CLINICAL ELECTRO-ENCEPHALOGRAPHY. II

EEG Reporting

EEG reporting is difficult because of the quantity of information in a record and also because of changes in the patient's level of arousal which may be hard to assess (see "Difficulties of EEG" in Part I: *Brit. J. Ophthalmol.* (1968), **52**, 426).

The report consists of a descriptive and an interpretative part. The background rhythms are described: their amplitude and frequency; symmetry between the hemispheres which usually behave similarly; the form of any discrete phenomena such as sharp waves or bursts of spikes and waves; and the location and occurrence of focal abnormalities as indicated by "phase reversal". The interpretation of these phenomena in relation to the clinical situation is then carried out, bearing in mind that the EEG is but one physical sign which like others must be taken in relation to the whole clinical picture.

Value of the EEG

There are many different situations in which this investigation may be of value, *e.g.* in patients with anoxic brain damage following cardiac arrest, in those with hepatic encephalopathy, and in

Type of Activity	Waveform	Remarks
Lambda waves		Occur over the occipital region in some normal subjects when the eyes are open
Spikes		Occur particularly in focal epilepsies
Spike and Wave		Occurs mainly in generalized epilepsies
Triphasic Waves		Occur mainly in hepatic disease

FIG. 2.—Various waveforms

EEG and neuro-pathological studies show that a tumour usually has to reach about 2 cm. in diameter before it can be readily detected. A repeat EEG after an interval of time, however, may show that a minor local abnormality has developed into a major delta focus suggesting the presence of an expanding lesion.

The EEG in epilepsy may show the presence of spike and wave discharges, as in a child with "petit mal" attacks, or a spike focus, as in a patient with temporal lobe epilepsy (Fig. 2). If a temporal lobe abnormality is suspected but not found in the resting or sleep EEG, pentaethylene tetrazol (Metrazol) injection may activate such a focus. In a patient in whom surgery is contemplated for intractable epilepsy, depth electrodes (a fine leash of wires) may be inserted through a burr hole and recordings then carried out. Recordings may also be made at operation from the cortex (electro-corticography—ECoG) so that the extent of the discharging area can be mapped out. ECoG is more sensitive than EEG, as the scalp and skull cause a three-fold reduction in brain potentials.

When some normal subjects look at patterned visual stimuli the EEG may show triangular waves symmetrically over both occipital regions. These are known as lambda waves (Fig. 2) and are absent when the subject fixes a blank card or when he is in the dark, even with his eyes open and moving. Another phenomenon observed over the same region of the brain is the response to

photic stimulation, each brief flash evoking a small deflection. Sometimes, however, such photic stimulation may produce an epileptic discharge similar to the spike and wave abnormality seen in patients with "petit mal"; this abnormality known as "light sensitivity" may also appear in patients who have had fits while watching television.

Patients who are totally blind show no response to flashes of light and in addition alpha activity is greatly decreased or even absent. Alpha rhythm is, however, usually seen in patients whose blindness started after the age of 3 months. Although the EEG is of limited value in detecting blindness, it may sometimes indicate the cause. The abnormalities are of epileptic type and spikes, sharp waves, or spike and wave usually occur over the occipital region; these may be related to fits. Retrolental fibroplasia is the commonest cause of blindness associated with spike abnormalities.

FIG. 3.

FIG. 3.—Apparatus for "averaging studies" of occipital activity, the computer being triggered by eye movements or by the stroboscope, when a flash is used as the stimulus.

FIG. 4.—Averaged occipital activity following eye movement using the "computer of average transients". Each tracing represents the averaged activity following fifty consecutive eye movements. Each run was repeated and superimposed producing similar pairs of tracings, indicating the repeatability of the response. The upper pair was evoked with a blank card and the lower pair with patterned stimulus cards.

FIG. 4.

Recent Advances and Future Developments

In order to deal with the quantity of information in an EEG, numerous computer techniques are being developed. These include frequency analysis and pattern recognition. Another recent development is the "averaging computer", especially suitable for investigating the visual system in particular the evoked occipital response to flash and the response of scanning eye movements over a patterned visual field with ordinary illumination. The technique is essentially one of summing brief periods (*e.g.* 0.5 sec.) of cerebral activity following a flash or eye movement; random background activity cancels itself out, while responses which bear a fixed time relationship to the stimulus are summed and thus become more obvious. The arrangement of the apparatus used in one technique which employs a computer of average transients is shown in Fig. 3, and the evoked responses with patterned and blank fields in Fig. 4. This or similar techniques will eventually be in common use both for neurophysiological and clinical investigations.

GENERAL REFERENCE

KILOH, L. G., and OSSELTON, J. W. (1961). "Clinical Electro-encephalography", 1st ed. Butterworths, London.

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