Seizure 22 (2013) 572–576

Contents lists available at SciVerse ScienceDirect

Seizure

journal homepage: www.elsevier.com/locate/yseiz

Etiologies of epilepsy and health-seeking itinerary of patients with epilepsy in a resource poor setting: Analysis of 342 Nigerian Africans

Olubunmi A. Ogunrin [a,*], Ademola Adeyekun [b], Philomena Adudu [c]

[a] Neurology Unit, Department of Medicine, University of Benin, Benin City, Nigeria
[b] Department of Radiology, University of Benin, Benin City, Nigeria
[c] Department of Anesthesia, University of Benin, Benin City, Nigeria

ARTICLE INFO

Article history:
Received 5 February 2013
Received in revised form 10 April 2013
Accepted 11 April 2013

Keywords:
Etiology
Epilepsy
Itinerary
Nigeria

ABSTRACT

Purpose: The understanding of causation of epilepsy, especially in resource poor African countries where prevalence rates are very high, would aid strategies for primary prevention. This study sought to determine the causes of epilepsy in Nigerian Africans and health-itinerary of patients with epilepsy.
Method: This was an observational, cross-sectional descriptive study of consecutive newly diagnosed adult patients with epilepsy using a mixed-methods approach of face-to-face in-depth interview of patients' parents and relations, health care personnel who had given medical attention at any time and telephone interview. A structured interview schedule was used to obtain demographic information, details of seizure variables, health seeking itinerary and history of previous hospitalizations. Data was analyzed descriptively with SPSS version 17.
Results: Three hundred and forty-two patients with epilepsy with a mean age of 31.4 ± 11.98 years participated in the study. Most of the patients (68.1%; 233/342) were unemployed and students. There were 270 (78.9%) patients with generalized epilepsy. No identifiable etiology was found in 37.7%, but of the remaining 62.3%, the commonest causes included post traumatic (19.6%), recurrent childhood febrile convulsions (13.2%), post-stroke (6.7%), brain tumors (5.9%), neonatal jaundice (5.3%), birth-related asphyxia (5%) and history of previous CNS infections (4.7%). Family history of epilepsy was obtained in 9.9%, all of whom had primarily generalized seizures. 61.4% of them sought initial attention from the traditional healers or in prayer houses.
Conclusion: This study showed the pattern of causes of epilepsy in Nigerian Africans. The health seeking behavior and itinerary of the PWE revealed a preference for traditional healers. There is need for health policies and epilepsy awareness campaigns to prevent causes of seizures and improve the knowledge of the public respectively.

1. Introduction

At a conservative estimate, 80% of the 50 million people worldwide with epilepsy are living in the resource poor countries.[1] In the developed nations, epilepsy occurs with an annual incidence ranging from 20 to 70 cases per 100,000 and a point prevalence of 0.4–0.8%.[2,3] However, the incidence of epilepsy in resource poor countries may be as high as 190 per 100,000 people.[4] Most patients suffering from epilepsy in African countries prefer anonymity and are reluctant to disclose their condition because of the stigma attached to the disease.[5,6] This factor affects the prevalence rates hence there is likelihood that most of the reported prevalence rates represent a 'tip of the ice-berg' as the chances of under-reporting are high. The prevalence rates of epilepsy reported in Africa are based on surveys of defined communities and hospital admissions. Prevalence rates in Nigeria vary between 5.3 and 37 per 1000 persons with the highest rates recorded in rural areas, especially communities without health care facilities.[7]

The burden of epilepsy in sub-Saharan African countries calls for immediate action and intervention. In the past, the World Health Organization (WHO), the International League Against Epilepsy (ILAE) and the International Bureau for Epilepsy (IBE) launched the campaign to 'bring epilepsy out of the shadows', in a bid to address the issues that militate against the identification and treatment of patients with epilepsy (PWE) in the sub-region but not much has been done to realize this objective in most countries within the region. The prevention of epilepsy is highly desirable in sub-Saharan Africa because of the morbidity, mortality and the stigmatization associated with the disease. One of the significant steps toward primary prevention of epilepsy is identification of causes of the disease.[8] This becomes especially important because

* Corresponding author at: Department of Medicine, PMB 1154, University of Benin, Benin City, Nigeria. Tel.: +234 8023344044.
E-mail address: bunmifunmi@hotmail.com (O.A. Ogunrin).

1059-1311/$ – see front matter © 2013 British Epilepsy Association. Published by Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.seizure.2013.04.012

worse overall prognosis, persistent seizures and higher mortality have been associated with epilepsies due to structural causes.[8] Fortunately, most of the etiologies of structurally related epilepsies in sub-Saharan Africa are preventable or modifiable disorders which include central nervous system (CNS) infections (including parasitic infections), childhood febrile convulsions and traumatic brain injury, an important observation which was recently substantiated by Ngugi et al.[9] This is critical to formulation of health policies and programs aimed at preventive strategies.

Infections accounted for up to 26% of cases of epilepsy reported in Africa.[8] Previous studies among Nigerians have shown that central nervous system (CNS) infections accounted for most cases of structurally related epilepsies[10,11] especially in northern part of the country where epidemic meningitis is common. In areas of sub-Saharan Africa where it is endemic, neurocysticercosis has been reported to be responsible for majority of cases although this has been rarely reported in Nigeria. Recurrent childhood febrile convulsion was reported by several authors as a predisposing cause among Nigerians.[10–14] However, causes like cerebral tumors and tuberous sclerosis were rarely reported presumably due to lack of neuro-imaging facilities.

The health seeking behavior of people has been associated with their knowledge of disease causation, prevailing socio-cultural factors and societal beliefs especially myths surrounding epilepsy, and availability and proximity of health facilities. The practice of using traditional healing methods for the treatment of epilepsy is common in sub-Saharan African societies, especially among the rural and uneducated dwellers.[15] Danesi and Adetunji[16] had reported that most Nigerian patients with epilepsy sought alternative treatment with trado-medical practitioners. This interferes with timely and appropriate medical interventions with resulting disabilities.

The data on the incidence and etiologies of epilepsy in sub-Saharan Africa are scarce. Studies are needed to determine the causes of epilepsy in our populations as a better understanding of the pattern of the etiologies would aid the design of health policies to lower the incidence of epilepsy through the formulation and implementation of community and national preventive strategies and public health education programs. This study sought to determine the causes of epilepsy and health-seeking itinerary of patients with epilepsy.

2. Method

This was an observational, cross-sectional descriptive study of consecutive newly diagnosed patients with epilepsy presenting to the neurology clinic of the University Teaching Hospital, Benin City a tertiary health facility in cosmopolitan southern Nigeria. This facility serves as a major referral center for neurological disorders in south–south Nigeria. All adult patients (i.e. patients above 14 years of age) presenting to the clinic and diagnosed with epilepsy between January and December 2008 (the study period) were recruited. These patients were not incident cases as they had had active epilepsy before seeking medical attention in the neurology clinic. The diagnosis of epilepsy was based on eye witness corroboration of recurrent afebrile seizures and electro-encephalographic (EEG) changes. The seizures were classified according to the International League against Epilepsy (ILAE) classification of 1981.[17]

The study employed mixed methods approach using key informants' interview and a survey of the PWE. In-depth interviews of key informants, i.e. patients' parents and relations, health care personnel who had given medical attention at any time were conducted, and where it was not possible to conduct face-to-face in-depth interview, telephone interview was conducted to obtain medical information of patients. In addition, available medical records (i.e. medical notes, summaries and results of investigations including electroencephalograms (EEG), computerized tomographic (CT) brain scans, cerebrospinal fluid (CSF) analysis, serum calcium, serum bilirubin, electrolytes and urea, blood glucose and complete blood count) from hospitals or clinics attended by patients previously were reviewed.

A structured interview schedule was used to obtain demographic information (age, sex, level of education, employment status, marital status and domicile), seizure variables (duration of epilepsy, frequency of seizures, type of seizure based on eye witness, medication type and presence/absence of status in the past), health seeking itinerary and history of previous hospitalizations. The duration of epilepsy was estimated as the historic time interval between the first attack ever and the initial presentation in the neurology clinic. For the purpose of descriptive analysis, seizure frequency was graded as 'very frequent' – more than one attack per day, 'frequent' – 1–3 fits per week, 'average' – 1–3 fits per month, 'less frequent' – once in 3–6 months and 'infrequent' – once in a year. Informed consents were obtained from patients and approval to conduct study was given by the Hospital Ethics Committee.

3. Results

A total of 342 patients were diagnosed with epilepsy during the study period comprising 202 males (59%) and 140 females (41%). The mean age of the patients was 31.4 ± 11.98 years with a range of 16–76 years. The mean age of males was 32.6 ± 15.4 years (range 16–76 years) with a modal frequency of 24 years and that of females was 29.7 ± 11.7 years (range 18–62 years) with a modal frequency of 32 years. Most of the patients (68.1%; 233/342) were unemployed and students. Similarly, most were either single students or single, unmarried and unemployed patients (57.9%; 198/342). Most of the PWE received primary education but could not complete secondary education due to frequent seizures. The details of age distribution, level of education, employment and marital status are presented in Table 1.

There were 270 (78.9%) patients with generalized epilepsy comprising 230 (67.2%) with primarily generalized type and 40 (11.7%) with secondarily generalized type. The primarily generalized types consisted of generalized tonic–clonic seizures (213/342; 62.3%), absence seizures (5/342; 1.5%), drop attacks (atonic seizures) (4/342; 1.2%), clonic seizures (4/342; 1.2%), tonic seizures (2/342; 0.6%) and myoclonic epilepsy (2/342; 0.6%). Focal or localization-related seizures were present in 72 (21.1%) patients. Most of the focal seizures were of the complex type (CPE) constituting 16.4% (56/342). The remaining 16 (4.7%) patients presented with simple partial seizures. The median age of onset of seizures was 12 years. Most of the patients presented after a duration of 10 years (61.7%; 211/342) with a mean duration of epilepsy of 10.8 ± 2.1 years. Similarly most of the patients had frequent seizures at presentation (68.7%; 235/324), i.e. more than 1–3 seizure attacks in a week (Table 2).

One hundred and twenty-nine patients, comprising 37.7%, had no identifiable etiology implying that the prevalence of idiopathic and structurally related epilepsies from this study were 37.7% and 62.3% respectively. Of the structurally related epilepsies (62.3%; 213/342), previous birth-related asphyxia was found in 17 patients (5%), recurrent childhood febrile convulsions accounted for 13.2% (45/342), history of significant previous neonatal jaundice that necessitated hospitalization with or without exchange blood transfusion was found in 18 patients (5.3%), history of previous CNS infections was found in 16 patients (4.7%), brain tumors accounted for 5.9% (20/342), post stroke seizures accounted for 6.7% (23/342) and post traumatic seizures accounted for 19.6% (67/342) with 64.7% (46/67) of them

Table 1
Demographic information of PWE ($N = 342$).

Demographic variables	Frequency (%)
Age distribution	
15–25	101 (29.5)
26–35	107 (31.3)
36–45	73 (21.3)
46–55	38 (11.1)
56–65	13 (3.8)
>65	10 (2.9)
Sex	
Male	202 (59)
Female	140 (41)
Level of education	
Un-educated	51 (14.9)
Primary[a]	94 (27.5)
Secondary[b]	112 (32.7)
Tertiary[c]	85 (24.9)
Marital status	
Single	198 (57.9)
Divorced	23 (6.7)
Separated	12 (3.5)
Married	109 (31.9)
Employment	
Unemployed	145 (42.4)
Students	88 (25.7)
Employed	
Artisans	45 (13.2)
Public service[d]	64 (18.7)

[a] Primary level of education refers duration of schooling ≤6 years with no post-primary education.
[b] Secondary level refers duration of schooling >6 years but <12 years with no post-secondary education.
[c] Tertiary level refers duration of schooling ≥12 years (university or equivalent institutions).
[d] White-collared job.

developing seizures from traumatic brain injuries following road traffic accidents. The details of the remaining causes are presented in Table 3.

The distribution of causes by age and sex revealed predominance of cerebral tumors between the ages of 46 and 76 years. The commonest cerebral tumor was meningioma (55%; 11/20) with a female preponderance, followed by gliomas (35%; 7/20) which were more common among the males while the remaining three patients (15%) had pituitary tumors. Post-traumatic brain injury was common to all age groups with a male preponderance with the exception of the age group 15–25 years that has less than ten patients (8.9%; 6/67). Post-stroke seizures were also more common in the males between the age groups of 46 and 76 years with a greater percentage occurring in stroke survivors who suffered cerebral infarct (15/23: 65.2%). There were four patients in the age group 15–25 years (4/101: 4%) with sickle cell disease who developed post-stroke seizure. The previous history of birth-related asphyxia, CNS infections, and neonatal jaundice was more common between the ages of 15 and 25 years with no sex predilection. Recurrent childhood febrile convulsions was however more common between the ages of 15 and 25 years with a slight female preponderance.

Table 2
Pattern of seizure variables.

Variables	Frequency (%)
Seizure types	
Focal	
Without loss of consciousness	16 (4.7)
With loss of consciousness	56 (16.4)
Generalized	
Primary	230 (67.2)
Secondary	40 (11.7)
Seizure frequency[a]	
Very frequent	87 (25.4)
Frequent	148 (43.3)
Average	33 (9.7)
Less frequent	55 (16.1)
Infrequent	19 (5.5)
Duration of epilepsy	
Less than 1 year	31 (9.1)
1–5 years	60 (17.5)
6–10 years	40 (11.7)
11–15 years	132 (38.6)
>15 years	79 (23.1)

[a] 'very frequent' – more than one attack per day; 'frequent' – 1–3 fits per week; 'average' – 1–3 fits per month; 'less frequent' – once in 3–6 months; 'infrequent' – once in a year.

Table 3
Causes of epilepsy identified in PWE.

Etiologies	Frequency (%)
Unknown causes	129 (37.7)
Birth-related (asphyxia)	17 (5)
Recurrent childhood febrile convulsions[a]	45 (13.2)
Neonatal jaundice	18 (5.3)
Post-meningitis	16 (4.7)
Post traumatic brain injury	67 (19.6)
Post stroke[b]	23 (6.7)
Brain tumors	20 (5.9)
Chloroquine-induced	3 (0.9)
Tuberous sclerosis	3 (0.9)
Fahr's syndrome	1 (0.3)

[a] 'childhood febrile convulsions' was used as a descriptive term to include a relatively wide spectrum of conditions (i.e. from complex febrile seizures to Dravet syndrome to true prolonged febrile seizures).
[b] Post stroke epilepsies occurred in stroke survivors, i.e. 15 patients with cerebral infarct and 8 patients with intracerebral bleeds.

Table 4
Health-seeking itinerary of PWE.

Facilities	Frequency (%)
Traditional healers	124 (36.3)
Prayer houses	86 (25.1)
Private medical clinics	56 (16.4)
General hospitals	40 (11.7)
University teaching hospitals	36 (10.5)

Family history of epilepsy was obtained in 34 patients (9.9%), all of them with primarily generalized seizures. Six of the 34 gave history of epilepsy in first-degree relations (siblings and parents), 17 reported epilepsy in second-degree relations (uncles, aunts and grand-parents), and 11 reported epilepsy in third-degree relations (cousins).

Analysis of the pattern of itinerary of the patients revealed that 61.4% (210/342) of them sought initial attention at the trado-medical or spiritual homes. The remaining 132 patients sought initial medical attention at private medical clinics, government health centers, general hospital or teaching hospital – details are presented in Table 4.

4. Discussion

This study showed identifiable, mostly preventable, causes in more than half of patients with epilepsy seen in a neurology clinic of a tertiary health care facility. In addition, it demonstrated a trend of seeking initial medical attention with the traditional herbalists and in spiritual homes. Epilepsy was prevalent between the second and third decades of life in adult Nigerians. The median age of onset of seizures of 12 years implied that a significant cohort of

childhood epilepsies remained active into adulthood, constituting a huge burden on health care delivery.

An earlier study conducted among Nigerian Africans reported identifiable etiologies in 34.9% of patients.[12] This was significantly lower than the percentage found in our study. This may not be unconnected to the non-availability of neuro-imaging facilities like CT scan at the time of the earlier study and also the methodological approach employed in the present study. This finding implied that the prevalence of idiopathic epilepsies may not be as high as previously reported. The commonest cause of structurally related epilepsy in Nigerians reported by Dada[18] and Ahmed and Obembe[19] was central nervous system infections, (mainly bacterial meningitis, cerebral malaria and abscess) but we found the commonest cause among the patients with structurally related epilepsy to be post-traumatic brain injury. CNS infections accounted for a lower prevalence in this study which was similar to what Danesi[12] reported earlier. Recurrent childhood febrile convulsion which has been linked with complex partial epilepsy due to mesial temporal sclerosis[20] was a common cause in this study. This was in keeping with previous reports.[11,12,18,19]

Cerebral trauma and hypoxia were among the identifiable causes of epilepsy in Nigeria.[11,12,18] They may occur in the perinatal period owing to poor obstetric care, or throughout life in acts of violence at home, work and in traffic accidents. The prevalence of traumatic brain injury as a cause of structurally related epilepsies in Africa varies based on severity of the injury.[8] In a large series of patients, it accounted for 3.4%.[12] Previous reports have shown a prevalence between 8% and 12% of structurally related epilepsies in Nigeria.[11,12] We however obtained a higher prevalence of 19.6% in our study for brain trauma and 5% for birth-related hypoxia. This higher percentage may be as a result of meticulous search for causes of epilepsy in our patients especially using previous medical notes where documentations existed for patients who unknowingly had significant traumatic brain injuries and perhaps increasing rate of vehicular accidents in the country.[21,22] Most of our patients had brain trauma from motor vehicle accidents as has been reported previously.[22]

Cerebral tumors accounted for 1–10% of structurally related epilepsies in sub-Saharan Africa[8] which is similar to the prevalence observed in this study, although an earlier study reported a prevalence of 10–12% among Nigerians.[23] With the introduction and installation of CT in some tertiary institutions in several sub-Saharan African countries, more cases of epilepsy secondary to cerebral tumors are becoming obvious. Vascular lesions especially post stroke epilepsy accounted for 3.3%[21] and 1.3%[12] of cases of structurally related epilepsies in Nigeria but this study however revealed a prevalence of 6.7% which is similar to what obtained in several other African countries where a prevalence of 6–20%[8] has been reported. The low prevalence of epilepsy in sickle cell disease patients was not surprising as an earlier study by Ogunniyi et al.[24] had corroborated this. This may not be unrelated with the high mortality associated with sickle cell disease in resource poor countries. Furthermore, Adamolekun et al.[25] showed that patients with sickle cell disease who developed epilepsy were unlikely to present voluntarily for treatment. This in addition may account for low prevalence figure observed in this study.

Family history of epilepsy was obtained from a small percentage of the patients suggesting the possibility of inherited epileptic syndromes. There is little or no information on genetic epidemiology of epilepsy among Nigerian Africans.

A small percentage of our patients had seizures anytime they took chloroquine for malaria treatment. These patients were adults with no features of cerebral malaria. Generalized seizures have been reported in non-epileptic Nigerian subjects with normal EEGs following administration of therapeutic doses of chloroquine.[26] The mechanism for this effect of antimalarial drugs is unclear, but inhibition of glutamate dehydrogenase activity by chloroquine may be a reason.

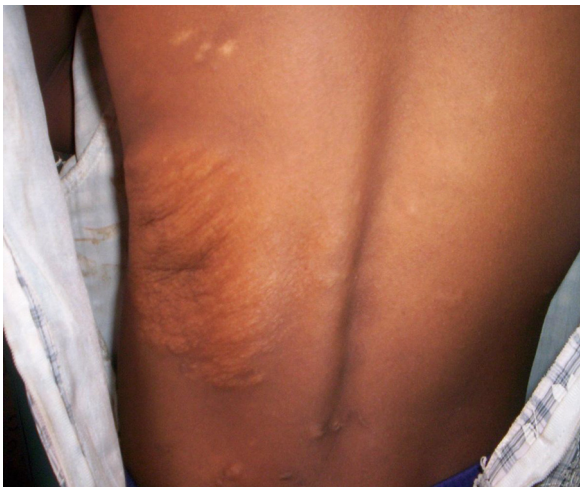

Fig. 1. Picture of 'shagreen' patch in a patient with tuberous sclerosis.

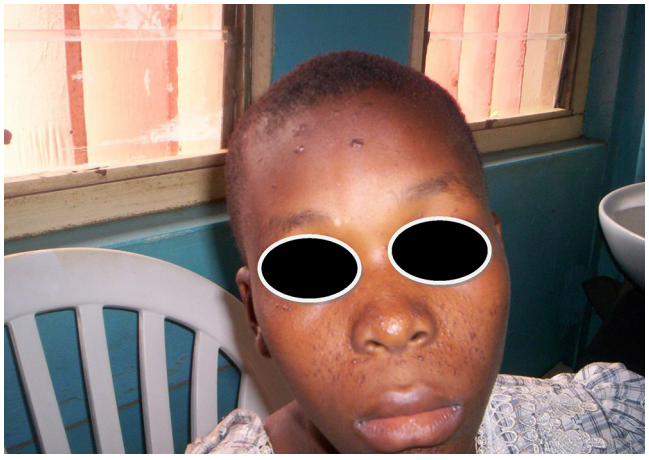

Fig. 2. Picture showing facial angiofibromas – 'adenoma sebaceum' in same patient with tuberous sclerosis.

For the first time, we reported a case of Fahr syndrome causing epilepsy in a Nigerian as part of this series. Tuberous sclerosis has been previously reported as a rare cause of epilepsy in Nigerians.[27] The diagnoses were based on the CT brain scan features of periventricular hyper-dense lesions ('tubers') and classical skin lesions for tuberous sclerosis (see Figs. 1 and 2), and bilateral dentate and widespread basal ganglia calcification for Fahr syndrome (see Fig. 3). This underscores the importance of neuro-imaging in the evaluation of causation of epilepsy.

This study also revealed the enduring trend of preference for alternative therapy among the Nigerian patients with epilepsy. A significant percentage of PWE sought medical attention with traditional herbalists or in spiritual homes before presenting in the hospital. The traditional healers often devote more time to listen to and talk with PWE and their relations, providing holistic support which is not readily available with health care workers. Though this trend may reflect lack of public awareness of epilepsy and confidence in the health care sector, this is a potential strategy to employ in identifying and treating PWE. Public enlightenment campaigns on epilepsy and provision of accessible and affordable hospital- and community-based approach to care would prevent this trend.

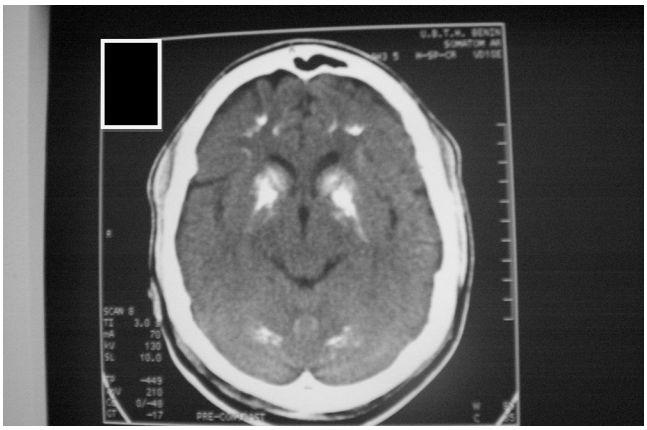

Fig. 3. Computerized brain scan film showing bilateral ganglionic and dentate calcification in Fahr syndrome.

5. Limitations of the study

This is a hospital-based study so the population studied may not exactly be representative of the urban community but we believe the findings of this study will draw attention to the possible causes of epilepsy in the environment of our practice. Though it is difficult to categorically label childhood febrile seizures as a cause for adult seizures since no information was obtained on how many of those with childhood febrile seizures did not go on to develop seizures in adulthood, the historic evidence of recurrence of febrile seizures in this category of patients with eventual development of afebrile seizures in adulthood suggest a plausible association.

6. Conclusion

Though most of the patients had idiopathic epilepsy, this study revealed post-traumatic brain injury and recurrent childhood febrile convulsion as the commonest causes of structurally related epilepsies. These causes are preventable which calls for urgent intervention strategies. A higher prevalence of PWE with cerebral tumors and stroke were observed due to ready availability of neuroimaging facilities. In addition, these facilities aided the identification of hitherto rare causes of epilepsy like tuberous sclerosis and Fahr syndrome. However the health seeking behavior and itinerary of the PWE have not changed. There is need for public epilepsy enlightenment to de-mystify epilepsy and improve the knowledge of the people. Campaign for regular use of safety seat belts when driving and wearing of head helmets will reduce head injury following vehicular accidents, and modification of risk factors for stroke will reduce stroke incidence and consequently post-stroke epilepsy.

Acknowledgements

The authors acknowledged the expert interpretation of the computerized tomographic scan film of the patient with Fahr syndrome by Dr. Jocelyne S. Lapointe of Korle-Bu Neuroscience Foundation during her visit to the University of Benin teaching hospital.

References

1. Senanayake N, Roman GC. Epidemiology of epilepsy in developing countries. *Bulletin of the World Health Organization* 1993;**71**:247–58.
2. Shovon SD. Epidemiology, classification, natural history and genetics of epilepsy. *Lancet* 1990;**336**:93–6.
3. Hauser WA, Annegers JF, Kurland LT. Prevalence of epilepsy in Rochester, Minnesota: 1940–1980. *Epilepsia* 1991;**32**:429–45.
4. Shorvon SD, Farmer PJ. Epilepsy in developing countries: a review of epidemiological, sociocultural and treatment aspects. *Epilepsia* 1988;**29**(Suppl. 1): S36–54.
5. Awaritefe A, Longe AC, Awaritefe M. Epilepsy and psychosis, a comparison of societal attitudes. *Epilepsia* 1985;**26**:1–9.
6. Awaritefe A. Epilepsy: the myth of a contagious disease. *Culture Medicine and Psychiatry* 1989;**13**:449–56.
7. Osuntokun BO, Adeuja AO, Nottidge VA, Bademosi O, Olumide A, Ige O, et al. Prevalence of epilepsy in Nigerian Africans: a community-based study. *Epilepsia* 1987;**28**:272–9.
8. Preux PM, Druet-Cabanac M. Epidemiology and etiology of epilepsy in sub-Saharan Africa. *Lancet Neurology* 2005;**4**:21–31.
9. Ngugi AK, Bottomley C, Kleinschmidt I, Wagner RG, Kakooza-Mwesige A, Ae-Ngibise K, et al. Prevalence of active convulsive epilepsy in sub-Saharan Africa and associated risk factors: cross-sectional and case-control studies. *Lancet Neurology* 2013;**12**:253–63.
10. Dada TO. Epilepsy in Lagos, Nigeria. *African Journal of Medical Sciences* 1970;**1**:161–84.
11. Obembe A, Ahmed MH. Epilepsy in Kaduna: a study of 164 youths. *Nigerian Medical Practitioner* 1988;**16**:45–8.
12. Danesi MA. Classification of the epilepsies: an investigation of 945 patients in a developing country. *Epilepsia* 1985;**26**:131–6.
13. Osuntokun BO, Odeku EL. Epilepsy in Ibadan, Nigeria: a study of 522 cases. *African Journal of Medical Sciences* 1970;**1**:185–200.
14. Osuntokun BO. Epilepsy in the developing countries: the Nigerian profile. *Epilepsia* 1972;**13**:107–11.
15. Watts AE. The natural history of untreated epilepsy in a rural community in Africa. *Epilepsia* 1992;**33**:464–8.
16. Danesi MA, Adetunji JB. Use of alternative medicine by patients with epilepsy: a survey of 265 epileptic patients in a developing country. *Epilepsia* 1994;**35**:344–51.
17. Commission on Classification and Terminology. International League Against Epilepsy. Proposed revisions of clinical and electroencephalographic classification of epileptic seizures. *Epilepsia* 1981;**22**:480–501.
18. Dada TO. The epilepsies: the incidence and causation in Nigeria. *Medecine d'Afrique Noire* 1976;**23**:320–9.
19. Ahmed MH, Obembe A. Electroencephalographic abnormalities in 351 Nigerians with epilepsy. *West African Journal of Medicine* 1991;**10**:216–21.
20. Engel Jr J, Birbeck GL, Diop AG, Jain S, Palmini A. *Epilepsy: global issues for the practicing neurologist*. 1st ed. New York: Demos Medical Publishing; 2005.
21. Nzegwu MA, Banjo AAF, Akhiwu W, Aligbe JU, Nzegwu CA. Morbidity and mortality among road users in Benin City, Nigeria. *Annals of African Medicine* 2008;**7**:102–6.
22. Ogunrin OA, Adeyekun AA. Profile of post-traumatic epilepsy in Benin City, Nigeria. *West African Journal of Medicine* 2010;**29**:153–7.
23. Adamolekun B. The aetiologies of epilepsy in tropical Africa. *Tropical and Geographical Medicine* 1995;**47**:115–7.
24. Ogunniyi A, Osuntokun BO, Bademosi O, Adeuja AO, Schoenberg BS. Risk factors for epilepsy: case-control study in Nigerians. *Epilepsia* 1987;**28**:280–5.
25. Adamolekun B, Durosinmi MA, Olowu W, Adediran I. The prevalence and classification of epileptic seizures in Nigerians with sickle-cell anaemia. *Journal of Tropical Medicine & Hygiene* 1993;**96**:288–90.
26. Adamolekun B. Seizures associated with chloroquine therapy. *Central African Journal of Medicine* 1992;**38**:350–2.
27. Ogunrin AO. Misdiagnosis of tuberous sclerosis in a Nigerian girl: a case report and review of literature. *Annals of African Medicine* 2010;**9**:95–101.