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FULL-LENGTH ORIGINAL RESEARCH

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Clinical and etiological characteristics of epilepsy in people from Niger: a hospital-based study from a tertiary care referral center of Niamey, Niger

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Abstract

Objectives: Epilepsy constitutes a major public health concern in the world particularly in developing countries, especially in sub-Saharan African countries. We designed this study to evaluate epilepsy management at a tertiary referral center in Niger to obtain a comprehensive understanding to determine the intrahospital deficiencies to improve and to make recommendations in terms to improve epilepsy management in Niger.

Methods: We conducted a retrospective study at the Neurology Outpatient Clinic of the National Hospital of Niamey (Niger) between May 2013 and May 2018 (5 years), collecting all cases of patients diagnosed with epilepsy by the neurologists. From the registers of consultation, we collected for each patient the demographic, clinical, etiological, and therapeutic data, as well as the outcomes during follow-up visits.

Results: Of the 4576 patients seen during the period of the study, 1350 patients consulted for epilepsy with a hospital frequency of 29.5%. The mean age of the patients was 18.55 ± 17.15 years (range: 3 months to 83 years) with a predominance of the male sex (sex ratio at 1.5). Patients younger than 20 years were the most represented (61.6%). All patients underwent EEG. Only 463 patients (35.2%) underwent brain imaging. Generalized tonic-clonic seizures were the most frequent (50%) followed by typical absences seizures (11.8%). Cerebrovascular disease, central nervous system infections, and head injuries were the main etiologies. First-generation AEDs were the most prescribed (99%). The proportion of patients with drug-resistance was 9.6%.

Significance: Our study shows limited access to newer generation AEDs and diagnostic tests of epilepsy in Niger. Considerable efforts should be made to facilitate for people living with epilepsy the accessibility to diagnostic tests and newer generation AEDs in order to improve the quality of epilepsy management in Niger.

KEYWORDS

epilepsy, hospital-based study, Niamey, Niger, sub-Saharan Africa

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1 | INTRODUCTION

Epilepsy is one of the most common chronic neurological diseases affecting more than 50 million people worldwide of all ages regardless of gender, and regardless of their geographic and ethnic origin.[1] It constitutes a major public health concern in the world particularly in developing countries, especially in sub-Saharan African countries. Nearly 80% of people worldwide living with epilepsy reside in developing countries.[1] The prevalence of epilepsy is high in sub-Saharan Africa, particularly in rural areas and mainly in young people.[2,3] The authors give as the explanation for this high prevalence the existence of many risk factors in sub-Saharan African countries such as infectious diseases, genetic factors, poor sanitary coverage favoring perinatal conditions, especially febrile convulsions, and birth asphyxia.[3–5] In Niger, people living with epilepsy are usually cared for by nonphysician healthcare workers, nonspecialist physician, and non-neurologist physicians who work in health facilities with limited access to electroencephalogram (EEG), neuroimaging, and a referral neurologist. Until the beginning of the year 2018, Niger had only one tertiary care referral center (National Hospital of Niamey) which had neurologists. Today, Niger has two tertiary care referral centers that have department of neurology all based in the city of Niamey and which cover a small portion of the general population of Niger. This shows that people living with epilepsy and other neurological diseases are essentially cared for by non-neurologist physicians in Niger. We designed this study to evaluate epilepsy management at a tertiary referral center in Niger to obtain a comprehensive understanding to determine the intrahospital deficiencies to improve and to make recommendations in terms to improve epilepsy management in Niger.

Key Points

- Epilepsy is a common reason for consultation at the Neurology Outpatient Clinic of the National Hospital of Niamey (Niger) with a prevalence of 29.5%
- Men and patients younger than 20 years were the most affected in 60.1% and 61.6%, respectively
- We found a high proportion of idiopathic generalized epilepsies (childhood absence epilepsy, juvenile absence epilepsy, juvenile myoclonic epilepsy, and generalized tonic-clonic seizures alone) in the present study (46.1%)
- Cerebrovascular disease, cerebral malaria, and head injuries were the most common identified etiologies of epilepsy in Niger
- The first-generation AEDs (VPA, CBZ, and PB) were the main AEDs prescribed in our study

2 | METHODS

2.1 | Study design

We retrospectively collected from the registers of consultation all patients diagnosed with epilepsy by neurologists at the Neurology Outpatient Clinic of the National Hospital of Niamey (Niger) over a period of 5 years from May 2013 to May 2018. Until the beginning of the year 2018, this hospital was the sole largest urban and tertiary care referral center in Niger which had neurologists. People living with neurological diseases were generally referred to this referral center for specialized care before the year 2018. This hospital covers an area of 23 120.50 m^2 and comprises 36 buildings with a bed capacity of 790. Until this day, it attracts people from all corners of the country to seek medical care in various medical fields. The Department of Neurology of this hospital has a small bed capacity (only 16 beds). Patients living with neurological conditions are essentially followed in consultation.

The study was approved by the Institutional Review Board of the Faculty of Medicine of Abdou Moumouni University of Niamey (Niger) in accordance with the Declaration of Helsinki.

2.2 | Patients

The study included people of all ages that consulted at the Neurology Outpatient Clinic of the National Hospital of Niamey (Niger) for epilepsy. The diagnosis of epilepsy was made for all patients by neurologists according to the 2014 revised definition of epilepsy of ILAE Official report: at least two unprovoked (or reflex) seizures occurring more than 24 hours apart or one unprovoked (or reflex) seizure in individuals who have risk factors such as cerebrovascular disease, central nervous system infection, and traumatic brain injury.[6] From the registers of consultation, we collected for each patient the following information (data collected by neurologists during follow-up visits): age of diagnosis, gender, past medical history, type of seizure, type of epilepsy, and antiepileptic treatment. All patients underwent EEG. Brain imaging (MRI or CT scan) had not been performed in many patients because of limited access. It was done in some cases of suspected cerebral lesions (such as cerebrovascular disease, history of head trauma, brain tumors, and congenital brain anomalies in patients who had financial resources. In total, only 463 patients (35.2%) underwent brain imaging, and mainly brain CT scan. Biological examinations (blood

count, fasting blood glucose, creatinine, urea, sodium, potassium, erythrocyte sedimentation rate, C-reactive protein, transaminases, serological tests for human immunodeficiency virus, syphilis, hepatitis B, and hepatitis C) were performed in some patients. Systemic immunological tests (soluble antinuclear antigen antibodies, antinuclear antibodies, anti-double-stranded DNA, etc.) and measurement of antineuronal antibodies in blood and or CSF were not performed. All patients were followed and evaluated during the period of study by neurologists. The response to antiepileptic treatment was evaluated during follow-up visits. Epilepsy was considered as drug-resistant in case of failure to achieve sustained seizure freedom despite adequate trials of two well-tolerated and appropriately chosen antiepileptic drugs (AEDs) prescribed as monotherapies or in combination according to the definition of drug resistance proposed by ILAE.[7] We considered a patient to have poor drug compliance when epileptic seizures are well controlled in case of regular drug intake and then in case of recrudescence of epileptic seizures when drug intake is imperfect or irregular (drug intake jump). Among patients with drug-resistant epilepsy, none of them had received treatment or other products outwards the AEDs that could lower the epileptogenic threshold during the follow-up visits.

2.3 | Statistical analysis

In the descriptive analysis of the data, patient characteristics were expressed as percentages for the qualitative variables and mean ± standard deviation for the quantitative variables. The chi-square test of Pearson was used to compare the proportions of the qualitative variables. Student's *t* test was used to compare two observed means. To examine the difference between several groups, we used 1-way ANOVA. *P*-values <0.05 were considered statistically significant. All statistical analyses were performed with SPSS software version 20.0 (SPSS Inc.).

3 | RESULTS

3.1 | Demographic characteristics

Of the 4576 patients seen at the Neurology Outpatient Clinic of the National Hospital of Niamey (Niger) between May 2013 and May 2018, 1350 patients had epilepsy with a hospital frequency of 29.5%. Table 1 summarizes the demographic characteristics of the patients. We included 812 men and 538 women with males-to-females ratio of 1.5. Patients were aged from 3 months to 83 years with a mean age of 18.55 ± 17.15 years. Seven hundred and seventy-one patients (57.1%) were younger than 18 years, among which 392 (29%) were younger than 5 years. Only 35 patients (2.6%) were older than or equal to 65 years, including 22 men and 13 women. Cerebrovascular disease (2.1%), birth asphyxia (2%), and head injuries (1%) were the main risk factors for epilepsy.

TABLE 1 Demographic characteristics of patients (n = 1350)

Variables	Number (%)
Sex	
Males	812 (60.1%)
Females	538 (39.9%)
Sex ratio (Males/Females)	1.5
Age (y)	
Mean	18.55 ± 17.15
Range	0.25 (3 mo) and 83
Mean/Males	18.16 ± 17.75
Mean/Females	19.14 ± 16.72
0.25-4	392 (29%)
5-9	106 (7.9%)
10-14	184 (13.6%)
15-17	89 (6.6%)
18-27	228 (16.9%)
28-37	164 (12.1%)
38-47	72 (5.3%)
48-57	42 (3.1%)
58-67	52 (3.9%)
68-77	18 (1.3%)
78-83	3 (0.2%)
Past medical history	
Sickle cell disease	6 (0.4%)
Human immunodeficiency virus infection	3 (0.2%)
Arterial hypertension	5 (0.4%)
Migraine	19 (1.4%)
Trisomy 21	3 (0.2%)
Arterial hypertension associated with diabetes	2 (0.1%)
Congenital cardiac disease	1 (0.1%)
Drug addiction	3 (0.2%)
Cerebrovascular disease	28 (2.1%)
Febrile convulsions in childhood	5 (0.4%)
Bacterial meningitis	7 (0.5%)
Cerebral malaria	18 (13%)
Birth asphyxia	27 (2%)
Cerebral toxoplasmosis	2 (0.1%)
Head injury	14 (1%)
Cerebral tuberculoma	2 (0.1%)

We found no significant difference between the mean age of men and women (18.16 ± 17.75 years for men vs 19.14 ± 16.72 years for women). The frequency of head injuries is higher in men than in women (10.1% for men vs 1.7% for women).

TABLE 2 Clinical and therapeutic characteristics and outcomes during follow-up visits of patients

Variables	Total ($n = 1350$)	Gender			Age group				
		M ($n = 812$)	F ($n = 538$)	*P* value	0.25-17 ($n = 771$)	18-37 ($n = 392$)	38-67 ($n = 166$)	6883 ($n = 21$)	*P* value
Seizure types									
TAS	159 (11.8%)	99 (12.2%)	60 (11.2%)	>0.2	154 (20%)	5 (1.3%)	0	0	<0.001
AAS	57 (4.2%)	39 (4.8%)	18 (3.3%)	>0.2	57 (4.2%)	0	0	0	<0.001
GAS	20 (1.5%)	12 (1.5%)	8 (1.5%)	>0.2	17 (2.2%)	2 (0.5%)	1 (0.6%)	0	<0.001
GMS	112 (8.3%)	70 (8.6%)	42 (7.8%)	>0.2	75 (9.7%)	30 (7.7%)	7 (4.2%)	0	<0.05
GES	42 (3.1%)	23 (2.8%)	19 (3.5%)	>0.2	42 (5.5%)	0	0	0	<0.001
GTCS	675 (50%)	389 (47.9%)	286 (53.2%)	>0.05	288 (37.4%)	276 (70.4%)	104 (62.6%)	7 (31.8%)	<0.001
GMTCS	113 (8.4%)	77 (9.5%)	36 (67%)	>0.05	109 (14.1%)	4 (1%)	0	0	<0.001
FAS	76 (5.6%)	39 (4.8%)	39 (7.2%)	>0.2	0	47 (12%)	24 (14.5%)	5 (23.8%)	<0.001
FIAS	21 (1.6%)	17 (2.1%)	4 (0.7%)	<0.05	0	13 (3.3%)	2 (1.2%)	6 (27.3%)	<0.001
FBTCS	75 (5.6%)	47 (5.8%)	28 (5.2%)	>0.2	29 (3.8%)	15 (3.8%)	28 (16.9%)	3 (13.6%)	<0.001
Associated clinical signs									
Hemiparesis	24 (1.8%)	15 (1.8%)	9 (1.7%)	>0.2	16 (2.1%)	4 (1%)	3 (1.8%)	1 (4.8%)	>0.2
Hemiparesis with aphasia	2 (0.1%)	1 (0.1%)	1 (0.2%)	>0.2	1 (0.1%)	0	1 (0.6%)	0	–
LA/PD	88 (6.5%)	58 (7.1%)	30 (5.6%)	>0.2	87 (11.3%)	1 (0.3%)	0	0	<0.001
Aphasia	2 (0.1%)	2 (0.2%)	0	–	0	0	1 (0.6%)	1 (4.8%)	–
Epilepsy types									
GE	1178 (87.3%)	709 (87.3%)	469 (87.2%)	>0.2	742 (96.2%)	317 (80.9%)	112 (67.5%)	7 (33.3%)	<0.001
FE	172 (12.7%)	103 (12.7%)	69 (12.8%)	>0.2	29 (3.8%)	75 (19.1%)	54 (32.5%)	14 (66.7%)	<0.001
Antiepileptic drugs									
VPA	559 (41.4%)	345 (42.5%)	214 (39.8%)	>0.2	482 (62.5%)	69 (17.6%)	8 (4.8%)	0	<0.001
CBZ	258 (19.1%)	152 (18.7%)	106 (19.7%)	>0.2	30 (3.9%)	129 (32.9%)	83 (50%)	16 (76.2%)	<0.001
LTG	11 (0.8%)	6 (0.7%)	5 (0.9%)	>0.2	8 (1%)	3 (0.8%)	0	0	>0.2
PB	367 (27.2%)	214 (26.4%)	153 (28.4%)	>0.2	141 (18.3%)	160 (40.8%)	62 (37.3%)	4 (19%)	<0.001
VPA + PB	41 (3%)	24 (3%)	17 (3.2%)	>0.2	27 (3.5%)	11 (2.8%)	3 (1.8%)	0	>0.2
VPA + LTG	2 (0.1%)	1 (0.1%)	1 (0.2%)	>0.2	0	1 (0.3%)	1 (0.6%)	0	–
CBZ + VPA	55 (4.1%)	34 (4.2%)	21 (3.9%)	>0.2	40 (5.2%)	8 (2%)	7 (4.2%)	0	>0.05
CBZ + PB	57 (4.2%)	36 (4.4%)	21 (3.9%)	>0.2	43 (5.6%)	11 (2.8%)	2 (1.2%)	1 (4.8%)	<0.05
Outcomes during follow-up visits									

(Continues)

TABLE 2 (Continued)

Variables	Total (n = 1350)	Gender			Age group				
		M (n = 812)	F (n = 538)	P value	0.25-17 (n = 771)	18-37 (n = 392)	38-67 (n = 166)	6883 (n = 21)	P value
SC	1053 (78%)	642 (79.1%)	411 (76.4%)	>0.2	652 (84.6%)	272 (69.4%)	115 (69.3%)	14 (66.7%)	<0.001
DR	130 (9.6%)	79 (9.7%)	51 (9.5%)	>0.2	102 (13.2%)	21 (5.4%)	7 (4.2%)	0	<0.001
PDC	167 (12.4%)	91 (11.2%)	76 (14.1%)	>0.1	17 (2.2%)	99 (25.2%)	44 (26.5%)	7 (33.3%)	<0.001

Note: Proportional differences were analyzed with chi-square test of Pearson.

Abbreviations: AAS, atypical absence seizures; CBZ, carbamazepine; DR, drug-resistance; F, females; FAS, focal aware seizures; FBTCS, focal to bilateral tonic-clonic seizures; FE, focal epilepsies; FIAS, focal impaired awareness seizures; GAS, generalized atonic seizures; GE, generalized epilepsies; GES, generalized epileptic spasms; GMS, generalized myoclonic seizures; GMTCS, generalized myoclonic-tonic-clonic seizures; GTCS, generalized tonic-clonic seizures; LA/PD, loss of acquisitions or psychomotor decline; LTG, lamotrigine; M, males; PB, phenobarbital; PDC, poor drug compliance; SC, seizure control; TAS, typical absence seizures; VPA, valproate.

3.2 | Clinical characteristics

Generalized tonic-clonic seizures represent 50% of cases (Table 2). Hemiparesis and loss of acquisitions or psychomotor decline were the main associated clinical signs. Generalized epilepsies represent 87.3% of cases. Table 3 summarizes the different epilepsy syndromes identified in our study. Generalized tonic-clonic seizures alone were the most common identified epilepsy syndromes. In 49.2% of cases, we could not identify epilepsy syndromes. We identified 622 cases (46.1%) of idiopathic generalized epilepsies (childhood absence epilepsy, juvenile absence epilepsy, juvenile myoclonic epilepsy, and generalized tonic-clonic seizures alone), among which generalized tonic-clonic seizures alone were the most represented (Table 4).

We found that patients with focal epilepsies were older than patients with generalized epilepsies (35.88 ± 20.87 years vs 16.02 ± 15.2 years). Focal impaired awareness seizures were more frequent in men than in women (2.1% vs 0.7%). Focal epilepsies were more frequent in patients older than 68 years.

3.3 | Etiological characteristics

Eighty-seven patients had an identified etiology (6.4%). Structural causes were the most common identified etiologies, of which cerebrovascular disease was the most represented followed by head injuries (Table 4). Among the infectious etiologies, cerebral malaria was the most common. Idiopathic generalized epilepsies (childhood absence epilepsy, juvenile absence epilepsy, juvenile myoclonic epilepsy, and generalized tonic-clonic seizures alone) represent 46.1% of cases. We found 611 cases (45.3%) of patients with epilepsy with unknown etiologies, among which we noted 22 cases of HHE syndrome (hemiconvulsion-hemiplegia-epilepsy syndrome), 34 cases of West syndrome, 79 cases of epileptic encephalopathy, and 476 cases of patients without identified epilepsy syndromes nor etiology and brain imaging (MRI or CT scan) not done. Patients diagnosed with epileptic encephalopathy had clinically generalized myoclonic-tonic-clonic seizures with loss of acquisitions or psychomotor decline and behavioral impairments. All these patients underwent brain CT scan, and the revealed abnormalities were white matter lesions of ischemic nature probably, tetra-ventricular hydrocephalus, and diffuse atrophy. It is possible that these patients had hypoxic-ischemic encephalopathy or encephalopathy related to congenital infections, although they have not been specified in these patients. All patients diagnosed with HHE syndrome underwent brain CT scan which was normal in four patients and showed cerebral hemiatrophy in 18 patients. Brain MRI could not be performed in these patients to search for hippocampal sclerosis. In patients West syndrome, birth asphyxia was found in most of them.

TABLE 3 Identified epilepsy syndromes

Variables	Total (n = 1350)	Gender group		
		M (n = 812)	*F* (n = 538)	*P* value
Childhood absence epilepsy	119 (8.8%)	79 (9.7%)	40 (7.4%)	>0.1
Juvenile absence epilepsy	71 (5.3%)	42 (5.2%)	29 (5.4%)	>0.2
Juvenile myoclonic epilepsy	55 (4.1%)	34 (4.2%)	21 (3.9%)	>0.2
Generalized tonic-clonic seizures alone	377 (27.9%)	216 (26.6%)	161 (29.9%)	>0.1
Myoclonic epilepsy in infancy	30 (2.2%)	17 (2.1%)	13 (2.4%)	>0.2
West syndrome	34 (2.5%)	17 (2.1%)	17 (3.2%)	>0.2
HHE syndrome	22 (1.6%)	14 (1.7%)	8 (1.5%)	>0.2
Unknown	642 (49.2%)	407 (50.2%)	257 (47.8%)	–

Note: Proportional differences were analyzed with chi-square test of Pearson.
Abbreviations: F, females; HHE syndrome, hemiconvulsion-hemiplegia-epilepsy syndrome; M, males.

Post-traumatic epilepsies were more common in men than in women (10.1% vs 1.7%). We found that the frequency of post-stroke epilepsies was higher in patients aged 38 to 68 years. Post-traumatic epilepsies were more common in patients aged 18-38 years.

3.4 | Therapeutic characteristics

Carbamazepine, valproate, and phenobarbital were the main molecules used in our patients. Dual therapy has been prescribed in 11.5% of cases (155/1350; Table 2). The carbamazepine-phenobarbital combination seems to be the most prescribed combination.

We found that valproate was more prescribed in patients younger than 18 years. Carbamazepine was more prescribed in patients older than 68 years.

3.5 | Outcomes during follow-up visits

One hundred and thirty patients (9.6%) had drug-resistant epilepsy, of which 102 patients were younger than 18 years (Table 2). Of the 130 patients with drug-resistant epilepsy, 77 patients had epileptic encephalopathy (Table 5). Twenty-two patients had no established etiological diagnosis with brain imaging not done. One hundred and sixty-seven patients (12.4%) had poor drug compliance with persistent epileptic seizures, of which 99 patients were aged 18-38 years. Among patients with poor drug compliance, 145 patients had no established etiological diagnosis.

Fourteen patients had presented at least one status epilepticus during the follow-up mainly due to the discontinuation of AEDs. We registered seven deaths, and in two patients, death occurred following a recurrence of stroke.

Sex had no influence on poor drug compliance. The frequency of patients with poor drug compliance was higher in patients older than 68 years. In post hoc analysis, we found that patients with poor drug compliance were older than patients with drug-resistant epilepsy (33.05 ± 16.31 years vs 8.85 ± 12.65 years) and patients with epilepsy well controlled by AEDs (33.05 ± 16.31 years vs 17.44 ± 16.67 years).

4 | DISCUSSION

Our study shows a high hospital frequency of epilepsy (29.5%) at the Neurology Outpatient Clinic of the National Hospital of Niamey (Niger). This high frequency observed at the level of this medical structure could be explained by the fact that it represents the largest reference center in the management of neurological diseases in Niger receiving populations from all corners of the country to seek medical care until the beginning of the year 2018. The study also shows limited access to newer generation AEDs, and only first-generation AEDs are regularly available. In addition to the limited financial resources of the patients to benefit from a complete workup, we notice that considerable efforts should be made at the National Hospital of Niamey in terms to improve the availability of diagnostic tests such as video EEG, systemic immunological tests, and measurement of antineuronal antibodies. Easy access to brain imaging and newer generation AEDs also permit to improve the quality of management of patients living with epilepsy.

The mean age of our patients was 18.55 years, demonstrating the young age of the majority of patients in the study sample. The study also showed a predominance of the male sex (sex ratio at 1.5), as previously reported in

TABLE 4 Etiologies

Variables	Total (n = 1350)	Gender group			Age group				
		M (n = 812)	*F* (n = 538)	*P* value	0.25-17 (n = 771)	18-37 (n = 392)	38-67 (n = 166)	68-83 (n = 21)	*P* value
Structural etiologies									
AVM	2 (0.1%)	0	2 (0.4%)	–	0	2 (0.5%)	0	0	–
CMe	3 (0.2%)	1 (0.1%))	2 (0.4%)	–	0	1 (0.2%)	2 (1.2%)	0	–
Stroke	39 (2.9%)	26 (3.2%)	13 (2.4%)	>0.2	6 (0.8%)	5 (1.3%)	22 (13.3%)	6 (28.6%)	<0.001
Head injury	14 (1%)	13 (1.6%)	1 (0.2%)	<0.05	4 (0.5%)	6 (1.5%)	4 (2.4%)	0	<0.001
Brain tumor	5 (0.4%)	4 (0.5%)	1 (0.2%)	–	0	3 (0.8%)	2 (1.2%)	0	–
Infectious etiologies									
BM	2 (0.1%)	2 (0.2%)	0	-	1 (0.1%)	0	1 (0.6%)	0	–
CM	18 (1.3%)	12 (1.5%)	6 (1.1%)	>0.2	18 (2.3%)	0	0	0	<0.001
CTo	2 (0.1%)	1 (0.1%)	1 (0.2%)	–	0	1 (0.2%)	1 (0.6%)	0	–
CT	2 (0.1%)	2 (0.2%)	0	–	0	0	2 (1.2%)	0	–
Idiopathic generalized epilepsies									
CAE	119 (8.8%)	79 (9.7%)	40 (7.4%)	>0.1	119 (15%)	0	0	0	<0.001
JAE	71 (5.3%)	42 (5.2%)	29 (5.4%)	>0.2	71 (9.2%)	0	0	0	<0.001
JME	55 (4.1%)	34 (4.2%)	21 (3.9%)	>0.2	30 (3.9%)	25 (6.4%)	0	0	<0.01
GTCSA	377 (27.9%)	216 (26.6%)	161 (29.9%)	>0.1	300 (38.9%)	77 (19.6%)	0	0	<0.001
Self-limited epilepsies									
MEI	30 (2.2%)	17 (2.1%)	13 (2.4%)	>0.2	30 (3.9%)	0	0	0	<0.001
Unknown etiologies	611 (45.3%)	363 (44.7%)	248 (46.1%)	>0.2	192 (24.9%)	272 (69.4%)	132 (79.5%)	15 (71.4%)	<0.001

Note: Proportional differences were analyzed with chi-square test of Pearson.

Abbreviations: AVM, arteriovenous malformation; BM, bacterial meningitis; CAE, childhood absence epilepsy; CM, cerebral malaria; CMe, cerebral meningioma; CT, cerebral tuberculoma; CTo, cerebral toxoplasmosis; F, females; GTCSA, generalized tonic-clonic seizures alone; HHE syndrome, hemiconvulsion-hemiplegia-epilepsy syndrome; JAE, juvenile absence epilepsy; JME, juvenile myoclonic epilepsy; M, males; MEI, myoclonic epilepsy in infancy.

TABLE 5 Patients with drug-resistant epilepsy by etiologies or epilepsy syndromes (n = 130)

Variables	Number (%)
HHE syndrome	21 (16.2)
Stroke	2 (1.5)
Cerebral tuberculoma	1 (0.8)
Brain tumor	1 (0.8)
Cerebral malaria	6 (4.6)
Epileptic encephalopathy	77 (59.2)
Unknown	22 (16.9)

Abbreviation: HHE syndrome, hemiconvulsion-hemiplegia-epilepsy syndrome.

many studies in sub-Saharan Africa.[8–14] However, the predominance of female sex has been reported in some studies in Nigeria,[15,16] Rwanda,[17] and Tanzanie.[18] In our study, patients younger than 20 years were the most affected (61.6%). Of the 832 patients younger than 20 years, 622 patients had idiopathic generalized epilepsies (childhood absence epilepsy, juvenile absence epilepsy, juvenile myoclonic epilepsy, and generalized tonic-clonic seizures alone). This predominance of patients aged under 20 years was previously reported in some studies in sub-Saharan Africa.[9,12,15,16,18] However, a great predominance of patients older than 20 years has been reported in a study from Benin.[8] In our study, the predominance of patients younger than 20 years may be because young people make up a very large proportion of the general population in Niger. To remind, people aged under 15 years represent 51.4% of the general population in Niger in 2018.[19] Although it does not seem to be the case in our study (high frequency of idiopathic generalized epilepsies: 46.1%), infectious diseases responsible for febrile convulsions in childhood and dystocic childbirths responsible for birth asphyxia would explain the early onset of epilepsy in sub-Saharan African people.

We noted in this study a predominance of generalized tonic-clonic seizures (50%). Several studies had previously reported this predominance of generalized tonic-clonic seizures in sub-Saharan African populations.[10,12,13,18] However, a Nigerian study reported a predominance of focal-onset seizures (55.4%).[15] This predominance of focal-onset seizures has been reported in a analysis of five studies, among which four came from Nigeria.[20] Idiopathic generalized epilepsies were the most common (46.1%) in our study mainly represented by generalized tonic-clonic seizures alone in 27.9% of all cases. The diagnosis of idiopathic generalized epilepsies (childhood absence epilepsy, juvenile absence epilepsy, juvenile myoclonic epilepsy, and generalized tonic-clonic seizures alone) was made based on clinical and electroencephalographic arguments. Only eighty-seven patients had an identified etiology (6.4%) in our study, and structural causes were the most common identified etiologies essentially represented by cerebrovascular disease and head injuries. A study from Togo reported a high proportion of patients with infectious and structural etiologies (69.4%).[13] A Nigerian study reported a proportion of idiopathic generalized epilepsies of 17.1%.[11] Despite the means to carry out additional examinations (such as laboratory tests, brain CT scan, or/and MRI), which is not always possible in studies conducted in some sub-Saharan African countries, we found a high proportion of idiopathic generalized epilepsies in our study than those so far reported. These findings reflect the interest of pursuing descriptive and analytical epidemiological studies in Niger to confirm or invalidate this abnormally high proportion of idiopathic generalized epilepsies.

Several risk factors favoring the occurrence of epileptic seizures have been reported in sub-Saharan African populations.[3,4,14] In our study, cerebrovascular disease was the main risk factor for epilepsy followed by birth asphyxia. Two Nigerian studies reported as the main risk factor for epilepsy head injuries and febrile convulsions in childhood.[14,15] In a study from Togo,[13] central nervous system infections (neurocysticercosis, varicella, cerebral malaria, and meningitis) were the main etiologies. Overall, the risk factors for epilepsy are diverse and variable according to the studies and populations studied (hospital patients or general population).

Valproate (VPA), carbamazepine (CBZ), and phenobarbital (PB) were the main AEDs prescribed in our study. Lamotrigine (LTG) was the sole newer generation AED prescribed in our study and only in 1% of patients. In Nigeria, a study reported only the prescription of first-generation AEDs (VPA, CBZ, and PB).[11] Similar findings were also reported in a study from Togo with PB as the first choice molecule.[10] Newer generation AEDs were used very little in our study because not only they are not available in Niger, but also they are expensive for patients, which are in the majority of cases farmers and petty traders who live in villages and suburban communities with a large number of them under the poverty line. In addition, the prescription of these ADEs would increase the rate of poor drug compliance. Epilepsy surgery is not available in Niger.

Our study has some limitations. First, as the study originates from a single-center, the generalization of our findings may be limited. However, for a comprehensive understanding and detailed recording of the patients' clinical characteristics and follow-up, patients of our neurology clinic were the best choice. In other hospitals of Niger, the diagnosis of epilepsy is made by nonspecialist physicians, and patients of these hospitals are not a good choice to obtain a comprehensive understanding of epilepsy management. Second, the retrospective nature of this study explains why some details were not provided especially profession, provenance (Rural or Urban), socio-economic

status, marital status, cultures, religion, etc. Therefore, we could not compare the characteristics of patients from urban populations and patients from rural populations in order to assess some risk factors for epilepsy between these populations.

5 | CONCLUSION

Our study shows limited access to newer generation AEDs and diagnostic tests of epilepsy in Niger. Considerable efforts should be made in Niger particularly at the National Hospital of Niamey to facilitate for people living with epilepsy the accessibility to diagnostic tests and newer generation AEDs in order to improve the quality of epilepsy management in Niger. On the other hand, our study provides a description of demographic, clinical, and etiological characteristics of epilepsy in hospital patients from Niger. These hospital findings permit to create a database on epilepsy that will provide data for comparison with data of future studies on epilepsy in Niger. To determine the exact incidence and prevalence of epilepsy as well as the major risk factors for this disease, a national door-to-door survey is needed in Niger using the validated epilepsy screening questionnaire of Limoges Neuroepidemiology Institute, ILAE, and Pan African Association of Neurological Sciences.[21]

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CONFLICTS OF INTEREST

All authors have read and agreed to the content of the manuscript. None of the authors has any conflict of interest to disclose. We confirm that we have read the Journal's position on issues involved in ethical publications and affirm that this report is consistent with those guidelines.

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