Electroencephalographic Characteristics of Violent Patients

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Abstract

This study was carried out on 70 subjects that had been admitted to the Forensic dept. of Psychological Medicine Hospital in Kuwait, for medicolegal assessment. They were clinically evaluated and diagnosed according to International classification of Diseases, 10 (ICD 10). Electroencephalographic study (EEG) was done for all of them, while Computerized Axial Tomography (CT scan) was done for only 25 subjects. Results: The ratio of the main clinical diagnoses were: schizophrenia 21.43%, psychoses 41.43%, antisocial personality disorder 18. 28% and substance use disorder 14.28%. EEG abnormalities were found in 42.86% of the whole group, 31% in psychotics, and 46.2% in antisocials. For the offenders of different crimes, EEG abnormalities were recorded in 40% among physically violent crimes. Temporal dysfunction was the most recorded abnormality, especially among rape offenders (55.56%). Conclusion: Psychosis and EEG changes can be considered as predictors of violence. Fronto-Temporal areas are the commonest sites to show such EEG abnormalities.

Introduction

Violence as a phenomenon has acquired a special position in the focus of interest of psychiatrists. This is not only because it is a common presentation of various psychiatric disorders but also because it is one of the requisite in forensic psychiatry to evaluate the violent behavior if it is a presentation of psychiatric disorder or not. The meaning of a violent act is not always understandable: It could be simply an occasional over reaction of a normal person to a particular situation or it may be a repetitive mode of reaction of a particular person even in minor stressful situations. Sometimes the violent acts emerge in response to fixed delusion or hallucination while in other times it is just a sort of pretending psychosis.

The association of mental illness with violent behavior was remarkable enough to stimulate psychiatrists to study the phenomenon and its validity. Modestin and Amman (1995), concluded from their study on 1265 psychiatric patients and a matched control group that violence was much more among mental illness patients than the control group and that alcoholic and drug users and schizophrenics had significantly higher criminality rate than other patients. In another study done by Guze and his colleagues (1974), they found that sociopathy, alcohol and drug addiction show violence more than schizophrenic and manic depressive patients.

Junginger (1996), noticed that violence observed in the mentally ill is associated with specific symptoms, mainly delusions and hallucinations. This point of view was previously concluded by Bartels et al., (1991) and shore et al., (1988) from their studies as they specified hallucinations and/or persecutory delusions to be the main origin of violent behavior in schizophrenics.

Accurate assessment of the violent patient may necessitate the use of all the available tools whether clinical assessment, psychometric studies, laboratory investigations and neuro physiological studies. Electroencephalography (EEG) has

a role in throwing lights on some aspects of violence and criminality. Mednick et al., (1985) found that EEG abnormalities were common among psychopaths while Paradiso et al., (1995) determined that the commonest finding was an excess of bilateral rhythmical theta activity with an amplitude equal to or greater than that of alpha rhythm.

There was also agreement that in a substantial proportion of psychopaths, EEG records showed higher ratio of the background slow waves on the expense of a lower ratio of alpha activity; such pattern had been called "immature pattern", but Macrae (1983) suggested instead the term "non - specific abnormality". Hill (1957) in a comprehensive EEG study on psychopaths found that paroxysmal disturbances including spike and slow discharges accrued in a fewness but their incidence was not significantly different from those in control groups,. Among criminals the most frequent abnormality was the non-specific pattern.

Many studies have searched for the relationship between the site and severity of EEG abnormalities and the mature of the violent act. The most frequent finding is that the temporal lobe is the most common site to show EEG changes in case of violence and aggression (Hill 1957 and Paradiso et al, 1995). However, no relationship between the type or degree of abnormality with the particular form of behavioral disorders could be ascertained. Devinsky (1991) pointed out that temporal lobe pathology is present as well in nearly all forms of behavioral disturbances. There are still a lot of questions waiting for answers about the actual role of temporal lobe pathology underlying aggression as well as other psychiatric and behavioral disturbances. The phenomenon of violence whether as a solitary symptom or as a consequence of a deeper condition can be considered as one of the gates through which we can access into the secrets of temporal lobe and its vague role in all psychiatric phenomena. In this study, with the help of EEG, we will try to know more about violence and its relation to other psychiatric disorders.

Subject and Methods

Sample:

Seventy male persons who were admitted to the Forensic ward in Psychological Medicine Hospital in Kuwait, during 1995, and who had been referred for medicolegal assessment for their responsibilities about different varieties of crimes. Some of this group was known before as psychiatric patients and had been admitted previously to general wards of the hospital.

Methodology:

Clinical assessment by at least two psychiatrists was done for the entire group. Diagnoses were put according to international classification of diseases (ICD 10). EEG was done for the seventy persons, and the used machine was computerized microscribe II with 23 channels and following the 10 - 20 systems. In a minority of subjects who were absolutely uncooperative (3 persons), sleep records were done. Computed Axial Tomography (CT scan) was done for only 25 subjects secondary to technical problems and also because the acquired police guarding during CT assessment was not always available (The place of CT scan was in another hospital and acquired guarded transportation).

Results

Figure (1) shows that schizophrenia was the most common diagnostic group among the whole sample, followed by antisocial personality disorder, and substance use disorder (21.43 %, 18.28 % and 14.28 % respectively). If all psychotics are grouped together; i.e., schizophrenia, delusional disorder, mood disorder, and atypical psychosis, they will represent 41.43% of the whole group. Other diagnostic groups was as follows: epileptic psychosis, mental subnormality, patents with sequel of head injury, hysteria, inadequate personality disorder, no psychiatric disorder, and lastly, adjustment disorder (depressive). As regards the ratio of the different crimes that were presented in our sample, fig (2) shows that physical assault and robbery were the most frequent (each was 20 %), followed by murder, rape, end attempted murder (14.29%, 12.86% and 11.43% respectively). Other types of crimes showed lower ratios. If crimes, which were characterized by physical violence, are grouped together; i.e., murder, attempted murder physical assaults and firing, they would constitute 35 cases (50%of the whole group).

Table (1) shows that psychotic patients had committed half of the crimes of physical violence followed by the antisocials (57.1% and 17.14% respectively). As regards rape, its offenders were belonging mainly to the psychotics followed by the antisocials and the mentally subnormal groups (33.3%, 22.2% and 22.2%) respectively. Crimes related to stealing (Robbery and Forgery) were more among inadequate and antisocial personality disorders, followed by the psychotic group (35.7% and 91.42% respectively. Fig. (3) and (4) show us the distribution of the different EEG finding according to clinical diagnoses and type of crimes respectively.

Psychoses were grouped together for statistical procedures, and they were found to represent 29 cases (about 40%) of the whole sample69% of these psychotics had normal records while temporal dysrhythmia was shown in 10.34%, generalized epileptogenic dysfunction in 6.9%and 13.8% showed non-specific theta waves. As regards the antisocial group, normal EEG was recorded in 53.8%, while 30.77% had temporal dysrhythmia. Both generalized epileptogenic dysfunction and non-specific theta waves were presented as 7.7% for each. Among the substance use disorders' group, the remaining 20% showed temporal dysrhythmia.

As shown in both Fig. (4) and Table (2), temporal dysfunction was the most prominent abnormality among offenders of all crimes in general, and of rape in particular, as it was recorded in 55.5% of rape offenders, while 33.3% had normal records, and the remaining 11.1% had non-specific theta waves. This ratio of temporal dysfunction among rape offenders (55.5%) was found to be significantly higher than that for the offenders of physically violent crimes and for the group of the study as a whole as they were recorded as 17.1% and 24.2% respectively. As shown in Table (3), the site of the recorded temporal dysfunction, was bilateral fronto-temporal in 35.3% of cases and bilateral temporo-parietal in 11.79%. Unilateral focal activity on the lift side was recorded in 35.3% and on the right side in 17.6%. CT scan was done for only 25 patients of the group, 56% of them showed abnormality that was associated also with EEG abnormalities in most of them.

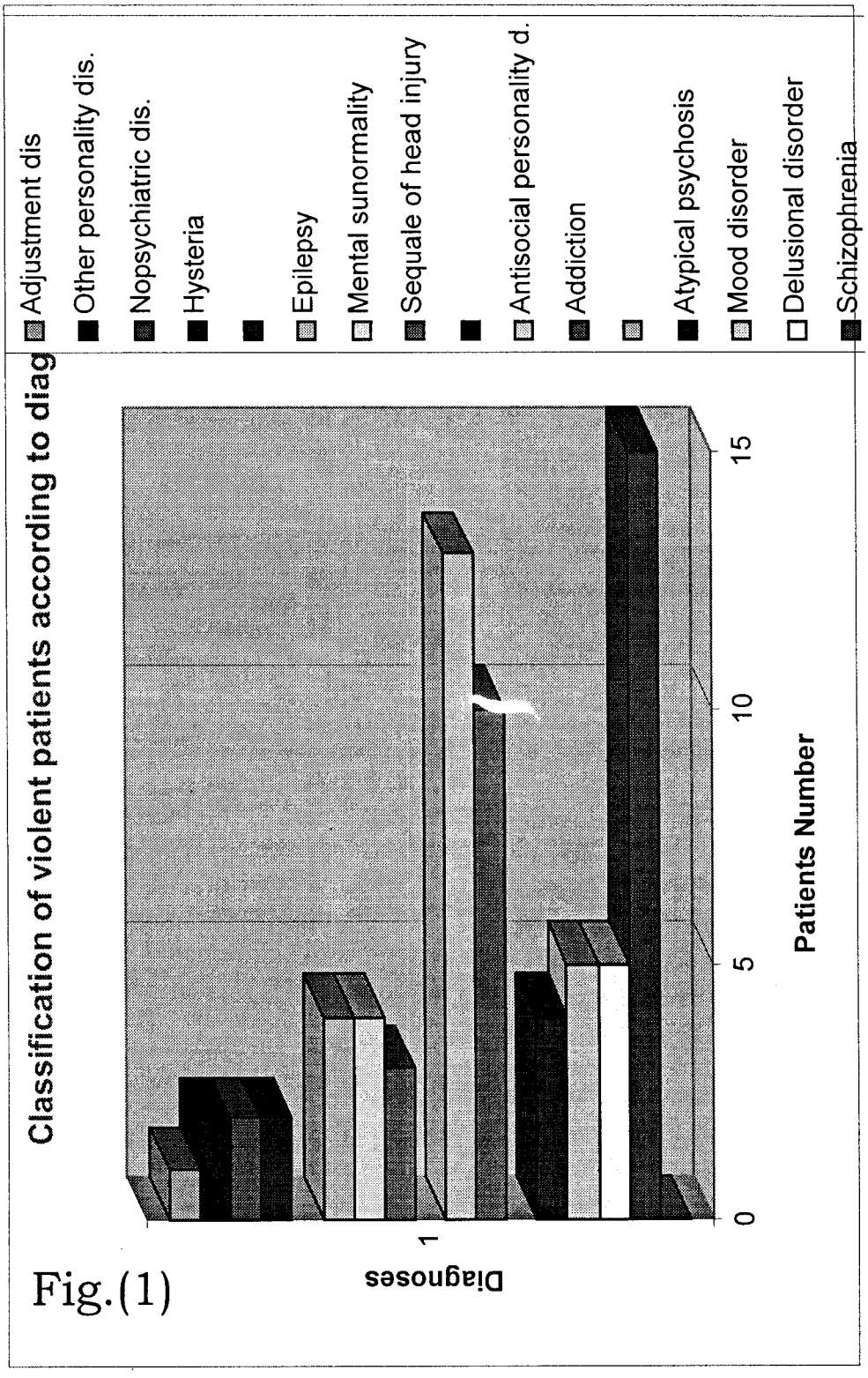
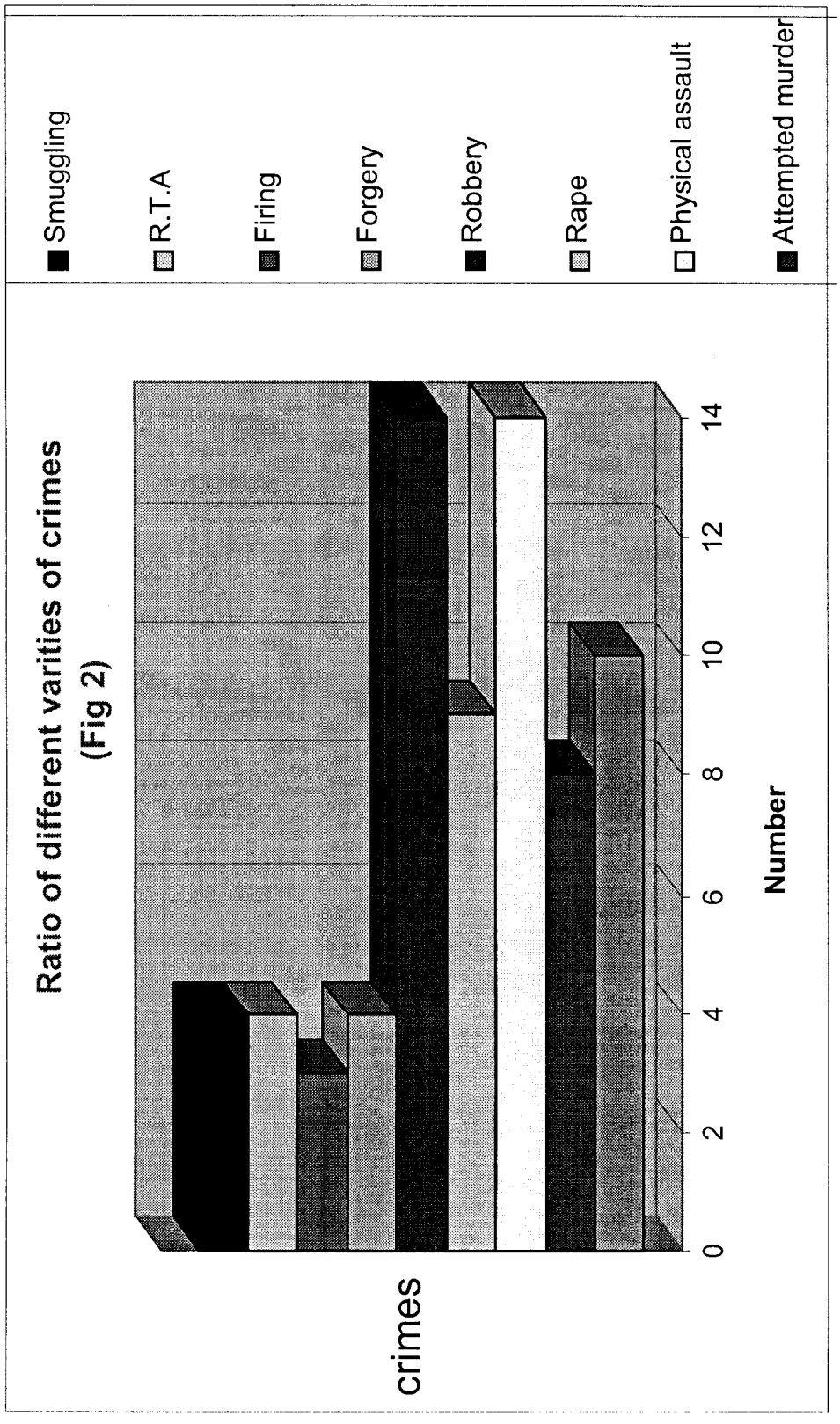


Fig.(1)

Diagnoses


Ratio of different varities of crimes
(Fig 2)
Smuggling
R.T.A
Firing
Forgery
Robbery
Rape
Physical assault
Attempted murder
crimes
0
2
4
6
8
10
12
14
Number

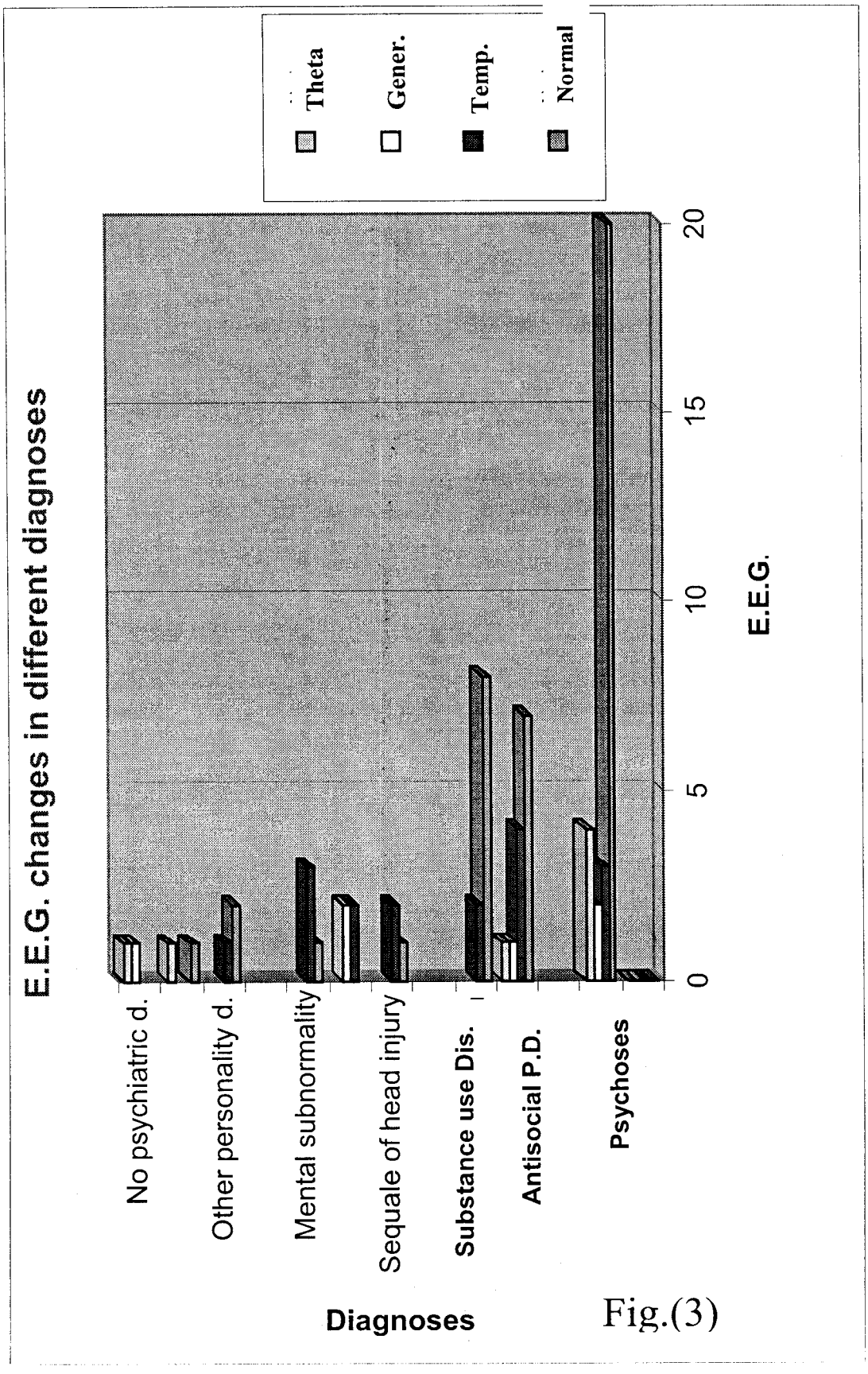

E.E.G. changes in different diagnoses
Theta
Gener.
Temp.
Normal
0
5
10
15
20
E.E.G.
No psychiatric d.
Other personality d.
Mental subnormality
Sequale of head injury
Substance use Dis.
Antisocial P.D.
Psychoses
Diagnoses

Fig.(3)

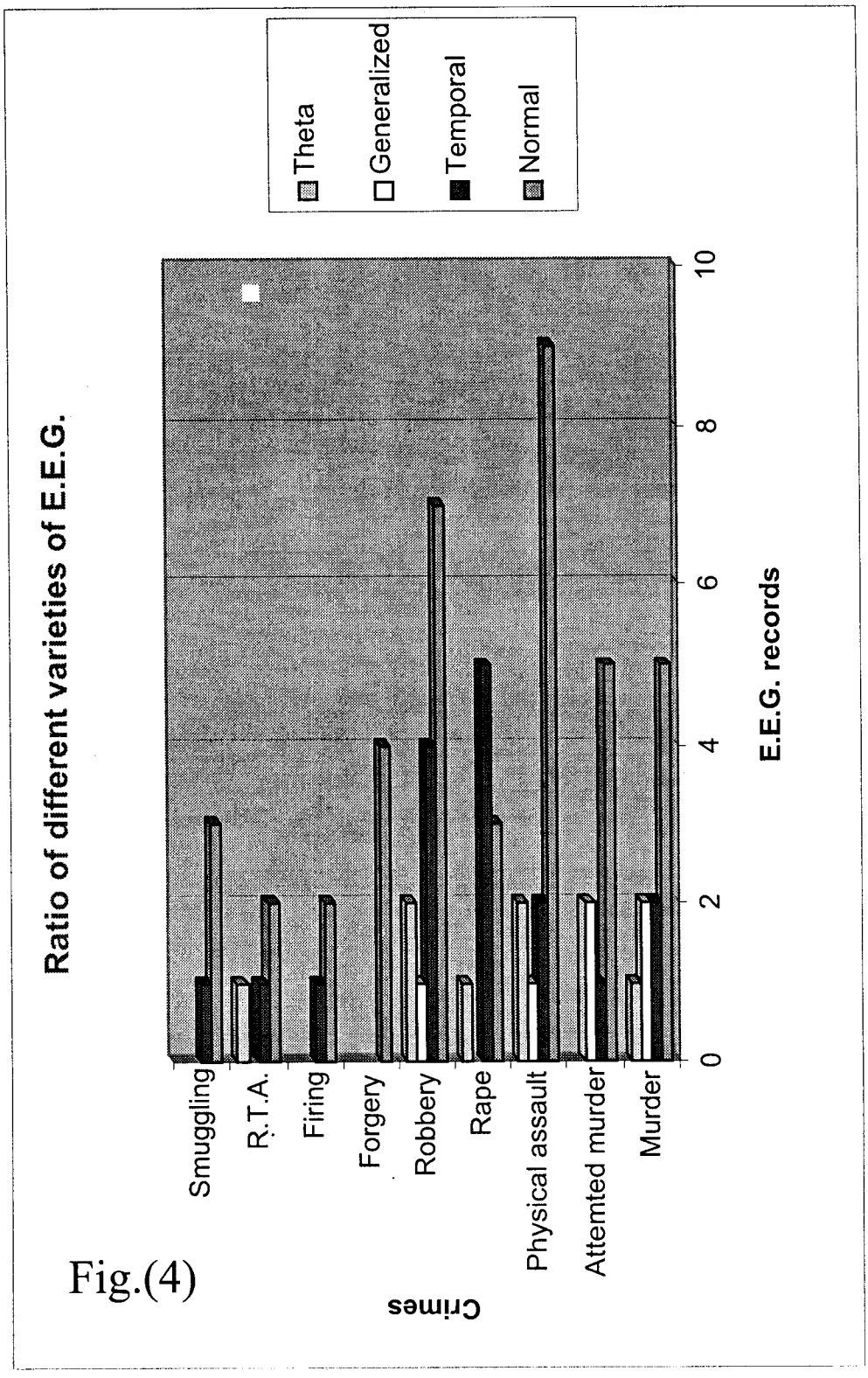

Ratio of different varieties of E.E.G.
Theta
Generalized
Temporal
Normal
0
2
4
6
8
10
E.E.G. records
Smuggling
R.T.A.
Firing
Forgery
Robbery
Rape
Physical assault
Attemted murder
Murder
Crimes

Fig.(4)

Table (1): Ratio of different type of crimes in different diagnostic categories.

Diagnosis	Physical Violence Crimes				Total			Rape			Stealing-related crimes		Total			Others		Total		
	Murder	Attempt.M	Phys.assault	Firing							Robbery	Forgery				Smuggling	R.T.A.			
	No.	No.	No.	No.	No.	%	Z	No.	%	Z	No.	No.	No.	%	Z	No.	No.	No.	%	Z
Psychoses:-																				
Schizophrenia (15)	3	3	2	2	10	28.6		2	22.22		2	1	3	16.67						
Delusional Dis. (5)	1	1	2		4	11.43														
Mood Dis. (5)	1		3	1	5	14.3														
Atypical Psychosis (4)			1		1	2.8		1	11.11		1		1	5.56						
Total (29)	5	4	8	3	20	33.3		3	33.33		3	1	4	22.2						
Antisocial P.D. (13)	2	2	2		6	17.13	}2.4*	2	22.22	} 1.2 Insig	5		5	27.78	}0.86 Insig					
Substance use Dis(10)	1	1	1		3	8.62		1	11.11		2		2	11.11		3	3	6	75	
Organic Person Dis(3)	1		1		2	5.7										1	1	2	25	}2.4*
Epilepsy (4)		1	1		2	5.7					1	1	2	11.11						
Mental Subn. (4)			1					2	22.22		1		1	5.56						
Anxiety State (3)					1	2.8					1	1	2	11.11						
Inadequate P.D. (2)											1	1	2	11.11						
No Psychiatric discord (2)	1				1	2.8		1	11.11											
Total (70)	10	8	14	3	35	100		9	100		14	4	18	100		4	4	8	100	

* = Significant at level < 0.05

R.T.A. = Road traffic accident PD = Personality Disorder

Table (2)
Ratio Of Different EEG Abnormalities According To The Type Of The Crime

Offenders of different crimes	Bilateral fronto-temporal		Bilateral temporo-parietal		Right-side focal activity		Left -side focal activity	
	No.	%	No.	%	No.	%	No.	%
Physical violence crimes (35)	3	8.57	1	2.86	2	5.71		
Rape (9)	1	11.11			1	11.11	3	3.33
Stealing related crimes (8)	1	5.56					2	11.1
Others (smuggling and RTA) (8)	1	12.5					2	25
Total	6	8.6	1	1.43	3	4.3	7	10
Z	insignificant		insignificant		insignificant		insignificant	

Note: statistical procedure was difficult because of the small number of cases

Table (3)
Localization Of Temporal Dysfunction In The Eeg Records Of Different Offenders

Type of Crime	Normal EEG			Temporal dysfunction			Non-specific theta waves			General Epileptic dysfunction		
	No.	%	Z	No	%	Z	No	%	Z	No.	%	Z
Physical violence crimes (35)	21	60	ins	6	17.14	ins	3	8.57	Ins	5	14.29	1.92*
Rape (9)	3	33.33	1.92 *	5	55.56	1.96 *	1	11.11	Ins			
Stealing related crimes (8)	11	61.11	ins	4	22.22	Ins	2	11.11	Ins	1	5.56	ins
Others (smuggling and RTA) (8)	5	62.5	ins	2	25	ins	1	12.5	ins			
Total	40	57.14		17	24.29		7	10		6	8.57	

*=significant at level <0.05. Note: Statistical comparisons are between the ratio of EEG finding in each type of crime with the ratio of the same finding in the entire group.

Discussion

This study was carried out on 70 persons who had been admitted to the Forensic Department in a psychiatric hospital to be medicolegally assessed for their criminal responsibility, most of them had history of previous psychiatric treatment and / or hospitalization.

The sample here is not just a violent group, but rather, it consists mainly of violent psychiatric patients.

Our finding about schizophrenia as the most common diagnosis among the group (21.43%) is comparable with that of Tewfic (1988), who had done her study in Egypt on those refereed to the Forensic Department for assessment, and she found that 25% of her study group were schizophrenics. The relation between schizophrenia and criminality (violent crimes in particular) has been confirmed in many studies, e.g. Odejide (1981), and Wessly et al., (1994),

who reported that 3.8% of a group of male schizophrenics were involved in offenses. In Egypt, Sadek (1971), found that 50% of murderers, who had been referred to a mental hospital, were schizophrenics, while Ghali (1979) reported that they were responsible for 60% of the violent crimes. Salem had confirmed also this view in her study in 1982. In our study, schizophrenics were responsible for 30% of murders and 28.6% of violent crimes in general, while psychotics as a whole were responsible for 50% of murders and 57% of violent crimes. Junginger (1996) emphasized that it is not simply the presence of mental illness that induces violence, but rather the specific presence of delusions and hallucinations. In confirmation to this view, Bartels et al., (1991) found that hallucinations and delusions were significant predictors of hostility in schizophrenics, and Straznickas et al (1993) reported that seven of 29 cases of physical assaults done by psychiatric patients were preceded by persecutory delusions.

Taylor found in his study (1985) that 93% of psychotic prisoners had active psychotic symptoms when they committed their crimes. Straznicker et al (1973), considered these types of crimes to be a sort of self-defense.

Delusional misbeliefs were found to represent the strongest motivational force among schizophrenics who committed violent acts or crimes (Kennedy et al, 1992; Taylor, 1985; and Junginger, 1996).

The second leading motivation among psychotics was found to be hallucinations, and particularly those of command (Mantell and Dietz, 1992; and Junginger, 1990). Yet there is a contrary view that command hallucinations have a little - if any – danger, and are very rarely to lead to violence (McNiel, 1994; and Goodwin et al, 1971).

As regards other psychiatric conditions that could be associated with violence, rather than psychoses, antisocials were presented in our study as 18.57%. The presence of antisocials among the group was expected and concomitant with the general idea about their tendencies to break the rules and not to consider the social and moral norms.

However, the ratio of antisocials as offenders of violent crimes (17.14%) was significantly less than that of the psychotics (57.1%), a finding, which raised many inquiries.

Firstly, this relative low ratio of antisocials among violent crimes can be explained partially by the nature of the sample, which

was consisting mainly of psychiatric patients. This explanation is supported by the findings of Sadek (1971) that the ratio of schizophrenics among murderers in the mental hospital was 50%, but in the prison it dropped to 13.33%, and consequently the ratio of antisocials was much higher in the prison than in the mental hospital.

Swanson (1994), concluded that although the presence of a major mental disorder such as schizophrenia was a significant predictor of violence. Till now psychopathy and substance abuse had stronger association. A similar view was that adopted by Guze and his colleagues (1974) who emphasized that sociopathy, alcohol and drug addiction are the main diagnostic categories to have violent behaviors.

Secondly, it is a point of argument if murder or any violent crime is a sort of extreme antisocial behavior that reflects the callous, aggressive and egoistic nature of these persons /or it is a sort of irrationality that is built on unreal beliefs and misinterpretations; or rather, it includes all these probabilities.

In this study, substance use disorder was diagnosed in 14.28% and most of the crimes that they had committed, rather than smuggling, were done under the effect of the substance they used to take.

The value of Electroencephalography as a diagnostic aid in psychiatry is a matter of controversy. The marked recent advances in investigation procedures and tools have provided a degree of accuracy, which may not be encountered with EEG, and consequently many physicians have objected its application in conditions rather than epilepsy.

On the other hand, the availability of EEG, its easy application, and being considered as cheap procedure, all these factors are still in favor of its use even as preliminary investigation. Still one other important factor, which is the nature of the abnormalities that could be recorded by EEG and which, was usually referred to as {functional}. This kind of abnormalities is still inaccessible to be detected by other instruments except those considered as developments of the ordinary electroencephalogram e.g. Brain Mapping.

As regards EEG value is assessing criminals and violent persons. It has been considered like a fact since several decades ago that a significant percentage of these persons have EEG changes mainly in the form of Fronto-temporal dysrhythmia that takes sometimes the pattern of epileptogenic dysfunction or alternatively, the pattern of scattered slow waves which is called {Non-specific pattern).

In our study, the ratio of EEG abnormalities in the group as a whole was 42.86% while it was about 46% and 31% for the antisocials and the psychotics respectively. Patients of substance use disorders showed abnormalities in only 20%. The ratio among psychotics is considered as relatively higher than those previously recorded which indicates that the association with violence increases the chance of the occurrence of EEG abnormalities. 40% of offenders of physically-violent crimes showed EEG abnormalities. Fronto-temporal areas were the sites of most of these abnormalities. This finding was in agreement with that of Millre et al., (1971) and Buzan (1995) who found that Fronto-temporal areas were the most likely site to show EEG abnormalities in violent and antisocial subjects. The ratio of temporal dysfunction among the group as

a whole was 24.2%, while for rape offenders only, it was recorded in 55.6%; half of them had focal activity in the left side.

These findings agree with what was previously mentioned by Devinsky et al., (1994) and Amen et al (1996), that left temporal lope is a common site of EEG abnormalities in cases of violence and aggression.

The relation between both temporal and frontal areas with the phenomenon of violence in general, and rape in particular is a complicated one. It is widely agreed now that temporal lobe with its infra-structures, particularly amygdala, is involved in the origin of human behaviors including aggression and violence (Griffin et al, 1987 and Post et al, 1988). On the other hand frontal lobe is known to have the function of higher control and its disturbance may lead, in many instances, to disinhibition and subsequent non-acceptable behaviors such as sexual promiscuity. Of course, we can not pretend that the relation between Fronto-temporal areas and violence is that simple combination between temporal lobe dysfunction and frontal lobe disinhibition effect, yet other multiple factors that may intervene and which are beside the limits of this study are still in need to be investigated.

The nature of EEG abnormalities, and not only their site, is still vague. Usually, these abnormalities resemble the epileptogenic dysfunction but sometimes it takes the form of non-specific slow waves (Macrae, 1983). These abnormalities can be considered as subclinical discharges which if repetitive enough, may through a process of Kindling ends in such violent behavior which in many times shares psychomotor epilepsy in some characters such as impulsivity and unpredictability.

It is quite certain that the temporal lobe still hides a lot of secrets to tell about human behavior, whether the rational or the irrational.

As regards the CT scan results, it has been difficult to interpret, because of the small heterogeneous group to whom it was done.

Conclusions

1- Schizophrenia is the most common diagnostic category to be met in Forensic wards.

2- Violent crimes are commonly committed by psychotic patients, while robbery and forgery are more likely to be committed by antisocial personality disorder' subjects.

3- EEG abnormalities are frequently recorded among psychiatric patients, but they are more common if violence is in association.

4- Both temporal and frontal lobes have a role in the causation of violence, but however, this role is still not clear enough.

5- Controlled studies on more homogenous groups are needed.

References:

Bartels, s.j. Drake, R.E.; Wallach, M.A and Freeman, D.H. (1991): Characteristics hostility in schizophrenic out patients. Schizophrenia Bull; 17 (1): 163-171.

Devinsky O. (1991): interracial behavioral changes in epilepsy. In O Devinsky, WH Theodore (Eds.), Epilepsy and Behavior (p.p.1-21). New York: Wiley-liss.

Ghali, H. (1979): Dangerous in psychiatry (A sample from Khanka mental hospital in Egypt). Egyptian J. psychiatry, 2:157-165.

Goodwin D; Alderson, P; and Rosenthal, R (1971): Clinical Significance of hallucinations in psychiatric disorders. Archives of General Psychiatry, 2: 76-80.

Guze, S. ; Woodruff, R. , and Clayton , P. (1974): Psychiatric disorders and criminality. Journal of the American Medical Association, 227:641-642.

Hellerstein, D.; Frosch, W.; and Koenigsbery , H. (1987). The clinical significance of command hallucinations. Am. J. Psychiatry, 144:219-221.

Hill D.; Pond D.; Mitchell W.; Falcomer MA (1957). Personality changes following temporal Lobotomy for epilepsy. J Ment. Sci 103:18-27.

Junginger, J. (1990): Predicting compliance with command hallucinations. A.M. J. Psychiatry, 147:245-247.

Junginger, J. (1996): Psychosis and Violence: The case for a content analysis of psychotic experience. Schizophrenia Bull. 22 (4): 91-103.

Kennedy, H.; Kemp, L.; and Dyer, (1992): Fear and Anger in delusional disorder. British Journal of psychiatry, 160: 488-492.

Macrae, A.K. (1983): An introduction to forensic Psychiatry in: Forensic Medicine for lawyers . Bristol John Wright and Sons.

Martell, D. and Dietz, P. (1992): Mentally disordered offenders who push or attempt to push victims onto subway tracks in New York City. Archives of Gen Psych., 49:472-475.

McNil, D. (1994): Hallucinations and violence. In: Monahan J. , and Steadman , H. (eds.) : violence and Mental Disorder : Developments in risk assessment. Chicago, IL: university of Chicago press. PP.183-202.

Mednick, S.A.; Volavka, J; and Gabrielli , W.F. (1985): EEG as a predictor of antisocial behavior. Criminology. 19(2): 219-119.

Modestin J.and Ammann R. (1996): Mental disorder and criminality: Male schizophrenia. Schizophrenia Bull. 22(1): 69-82.

Odejide , A.O. (1981). : Some clinical aspects of criminology: a study of criminal psychiatric patients at the Lantoro psychiatric institution .Acta Pychiatrica Scandinauca, 63: 208-224.

Paradiso , S . Hermann , B.p.; and Robinson , R.G. (1995): the heterogeneity of temporal lobe Epilepsy. The Journal of Nervous and mental Disease. 183(8): 538-547.

Sadek , A.A. (1971) : Neuro psychiatric study of Egyptian murderer .Thesis .Ain-Shams university.

Salem Sannaa Sayed (1988): A study of the correlation between certain steroid sex hormones and aggression in some psychiatric disorders. Thesis, Cairo university.

Shore, D.; Filson, C.R. and Johnson, W.E.C. (1988): Violent crime arrests and paranoid schizophrenia: schizophrenia Bull , 14(2): 279-281.

Straznickas, K; McNiel D; and Binder, R(1993): violence toward family caregivers by mentally ill relatives. Hospital and community psychiatry, 44:385-387.

Swanson,J. (1994) Mental disorder, substance abuse , and community violence : an epidemiological approach in : Monahan, J and Steadman ,H. (eds.) violence and Mental Disorder. Chicago ,IL: university of Chicago press P.P. 101-136.

Tewfic Nora Mohammed (1988): Forensic psychiatry in Egypt M.D. Thesis .Al-Azhar university.

Wessely ,S;Castle,D.;Douglas A.; et al (1994): The criminal careers of incident cases of schizophrenia psychological Medical . 24: 483-502.

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تغيرات رسم المخ فى المرضى العدوانيين

هذه الدراسة قد اجريت على سبعين شخصا من الذين تم حجزهم بقسم الطب الشرعى بمستشفى الطب النفسى بالكويت من اجل التقييم الطبى الجنائى و قد تم تقييمهم اكلينيكيا و تشخيصهم وفقا للتصنيف الدولى العاشر للامراض النفسية و عمل رسم مخ لكل اشخاص الدراسة بينما تم عمل اشعة مقطعية لخمسة و عشرين مريضا فقط.

النتائج: نسبة التشخيصات الاكلينيكية الاساسية هى:٢١,٤٣% فصام – ٤١.٤٣% امراض ذهانية – ١٨.٢٨% سوء استخدام عقاقير طبية ١٤,٢٨% الشخصية الاجرامية – اضطراب رسم المخ قد وجد في ٤٢,٨٦% من الجموعة كلها و ٣١% من المرضى الذهانيين و ٤٦,٢% من الشخصيات الاجرامية. و قد لوحظ ان اضطرابات رسم المخ موجودة فى ٤٠% من مرتكبى الجرائم العديد من الجرائم العدوانية و اضطرابات الفص الصدغى ٥٥,٥٦% كانت اكثر الاضطرابات و خصوصا فى جرائم الاغتصاب و قد وجد ان:

الاستنتاج: الذهان و تغير رسم المخ يمكن اعتباره كمؤشر للعنف و المناطق الجبهية الصدغية هى اهم الاماكن التى بها تغيرات برسم المخ.