CLINICAL ELECTRORETINOGRAPHY. II

Clinical Procedure

Because so many factors influence the waveform of the electroretinogram (ERG), it is not possible to assess the significance of results from different ERG departments unless a large number of normal subjects has been tested by an identical method. Despite the differences in methods most techniques are based on that of Karpe.

Where possible both eyes should be examined at the same time, the pupils being dilated with a cycloplegic. The response is picked up by two electrodes, one attached to the skin of the face or brow, the other held on the cornea in a contact lens.

The stimulus is a flash of light produced either by a discharge tube or by a continuous light interrupted by a shutter. The light source should fill as much of the visual field as possible and it should be possible to interpose neutral density or colour filters. Amplification and display are performed with an electronic amplifier and recorder, but an electroencephalogram machine or a modified electrocardiogram machine may be used.

Responses are elicited in the light and at intervals during dark adaptation. The flicker fusion may also be determined and the record is calibrated using an input of known voltage.

Difficulties with the ERG

The major difficulty is the application of the corneal electrode; this may not be tolerated or air bubbles may occur between contact lens and cornea. With an experienced operator and good local anaesthesia, this is rarely a problem in adults, but children are not suitable subjects. The ERG is readily produced under general anaesthesia and this is an ideal method in the young.

Even with the electrodes in place, eye movements may cause such a variation of the baseline that the response is distorted or even lost. Some eye movements in response to the stimulus may mimic the ERG, but the experienced operator can generally overcome such problems.

The ERG is a mass retinal response and focal lesions cannot be detected. If an attempt is made to stimulate just one part of the retina, light scattered within the eye will stimulate the rest of the retina. It is thus possible to obtain a normal ERG by stimulating the optic disc.

The ERG originates in the outer layers of the retina and a normal response may be produced from a blind eye if the lesion is proximal to the inner nuclear layer. The example of a normal ERG (Fig. 1*) was taken from a subject almost blind from chronic simple glaucoma.

Clinical Variations in the ERG

Despite the nuances of response it is theoretically possible to recognize, the clinical ERG may be subdivided simply as shown in Fig. 3 (opposite). It is not possible to determine absolute limits of normality and abnormality as the response varies greatly from person to person, and also in the same person from time to time. The interpretation of the ERG must be done in the clinic itself, based on the experience gained by applying its particular technique to previous cases.

Clinical Uses of the ERG

Variations in the ERG have been reported in numerous conditions, but as a routine clinical procedure the subtle variations described in particular cases are of no help and the diagnostic possibilities are much more limited.

* See Part I. *Brit. J. Ophthalm.* (1967) 51, 356.

FIG. 3.—Abnormal ERGs.

As an ERG may be produced by scattered light, a response may be obtained when opacities of the media prevent a view of the fundus.

In cases of poor vision or poor night vision, the ERG may help to localize the lesion and the change in waveform in the dark is a useful check of the subjective dark adaptation. In children it is of particular value and should be used as a routine investigation in any case in which a visual defect is suspected.

Many abiotrophic lesions are characterized by a loss of electrical response before any other symptom or sign, and the ERG is essential for the early diagnosis of these conditions. It is also essential for the diagnosis of early damage by retinotoxic drugs, as here again the electrical changes often precede any other manifestation of the damage, offering the possibility of anticipating and preventing an irreversible change.

Fundus abnormalities, particularly pigmentation in families with an abiotrophy, may be investigated by the ERG and unless the process is advanced it is possible to differentiate an inflammatory from an abiotrophic lesion.

The ERG also has a prognostic value, for retinal lesions associated with a relatively normal ERG have a better prognosis than those associated with an abnormal one. This is particularly true of retinal detachment and venous thrombosis.

Future Developments

Great effort has been expended in modifying the elicitation of the ERG to produce more accurate data and hence a more accurate diagnosis, but however useful this may be for statistical analysis or physiological research it is of little use in the clinical assessment of any one patient.

Recent developments have involved the application of "averaging techniques" using an electronic computer. By these means an ERG may be elicited without a contact lens, and it is also possible to produce a response from one spot in the retina, particularly the fovea.

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