

THE EEG AS A DIAGNOSTIC AND PROGNOSTIC AID IN THE DIFFERENTIATION OF ORGANIC DISORDERS IN PATIENTS OVER 60*

By

E. C. TURTON, M.D., M.Sc., M.R.C.P., D.P.M.

*Consultant Psychiatrist .
Barrow Hospital, near Bristol*

INTRODUCTION

THE problem of the increased number of elderly psychiatric patients universally encountered needs no stressing. The purpose of this paper is to assess the value of the electro-encephalogram (EEG) as an objective aid to diagnosis and prognosis in these persons. The great majority of the psychiatric patients seen over the age of 60 are either suffering from an affective disorder, almost invariably depressive in nature, or from an organic dementia whether senile or arteriosclerotic. The former is normally considered of good prognosis and the latter doubtful or bad according to the degree of the dementia and confusion.

However, there is bound to be some overlap between the affective disorders and the dementias but the amount is far from sure and it is these "mixed" cases which are both of interest, but also difficult diagnostically. Kay, Roth and Hopkins (1955) felt that the numbers of this group were small, although stressing the far worse prognosis, but this is a by no means universal opinion, for instance—Noyes (1948).

In an earlier part of this work, Maggs and Turton (1956) outlined briefly the previous literature on the subject and found no definite EEG difference between a group of "normal" subjects aged 60 or over and a second group of patients suffering from a depressive illness, but showing no clinical evidence of dementia. This was still the case even when the depressive group was divided into those of early onset, i.e., before 60 years, and those of late onset.

It was desirable to establish two somewhat similar points. First, is the prognosis worse where clinically no dementia is present and the EEG abnormal? Second, is the prognosis better where, even though clinically some dementia is present, the EEG is normal?

MATERIAL AND METHODS

In the beginning of 1952 a long-term survey of elderly patients and their EEGs was started and, as far as possible, all patients admitted to a psychiatric hospital, taking primarily short stay patients of good prognosis, were examined over a five-year period.

The commonest cause of failure to obtain an EEG was excessive agitation, this being particularly marked in the women and accounting for the lower percentage examined. Either the necessity to give E.C.T. quickly or this treatment having recently been given, were the next commonest causes for no EEG being performed.

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All the patients had satisfactory tracings obtained from an Ediswan 8-Channel electro-encephalograph. Overbreathing was not routinely practised, as many elderly persons find it difficult to increase their respiratory exchange sufficiently. In those cases where it was performed, the results were not noteworthy and are not included. Photic stimulation was routinely used and in a number of cases changes that would normally be considered of an epileptic nature occurred. The records were all reported according to a fixed pre-arranged plan and without clinical knowledge of the case. The patients were not under the influence of any drugs, other than mild night sedation, at the time of the examination.

The diagnosis in the great majority was of a depressive illness and in many cases it was, as expected, recurrent and characterized by pronounced agitation. Taking the group as a whole, dementia was only rarely present clinically, treatment was usually E.C.T. and the duration of stay in hospital predominantly brief.

RESULTS

During the period commencing 1 January, 1952, and ending 31 December, 1956, a total of 670 patients, 260 males and 410 females, aged 60 or over, were admitted to the hospital. Of this total 482 (75 per cent.), 207 males (80 per cent.) and 275 females (67 per cent.), had satisfactory EEGs performed and stayed long enough in hospital for adequate clinical assessment.

Table I shows the distribution of the cases examined according to sex,

TABLE I

Distribution of Patients According to Sex, Age and Record Type

| | | | | | | | | |
|--------------------------|----|---------------------------|----|----|----|----|----|-----|
| Total number of patients | .. | .. | .. | .. | .. | .. | .. | 482 |
| Sex | { | Male | .. | .. | .. | .. | .. | 207 |
| | | Female | .. | .. | .. | .. | .. | 275 |
| Age in years .. | { | 60-69 | .. | .. | .. | .. | .. | 376 |
| | | 70-79 | .. | .. | .. | .. | .. | 100 |
| | | 80+ | .. | .. | .. | .. | .. | 6 |
| Record type .. | { | Normal | .. | .. | .. | .. | .. | 211 |
| | | Borderline normal | .. | .. | .. | .. | .. | 142 |
| | | Slow wave changes | .. | .. | .. | .. | .. | 109 |
| | | Others | .. | .. | .. | .. | .. | 20 |

age and record type. The average age of the sample was not really high with 376 (78 per cent.) between 60-69, 100 (21 per cent.) between 70-79, and only 8 (1 per cent.) 80 or over. The number of borderline normal records showing predominantly fast activity is large—142 (29 per cent.). There are 109 (23 per cent.) with diffuse generalized slow changes and 20 (4 per cent.) with either epileptic or focal abnormalities.

Table II shows how the EEGs, considered abnormal with slow wave changes, are related to the clinical opinion. In 41 cases no clinical evidence of dementia was present; in 18—slight; in 30—moderate, and in 20—severe. There is a reasonable correlation between the more severely disorganized EEGs and the degree of dementia but it is quite clear that where the changes are less marked their significance in the light of clinical observation is, at the best, doubtful.

The eventual outcome of the 39 cases with abnormal records of moderate

TABLE II
Diffuse Slow Wave Changes Correlated with the Clinical Estimate of Dementia
 Clinical Estimate of Dementia

| EEG Generalized Slow Wave Changes | | Nil | Slight | Moderate | Severe |
|--------------------------------------|-------|-----|--------|----------|--------|
| Degree: | | | | | |
| (1) Moderate | | 39 | 17 | 29 | 10 |
| (2) Severe | | 2 | 1 | 1 | 10 |

degree and a clinical estimate of no dementia did not differ significantly from the general favourable outcome. Thirty-six were discharged within six months, although two of these have since been re-admitted three times and one six times. Two more left within the year and one died in hospital at seven months of a coronary thrombosis. This is in complete conformity with the outcome of the rest of the group.

Table III shows the results of the clinical assessment of the degree of

TABLE III
Degree of Clinical Dementia, Outcome and EEG Changes

| Degree of Clinical Dementia | Total | Good Outcome | Bad Outcome | Deaths | EEG | |
|-----------------------------------|-------|-----------------|----------------|--------|-----|----------|
| Moderate | .. | 37 | 10 | 22 | 5 | Normal |
| | | 36 | 20 | 11 | 5 | Abnormal |
| Severe | .. | 3 | 1 | 1 | 1 | Normal |
| | .. | 21 | 5 | 8 | 8 | Abnormal |

dementia compared with the outcome in terms of normal and abnormal EEGs. Once again, where the dementia was clinically considered severe, there is a fair degree of correlation between the EEG findings and the outcome. Where dementia of moderate degree was estimated clinically, the outcome for the patient was better if the EEG was abnormal than normal, the finding being significant at the 5 per cent. level. This result should probably be disregarded.

Various other factors were considered but are not being given in detail because they were not found to be significant. There was no definite sex difference in either the percentage of normal, borderline or abnormal records. Hypertension and age, within the limits investigated, did not appear to be a cause of abnormalities. Elevation of either or both systolic and diastolic pressures, even if severe, was perfectly compatible with normal records and those with marked persisting hypertension did not show a greater percentage of abnormal records.

There was a tendency for those with low pressures to have abnormal records, and this is probably related to the fact that some of these were in heart failure and the pressure was showing reduction from its usual level.

Photic stimulation evoked changes which would normally be considered epileptic in 30 cases (6.1 per cent.) where there was clinically no evidence of epilepsy and where the record taken at rest was quite normal. In 13 the changes were very marked and persistent. However, this finding is almost certainly not of any special significance as related to old age and it is better to regard these changes as a measure of the convulsive threshold, as suggested by Gastaut

(1953), rather than as a sign of a specific epileptic tendency. Inevitably, however, it reduces considerably the clinical value of the provocative procedure.

SERIAL EXAMINATIONS

In all, 145 patients (30 per cent.) had 2 or more records and these were to some extent selected, representing mainly either those who relapsed and had to return to hospital, or those who were never discharged. The distribution of the repeat recordings in time is shown in Table IV. Of these, only 22 showed a

TABLE IV

| <i>Repeat Examinations</i> | | | | | | |
|----------------------------|---------|----------|--------|---------|---------|-------|
| At Under | 1 Month | 6 Months | 1 Year | 3 Years | 5 Years | Total |
| | 23 | 37 | 15 | 52 | 18 | 145 |

significant change from the original one, being improved in 9, worse in 11, and fluctuant in 2.

Within a month a record taken from a patient suffering from a cerebral thrombosis had improved from a focal slow wave discharge to borderline normal. Within six months, four records had changed significantly without any corresponding clinical change. The other records which changed over longer periods of time again showed but little correspondence with the clinical state. Two patients had a persisting and prominent left anterior temporal delta focus over a period of five years' careful observation without change. It is somewhat surprising that so many of these patients retained similar records over the years, often showing little tendency to worsen or improve.

DISCUSSION

Taken as a whole, the results are disappointing. It is clear that in the majority of cases with severe dementia the EEG will be correspondingly abnormal, as was found by Weiner and Schuster (1956), and that these cases are the ones with the worst prognosis. But it is just these cases which are not a major diagnostic problem. Where there was only a moderate degree of dementia present clinically, this was a considerably better prognostic guide than the EEG changes. In contradistinction, a moderate degree of diffuse slow wave change in the EEG does not adversely affect the prognosis. Furthermore, a moderate degree of clinical dementia coupled with an abnormal EEG was found, somewhat improbably, to have a better outcome than in those cases where the EEG was normal.

Despite the fact that almost a third of the total had one or more repeat examinations, no further clinical information was obtained from these. Roseman *et al.* (1952) and Sheridan *et al.* (1955) had both stressed the increased value of serial recordings.

If the EEG changes are related to alterations in cerebral circulation, as suggested by Obrist and Bissell (1955), most of the inconsistencies in the results could be explained, and the fact that several patients with a blood pressure that had been reduced from a previously higher level with some associated heart failure, had abnormal records lends support to this theory.

CONCLUSIONS

1. Out of a total of 670 patients aged 60 years or over admitted during a five-year period, 482 had satisfactory EEGs performed and were clinically suitable for inclusion in the group.

2. There is only a poor correlation between EEG slow wave changes that are not gross, and a clinical diagnosis of dementia that is not severe. Hence the EEG is not a satisfactory weapon for routine use in attempting to assess the degree of early dementia in "mixed" cases, where affective components are also present, and ordinary psychiatric judgment still appears the soundest diagnostic and prognostic approach.

3. Where the EEG changes are severe, there is a reasonable correlation with the clinical state, but this is of little diagnostic or prognostic value, since these cases do not normally pose a clinical problem.

4. One hundred and forty-five patients had two or more records at varying intervals of time but there was no further significant information added.

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