Benefits and Limitations of Conventional EEG in a Psychiatric Clinic

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The use and validity of EEG in psychatric clinic is still controversial inspite of its reasonable acceptance in neurology departments . This could be attributed to many factors related to psychatric disorders Them selves and EEG technology. Inspite of these factors EEG could be considered an important non-invasive tool for studying the electrophysiological functions of the brain in psychiatric clinics. This study is a trial to throw light on some benefits and limitations of conventional EEG in psychatric clinic .

(Egypt.J.Psychiat., 2000, 23 : 55- 62).

INTRODUCTION

The existence of bioelectric potentials of the brain in man was recorded for the first time by the German Psychiatrist Hans Berger (1929). He made his discovery during a search for physiologic correlates of behaviour (Berger, 1937). EEG research during the past half century has not fulfilled his original expectations. No pathognomonic findings have been established for various behavioral phenomena. The EEG increasingly developed as a simple, noninvasive, neurologic diagnostic tool, but its use in psychiatry was limited primarily to determining gross cerebral organicity in psychiatric patients (Itil, 1978).

Many efforts intended to establish broad database of EEG data in psychiatry. The purpose is to determine whether the EEG can contribute to the diagnostic classification of psychiatric disorder, the discription of the course of the illness and prediction of the therapeutic outcome (Herman and Winterer, 1996). Houghes (1996), stated that: two thirds of psychiatric referrals for an EEG are expected to provide useful information. Also Graae et al. (1996) reported that abnormal EEG activity has been associated with various psychiatric disorders and behaviors.

Electroencephalographic (EEG) studies have been performed in psychiatric populations, and some have identified specific abnormalities within groups of functional psychoses. Differences in EEG findings among subgroups of functional mental illness need to be evaluated with careful consideration of the nosological systems employed in each study (Inui et al., 1998).

Still we can not say that EEG is a specific tool of investigation in psychiatry (as ECG in medicine or laboratory and radiological investigations in other specialities). The causes may be attributed to the conventional techniques used in EEG and to the nosological systems used in psychiatry.

In the conventional visual method of reading EEG, attention was given to low frequencies (lower than 7 cps) and to focal or generalized sharp waves, sikes, spike and wave, rather than faster frequencies (more than 7 cps) which are indicative of normal CNS function. Thus,

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depsite the existence of much higher-frequency activities in the brain, visual correlations with CNS pathology have been limited to a very low-frequency range. This was, in part, the result of limitations of EEG recording technology in the 40s and 50s, and the diffficulty of assessing high-frequency waves, with the naked eye (Itil, 1978).

Also, nosological non-establishment of psychiatric disorders and intermingling of symptoms between various disorders made the specific EEG correlation more difficult (Herman and Winterer, 1996) which added more to the problem.

However, this view was changed in the past 30 years with the development of computerized EEG (CEEG) system which enabled psychiatrists to rethink again about making use of CEEG to help them in diagnosis and differential diagnosis of psychiatric disorders using a quantitative, objective, simple, noninvasive tool of investigation. But, still computerized EEG is not available for common use especially in developing countries. This study is a trial to assess the value and limitations of EEG in a psychiatric clinic focusing on the relationship between various EEG abnormalities and clinical diagnoses using the available traditional 8-channel EEG apparatus with visual reporting method.

SUBJECTS AND METHODS

The sample of this study consisted of five hundered cases referred to EEG unit of psychatric clinic in Taif in the Kingdome of Saudi Arabia along a period of 13 months. This sample represented all those cases which were referred for EEG to investigate for etiological organic pathology and how much of this organic pathology if present could be correlated to the clinical diagnosis.

EEG records were done under standard conditions, hyperventilation and sometomes photic stimulation. The apparatus used was the Mingograf EEG-10-Siemens Elema 8 channels, with sensitivity usually 50 UV, time constant 0.3 sec., and filter 15 Hz. Ten twenty system of electrode placement was followed. Seven programs were used, one minute duration for each, then three minutes for hyperventilation and one minute for photic stimulation.

Records were interpreted visually by a psychiatrist with good experience in EEG.

RESULTS

Demographic data, clinical diagnosis and EEG results are shown in the following figures and tables:

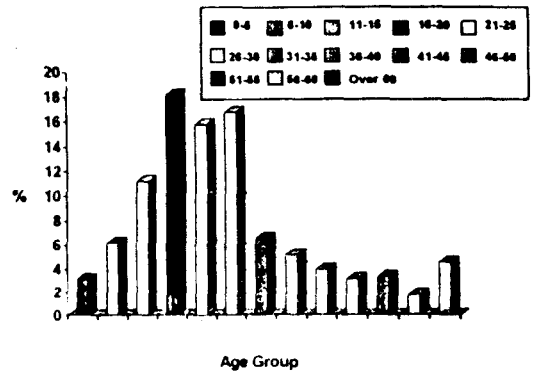
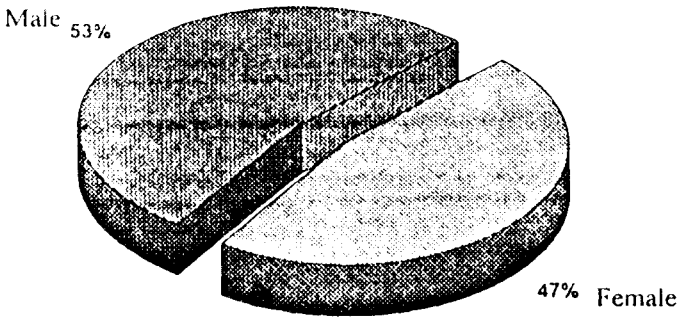


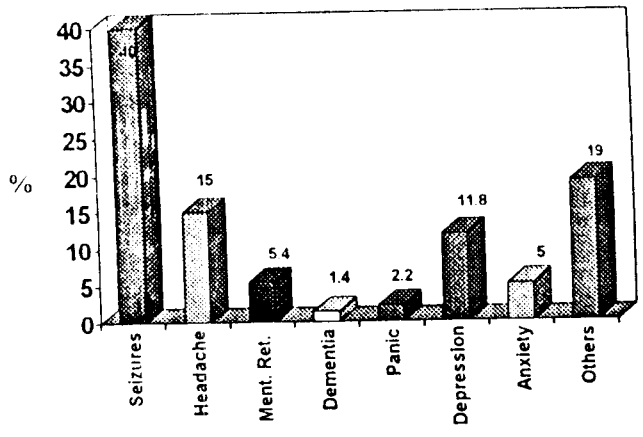
Fig. (1) : Age Distribution in The Whole Sample

Fig. (2) : Distribution in the Whole Sample



Z=1.77 (P>0.05), Insignificant difference

Fig. (3) : Diagnostic Groups In The Whole Sample



Diagnostic Groups (x^2=565; P < 0.001)

Table 1
EEG Abnormalities in Relation to Clinical Diagnosis

Diagnosis	No. (%)		Z
	Normal	Abnormal	
Seizures	33 (15.8)	176 (84.2)	13.9*
Headache	35 (52.2)	32 (47.8)	0.52
Mental Relation	4 (14.8)	23 (85.2)	5.2*
Dementia	3 (42.8)	4 (57.5)	0.5
Panic	5 (45.5)	6 (54.5)	0.4
Depersssion	36 (61)	23 (39)	2.4*
Anxiety	15 (60)	10 (40)	1.4
Others	56 (58.9)	39 (41.1)	2.5
Total		500 (100)	

* Statistically Significant

Table 2
Focal Versus Generalized EEG Abnormalities in Different Varieties of Seizures

Clinical Diagnosis	EEG Abnormalities				Z
	Focal		Generalized		
	No.	%	No.	%	
Grand mal epilepsy	18	24	57	76	6.4*
Petit mal epilepsy	0	0	6	100	*
Mixed type	0	0	9	100	*
Partial epilepsy	22	100	0	0	*
Non-specific (Fit F.I)	19	29.7	45	70.3	4.6*
Total	59	33.5	117	66.5	6.2*

* Statistically Significant

Table 3
EEG Abnormalities in Headache

Abnormalities	Patients	
	No.	%
Generalized paroxysmal dysythmia	8	25
Diffuse slow dysrythmia	5	15.6
Focal paroxysmal dysrythmia	2	6.3
Fast wave records	15	46.9
Diffuse slow dysrythmia (left side)	1	3.1
Diffuse slow dysrythmia (right side)	1	3.1

Table 4
EEG Abnormalities in Mental Retardation

Abnormalities	Patients	
	No.	%
Mild diffuse slow dysrythmia	14	61
Generalized epileptogenic dysrythmia	5	21.7
Fast wave records	2	8.7
Focal epileptogenic dysrythmia (left frontal area)	1	4.3
Signs of maturation defect	1	4.3

Table 5
EEG Abnormalities in Dementia

Abnormalities	Patients	
	No.	%
Mild diffuse slow dysrythmia	2	50
Mild generalized paroxysmal dysrythmia	1	25
Signs suggestive of altered states of consciousness	1	25

Table 6
EEG Abnormalities in Depression

Abnormalities	Patients	
	No.	%
Generalized paroxysmal slow dysrythmia	3	13
Signs suggestive of altered states of consciousness	2	8.7
Fast wave records	18	78.3

Table 7
EEG Abnormalities in Panic Disorders

Abnormalities	Patients	
	No.	%
Generalized paroxysmal slow dysrythmia	3	50
Fast wave records	3	50

Table 8
EEG Abnormalities in Generalized Anxiety Disorders

Abnormalities	Patients	
	No.	%
Slight diffuse cerebral dysrythmia	1	10
Fast wave records	9	90

DISCUSSION

It is not surprising that cases with epileptic phenomena are commonly referred for EEG because EEG helps in diagnosis of epilepsy either during the attack itself or inbetween the attacks.

Kiloh et al. (1981), indicated that interseizure records in epileptics may show only nonspecific abnormalities: this is true of 40% of non-activated records taken from epileptics; or they may be within normal limits: this occur with single routine recordings in 20-30% of cases. Moreover, spike and wave and similar epileptiform discharges are sometimes found in the EEGs of individuals who are not known to have had epileptic attacks of any kind, emphasizing that epilepsy must always be diagnosed on clinical grounds and not solely on EEG evidence.

However, in this study EEG abnormalities in patients with seizures were found higher (84.2%) compared to the study mentioned above. The difference may be attributed to the use of activation techniques (hyperventilation and photic stimulation). This indicates the value of activation techniuqes in minimizing missed cases. Inspite of that, there is still considerable cases (15.8%) who can be diagnosed only on clinical basis, which support the necessity of considering the clinical diagnosis even in the absence of manifest EEG abnormalities.

EEG findings helped to differentiate subtypes of epilepsy especially those having specific features like petit-mal epilepsy (100%) and to less extent partial epilepsy (22%). Also EEG features helped greatly to confirm diagnosis especially in absence of complete and accurate history or in cases confused to be either epilepsy or hysteria (cases referred to as fits for investigations).

Patients suffering headache with EEG abnormalities (n=32) showed a variety of EEG findings including generalized paroxysmal dysrythmia (25%), diffuse slow dysrythmia (15.6%), focal paroxymal dysrythmia (6.3%), fast wave records (46.9%), diffuse slow dysrythmia on left side (3.1%). These varities of findings stress the necessity of thorough investigation of cases suffering headache.

Diffuse slow dysrythmia were predominant (61%) in cases of mental retardation in addition to epileptogenic signs, which is not surprising to have such abnormalities in patients known to have gross cerebral biochemical, endocrinal and other pathological abnormalities.

Fifty percent of cases diagnosed as dementia showed mild diffuse slow dysrythmia, while 25% of cases showed mild generalized paoxysmal dysrythmia and the remaining 25% of cases showed signs suggestive of altered state of consciousness (slow waves alternating with apha and fast waves "fluctuating

record"). These findings could be interpreted in light of statement of Sito (1995) which suggested that the tendency of an increase of slow activity and a decrease of alpha activity was seen as the clinical severity of dementia increases.

In this study EEG findings suggestive of altered state of consciousness were also detecetd in two cases of depression out of twenty three (8.7%). Those patients (of dementia or depression) were not diagnosed clinically as suffering from disturbance of consciousness either because it was overlooked, or it was subtle to be identified clinically. It is well known that demented patients have low threshold for delirium (like any psychiatric condition associated with organic brain pathology), and also depression is one of the psychiatric disorders which could be seen associated with stupor in some cases.

Thus, EEG finding suggestive of altered state of consciousness, mentioned before, could be considered as alarm that those patients are liable to pass to delirious state with any additional precipitating factors, and this stage is a prelimenary stage for delirium which must be avoided.

In the 23 cases of depression studied, 78.3% showed fast waves, 13% showed generalized paroxysmal slow dysrythmia and 8.7% showed signs suggestive of altered state of consciousnsess. An exploratory study was done by Abu-El-Azayem and Abdin (1989) to discriminate between the depressive subgroups using quantitative EEG variables. The findings of their study indicated that quantitative EEG can differentiate between the three depressive subgroups: neurotic depression, endogenous psychotic and endogenous non-psychotic depression. While depressive disorders cause a variety of changes in the awake EEG that can only be partly be linked with the clinical picture (neurotic versus endogenous), the sleep EEG show a decrease in REM latency, and incerase in REM density and a decrase in sleep efficiency in patients with depressive symptom (Herman and Winterer, 1996).

Hughes (1996), stated that "in mood disorders the emphasis is on right sided foci; in addition to the controversial 6/ sec spike and wave complexes". However in the present study these findngs were not confirmed.

Fast wave records were found in 90% of patients with genealized anxiety disorder studied in that research. This could be a significant finding which correlates psychological tension with appearence of fast waves. Itil (1973), found that in patients with anxiety syndromes, there were a significant relationship between reduced 20-26Hz frequences in the primary wave and first derivative, and lowered anxiety scores on the Hamilton scale. Kalashinikova and Sorokina (1995), found that the index of general power of the alpha-rythm inversely dependent on the level of anxiety. Herman and Winterer (1996) stated that EEG recordings under experimentally induced anxiety do show typical changes: in normal persons there is usually an increase in desynchronous fast beta activity (hyperarousal accompanied by congnitive coping), whereas patients with anxiety disorder show hypersynchronized alpha activity, as is usually found in deep relaxation. Thus, hypersynchronized alpha ctivity might be an expression of a compensatory effort of the system to relax. Anxiolytics induce synchronous 14-18Hz beta or subalpha activity, which may force the system into more rigid patterns (relxation) and thus could counteract anxiety in normal persons if hyperarousal together with desynchronization is not sufficient. Furthermore, benzodiazepines also show an

increase in desynchronous fast beta activity, preferably in the frontocentral areas which could be useful in chronic anxiety in order to support congitive efforts.

It was noticed also that fast wave records were predominant in cases of headache and panic attacks.

This means that fast waves have a correlation with psychiatric disorders (as the slow waves have a correlation with neurologic disorders), and this correlation still needs more investigations aiming toward more specifications to make use of EEG in psychiatry.

REFERENCES

Abu-El-Azayem, A. and Abdin, A. (1989) Diagnostic discrimination between the depressive subgroups with quantitative EEG variables. *Arab. J. Psychiatry*, 1 P. 34.

Berger, H. (1937) On the electroencephalogram of man. Twelfth report. *Arch. Psychiatry. Nervenkr.* 106: 165-187.

Graae, F. et al. (1996) Abnormality of EEG alpha asymmetry in femal adolescent suicidal attempters. *Biol. Psychaitry*, 40: 706-13, Oct.

Herman, W. and Winterer, G. (1996) EEG in psychaitry: current status and outlook. Nervenarzt, 67: 348-59.

Hughes, J. (1996) A review of the usefulness of the standard EEG in psychiatry Clin. Electroencephalogr., 27: 35-9, Jan.

Inui, K. et al., (1998) Electroencephalographic findings in patients with DSM-IV mood disorder, schizophrenia and other psychotic disorders. *Biol. Psychaitry*, 43: 69 - 75, 1998 Jan 1.

Itil, T.M.; Polvan N.; Egilmez S.; Saletu B. and Marasa J. (1973) Anxiolytic effects of a new triazolobenzodiazepins U-31, 889, *Curr. Ther. Res.* 15 (9): 603-615.

Itil, T.M. (1978) The use of electroencephalography in the practice of psychiatry. International training course of computerized EEG and brain mapping. Cairo, P. 31, 32.

Kalashnikova, I. and Sorokina, N. (1995) The bioelectrical correlates of the personality anxiousness of two strong types of higher nervous activity. Zh Vyssh Nerv. Deiat. Im. I. P. Pavlova, 45: 661-8, Jul-Aug.

Kiloh, L.G. et al. (1981) Electroencephalography. Butterworth, London, P. 96.

Satio, N. (1995) Analytic study of EEG features of ageing with/without psychiatric disorders: focussing at the alterations in the EEGs of the healthy, depressive and demented elderies. Seishin Shinkeigakn Zasshi, 97: 801-24, 1995.

الفوائد والقصور فى استخدام رسم المخ الكهربائى فى عيادة طبنفسية

مازال هناك إختلاف فى وجهات النظر حول استخدام وجدوى رسم المخ الكهربائى فى العيادات الطبية النفسية، على الرغم من تحقق ذلك بشكل كبير فى أقسام الأمراض العصبية، ويمكن أن يعزى ذلك إلى عدة عوامل تتعلق بالاضطرابات الطبية النفسية ذاتها وأيضا بتقنية (تكنولوجية) رسم المخ الكهربائى.

وعلى الرغم من هذه العوامل فإن رسم المخ الكهربائى يعتبر وسيلة مهمة لدراسة الوظائف الكهربية الفسيولوجية للمخ فى العيادات الطبنفسية. وهذه الدراسة هى محاولة لإلقاء الضوء على فوائد وأوجه قصور رسم المخ الكهربائى التقليدى فى العيادات الطبنفسية.