ORIGINAL ARTICLE

Cognitive Function in Nigerians with Newly Diagnosed Epilepsy

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ABSTRACT: ***Objective:*** The objective of this study was to evaluate the pattern of cognitive disturbances in Nigerian Africans with newly diagnosed epilepsy, prior to onset of drug therapy. ***Methods:*** A total of 60 consecutive patients (mean age 31.6 ± 17.4, range 14 - 55 years) presenting with a clinical diagnosis of epilepsy were recruited for the study. Sixty healthy volunteers without a history of epilepsy and who were age-, sex- and level of education matched with the epileptic patients, were recruited as controls. The administration of cognitive tests was done with the FePsy computerized neuropsychological test battery. The tests administered were the visual and auditory reaction times, the continuous performance test and the recognition memory tests to assess mental speed, attention and memory respectively. The means of the cognitive performances of the epileptic patients and controls were statistically compared. ***Results:*** Epileptic patients performed worse than the controls across the spectrum of cognitive tasks assessed ($P = 0.00001$; $P < 0.025$), with the exception of the β parameter (response bias) of the vigilance test ($P = 0.488$; $P > 0.025$). ***Conclusions:*** The cognitive impairments of short-term memory, psychomotor speed and sustained attention observed in this study are similar to those reported in the literature for patients with epilepsy. The results of this study will be useful in the counseling of patients on their educational, social and vocational needs.

RÉSUMÉ: Fonctions cognitives chez des Nigériens présentant un diagnoctic récent d'épilepsie. ***Objectif:*** L'objectif de cette étude était d'évaluer le type de perturbations cognitives chez des Nigériens Africains présentant une épilepsie, avant d'administrer un traitement. ***Méthodes:*** 60 patients consécutifs (âge moyen 31.6±17.4, fourchette de 14 à 55 ans) ayant un diagnostic clinique d'épilepsie ont été recrutés pour cette étude. 60 volontaires sains sans histoire d'épilepsie, appariés pour l'âge, le sexe et le niveau d'éducation avec les patients épileptiques, ont été recrutés comme contrôles. L'évaluation des fonctions cognitives a été faite au moyen d'une batterie de tests neuropsychologiques informatisés (FePsy). Les épreuves administrées étaient le temps de réaction visuel et auditif, l'épreuve de performance continue et l'épreuve de reconnaissance mnésique pour évaluer la rapidité mentale, l'attention et la mémoire respectivement. Les moyennes de performance cognitive des patients épileptiques et des contrôles ont été comparées. ***Résultats:*** La performance des patients épileptiques était moins bonne que celle des contrôles pour toutes les épreuves de fonctions cognitives évaluées ($p=0.00001$; $p<0.025$), à l'exception du paramètre b (biais de réponse) de l'épreuve de vigilance($p=0.488$; $p>0.025$). ***Conclusions:*** Les déficits cognitifs au niveau de la mémoire à court terme, de la rapidité psychomotrice et de l'attention soutenue observés dans cette étude sont semblables à ceux rapportés dans la littérature chez les patients épileptiques. Les résultats de cette étude seront utiles pour conseiller les patients dans leurs choix éducatifs, sociaux et professionnels.

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Several specific cognitive deficits are known to occur in patients with epilepsy. These include deficits of memory, psychomotor speed, attention and concentration.[1-4] It is now widely recognized that cognitive impairment has a far greater impact on critical daily life functions such as learning in children and memory in adults, than has hitherto been suspected.[5]

Studies of the cognitive sequelae of epilepsy in Africans are generally lacking. Yet the study of cognitive dysfunction in patients with epilepsy in developing African countries has an added significance because of the high prevalence of epilepsy in these countries. Some of the highest prevalence rates of epilepsy in the world have been reported from the tropics of Africa.[6] This high prevalence may be related to poor obstetric care and childhood infections leading to a high incidence of symptomatic

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epilepsy.[7] Symptomatic epilepsy is significantly more likely to lead to cognitive dysfunction than idiopathic epilepsy.[8] Moreover, differences in the etiology of epilepsy and prevalence of symptomatic epilepsy between the developed and developing countries may produce different patterns of cognitive dysfunction. The pattern of cognitive dysfunction in epileptic patients in developed countries may therefore not be readily applicable to the developing countries of Africa.

The present study was designed to determine the pattern of cognitive disturbances in Nigerians newly diagnosed with epilepsy.

PATIENTSAND METHODS

Patient selection

Sixty consecutive patients, aged 14 years and above, presenting with a clinical diagnosis of epilepsy ,[6] with or without EEG confirmation were recruited from the outpatient clinics of the University of Benin Teaching Hospital, Benin City and the Uselu Psychiatric Hospital, Benin City between October, 1994 and October, 1996. Patients with seizures related to fever, drug or alcoholic consumption or to any other acute metabolic insult were excluded from the study.

Patients with psychiatric illness, mental subnormality and those with progressive neurological disorders were excluded from the study.

Patient demographic data

All patients completed questionnaires designed to obtain demographic information on the age, sex, level of education, age at onset of seizures, frequency of seizures and type of seizures. The seizure types were classified clinically, based on the International League Against Epilepsy (ILAE) classification.[9]

The patients comprised 37 males and 23 females with an average age of 31.58 ± 17.44 years (range 14 - 55 years). All but two of the patients were educated: 20 completed primary education, 28 completed secondary school, while ten had tertiary education.

The classification of seizure types was clinical. Fifty of the patients (83.3%) had generalized epileptic seizures, which included both primarily and secondarily generalized seizures. Of the patients with generalized seizures, 22 had a positive family history of seizures while 38 had a history of recurrent febrile convulsions in childhood.

Ten patients (16.7%) had partial seizures. Of these, three had a preceding history of prolonged labor with possible birth asphyxia and two had a history of significant head injuries from motor vehicle accidents. The remaining five had no predisposing risk factor.

The details of the demographic data of the patients and controls are as outlined in Table 1.

Laboratory investigations done on all patients included: (a) liver function tests (b) urea and electrolytes (c) blood sugar estimations and (d) if indicated, lumbar puncture for cerebrospinal fluid analysis. All the results of the laboratory investigations in all patients were within normal limits.

Table 1: Demographic information on epileptic patients and controls.

		Epileptic Patients (N= 60)	Controls (N = 60)
Mean Age in years ± (SD)		31.58 ± (17.44) (Range 14-55)	27.7 ± (12.65) (Range 14-45)
Sex	Male	37	35
	Female	23	25
Level of Education	Primary (1)	20	14
	Secondary (2)	28	32
	Tertiary (3)	10	13
	Nil (0)	2	1
Seizure Type			
	Partial	10	NA
	Generalized	50	NA

Subjects and drug therapy

The patients were recruited prior to commencing specific anti-epileptic drug therapy and were therefore assumed to be drug-naïve prior to cognitive testing. There were, however, no facilities for serum anti-epileptic drug (AED) estimation in our hospital to confirm this. Each patient was commenced on the appropriate AED immediately after cognitive testing.

Twenty-two patients had a seizure frequency of one or more per month, 29 patients had a seizure frequency of one in two to six months, while nine patients had a seizure frequency of one in 7-12 months. Cognitive testing was done only if the patients had been seizure-free for at least one week prior to the day of testing.

Controls

Sixty healthy, normal volunteers were recruited from the outpatients/staff clinics of the University of Benin Teaching Hospital as controls. These were age-, sex- and level of education matched with the epileptic patients. They had neither a personal or family history of seizures.

Cognitive testing

The administration of tests was done with the FePsy computerized neuropsychological test battery.[1,10] Test presentation and response registration were controlled by a microcomputer but one of the authors (O.O.) was always present to adjust instructions to the individual performance level of the patients.

(A) Short-term memory was assessed using the Recognition Memory Test (RMT). The test involves the use of study items that consist of three or four figures (for the visual, nonverbal memory test) and four or six words (for the visual, verbal memory test) which are presented simultaneously.

The task is divided into a study phase in which the material to be remembered is presented and a test phase in which recognition is tested. Delay between study phase and the test phase is fixed to two seconds. In the test phase, the figures or words are presented again and the target item has to be recognized.

Patients and control subjects with primary school education were tested using three figures and four words, while those with secondary and tertiary education were tested using four figures and six words. Patients and control subjects with no formal education were tested using three figures for visual (nonverbal) memory.

The results were calculated by the FePsy software as percentages of number of correct responses. The evaluation of the recognition task was performed in the context of the short-term memory function.[10]

(B) Psychomotor speed was assessed by testing the simple reaction time. In the auditory version, the testee is asked to react as quickly as possible to a sound stimuli of 800 hertz generated by the computer. For the visual version, the testee reacts as quickly as possible to a white square in the middle of the computer screen. In both versions the inter-stimulus interval is randomly varied from 2.5 to 4 seconds. The evaluation of the results was done within the context of psychomotor speed and information processing and alertness/ activation function.[2]

(C) Attention was assessed using the Continuous Performance Test, which involves the display of a string of eight characters, either 'XXXXXXXX' or 'XAXXXXXX'. The stimuli are presented during a short (i.e. 200 msec) period. The testee had to respond (by pressing a key on the keyboard) to the appearance of a character 'A' at a random position in the stimulus string. The results were computed by the FEPSYsoftware, according to a signal detection model.[10] This model yields two parameters (a) 'd'values (perceptual sensitivity) of one and above point to a good discrimination ability. (b) β Values (response bias) below one reflect impulsive response while values higher than one indicates a conservative way of responding.

Statistical analysis

The means of the cognitive scores of the patients with epilepsy and controls were calculated and the differences observed tested for statistical significance using the student 't'-test. Probability values less than 0.025 were regarded as statistically significant.

Results

All the patients with epilepsy and the controls completed the study.

Reaction times

The mean auditory and visual reaction times of the patients were significantly slower than in controls. (Table 2).

In the patients with epilepsy, the mean visual reaction times in the dominant and nondominant hands were considerably faster than the mean auditory reaction times in the dominant and non-dominant hands (dominant hands: 423.05ms visual vs 473.13 auditory; nondominant hands: 398.65ms visual vs 443.28ms auditory). This trend was also observed among the controls, albeit less strikingly.

Recognition memory test

The patients with epilepsy performed significantly worse than the controls in both verbal (words) and nonverbal (figures) tests of short-term memory. The performances of both patients and controls were better with words than with figures (Table 2).

Table 2: Mean cognitive scores for patients with epilepsy and controls in Africans and in people from European countries.

Cognitive Test	Patients with Epilepsy in Nigeria	Controls in Nigeria	Differences between patients with epilepsy and controls for the Nigerian cohort	Norms for Western countries controls
Auditory reaction time (SD)				
Dominant hand	473.1 ± 190.8	296.2 ± 126.3	P< 0.001	230.1 ± 30.9
Nondominant hand (values in msecs)	443.3 ± 148.2	284.6 ± 67.4	P< 0.001	229.7 (35.4)
Visual reaction time. (SD)				
Dominant hand	423.1 ± 154.5	266.9 ± 80.8	P< 0.001	297.8 (50.9)
Nondominant hand (values in msecs)	396.7 ± 144.7	272.8 ± 63.2	P< 0.001	311.2 (61.9)
Recognition memory test				
Words	41.9%	75.8%	P< 0.001	80.1%
Figures (all values are % correct)	34.2%	53.6%	P< 0.001	50.4%
Vigilance test				
'd'Perceptual sensitivity	0.63	1.8	P< 0.001	1.7
β Discrimination ability	0.79	0.8	NS p = 0.7	0.7

Sample size for the Western norms range from n = 61 for visual reaction time to n = 240 for auditory reaction time. Norms are based on the same age-group as derived for the Nigerian norms.

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Attention

The perceptual sensitivity (d' parameter) of the patients with epilepsy (0.634) was less than 50% of the controls' sensitivity (Table 2). This difference was statistically significant (Table 2). Both patients and controls reacted to the stimuli in an impulsive manner as reflected in the B scores.

Cultural comparison

Table 2 also gives norms for controls in Western countries (The Netherlands, Scandinavian countries, Germany and the UK). This shows one significant difference (t-Test $p<0.001$): auditory reaction times are faster than visual reaction times in controls from Western countries, which is also in line with literature.[10,11] On the other hand, visual reaction times are faster than auditory reaction times in the Nigerian patients and control subjects.

Discussion

Information on the pattern of cognitive functioning of patients with epilepsy is important in patient management, especially in the rational choice of anti-epileptic drug therapy.

This study compared the cognitive function of drug-naïve Nigerian patients with epilepsy with normal control subjects. To standardize the assessment procedure, we used a computer-based neuro-psychologic test battery, which has been shown to be highly sensitive in detecting cognitive dysfunction in patients with epilepsy. This setting is unique and has not been carried out in Africans with epilepsy.

Our study showed significant impairments in critical cognitive functions of the patients with epilepsy, specifically in short-term memory, psychomotor speed/alertness, and the performance of tasks that require sustained attention.

Cognitive disturbances in epilepsy may occur *ab initio* or may be due to the effects of anti-epileptic drugs. The patients we have studied were yet to commence AED treatment, suggesting that the deficits we observed were related more to the epileptic process, rather than to AEDs. This is consistent with other research findings documenting cognitive deficits in untreated seizure patients in comparison with normal control subjects.[3,4]

The cognitive impairments we have observed are similar to those reported in the general literature for patients with epilepsy. Loiseau et al[11] showed that patients with epilepsy have memory impairment sufficient to give a statistically significant difference in memory scores when compared with age and level of education - matched normal subjects.

The speed of visual and auditory information processing, as determined by the reaction times, was retarded in our patients, which is also in line with the observation of other authors.[4,10] However, auditory reaction times in the patients with epilepsy were considerably slower than visual reaction times, contrary to studies in Europeans which suggested that auditory reaction times are at least 60 milliseconds faster[10,11] (see also Table 2).

The reasons for these are unclear, but may conceivably be related to differences in the etiologies of epilepsy in European and African patients. Further studies of cognitive function in Africans with epilepsy are needed to shed more light on this interesting observation.

Impairment of attention, demonstrated in this study by low scores in the continuous performance test, is well known to occur in patients with epilepsy.[4,8,10] These attention deficits may contribute to memory impairment, as attention is required for information retention. Personnel involved in the care of epileptic patients in developing countries should be aware of the patterns of cognitive impairment in epilepsy in order to appropriately counsel patients on their educational, social and vocational needs.

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