THE ELECTROENCEPHALOGRAM IN AGED PATIENTS OF A MENTAL HOSPITAL.

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This paper describes a preliminary survey, in which an attempt was made to discover if recognizable E.E.G. patterns could be correlated with consistent patterns of behaviour in a group of aged mental hospital patients.

The general characteristics of the E.E.G. in old age have been described. Greenblatt (1944) in a large survey of very varied neuropsychiatric cases found that the senile and arteriosclerotic psychoses were included among those in which abnormal slow activity in the E.E.G. had a peculiarly high incidence. Hoch and Kubis (1941) found the E.E.G. to be very variable in senile dementia, 5 to 7/sec. activity being common, while many had low voltage records. Davis (1941) reported that the fast alpha rhythms of 11 and 12/sec. were absent in their patients over 70 years of age, and that the alpha index decreased with old age while there was a simultaneous increase in slow delta activity. Mundy-Castle (1951) confirmed that the mean alpha amplitude was significantly less in a senile than in a younger group, but noted that in contra-distinction to this, the theta activity, when it occurred in seniles, was of significantly higher amplitude than the theta activity observed in the younger group. However, suprisingly in view of the impression derived from the previously-mentioned papers, suggesting that slow activity is the most characteristic feature of the E.E.G. in old age, he noted that there was a statistically significant decrease in theta activity in the senile group as compared with the younger group. Of 12 senile subjects displaying theta activity, 10 possessed abnormal E.E.G.'s. He concluded that theta activity occurring over the age of 65 years and associated with an abnormal E.E.G. represented a different process from that occurring in the younger age-groups, in which it is regarded as a reflection of maturation processes.

Observations on the mental states of the individuals whose E.E.G.'s are described are not numerous. Davis and Davis (1939) noted that an alert old woman with general arteriosclerosis had a normal E.E.G. which began to show slow activity as her faculties began to fail; and Liberson and Seguin (1945) found that confusion and irritability were more marked in those of their senile and arteriosclerotic patients who had abnormal slow records, whereas anxiety, agitation and delusions were more marked in others.

In the present paper no new description of the E.E.G. of old age is attempted; but as it is clear that the E.E.G. in old age is very variable, a search is made for clinical correlates of some of the more easily recognizable types of E.E.G.

Material and Method.

The clinical states and electroencephalograms of sixty-five patients were studied. The patients were of 60 years of age or over. Their psychiatric diagnoses were diverse, including schizophrenia, depressions of various types, senile and arteriosclerotic dementia, and others. The patients were ambulant and had no physical signs or symptoms of focal neurological disease.

Recording was by a six-channel Ediswan electroencephalograph using bipolar silver-silver chloride saline pad electrodes. The E.E.G. was reported with regard to frequency of the alpha rhythm, its distribution, responsiveness to visual attention, microvoltage, and the alpha index (Saul *et. al*, 1937). The last gives an indication of the percentage of the record from the occipital areas occupied by the alpha rhythm. For the purpose of this measurement, any frequency from 8–13/sec. was included if there was a clearly recognizable run of at least three waves of a microvoltage of ten or more. It was not possible to define the faster rhythms with any clarity. Lower frequencies were reported as to their microvoltage, frequency and number of clearly recognizable waves per minute, or as to per cent. time if they were numerous.

Intellectual deterioration was determined by psychiatric interview. Orientation for name, age, situation and time was easily assessed, but because of variable co-

operation, memory and concentration were more difficult to determine. Four rough groupings were therefore used, according to the probable value of the psychiatric assessment.

1. "*No deterioration*": In these patients co-operation was good and the assessment reasonably accurate.

2. "*Probably no deterioration*": Applied to two patients only. These were individuals who were usually withdrawn but occasionally engaged in conversation sufficiently to permit some questioning.

3. "*Probably some deterioration*": This was applied to three patients who were unco-operative, suspicious or deluded. In these cases the patient could sometimes be persuaded into conversational situations in which he had to use memory and concentration; the psychiatrist exercised his judgment on this, taking into account also the patient's psychiatric history and the degree to which he was capable of discussing his own and general affairs.

4. "*Definitely deteriorated*": This group includes two different types of patient. One of these is the patient, typically an arteriosclerotic, who has insight into his disabilities and has a tendency to evade questions which would uncover his limitations. The other type is that of the co-operative patient whose responses make it very obvious that deterioration is present. The clinical description of the majority of the cases was made by one of us (W. T. McC.) without knowledge of the E.E.G., and the E.E.G. was reported by the other (W. McA.) with no knowledge of the patient to whom it referred. There were 10 cases in whom the E.E.G. had been seen when the case was described. The final assessment of these cases was reached after discussion and agreement between the authors.

Findings.

Davis's observation, that in patients of over 70 years the fast alphas of 11 and higher were not found did not hold for this series. In 33 patients of 70 and over, an alpha of 11/sec. or over was found 4 times, and in 59 patients of 60 years and over it was found 11 times.

No correlation could be made out between the alpha index and the alpha frequency. The presence of rhythmic activity in the alpha band from the frontocentral areas could not clearly be shown to correlate with the microvoltage of the alpha from the occipital areas. A slight correlation, however, was found between the alpha index and the frontocentral rhythm, there being a tendency for the alpha index to be high in cases where alpha activity was found in the frontocentral areas (Fig. 1). There was also a small correlation between the alpha index and the microvoltage (Fig. 2).

Fifteen patients gave records showing definitely abnormal slow activity. The mildest degree of this showed waves of 4 to 7/sec., of a microvoltage of about two-thirds that of the alpha, and occurring as often as about 30 or more such waves in a minute. In the grossly abnormal records 2 to 7/sec. activity was almost continuous. In 14 of these 15 cases there was evidence of intellectual deterioration, 13 being described under "definite deterioration" and one under "probably some deterioration." The individual considered to be showing "probably no deterioration" was described in the psychiatric summary as "an arrogant, withdrawn, deluded old schizophrenic of long standing."

Fifty patients gave normal records, and 47 were considered to show "no deterioration." Of the 3 others, one "probably not deteriorated" was an old schizophrenic, and two "probably deteriorated" were also schizophrenics, one an active old dement, grossly deluded and apparently quite deteriorated, while the other was "superficially lucid; orientation varies, but he always knows the hospital and people."

The table below summarizes this distribution of deterioration and E.E.G. abnormality:

Table I.

E.E.G.	Psychiatric assessment.	
Abnormal, 15	Definitely deteriorated	13
	Probably deteriorated	1
	Probably no deterioration	1
Normal, 50	Not deteriorated	47
	Probably deteriorated	2
	Probably no deterioration	1

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From this it can be seen that when the psychiatric assessment was given with confidence and without qualification an abnormal E.E.G. was associated with intellectual deterioration, and a normal E.E.G. with no deterioration.

The 47 E.E.G.s of patients who were not deteriorated were then considered. No correlation could be made out between on the one hand psychiatric diagnosis,

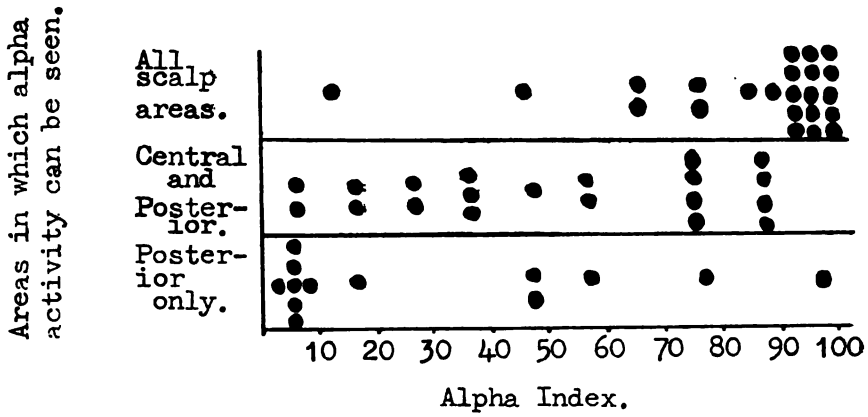

FIG. 1.

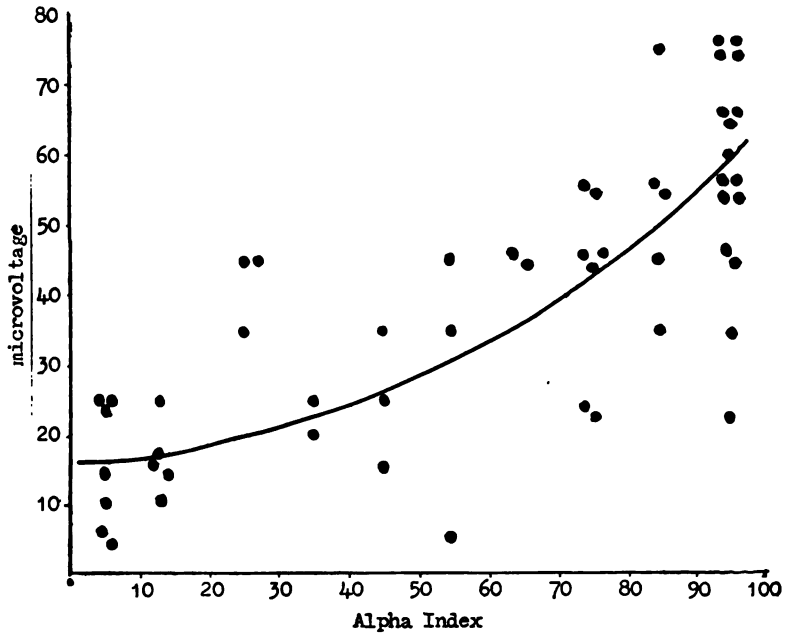

FIG. 2.

sex, age, duration of stay in hospital or prevailing mood, and on the other hand alpha frequency, distribution, index or microvoltage. The E.E.G.s were then arranged in a series, from that with the highest to that with the lowest alpha index. There were 16 patients in whom the alpha index was below 50. The psychiatric assessment of each of these patients included a statement to the effect that he was a restless or " active " individual. There were 31 patients with an alpha index of over 50 and 25 of these were considered to be inactive, quiet, "passive " individuals.

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The assessment of activity or passivity involved an impressionistic judgment by the psychiatrist in consultation with the nursing staff. In the majority of cases the distinction was relatively clear and simple. The " passive " or " inactive " individuals typically took little interest in their surroundings, rarely made any attempt to break their routine, and often required a good deal of prompting even to look after their immediate affairs; whereas the " active " or " restless " individuals were usually well informed on local gossip, showed an interest in general affairs, and had hobbies and interests outside their routine. In some patients the decision involved some careful weighing of circumstances. For example, a physically healthy, intelligent woman, recovered from an organic confusional state, who had an assured income and a good home where a few responsibilities awaited her, was considered to be in the inactive or " passive " group, despite full attendance at classes and entertainments, because she continually postponed her date of departure on trivial pretexts. Another woman was considered to be " active " although her class and work record was essentially the same as that of the aforementioned patient. Her work record was maintained although she had several physical disorders which could have been used as an excuse to lead a much more indolent life, had she wished.

The nurses' daily reports were consulted for further information, and in the " passive " group, confirmatory information was found, in expressions such as " quiet and rather uninterested," " lazy," " apathetic," and " gives no trouble." In the " active " group, 10 of the 16 patients frequently figured in the reports because of mild disturbances their activity or restlessness had provoked. This took various forms, of which meddlesome interference with other patients, incessant importunities and recurrent failure to observe parole regulations were the commonest.

There were 6 patients who were restless and over-active, whose E.E.G.'s showed a high alpha index. Four of these were cases of recurrent mania or hypomania. The two others were cases of recurrent depression in remission at the time of examination. They had never been considered manic in the intervals between the depressions.

Discussion.

In this study the observations that abnormal slow activity in the E.E.G. is of particularly high incidence in the senile and arteriosclerotic psychoses is confirmed. The correlation between the appearance of abnormal slow activity and intellectual deterioration is high, although not perfect. As the series included a wide variety of disorders, it is possible that inability to co-operate in the examination from other causes than intellectual deterioration of the senile and arteriosclerotic types is to be considered, particularly as the 5 cases in which the psychiatric assessment was uncertain and qualified were withdrawn and unco-operative schizophrenics. It was not possible to show any correlation between the degree of deterioration and the degree of abnormality in the E.E.G., possibly for similar reasons. It will be necessary to carry out further observations on a more homogeneous series of cases of senile and arteriosclerotic degeneration.

It is probable that impaired cerebral blood-flow is an important factor in producing the abnormal E.E.G. and the intellectual deterioration in senile and arteriosclerotic patients. In this series no correlation whatever could be made out between the state of the peripheral arteries and the E.E.G. or the presence or absence of deterioration. This is not at all surprising, as palpable peripheral arteries indicate medial sclerosis which runs a benign and symptomless course (Firstbrook, 1951). Freyhan *et al.* (1951), however, have shown that there is a significant reduction in cerebral blood-flow; oxygen consumption and an increase in cerebrovascular resistance in patients with senile and arteriosclerotic psychoses as compared with young adults. Kety *et al.* (1948), Lovett Doust and Schneider (1952) and many others have drawn attention to mental changes that occur in anoxic anoxia; and Brazier (1946), Davis *et al.* (1938) and Gibbs and Davis (1935) have described the slowing of the E.E.G. that occurs with anoxia. Since anoxia, slow activity in the E.E.G. and confusion are associated under experimental conditions in young subjects, and impaired cerebral circulation has been found in senile psychoses in which there is also abnormal slow activity in the E.E.G., it is tempting to relate the latter to the impaired cerebral circulation and anoxia. It remains, however, to be shown that there is a difference between deteriorated and non-deteriorated aged individuals in respect of cerebral blood-flow and oxygen consumption.

The findings in the group in which the E.E.G. was normal agree fairly closely with those of Saul *et al.* (1937–1949), who studied individuals in psychoanalysis and found a high alpha index to be characteristically associated with a passive dependent, receptive attitude ; submissiveness, a desire to retreat from others and from dangers, effort and responsibility ; while a low alpha index was usually associated with a " consistent, well-directed, freely indulged drive to activity." They distinguished this from the hypomanic type of activity, which they consider to be in the nature of a defence, and which is associated with a high alpha index. In the present series hypomania and mania was associated with a high alpha index, and these cases formed the chief exception to the finding that there was a correlation of passivity with a high alpha index. In all cases where the alpha index was low the subjects were considered to be active individuals.

In this preliminary survey the descriptions implied by the terms " passivity " and " activity " are only approximate and imprecise, the formulation of the cases having been largely impressionistic. Further studies are in progress in the hope of discovering more definitely the qualities of behaviour which led to these impressions, and so evolving better defined descriptions.

Summary.

E.E.G.'s were taken from 65 individuals of 60 years and over, suffering from a variety of psychiatric disorders.

In 15 patients there was abnormal slow activity in the E.E.G., and in 13 of these there was reliable evidence of intellectual deterioration.

In 50 patients the E.E.G. was normal, and 47 of these showed no sign of intellectual deterioration.

In 16 out of these 47 patients there was a low alpha index, and these were considered to be active, restless individuals.

In the other 31 there was a high alpha index. Twenty-five were considered to be passive, inactive individuals, while of the remaining 6, 4 were cases of recurrent mania and 2 of recurrent depression.

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