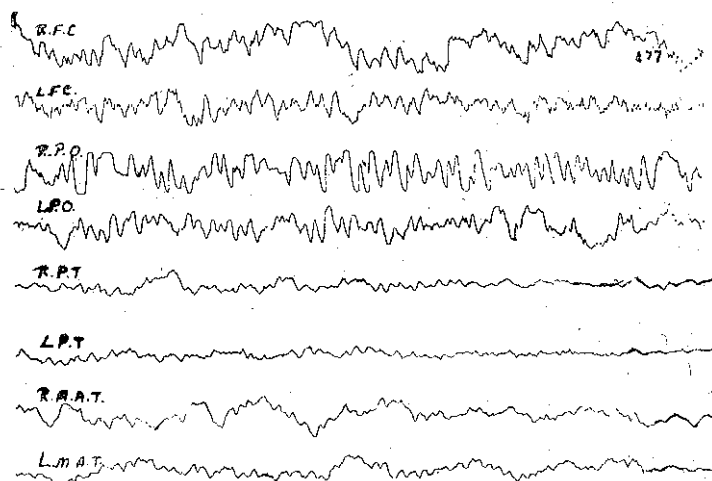
In diagnostic electro-encephalography the electro-encephalogram in the period between seizures is of much greater importance than that during an overt seizure.

Patient with *petit mal* seizures. A male child : age 11 years of normal personality and average intelligence ; no hereditary predisposition.

(a) E.E.G. during an overt



(a) E.E.G. during an overt seizure



(b) E.E.G. during interseizure period

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seizure.

(b) E.E.G. during interseizure period.

Electro-encephalogram and the treatment of Epilepsy

The type of anti-epileptic therapy has to be determined on the basis of the clinical facts. Electro-encephalogram is not yet a sure help in the selection of drugs. Anticonvulsant drugs (Phenobarbital, Dilantin, Bromides) modify, but do not abolish electro-encephalographic abnormality.

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