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Seizure type and interictal epileptiform EEG patterns in Nigerians

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Abstract
Introduction: *The purpose of this study was to define and establish the relationship of clinically diagnosed seizures with electroencephalographic (EEG) pattern and to determine the effective role of EEG in diagnosis of patients suffering from epileptic seizures.*
Methods: *We reviewed the charts of 615 patients with seizure disorder who had an electroencephalography performed between over three years. The data using EEG-findings was broken into the following nine study groups: I) normal, II) Generalized Slowing, III) Generalized Sharp and Slow waves, IV) Generalized Sharp and Slow waves with focal spikes, V) Focal Spikes, VI) focal sharp and slow waves, VII) Focal Slow waves, VIII) Generalized spike and IX)Generalized slow waves plus focal sharp waves. The role of EEGs in the diagnosis of seizures was evaluated by comparing the Clinical Neurological pattern of the cases with their EEG-findings.*
Results: *A total of 615 patients with male to female ratio of 1.5:1. Generalized tonic-clonic seizures were the most common type of seizures (47.6%), followed by partial seizures with secondary generalization (34.9%). Nocturnal seizures was present in 3.1% (n=19), absence seizures in 0.2%, myoclonic epilepsy in 0.7% and complex partial seizures in 5.1%. The relationship of various types of seizures with EEG-patterns showed that general concordance rate of 63.3%concordance and 36.7%discordance EEG findings.*
Conclusions: *That 55.57%patients were finally diagnosed with the EEG re-emphasizes its importance in the final diagnosis especially in classification of seizures.*
Keywords: *EEG-pattern; Epilepsy; Seizures.*

INTRODUCTION

Epilepsy comprises a broad range of disorders, which vary from benign to progressive and disabling. It is a common neurologic condition that affects approximately 50 million people worldwide, 80% of whom reside in developing countries[1] (World Health Organization. Epilepsy Fact sheet, 2012). Osuntokun et al, in1970in an earlier studies[2] in Ibadan, Nigeria found the prevalence of epilepsy in defined communities to vary from 5/1,000 to 37/1,000. In 1983, Danesi MA[3], reported a prevalence of between 8/1,000 and 13/1,000 inhabitants in the urban community of Lagos but with a computed rate of 3.1/1,000. However, in 2005, the Global Campaign against Epilepsy coalition publication which contained detailed information on epilepsy care in 160 countries (97.5% of the world's population) noted an estimate of the prevalence of epilepsy in Africa of 11.29 per 1 000 population, resulting in 3, 367, 000 affected individuals[3] (*Atlas; Epilepsy Care in the World 2005)*. Though the data regarding the number of people with epilepsy were not collected using stringent research methods as for epidemiological studies, the prevalence is 26% higher than the worldwide mean prevalence of 8.93 per 1 000 population.

Electroencephalography (EEG) is a valuable test in the definition of epileptogenic areas beyond the structural lesion[4] (Kutsy 1999). The widespread use of EEG in clinical practice and its comparison with neurological pattern is a major development in the treatment of patients with specific syndromes, as well as with ill-defined spells thought to be epileptic in nature. In a study conducted by Senanayake[5] (1993) among persons with epilepsy in Sri Lanka, he noted that routine EEG confirmed the clinical diagnosis in the majority of cases. Similarly, Kabiraj, et al.[6] (2003) and Jerger, et al[7]. (2001) studied the EEG-pattern in complex partial seizures and made comparisons with their clinical neurological pattern. Generalized seizures have a broad spectrum. Martinez, et al[8]. (2000) reviewed Electroence-phalograms and found that epilepsy with a typical spike and wave (SW) pattern should be considered benign, while those with a slow (SW) patterns should be considered malignant, and those with fast SW pattern treacherous.

To enhance the further diagnostic use of EEG it is important to determine how strongly patterns are correlated with clinical seizures. In an earlier study Hammer, et al(1999)[9] concluded that EEG monitoring and neuroimaging may be critical for clarifying the focal or generalized nature of epilepsy. Similarly, Nowack, et al. (2002)[10] studied EEG patterns and lateralized bursts of theta, and found the rhythm of the pattern to be most strongly correlated with seizures. Watanabe, et al. (2000)[11] and Bauzano,et al. (2001)[12] concluded that EEG aspects of epilepsies help in the confirmation of diagnosis. Similarly, Massa, et al. (2001)[13] conducted a study to search for clinical or EEG markers allowing early detection of patients prone to such complications.

The current literature review and the importance of further research on the subject brought us to conclusion that a comprehensive study with reference in EEG-patterns was required in epileptic seizures, in our environment. The present study was designed to highlight and establish the relationship of clinically diagnosed Seizures with EEG pattern and to determine the effective role of EEG in diagnosis of patients suffering from epileptic seizures.

MATERIALS AND METHODS

The study is a retrospective review of patients who had EEG done because a seizure disorder. An audit of the charts of 615 patients with seizure disorder who had EEG done were analysed The data of adult patients (>15 years) who presented and had EEG donebetween January 1, 2013, and September 30, 2016, were used for the study.The inclusion criteria were newly diagnosed patient within 4 weeks prior to referral.

The first author (a Neurologist), and a Clinical Neurophysiologist performed the EEG tests and neurological examinations on all patients. A digital EEG (Nicolet Voyageur) was used with an

international10-20 system, and standard parameters. Demographics, age at first seizure, seizure types and EEG findings were retrieved. Keeping in view the clinical diagnosis and EEG-characteristics, the patients were divided into the following nine study groups: I) Normal, II) Generalized Slowing (GS), III) Generalized Sharp and Slow waves (GSSW), IV) Generalized Sharp and Slow waves with Focal Spikes(GSSW +FS), V) Focal Spikes (FS),VI) Focal Sharp and Slow waves(FSSW), VII) Focal Slow waves (FSW), VIII)Generalize Spikes (GS), IX)Generalized Slow plus Focal Sharp waves(GS+FSW).

The association between categorical variables was investigated by means of chi-square (or Fisher's exact test) and means compared by independent T-test. A *P* value less than 0.05 was considered statistically significant.The data were computed and analyzed using the Statistical Package for Social Sciences version 22 statistical software .

RESULTS

A total of 615 patients, with male accounting for 373of all cases (male to female ratio of 1.5:1) and ages ranging from 16 to 82years (mean age of 35.6years) were studied. The gender and age distribution is as represented in figure I.

The cases were referred as newly clinically diagnosed seizure patients. In this study, seizures most commonly began in the fourth decade of life. Fig ii showed the frequency of clinical diagnosis. Generalized tonic-clonic seizures were the most common type of seizures (47.6%), followed by partial seizures with secondary generalization (34.9%). Purely partial seizures without secondary generalization occurred in 7.5% of the patients, atonic seizures in 1.5%, and tonic seizures in 0.3%. Nocturnal seizures was present in 3.1% (n=19), absence seizures in 0.2%, myoclonic epilepsy in 0.7% and complex partial seizures in 5.1%. There were no statistical significant age difference in patients with all these seizures Noctural ($P = 0.623$), generalized toni-clonic ($P = 0.600$), or atonic seizures ($P = 0.702$).

The EEG findings, on analysis, showed that 391of the 615 (63.6%) had an abnormal EEG. The EEG-findings according to the various groups is in table 1. Most patients with no abnormal EEG were younger ($P = 0.713$). The frequency of different group of EEG wave patterns are as shown in fig III.

The relationship of various types of seizures with EEG-patterns showed that concordance and discordance EEG findings such as clinically diagnosed primarily generalized seizure n= 327, 145(discordance rate of 44.34%) had normal EEG, and 182 (concordance 55.66%), partial seizures with secondary generalization n=284, abnormal EEG were found in 73 (concordance 25.7%) normal EEG in 211,(discordance74.3%), partial seizure n= 46, abnormal EEG was in 29(concordance of 63.04%) and normal in 17 (discordance of 36.96%) and complex partial seizure n=72 normal EEG in 31 (discordance of 43.06%)and abnormal EEG of 41(concordance of 56.94%).

Figure I. Gender and Age Distribution of all Patients

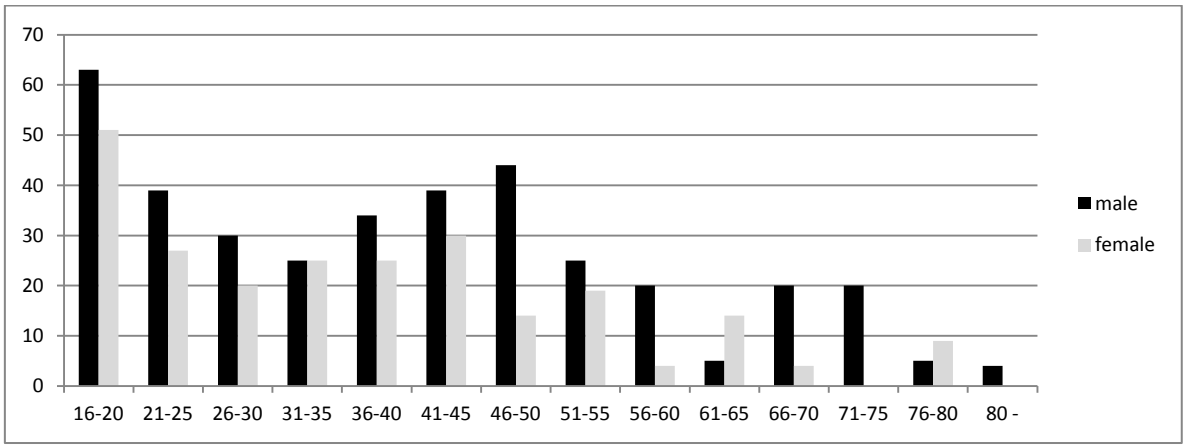
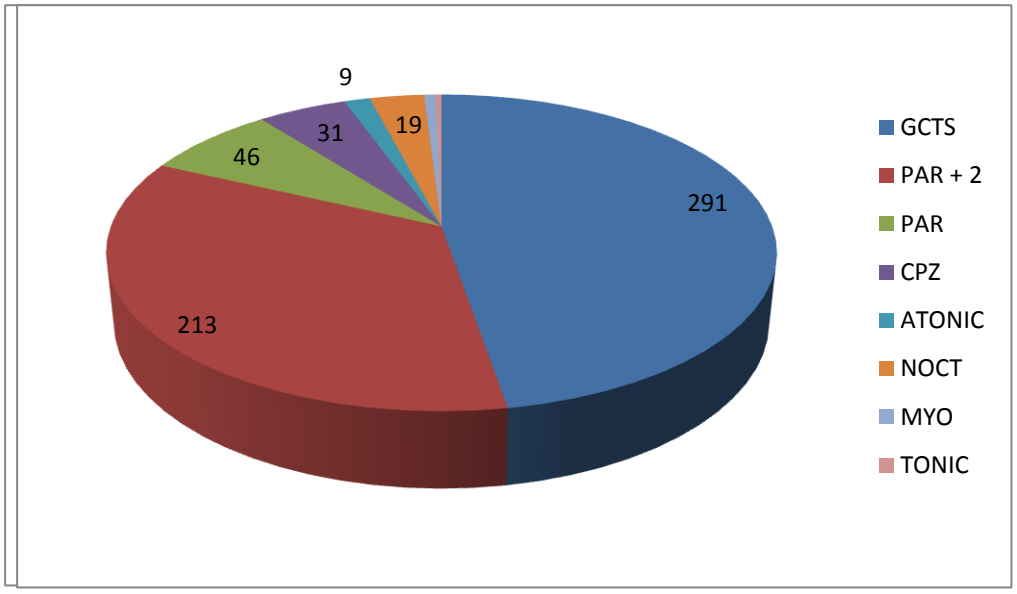
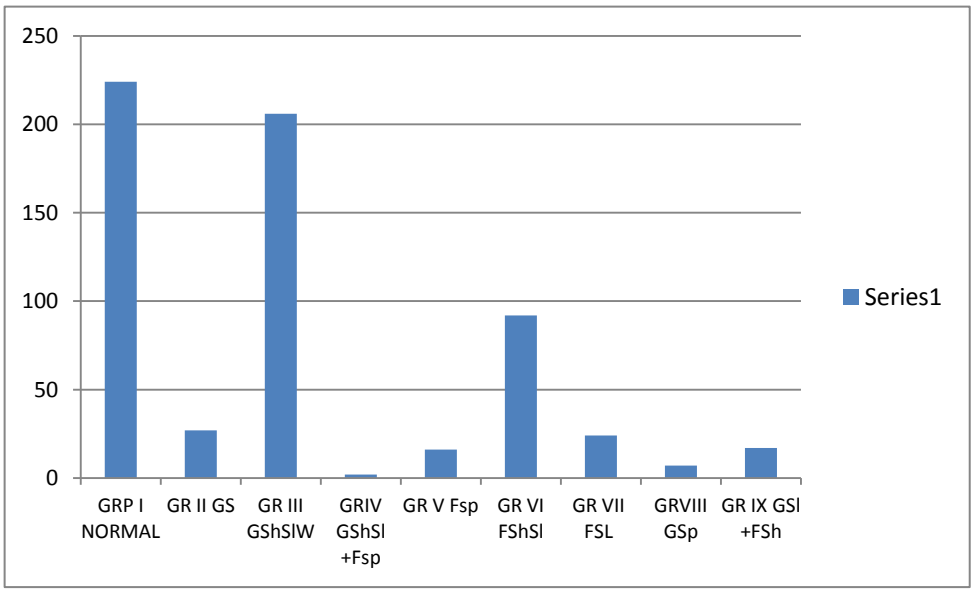


Fig II. Frequency of Seizure Types



GCTS=GENERALISED CLONIC TONIC SEIZURE, PAR+2= PARTIAL SEIZURE WITH SECONDARY GENERALIZATION, PAR = PARTIAL SEIZURE, CPZ= COMPLEX PARTIAL SEIZURE, ATONIC = ATONIC SEIZURE, NOCT= NOCTURNAL SEIZURE, MYO= MYOCLONIC SEIZURE, TONIC= TONIC SEIZURE

Fig III Frequency of EEG findings

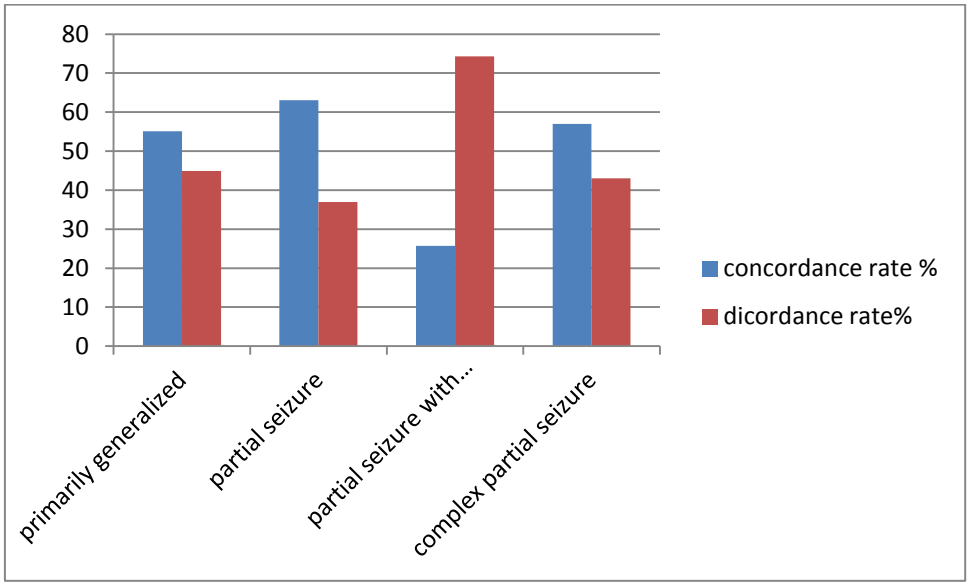


GR II GS= GROUP II GENERALISED SLOW WAVE, GR III GShSIW= GROUP III GENERALISED SHARP AND SLOW WAVES, GRIV GShSI + Fsp = GROUP IV GENERALISED SHARP AND SLOW WAVES PLUS FOCAL SPIKES, GRV Fsp = GROUP V FOCAL SPIKES. GRVI FShSI = GROUP VI FOCAL SHARP AND SLOW WAVES, GRVII FSL= GROUP VII FOCAL SLOW WAVES, GRVIII GSp= GROUP VIII GENERALISED SPIKES, GR IX GSI + FSh= GROUP IX GENERALISED SLOW WAVES PLUS FOCAL SHARP WAVES.

Table I Data of EEG Findings

GroupI normal	Group II Generalised slowing	Group III Generalised sharp and slow waves	Group IV generalized sharp and slow waves with focal spikes	GroupV focal spikes	GroupVI focal sharp and slow waves	GroupVII focal slow waves	GroupVIII Generalised spikes	GroupIX generalised slow plus focal sharp waves	
N=224(36.66 %)	N=27(4.4 %	N=206(33.06 %)	N=2 (0.32%)	N=16(2.6 %)	N=24(3.9 2)	N=24(3.92 %)	N=7 (1.4%)	N=9(1.47 %)	

Fig IV; Discordance and Concordance Chart of EEG Findings and Clinical Diagnosis



DISCUSSION

The cases referred for the study were clinically diagnosed as seizures in the patients ranging from 16 - 82 years in age. The relationship of Seizures was established with their EEG-pattern. The frequency of EEG-abnormalities as Generalized Sharp Waves/Spikes (GSWS) was significantly higher (36.73%) when compared to other study groups[paper]. Similarly, an earlier study by Owolabi, etal (2014)[14] found the EEG-abnormalities were epileptiform activity, in 54%of the cases. Al-Suleiman (2001)[15], found the EEG-abnormalities were epileptiform activity, in 51%of the cases. The percentage of cases in the present study showing Normal EEG was found to be 44.85%. However, the frequency of EEG-abnormalities identified as Generalized Slowing(GS) and Focal Slowing (FS) were 19.38% and 1.02% respectively. The analysed results of our study showed that the incidence of EEG-abnormality as Generalized Sharp Waves/ Spikes, is highly prevalent and significant in generalized seizures (36.73%), when compared to other study groups. However, the frequency of abnormalities (36.73%) identified in GSWS Group in this study is comparatively lower than the abnormalities (51.73%) observed in other study group with Seizures[paper]. These findings may be age dependent, indicating the occurrence of abnormalities as GSWS decreases with age. There are pathognomonic EEG-features in all the sub-types of epileptic seizures similar to earlier findings (Kabiraj M.M, et al 2003[16]The most frequent EEG-abnormalities in the present study were observed as GSWS, in GSZ, as these are major diagnostic electro-cerebral features reported in almost all series of epileptic seizures. We compared the Clinical Neurological Pattern of the cases with their EEG-findings to diagnose seizures with certainty. In earlier studies

performed by Niedzielska,et al. (1997)[17], Jerger, et al. (2001)[18], and Kabiraj, et al. (2003)[19]Owolabi et al (2014)[20], the EEG-findings were compared to a neurologist's clinical judgment to detect the early seizures. Hammer, et al. (1999)[21]Stanley C.et al 2014[22] concluded that EEG monitoring and neuro-imaging may be critical for classifying focal or generalized nature of epilepsy. Kutsy (1999)[23] and Niedzielska,et al. (2001)[24] indicated that in patients withany seizure disorder, the EEG examination is the mainstay in making the proper therapeutic decision and defining the probable epileptogenic area. The results of comparison of Neurological patterns with EEG-findings in the present study showed thatoverall55.85% of the cases had concordance with their EEGs. Our findings were as follows: primarily generalized seizures (321), partial seizure (46), partial seizure with secondary generalization (213), and complex partial seizure (31.), in clinical neurological pattern. Whereas EEG-findings were as follow: primarily generalized seizures (178), partial seizure (29), partial seizure with secondary generalization (86), and complex partial seizures (28.) and normal EEG (290). Overall 44.46% of the cases were found to show dis-concordance in Neurological Pattern and their EEG findings. Their detail is as follows: in the 44.6% of cases indicating primarily generalized: partial seizure (36.96%), partial seizure with secondary generalization (63.56%), and complex partial seizures (9.7%.), Neurological Patterns were found as Normal in EEG-findings in 290 patients a discordance rate of 44.46% fig iv compared the concordance and discordance patterns. The role of EEGs in the diagnosis of seizures was evaluated by comparing the clinical neurological pattern of the cases with their EEG-findings. Generalized sharp and slow waves was the dominant EEG abnormality seen in patients (33.06%). Epileptiform activity was present in 321 studied patients (55.5%). This study documents the variability of clinical and electrophysiological features in well-characterized referred patients with adult-onset epilepsy.

CONCLUSIONS

The EEG is a dynamic test. It expresses the ongoing electrical activity of brain at the time of recording. Overall, normal EEG does not exclude the presence of epileptic seizures. The patient may be under the control with anti-epileptic drugs (AEDs) at the time of EEG-test or interictal phase. The cumulative percentage of 44.4% of cases showed normal EEG when compared to the final diagnosis confirmed by the EEG examinations. The present study can conclude that 55.57% ofthe cases were diagnosed as having clinical Seizures, which is concordant with EEG findings. That 55.57%patients were finally diagnosed with the EEG re-emphasizes its importance in the final diagnosis especially in classification of seizures.

REFERENCES

1. World Health Organization. Epilepsy Fact Sheet N°999. 2012. Available at: http://www.who.int/mediacentre/factsheets/fs999/en/index.html
2. Osuntokun BO, et al. Prevalence of the epilepsies in Nigerian Africans: A community-based study. Epilepsia. 1987;28:272–9.
3. Danesi MA, Oni K. Profile of epilepsy in Lagos, Nigeria. Trop Geogr Med. 1983;35:9–13.
4. World Health Organization, author. Atlas: epilepsy care in the world. Geneva: WHO; 2005.
5. Kutsy, R.L. 1999. Focus Extra Temporal Epilepsy: Clinical Features, EEG Patterns, and Surgical Approach. Neurol Sci. 166(1):1-15.
6. Senanayake N. 1993 .Classification of epileptic seizures: a hospital-based study of 1,250 patients in a developing country. Epilepsia(34)812–818
7. Kabiraj, M.M, et al. 2003. EEG-Pattern in Patients with Complex Partial Seizures. GJST.3(2):152-158.

8. Jerger, K.K., et al. 2001. Early Seizure Detection. Clin Neurophysiol.18(3):259-68.
9. Matinez, M.B., et al. 2000, Generalized Spike and Wave Patterns in Children: Clinical Correlates. Pediatr Neurol.22 (1):23-8.
10. Hammer, H.M., et al. 1999. Symptoma-tology of Epileptic Seizures in the First Three Years of Life. Epilepsia.40(7):837-44.
11. Nowack, W.J., et al. 2002. Clinical Correlate of EEG Rhythmcity. J ClinNeurophysol.19(1):32-6.
12. Watanbe, K. and A. Okumura. 2000. BenignPartial Epilepsies in Infancy. Brain Dev.22(5):296-300
13. Bauzanao, P.E, and B.A.C. Rodriguez. 2001. Electroencephalographic Diagnosis of Idiopathic Generalized Epilepsies of Childhood. RevNeurol.32(4):365-72.
14. Massa, R., et al. 2001. EEG Criteria Predictive of Complicated Evolution in Idiopathic Rolandic Epilepsy. Neurology.57(6):1071-9.
15. Gosavi TD, et al.2015 Ictal and interictal EEG patterns in patients with nonconvulsive and subtle convulsive status epilepticus; Epilepsy Behav. (49):263-7
16. Owolabi L, etal 2014Clinico-Electroencephalography Pattern and Determinant of 2-year Seizure Control in Patients with Complex Partial Seizure Disorder in Kano, Northwestern Nigeria. Ann Med Health Sci Res. (2):186-91.
17. Al-Suleman, A.A, 2001. Epilepsy in Saudi Children with Cerebral Palsy. Saudi Med J. 22(1):19-21
18. Niedzielska, K., et al. 1997. Differential Diagnosis in Idiopathic Generalized Epilepsies with Tonic-Clonic Seizures: Assessment of the use of Ambulatory EEG and Video/EEG Monitoring. Neural Neurochir Pol.31(2):217-27.
19. Stanley C. et al 2014 Patterns of diagnosis and therapeutic care of epilepsy at a tertiary referral center in Nigeria. Epilepsia vol 55 (3)442-447.