

Original Article

Spectrum of Neurological Diseases in Two Cameroonian Hospitals, Urban and Rural: A Retrospective Cross-Sectional Study in Yaoundé and Bafoussam

Spectre des Maladies Neurologiques dans Deux Hôpitaux Camerounais, Urbain et Rural : Étude Transversale Rétrospective à Yaoundé et Bafoussam

Leonard Ngarka^{1,2,3}, Donoh Stéphane², Njit Edith N., Paul K. Tchaptchet M.^{1,2,3}, Tcheutchoua Foka Kathy¹, Leonard Nfor N^{1,3}, Alfred K. Njamnshi^{1,2,3}

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Affiliations

1. Neurology Department, Yaoundé Central Hospital, Cameroon
2. Faculty of Medicine and Biomedical Sciences, The University of Yaoundé I, Cameroon
3. Brain Research Africa Initiative (BRAIN), Yaoundé, Cameroon

Corresponding Author

Leonard Ngarka

E-Mail: lngarka@yahoo.com

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ABSTRACT

Introduction. Neurological diseases represent a significant public health concern in developing countries. In Cameroon, the available data on this subject are relatively heterogeneous, with the majority of studies concentrated in urban areas. It was thus proposed that the study be conducted in two hospitals, one in an urban and one in a rural setting. Our objective was to determine the spectrum of neurological diseases at the Yaoundé Central Hospital (YCH) and the Bafoussam Regional Hospital (BRH). **Methodology.** We conducted an observational, descriptive, cross-sectional, retrospective study at the HCY and HRB over a 02-year period. Patients' data were collected from clinical records using a questionnaire. The tenth edition of the International Classification of Diseases was used to classify the neurological diseases encountered. **Results.** A total of 489 patients were enrolled in the study, 252 from YCH and 237 from BRH. The mean age of the sample was 51.2 ± 18 , 6 years, with a F/M ratio of 1.03. The most prevalent medical history was hypertension (46.6%), followed by HIV infection (15.1%). The prevalence of episodic and paroxysmal conditions was higher in the study hospitals (53.8%). The principal discrepancies in aetiology between the two study hospitals were as follows: the frequency of epilepsy in YCH (9.1%), which was three times higher than in BRH (3.0%), and the frequency of trauma in BRH, where it was exclusively found (16.5%). The overall outcome was favourable in 70.3% of patients, but unfavourable outcomes were more prevalent in BRH (16.5%) than in YCH (9.9%). The overall mortality rate was 12.7%, with over half of these deaths occurring at BRH. **Conclusion.** Neurological conditions represent a significant burden among patients in our two study hospitals. The pathologies found are diverse and significant, confirming the wide variability of neurological conditions. It is therefore evident that there is a necessity to increase awareness among the general public and healthcare professionals of the advantages of developing additional strategies to alleviate the impact of these conditions in our society.

RÉSUMÉ

Introduction. Les maladies neurologiques représentent une préoccupation majeure de santé publique dans les pays en développement. Au Cameroun, les données disponibles sur ce sujet sont relativement hétérogènes, la majorité des études étant concentrées en zone urbaine. Il a donc été proposé de mener cette étude dans deux hôpitaux, l'un en milieu urbain et l'autre en milieu rural. Notre objectif était de déterminer le spectre des maladies neurologiques à l'Hôpital Central de Yaoundé (HCY) et à l'Hôpital Régional de Bafoussam (HRB). **Méthodologie.** Nous avons mené une étude observationnelle, descriptive, transversale et rétrospective à l'HCY et à l'HRB sur une période de 2 ans. Les données des patients ont été recueillies à partir des dossiers cliniques à l'aide d'un questionnaire. La dixième édition de la Classification Internationale des Maladies (CIM-10) a été utilisée pour classer les pathologies neurologiques rencontrées. **Résultats.** Un total de 489 patients a été inclus dans l'étude, dont 252 à l'HCY et 237 à l'HRB. L'âge moyen de l'échantillon était de $51,2 \pm 18,6$ ans, avec une sex-ratio F/H de 1,03. Les antécédents médicaux les plus fréquents étaient l'hypertension artérielle (46,6 %), suivie de l'infection par le VIH (15,1 %). La prévalence des affections épisodiques et paroxystiques était plus élevée dans les hôpitaux de l'étude (53,8 %). Les principales disparités étiologiques entre les deux centres étaient les suivantes : la fréquence de l'épilepsie à l'HCY (9,1 %) était trois fois plus élevée qu'à l'HRB (3,0 %), tandis que les traumatismes étaient exclusivement retrouvés à l'HRB (16,5 %). L'évolution globale a été favorable pour 70,3 % des patients, mais les issues défavorables étaient plus fréquentes à l'HRB (16,5 %) qu'à l'HCY (9,9 %). Le taux de mortalité globale était de 12,7 %, avec plus de la moitié de ces décès survenus à l'HRB. **Conclusion.** Les affections neurologiques représentent un fardeau important pour les patients de nos deux hôpitaux d'étude. Les pathologies rencontrées sont diverses et significatives, confirmant la grande variabilité des troubles neurologiques. Il est donc évident qu'il est nécessaire de sensibiliser davantage le grand public et les professionnels de santé aux avantages du développement de stratégies supplémentaires pour atténuer l'impact de ces affections dans notre société.

HIGHLIGHTS FOR READERS IN A HURRY

What is already known on this topic. Neurological disorders contribute substantially to morbidity and mortality in low-income countries, yet reliable epidemiological data remain scarce in sub-Saharan Africa. Most Cameroonian studies are confined to urban referral hospitals.

The question this study addressed. This study reports the differences in the spectrum, clinical presentation, and outcome of neurological conditions between an urban university hospital (Yaoundé) and a semi-rural regional hospital (Bafoussam).

What this study adds. This first direct urban–rural comparison in Cameroon shows that stroke is the leading pathology in both sites. However, traumatic brain injury is almost exclusive to Bafoussam (16.5%), while epilepsy and inflammatory CNS diseases are three times more frequent in Yaoundé. In-hospital mortality is more than doubled in the rural setting (18.1% vs. 7.5%).

Implications. Strengthening imaging and rehabilitation facilities in rural areas is a priority. Trauma prevention and hypertension control must be intensified there. In urban settings, access to antiepileptic drugs and antiretrovirals remains to be optimized. Multicenter prospective studies are needed to refine these disparities and evaluate targeted interventions.

INTRODUCTION

Neurological disorders (NDs) cover a wide range of pathologies resulting from damage to the nervous system. [1]. They have increased considerably over the last 25 years due to population growth and ageing. [2]. Globally, NDs represent a major health challenge both on a global scale and at the level of each country according to *the 2016 Global Burden of Disease (GBD) data* [2], which ranked ND as the leading cause of disability-adjusted life years and the second leading cause of death worldwide, each accounting for 11.6% and 16.5 [2]. In Europe, in 2017, the GBD also found ND to be the third leading cause of morbidity and mortality, accounting for 13.3% and 19.5% respectively [2].

Africa, for its part, still lacks systematized data on the issue, yet a study carried out in 2019 by Winkler *et al* showed a greater burden of NDs in middle- and low-income countries [3]. In West Africa, in Côte d'Ivoire in 2019, Diallo *et al* found a mortality rate of 20.74% and a morbidity rate of 73.8%. [4]. In Benin in 2013, Ossou-Nguet *et al.* found a mortality rate of 11.2%, with stroke and meningoencephalitis the most common conditions (44.4% and 8.6%) [5]. In Central Africa, in Cameroon in 2019, Doumbe *et al.* found a mortality rate of 19.1% and a morbidity rate of 57.2% in a hospital study of a rural and urban population [6]. In addition, in Yaoundé in 2016, Tegueu *et al* found a prevalence of 20.1%, with episodic and paroxysmal conditions in the lead at 46.5%. The study conducted in 2019 by Winkler *et al.* showed a greater burden of NDs in middle- and low-income countries [7]. Cameroon is a middle-income country where the majority of studies on NDs are concentrated in the country's capital cities. The geographical and socio-cultural distribution of the country's population is very varied, and the fairly heterogeneous data on this worrying subject cannot

guarantee effective planning of the resources allocated to its management. It was therefore necessary to carry out a study highlighting the diversity of neurological diseases in the country, by comparatively studying their profile in two hospitals located at different levels of the health pyramid.

MATERIAL AND METHOD**Type and location of study**

We carried out a cross-sectional and retrospective study over a period of 2 years: from January 2020 to December 2021 and over a period of 06 months (i.e. from 01 December 2021 to 31 May 2022). Data collection took place from March to May 2022, i.e. 3 months.

Patients were recruited from the neurology and neuropsychiatry departments of the YCH and BRH respectively. Bafoussam Regional Hospital is the referral hospital in the West region of Cameroon. Yaoundé Central Hospital is one of the referral hospitals in the Centre region. These hospitals were considered suitable for our study because, as referral hospitals in their own regions, they have a diversity of pathologies and a broader spectrum of general disorders.

Procedure

After obtaining ethical clearance from the Institutional Research Ethics Committee (IERC) of the Faculty of Medicine and Biomedical Sciences of Yaoundé 1, we obtained research authorisations from the study hospitals. The records of patients hospitalised at the YCH and the BRH were retrieved from the archives' office of the neurology department and the centralised archives' office respectively. Files meeting the criteria for inclusion were retained.

Data collection

Data was collected using a pre-established questionnaire including: socio-demographic data (sex, age, profession, marital status, place of residence, region), medical history (arterial hypertension, diabetes, HIV, history of neurological disease, alcohol consumption, smoking), clinical profile of neurological disease (presenting complaint, mode of onset, consultation delay, mode of seeking care, death). Each file was searched for information corresponding to the questionnaire, which the principal investigator duly completed. Neurological conditions were classified according to the 10th revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10), which is subdivided into eleven groups:

Inflammatory diseases of the central nervous system (G00-G09)

Systemic atrophies primarily affecting the central nervous system (G10-G14)

Extrapyramidal and movement disorders (G20 - G26)

Other degenerative diseases of the nervous system (G30-G32)

Demyelinating diseases of the central nervous system (G35-G37)

Episodic and paroxysmal disorders (G40-G47)

Nerve, nerve root and plexus disorders (G50-G59)

Polyneuropathies and other disorders of the peripheral nervous system (G60-G64)

Diseases of the myoneural junction and muscle (G70-G73)

Cerebral palsy and other paralytic syndromes (G80-G83)
Other disorders of the nervous system (G90-G99)
Sampling

To estimate our minimum sample size, we used the following formula applicable to descriptive studies: $N = (Z^2 * p * q) / e^2$

Where Z = variance, p = prevalence of neurological diseases, $q = 1 - p$, e = precision

For a risk α of 5% and a confidence interval of 95%, let $Z = 1.96$ and $e = 5\%$.

A study by Calixte et al. in a neurology clinic in Yaoundé found a hospital prevalence of neurological conditions of 20.15%. We used this value to estimate our minimum sample size, i.e. $p = 20.15\%$.

Data analysis

The data from the questionnaires were entered into and analysed with Statistical Package for Social Sciences (SPSS) software version 23.0. The graphs were designed using the same software. Categorical variables were presented in counts and percentages. Scale variables were presented in means and standard deviations. The Chi-square (χ^2) test was used to test the statistical significance of the difference between proportions. The student t-test for independent samples was used to compare means. The significance threshold was set at 5%. A p-value of less than 0.05 was therefore considered statistically significant.

Ethical considerations

The authors certify that all the procedures used for the elaboration of this work comply with the standards of the competent national and institutional committees on human experimentation, and with the Helsinki's Declaration of 1975 revised in 2008. The entire procedure was approved by the Institutional Ethics and Research Committee (IERC) of the Faculty of Medicine and Biomedical Sciences of the University of Yaoundé I (Ref: N°07/UYI/FMSB/VDR/CS on 28/04/2022). Authorisations were obtained from the General Management of the hospitals concerned (YCH and BRH) and all information obtained was kept confidential.

RESULTS

Socio-demographic characteristics of the population

The mean age in our general population was 5.26 ± 18.56 years, 50.75 ± 19.8 years in the HRB group and 51.75 ± 17.4 years in the HCY group. The overall population was predominantly female (50.70%), with an F/H sex ratio of 1.03:1. Married people were more represented (56.7%). (Table I)

Table I: socio-demographic characteristics

Variables	HCY n (%) N=252	HRB n (%) N=237	Total n (%) N= 489
Age (years)	51.75 ± 17.375	50.75 ± 19.758	51.26 ± 18.556
Sex			
M	116(46.0)	125(52.7)	241(49.3)
F	136(54.0)	112(47.3)	248(50.7)
Marital status			
Single	77(31.0)	61(25.7)	138(28.5)
Married	132(53.2)	143(60.3)	275(56.7)
Divorced	7(2.8)	1(0.4)	8(1.6)
Widower	32(12.9)	32(13.5)	64(13.2)

Clinical profile and classification of neurological disorders

Medical history and co-morbidities

The proportion of known nervous system disorders was dominated by epilepsy (3.6% vs. 1.7%), with no significant difference between the two groups. Arterial hypertension was predominant in both groups, 47.6% vs. 45.6%. However, patients in the YCH group had a greater history of stroke ($p < 0.001$) and HIV infection ($p < 0.001$), while those in the BRH group had a higher frequency chronic alcoholism ($p < 0.001$). The frequency of HIV infection at the YCH (23.4%) was significantly higher than that observed at the BRH (6.3%) (Table II).

Table II: Distribution of the frequency and types of previous nervous system pathologies in the population

Variables	HCY n (%) N= 252	HRB n (%) N= 237	Total n (%) N=489	p value
Different nervous system pathologies				
Epilepsy	9(3.6)	4(1.7)	13(2.7)	0.156
Dementia	6(2.4)	0(0.0)	6(1.2)	0.018
Parkinson's disease	4(1.6)	0(0.0)	4(0.8)	0.070
Psychiatric disorders	5(2.0)	3(1.3)	8(1.6)	0.396
Comorbidities				
Previous stroke	44(17.5)	10(4.2)	54(11.0)	< 0.001
Hypertension	120(47.6)	108(45.6)	228(46.6)	0.552
HIV infection	59(23.4)	15(6.3)	74(15.1)	< 0.001
Diabetes	25(9.9)	26(11.0)	51(10.4)	0.408
Chronic alcoholism	22(8.7)	44(18.6)	66(13.5)	0.001
Neoplasia	5(2.0)	0(0.0)	5(1.0)	0.036
Tobacco	40(15.9)	23(9.7)	63(12.9)	0.028

Presenting complaint

The three main presenting complaints were motor deficit (40.9% vs. 35.4%), altered consciousness (30.6% vs. 43.0%; $p = 0.003$) and headache (28.6% vs. 43.0%). ($p = 0.008$). (Table III)

Table III: Distribution of presenting complaints in the population

Variables	HCY n (%) N=252	HRB n (%) N=237	Total n (%) N=489	p value
Presenting complaints				
Motor deficit	103(40.9)	84(35.4)	187(38.2)	0.127
Impaired consciousness	77(30.6)	102(43.0)	179(36.6)	0.003
Headache	72(28.6)	75(31.6)	147(30.1)	0.260
Convulsion	37(14.7)	24(10.1)	61(12.5)	0.082
Falls from its height	11(4.4)	24(10.1)	35(7.2)	0.01
Agitation	14(5.6)	21(8.9)	35(7.2)	0.211

ICD-10 classification of neurological conditions

The ICD-10 classification showed that episodic and paroxysmal disorders were preponderant in both groups, but more in the YCH group (56.7%) than in the BRH group ($p=0.001$). The same was true of inflammatory diseases of the central nervous system, 29.4% vs. 15.2% ($p<0.001$). Non-neurological conditions and other nervous system conditions were less frequent in YCH than in BRH, at 3.6% vs 18.6% ($p<0.001$) and 4.0% vs 15.2% ($p<0.001$) respectively (Table IV).

Table IV: Distribution according to ICD-10 neurological disease classification

ICD-10 Classification of Neurological Conditions	HCY n (%) N=252	HRB n (%) N=237	Total n (%) N=489	p value
Episodic and paroxysmal disorders	143 (56.7)	114 (48.1)	257 (52.6)	0.034
Inflammatory diseases of the central nervous system	74 (29.4)	32 (13.5)	106 (21.7)	<0.001
Non-neurological conditions	9 (3.6)	44 (18.6)	53 (10.8)	<0.001
Other nervous system disorders	10 (4.0)	36 (15.2)	46 (9.4)	<0.001
Affection of the nerves, nerve roots and plexuses	2 (0.8)	6 (2.5)	8 (1.6)	0.123
Polyneuropathies and other disorders of the peripheral nervous system	2 (0.8)	3 (1.3)	5 (1.0)	0.471
Extrapyramidal syndromes and movement disorders	1 (0.4)	1 (0.4)	2 (0.4)	0.735
Other degenerative diseases of the nervous system	1(0.4)	0(0.0)	1(0.2)	0.515
Undetermined	10 (4.0)	1 (0.4)	11 (2.2)	0.007

Main neurological diagnoses in the total sample

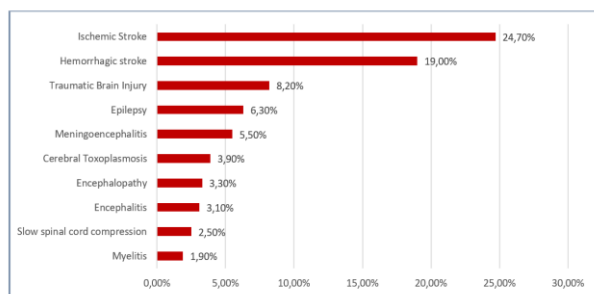


Figure 1: Distribution in the entire study population according to the 10 main neurological conditions diagnosed

The most commonly diagnosed conditions in the study population were stroke (43.7%), followed by traumatic brain injury (8.2%) and epilepsy (6.3%).

Top 10 diagnoses by hospital

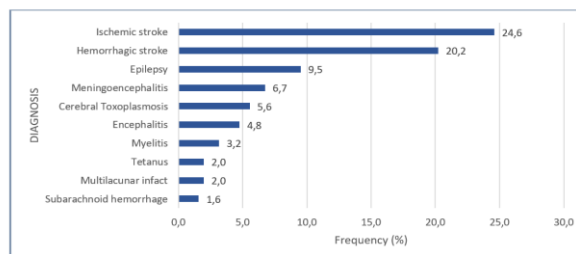


Figure 2: Top 10 neurological diagnoses at the YCH

The main neurological diagnoses at YCH were: ischemic stroke (24.6%), hemorrhagic stroke (20.2%) and epilepsy (9.5%).

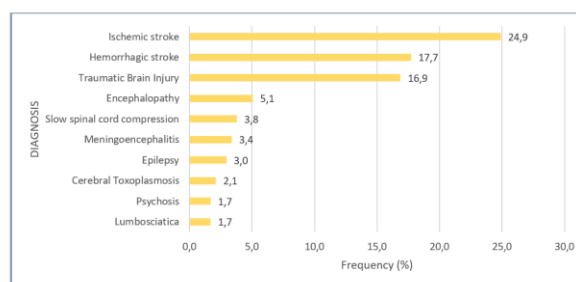


Figure 3: The 10 main diagnoses at BRH

The main neurological diagnoses at BRH were ischemic stroke (24.9%), hemorrhagic stroke (17.7%), and traumatic brain injury (16.9%).

Length of hospital stay

The average length of hospital stay was higher for patients admitted to the YCH than for those admitted to the BRH, i.e., 10.29 ± 6.46 days compared with 8.01 ± 5.45 days, respectively ($p<0.001$). A higher proportion of patients in our overall sample was discharged before 8 days, i.e., 46.2%, while 4.7% of patients remained hospitalised for more than 21 days. (Table V)

Table V: Distribution in the population according to length of hospitalisation

Variables	HCY n (%) N=252	HRB n (%) N=237	Total n (%) N=489	p value
Average length of hospital stay (in days)	$10,29 \pm 6,46$	$8,01 \pm 5,45$	$9,18 \pm 6,09$	<0,001
Length of hospital stay (in days)				
≤ 7	93 (36,9)	133 (56,1)	226 (46,2)	<0,001
8-14	109 (43,3)	81 (34,2)	190 (38,9)	0,025
15-21	36 (14,3)	14 (5,9)	50 (10,2)	0,002
> 21	14 (5,6)	9 (3,8)	23 (4,7)	0,241

Hospital mortality rate

The mortality rate was lower in YCH than in BRH, 7.5% versus 18.1% ($p < 0.001$).

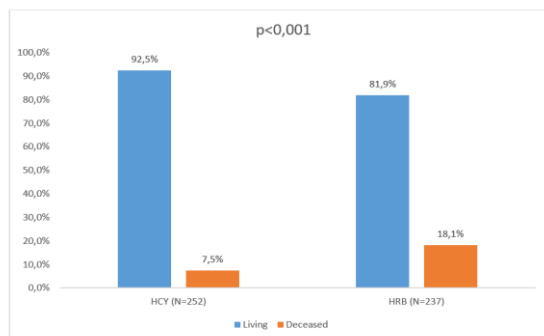


Figure 4: Distribution according to mortality rate

Patient outcomes

Most patients had a favourable outcome during hospitalisation (81.1% vs 79.9%). (Table VI).

Table VI: Distribution according to patients' outcome.

Variables	HCY n (%) N=233	HRB n (%) N=194	Total n (%) N=427	p value
Evolution				
Favourable	189 (81,1)	155 (79,9)	344 (80,6)	0,422
Stationary	38 (16,3)	38 (19,6)	76 (17,8)	0,225
Unfavourable	6 (2,6)	1 (0,5)	7 (1,6)	0,096

DISCUSSION

In our study, the mean age was 51.26 ± 18.56 . This age is close to that found by Doumbe et al. [6] in Cameroon, in 2019, who found a mean age of 48.67 ± 18.62 years. It is also very close to those obtained by Diallo et al. in Côte d'Ivoire in 2019 and Ossou-Nguiet et al. in Benin in 2013, which were 52.79 ± 18.12 and 49.7 ± 16.8 years respectively [4, 5]. However, it differs from that of Tegueu et al in Cameroon (44.83 ± 17.13). This disparity may be explained by the small size of our sample ($n=589$) compared with that of Tegueu et al ($N=912$) and also by its higher proportion of pupils/students (13.82%). Neurological conditions predominated in female patients (50.7%), with a F/H sex ratio of 1.03. This result is similar to those obtained by Tegueu et al. [8] 2013 in Cameroon who found a female predominance at 50.9% and a F/M sex ratio of 1.03. The predominance of women in our study may be due to the low level of physical activity among women and their rapid cessation of all activity after retirement age.

The frequency of known nervous system disorders was 8.3% and 2.5% in YCH and BRH respectively ($p=0.004$), dominated by epilepsy (3.6% vs 1.7%) and psychiatric disorders. This result is broadly similar to that of Sarfo et al. [9] in Ghana in 2016, who found epilepsy and dementia to be the two antecedents most frequently associated with NDs. The past histories most frequently found in the overall population were: hypertension (46.6%) and HIV infection (15.1%). These results are similar to those of

Mapoure et al. [10] in Cameroon in 2018, who found arterial hypertension (41%), HIV infection (14.4%) and diabetes (11.68%) as the most frequent antecedents and those of Doumbe et al. in Cameroon, who found arterial hypertension (25.3%) and HIV infection (10.5%) as the main comorbidities.

Motor deficit was the most frequent presenting complaint (38.2%), followed by altered consciousness (36.6%) and headache (30.1%). These results are similar to those obtained by Mapoure et al [11] in Cameroon in 2018, who found motor deficit to be the most common disorder (17.8%). However, this result differs from that of Tegueu et al. in Yaoundé, Cameroon, in 2013, who found headache (28.7%), lower back pain (12%) and neck pain (10.8%). This difference can be explained by the difference in approach of our studies, with the Tegueu et al.'s study being carried out on outpatients.

The profile of neurological conditions revealed episodic and paroxysmal conditions as the most frequent in our study hospitals, accounting for 53.8%. Bongnso et al. [12] in Cameroon in 2012 also found episodic and paroxysmal conditions to be more frequent (47.4%) in a hospital study comparing neurological conditions at YCH and Douala General Hospital. This is also similar to the findings of Tegueu et al. in Cameroon, Diallo et al. in Côte d'Ivoire, and Sarfo et al. in Ghana, who all found a predominance of episodic and paroxysmal disorders of 46.48%, 64.44%, and 57.1%, respectively [3, 6, 13].

Stroke was the most frequently diagnosed pathology in our two study groups (43.7%), followed by head trauma (8.2%) and epilepsy (6.3%). This result is similar to that found by Mapoure et al [11] in Cameroon in 2018, i.e., stroke (30.02%) in the lead, headaches (13.33%), central nervous system infections (11.31%), and epilepsy (11.09%).

With regard to the diagnosis of NDs, the main differences observed in our study hospitals were: the frequency of epilepsy found in the YCH (9.5%), which was triple that of the BRH (3.0%), and the frequency of trauma in the BRH, where it was found exclusively (16.5%). These aetiologies were found to be the two main causes of epilepsy in a study by Njamnshi et al. [14] in 2013 in Cameroon.

The average length of hospital stay in our overall sample was 9.18 ± 6.09 , and 95.3% of patients were discharged within 21 days of hospitalisation. YCH patients had a significantly longer hospital stay than BRH patients (10.3% vs. 8%), $p < 0.001$. The mean length of hospital stay in our population differs from that obtained by Ossou-Nguiet et al. [5] In Benin, an average hospital stay was found to be 16.7 days. This difference may be explained by the difference between the overall size of our sample ($n=489$) compared with 139 cases in the study by Ossou-Nguiet et al.

The mortality rate in the overall population was 12.7%. This rate was significantly higher ($p < 0.001$) at the BRH (18.1%) than at the YCH (7.5%). The high mortality rate at the BRH could be explained by the difficulties encountered by patients in accessing care at this hospital, where the majority of patients came from rural areas (65.4%). The mortality rate in our overall population was similar to that found by Oussou-Nguiet et al. [5] in Benin and Mukendi et al. [15] in Congo in 2017, who found a mortality rates of 11.2% and 8.2% respectively. However,

this rate differs markedly from that obtained by Doumbe *et al.* in Cameroon, who found a mortality rate of 19.1% in a study conducted on a hospital population in four towns in Cameroon. This difference may be explained by the methodology of our study, which differs from that of Doumbe *et al.*, who included paediatric patients, and also by the significant difference in our sample sizes.

The outcome was favourable in 80.6% of patients in our overall sample, and patients were discharged on medical advice in 85% of cases. These results are similar to those observed by Diallo *et al.* [4] in Côte d'Ivoire and Oussou-Nguet *et al.* [5] in Benin, with a favourable outcome in 69.8% and 82.8% respectively.

Limits of the study

Although our specific objectives were achieved, our study has certain limitations: firstly, the recruitment of cases in two settings 320 km apart posed logistical constraints and a significant cost to the investigators. These difficulties reduced the data collection time at the YCH and concentrated it at the BRH, where collection was particularly difficult due to an alphanumeric filing system for patient records. This difficulty reduced the size of our overall sample, which would have been larger and more representative of the population of each study site.

CONCLUSION

NDs predominated in female patients with an F/M sex ratio of 1.03 and a mean age of 51.26 ± 18.56 years. Motor deficit was the predominant presenting complaint and the main disease group was represented by episodic and paroxysmal disorders, with vascular aetiology also predominating in both groups. The overall outcome was favourable in our study population, and the death rate in BRH was more than double that in YCH.

DECLARATIONS

Conflicts of interest

We have no conflicts of interest to declare.

Authors' contributions

All authors participated in the design, data collection, data analysis, and writing of the manuscript. All authors approved the final version.

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The authors would like to thank the managers of the Bafoussam Regional Hospital and Yaoundé Central Hospital for allowing us to recruit participants from these hospitals under their responsibility.

Ethical approval and consent

The authors certify that all the procedures used for the elaboration of this work comply with the standards of the competent national and institutional committees on human experimentation, and with the Helsinki's Declaration of 1975 revised in 2008. The entire procedure was approved by the Institutional Ethics and Research Committee (IERC) of the Faculty of Medicine and Biomedical Sciences of the University of Yaoundé I (Ref: N°07/UYI/FMSB/VDRC/CSD on 28/04/2022). Authorisations were obtained from the General Management of the hospitals concerned (YCH and BRH) and all information obtained was kept confidential.

Financing

We have not received any funding for this study.

Data availability

The data presented in this article are available free of charge from the authors on request.

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