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Original Research Article

Frequency and Severity of Admission Hyperglycemia in Acute Stroke in Burkina Faso

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Abstract: ***Objective:*** To determine frequency and prognosis of stroke in patients with hyperglycemia in the acute phase at the Neurology department of Yalgado Ouedraogo Teaching University Hospital. ***Patients and methods*:** We conducted a 6 years cross-sectional study on acute stroke patients admitted in the neurology department of Yalgado Ouedraogo Teaching Hospital from 1st January 2011 to 30 June 2017. This study included only patients with hyperglycemia at admission (≥ 6.1 mmol/l). ***Results:*** The overall frequency of admission hyperglycemia was 7.27% with respectively 8 % in AIS and 6.1% in ICH. The overall mean age of patients with was 58.83 years. The majority of patients was male gender (52.6%). According to diabetes status, 70.8% of patients were known diabetics (39.4%), 31.4% new diabetics and 29.2% had stress hyperglycemia. The frequency of known diabetics was higher in AIS (p=0.000003) while stress hyperglycemia was most frequent in ICH (p= 0.0001). The majority of patients (74.5 %) had severe neurological deficit with NIHSS >15. Severe hyperglycemia (≥ 11.0 mmol/l) was present in 62.7% of patients. The majority of patients was treated with insulin (52.6 %) who was given alone mostly in AIS (p<0.05). Patients who did not received any treatment were in the group of ICH (p<0.05). The overall mean length of stay was 13.35 days. At discharge, 60.6% of patients were euglycemics. The overall mortality was 22.6% with higher mortality in ICH (p<0.05). At discharge, the majority of survivors (69.3%) had worse functional outcome (mRS>2). The factors influencing the mortality of AIS were known diabetes, severe hyperglycemia and no hypoglycemic agents (p<0.05). In ICH, the mortality risk factors were previous diabetes, glucose level (7-7.7 mmol/l) and t combined hypoglycemic agents. ***Conclusion:*** Admission hyperglycemia in stroke is rare in our context. Stress hyperglycemia is most common in ICH. Insulin treatment was mostly used. Mortality rate of higher both in AIS and ICH.

Keywords: Stroke, hyperglycemia, diabetes, Burkina Faso.

INTRODUCTION

Hyperglycemia is common in the early phase of stroke and all 30–60% of acute stroke patients are hyperglycemic at presentation [1-3]. There are early and late hyperglycemic phases in nondiabetic as well as diabetic patients. Thus, blood glucose levels rise in the first 12 hours of stroke and then decrease and stabilize within a few weeks. Several studies have found a detrimental effect of acute hyperglycemia on outcome from ischemic and hemorrhagic stroke [4-6]. Hyperglycemia associated with DM is a well-established risk factor for vascular disease. The effect of hyperglycemia at hospital admission on stroke outcome is of great interest to the neurologic research community. Studies evaluating the association of glycemia derangements and ICH are rare in comparison with other types of stroke[6, 7]. In Africa, studies according to hyperglycemia during acute phase of stroke were rarest, in Nigeria [8, 9]. In Burkina Faso, there are no data on the frequency and influence of admission hyperglycemia on clinical stroke outcome. Furthermore, the frequency of hyperglycemia in hemorrhagic stroke in Nigeria has not been clearly defined. The aim of this study was to determine the prevalence of hyperglycemia in stroke patients and to investigate the impact of hyperglycemia on in-hospital death among these patients.

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Patients and Methods

Study Design

We conducted a 6 years retrospective cross sectional study at Neurology Department of Yalgado Ouedrago University Hospital from January 2011 to June 2017 (Ouagadougou, Burkina Faso).

Study Population

We reviewed the data of 1884 stroke patients (1130 ischemic stroke and 754 hemorrhagic stroke) admitted in the Neurology Department during study period. Only patients with admission hyperglycemia were included in the study. Patients were designated as having hyperglycemia at admission if the first blood glucose value was ≥ 6.1mmol/l. Patients without 2 blood glucose measurements were not included in the study.

Assessments

The definition of Stroke was defined "rapidly developed clinical signs of focal (or global) disturbance of cerebral function lasting more than 24 hours, unless interrupted by surgery or death, with no apparent cause other than a vascular origin". We defined admission hyperglycemia as a blood glucose concentration ≥ 6.0 mmol/l (108 mg/dl), and severe hyperglycemia as blood glucose ≥11.1 mmol/l (200 mg/dl) [10]. Patients were subdivided into 3 groups according to history of diabetes mellitus, sugar and HbA1c levels: hospital-related hyperglycaemia (stress hyperglycemia), newly detected diabetes mellitus and known diabetes mellitus. Patients were considered to be diabetic (known or new detected) if they are fasting blood glucose ≥ 6.1 mmol/l with glycated hemoglobin more than 6.5%. Patients without history of diabetes in past and normal HbA1c level (≤6.5%) on presentation was labeled have stress hyperglycemia. Patients were grouped by stroke subtype and blood glucose concentration (6.2-6.9, 7.0-7.7, 7.8-11.0, and >11 mmol/l).

Study Data

The study data included sociodemographic data (age , gender, location, profession), history of diabetes mellitus (known diabetic, new detected diabetes mellitus, stress hyperglycemia), vascular risk factors, admission hyperglycemia level, stroke severity (NIHSS score), hyperglycemia treatment (insulin, oral hypoglycemic agent, others) and stroke outcome (mRS, mortality rate). These variables were calculated for both ischemic and hemorrhagic stroke, and further compared in ischemic and hemorrhagic stroke. The data collected were analyzed using the EPI Info software version 7. The Pearson Chi-square statistical test was used to compare the proportions.

Ethics Considerations

We are the authorization of the ethic committee of University Joseph Ki Zerbo and Yalgado Ouedraogo Teaching Hospital before study. We keep the confidentiality about patient's identity.

RESULTS

Hyperglycemia Frequency

During study period, 1884 stroke patients (1130 ischemic stroke and 754 hemorrhagic stroke) were admitted in the Neurology Department. One hundred and thirty-seven (7.2%) patients had admission hyperglycemia at acute phase of their stroke. Hyperglycemia was present in 91 (66.4%) patients with ischemic stroke and 46 (33.6%) with hemorrhagic stroke. First stroke patients accounted for 89.8% (n=123) of patients with hyperglycemia. The frequency of admission hyperglycemia between subjects with **AIS** and ICH was respectively 8% (91/1130) and 6.1% (46/754). The delay between stroke symptoms onset and admission in hospital was 3.65 days (Ranges 1 hour and 12 days). Seventy-four (54 %) hyperglycemic patients were admitted during the first 24 hours, 42 (30.6%) between 24-48 hours during 48 hours and 21 (15.3%) after 72 hours.

Sociodemographic features and vascular risks factors

The overall mean age of patients with hyperglycemia was 58.83 years, ranging from 26 to 81 years Patients with ischemic stroke were significantly older than patients with hemorrhagic stroke: 60.44 years versus 55.65 years ($p<0.005$). Older patients ≥ 60 years accounted for 43.79% (n=60) of stroke patients with hyperglycemia. They were significantly present in AIS than in ICH: 50.5% versus 30.4% (p=.0.00009). Male gender was predominating in stroke patients with hyperglycemia (52.6%). The frequency of male gender in ICH was significantly elevated than in AIS: 67.3% versus 45.1% (p= 0.004). Female gender was mostly frequent in AIS than in ICH: 54.9% versus 32.6% (p=0.0008).

Diabetes Status

According to diabetes status, 70.8% of patients with hyperglycemia were known diabetes mellitus (39.4%), 31.4% NDDM and the remaining (29.2%) had stress hyperglycemia. Of known diabetics (KDM), 31 (57.4%) were treated before admission with hypoglycemic agents. In patients with ischemic stroke and hyperglycemia, known diabetics accounted for 48.4%, news diabetics for 31.9 %. The frequency of KDM in AIS and sICH was respectively 48.4 % and 21.7 % (p=0.000003). The frequency of NDDM was marginally higher in AIS than in ICH: 31.9 %) versus 30.4 % (p=0.000001). Inversely, the frequency of stress hyperglycemia was higher in ICH than in AIS: 47.8% versus 19.8 % (p= 0.0001).

Others vascular risk factors

Hypertension was the most common vascular risk factors (75.2%) associated to diabetes status in stroke patients with hyperglycemia followed by chronic alcohol (40.9%) and dyslipidemia (32.1%). The frequency of hypertension in AIS and ICH was respectively 74.7% and 76.1% (p= 0.148).

Dyslipidemia, obesity and history of stroke were most common in AIS than in ICH ($p < 0.05$). The frequency of chronic alcohol, cigarette smoking and family diabetes was higher in ICH than in AIS ($p < 0.05$).

Clinical characteristics

At admission, 85.4% (n= 117) of patients with hyperglycemia had elevated blood pressure. The majority of stroke patients with hyperglycemia (74.5 %) had severe neurological deficit with NIHSS Score >15. The overall mean glucose was 12.3 mmol/L, ranging from 6.44 mmol/l to 56.79 mmol/l. The majority of stroke patients (62.7%) had severe hyperglycemia (≥ 11.0 mmol/l). His frequency in AIS and ICH was respectively 63.7% and 60.8% (p=0.06). Patients with glycemic level between 7.8-11.0 were mostly represented in sICH (23.9 %, p= 0.001) and those with GL between 7.0-7.7 in ICH (10.9 %, p= 0.000011). The Table II gives the distribution of patients according to glycemic level at admission.

Hyperglycemia Management

The majority of stroke patients was treated with insulin (52.6 %) and 40.9% with oral hypoglycemic agents. A total of 35 (25.6%) patients with hyperglycemia did not receive any corrective treatment, 20.9% in ischemic stroke and 34.8% in hemorrhagic stroke. Insulin alone the most common treatment in ischemic stroke with (37.4%) and oral hypoglycemic agents in hemorrhagic stroke (28.3%). Insulin and combined treatment were mostly used in ischemic stroke than in hemorrhagic stroke ($p <0.05$). Patients with hemorrhagic stroke did not received any corrective treatment ($p <0.05$). Table IV presents the antidiabetic treatment according to stroke subtypes.

Stroke outcome

The overall mean length of stay of stroke patients with hyperglycemia was 13.35 days. This duration was respectively 13.8 days for ICH and 12.78 days for AIS. During hospitalization stay, 83 (60.6%) patients normalized their glycemic level. There was no episode of hypoglycemia was found in our study. The overall mortality was 22.6% (n=31). According to diabetes status, the mortality rate was respectively 35 %, 18.6 % and 16.7% (p=0.000001). The mortality rate was 26.2% in patients with severe hyperglycemia (p=0.004). Comparatively to patients with ischemic stroke, patients with hemorrhagic stroke had elevated mortality rate (26. 1 % versus 20.9 %, p= 0.0001). According to hyperglycemia treatment, the mortality rate was respectively 23.9 in patients treated with insulin alone, 30 % with combined treatment and 26.9 % with only oral hypoglycemic agents. At discharge, 95 (69.3%) survivors had functional worse outcome according to modified ranking score (>2) and 54 (54.9%) had persistent hyperglycemia.

Analysis of mortality risk factors according to stroke sub-types

Among patients with ischemic stroke and hyperglycemia, previous diabetes mellitus, severe hyperglycemia and absence of hyperglycemia treatment were identified as mortality risk factors ($p<0.05$). In patients with ICH and hyperglycemia, those who had previous diabetes mellitus, glucose level (7-7.7 mmol/l) and treated with combined treatment had more risk of death. The tables IV and V gives the distribution of mortality risk factors according to glycemic level, history of diabetes mellitus and type of antidiabetic drugs among ischemic and hemorrhagic stroke patients.

Table I: Demographic and vascular risk factors according to stroke sub-types with hyperglycemia

Variables	Total sample (n=137)	AIS (n=91)	ICH (n=46)	P value
Age group (years)				
< 40	10 (7.3%)	6 (6.6%)	4 (8.7%)	0.000001
41- 50	22 (16.06%)	13 (14.3%)	9 (19.7%)	0.00000001
51-60	45 (32.85%)	26 (28.6%)	19 (41.3%)	0.000002
> 60	60 (43.79%)	46 (50.5%)	14 (30.4%)	0.00009
Gender				
Men	72 (52.55%)	41 (45.1%) 56.9	31 (67.3%)	0.004
Women	65 (47.45%)	50 (54.9%)	15 (32.6%)	0.0008
Diabetes status				
Known DM	54 (39.4 %)	44 (48.4 %)	10 (21.7 %)	0.000003
Newly detected DM	43 (31.4 %)	29 (31.9 %)	14 (30.4 %)	0.000001
Stress hyperglycemia	40 (29.2%)	18 (19.8 %)	22 (47.8%) 55	0.0001
Family Diabetes	11 (8%)	7 (7.7%)	4 (8.7%)	0.0000001
Others vascular risk factors				
Hypertension	103 (75.2%)	68 (74.7%) 66	35 (76.1%)	0.148
Chronic alcohol	56 (40.9%)	33 (36.3%) 58.9	23 (50%)	0.00015
Dyslipidemia	44 (32.1%)	33 (36.3%) 75	11 (23.9%)	0.0000001
Smoking	20 (14.6%)	11 (12.1%) 55	9 (19.6%)	0.00000001
Obesity	16 (11.7%)	11 (12.1%) 68.8	5 (10.9%)	0.0000001
History of stroke	14 (10.2%)	10 (11%)	4 (8.7%)	0.0000001

Table II: Level of glycemia and hyperglycemia treatment according to stroke subtype

Blood glucose (mmol /l)	Total sample (n=137)	AIS (n=91)	ICH (n=46)	P value
6.2- 6.9	9 (6.5%)	7 (7.7 %)	2 (4.3 %)	0.0000001
7.0- 7.7	13 (9.4%)	8 (8.8 %)	5 (10.9 %)	0.00001
7.8-11.0	29 (21.1%)	18 (19.8 %)	11 (23.9 %)	0.001
≥ 11.0	86 (62.7%)	58 (63.7 %)	28 (60.8%)	0.06
Hyperglycemia treatment				
Insulin	46 (33.6%)	34 (37.4%)	12 (26.1%)	0.00001
Combined	26 (19 %)	21 (23.1%)	5 (10.9 %)	0.00000001
Oral	30 (21.9%)	17 (18.7%)	13 (28.3%)	0.0000000000001
No treatment	35 (25.6%)	19 (20.9%)	16 (34.8%)	0.0000000000001

Table III: Mortality risk factors in stroke patients with hyperglycemia

	Total sample (n=137)	Mortality		P value
		Dead (n=31)	Alive (n=106)	
Glycemic severity at presentation (mg/dL)				
6.1-6.9	9 (6.57%)	1 (0.73%)	8 (5.84%)	
7.0-7.7	13 (9.49%)	1 (3.2 %)	12 (8.76%)	
7.8-11.0	29 (21.17%)	7 (22.6 %)	22 (16.06%)	
≥ 11.0	86 (62.77%)	22 (71 %)	64 (46.71%)	0.004
Glycemic group				
KDM	54 (100%) 16 ?7	9 (29 %)	45 (83.33%)	
NDDM	43 (100%) 18.6	8 (25.8%)	35 (81.4%)	
SH	40 (100%) 35	14 (45.2%)	26 (65%)	0.000001
Sub type of stroke				
AIS	91 (100%)	19 (61.3%)	72 (79.12%)	
SICH	46 (100%)	12 (38.7 %)	(73.91%)	0.0001
Hyperglycemia treatment				
Insulin	46 (33.58%) 23.9	11 (35.5 %)	35 (25.55%)	
Oral diabetic	30 (21.89%)	9 (29 %)	21 (15.32%)	0.003
Combined	26 (18.98%)	7 (22.6 %)	19 (13.87%)	
No treatment	35 (25.55%)	4 (12.9 %)	31 (22.63%)	

Table VI: Mortality risk factor AIS with hyperglycemia (n=91)

Parameters	Dead (n=19)	Alive (n=72)	P value
Glycemic (mg/dl)			
6.2-6.9	0	7 (100%)	0.0003
7.0-7.7	0	8 (100 %)	0.05
7.8-11.0	4 (22.2%)	14 (67.8 %)	0.001
≥ 11.0	15 (25.9%) 78.9	43 (74.1%)	0.0000000001
Diabete status			
Know DM	7 (15.9 %) 36.8 %	37 (40.66%)	0.0006
Newly detected DM	4 (13.8 %) 21.1%	25 (27.47%)	0.001
Stress hyperglycemia	8 (44.4 %) 42.1%	10 (10.99%)	0.01
Hyperglycemia treatment			
Insulinotherapy	6 (6.59%) 31.6 %	28 (30.77%)	0.002
Combined	5 (5.49%) 26.1%	16 (17.59%)	0.008
Oral antidiabetic	5 (5.49%) 26.1%	12 (13.19%)	0.005
No treatment	3 (3.3%) 15.8%	16 (17.58%)	0.0008

Table V: Mortality risk factors in ICH with hyperglycemia (n=46)

Parameters	Dead (n=12)	Survivors (n=34)	P value
Blood glucose level (mg/dl)			
6.1-6.9	1 (2.17%)	1 (2.17%)	0.009
7.0-7.7	1 (2.17%)	4 (8.7%)	0.0012
7.8-11.0	3 (6.53%)	8 (17.39%)	0.01
≥ 11.0	7 (15.22%) 58.3 %	21 (45.65%)	0.003
Diabetes status			
Know DM	2 (4.35%)	8 (17.39%)	0.0008
Newly detected DM	4 (8.7%)	10 (21.74%)	0.08
SH	6 (13.04%) 50%	16 (34.78%)	0.005
Hyperglycemia treatment			
Insulin	5 (10.87%) 41.7%	7 (15.22%)	0.07
Combined	2 (4.35%) 33.3 %	3 (6.53%)	0.0009
Oral antidiabetic	4 (8.69%)	9 (19.56%)	0.001
No treatment	1 (2.17%)	15 (32.61%)	0.05

DISCUSSION

Frequency of hyperglycemia in acute stroke

This glycemia cutoff point was convergent with other authors' reports. In the present study, the frequency of admission hyperglycemia in acute stroke (7.2%) was lower than observed in others studies in Africa Kossivi et al. in Togo (42;5%) [11], Tshituta et al in RD Congo (54.6%) [12] and Bouatay et al. in Tunisia (61%) [13]. With the regard to stroke subtypes, the frequency of hyperglycemia in AIS was 8 %, lower than those observed in Nigeria by Wahab *et al*., (34%) [8] in first acute ischemic stroke and Ogunrin et al (28%) [9] with a same cut off of 140mg/dl. This frequency was 6.1% in ICH with a lower frequency than in previous studies done by Shaikh (27.3%) using a fasting blood sugar of ≥120mgdl [14], Passero [15] in India (17 %). The frequency of hyperglycemia in stroke ranges from 6 to 50% from various studies due to differences in the definition of hyperglycemia, the time of glucose measurement and inclusion or exclusion of diabetic patients [16–20]. The relative fair frequency in our context could be explained by the fact that more than 54% of patients were admitted in the first 24 hours after stroke onset. Blood glucose levels seem to decline within the first 24 hours after stroke onset but they rise again after 24 to 88 hours, regardless of whether the patient has diabetes mellitus [21–23].

Sociodemographic characteristics and vascular risk factors

Patients with hyperglycemia were younger (mean age: 58.83 years) than in others studies, as in Egypt (64.5 ± 10.8 years) [24] and in DR Congo (60.1 ± 14.3 years) [12]. This difference could be explained by study profile, inclusions criteria's and hyperglycemia definitions. According to subtypes stroke, the mean age of ischemic stroke patients was 60.44 years, similar than in the study of Wahab in Nigeria (58.6 ±14.1 years) [8]. Diabetics were older than patients with stress hyperglycemia (mean age: 59.42 years versus 57.4 years, p=0.001). The majority of patients with hyperglycemia were male gender (52.6%), as in the study of Weshaby in Egypt (56.1%) [24].

Distribution of patients according to diabetes status

Hyperglycemia is a common problem in persons with diabetes mellitus after an acute stroke [25, 26]. History of diabetes was documented in 39.4 % of patients with hyperglycemia, higher than in the study of Drury (16%) [27]. The high frequency of diabetics in our context could be explained by the fact that a great number of known diabetics (42.6 %) were not treated before admission. The frequency of undiagnosed DM in this report was 31.4% of patients were diagnosed news diabetics, previously unrecognized diabetes mellitus. In ischemic stroke patients, the distribution of hyperglycemia according to diabetes status was similar than in the study of Staszewski *et al*., in which 40% of patients have known diabetes, about 33% have unrecognized diabetes, and the rest have transient hyperglycemia [28]. Stress hyperglycemia was mostly observed in ICH than in AIS: 47.8% versus 19.8 % (p= 0.0001). Stress hyperglycaemia is a common finding in patients presenting with intracerebral haemorrhage [29]

Use of Insulin

According to the international recommendations of the American Heart Association (AHA) and European Stroke Organization (ESO) guidelines on ischemic stroke management, seals patients with a blood sugar level higher than 10-11 mmol / l must benefit from an insulin treatment, namely 62.7% of patients in our series [30, 31]. In practice, only 52.6% of patients were treated with insulin, or around 83% of patients requiring insulin treatment. Insulin access seems better in our study than in Drury's in Australia (31%) [27]. In our context, we do not have hyperglycemia management protocols in our department, hence the systematic use of the advice of a dialectologist for the prescription of insulin. One of the barriers that has been observed in the implementation of updated protocols for the management of

hyperglycemia in patients with acute stroke is the fact that insulin infusions were not previously allowed in some stroke units [32]. Our study showed that insulin and oral insulin / anti-diabetic treatment were prescribed more during ischemic stroke than in hemorrhagic stroke. We do not have comparative data in the literature on the use of insulin in subtypes of stroke. This trend could be explained by the fact that stress hyperglycemia, which resolved itself, was more frequent during hemorrhagic stroke.

Stroke Prognosis

The overall length of stay for stroke patients with hyperglycemia was 13.35 ± 8.4 days, similar than in a previous study in Burkina (13 days) [33]. Ischemic stroke patients with hyperglycemia had a longer duration than those with hemorrhagic (13.8 days versus 12.78 days), in line with the study of Wang et al. in China [34]. The mortality rate of 22.6% in our sample is higher than observed Napon (20 %) in the same hospital for all subtypes of stroke [33]. The case fatality rate was higher in ICH because the majority of this patients had stress hyperglycemia. In addition, these patients were not treated with either insulin or oral hypoglycemic agents when they had a high blood sugar between 11 mmol and 56.79 mmol / l. The mortality rate from ischemic stroke in our study (20.9%) was lower than that observed in the Nigerian series, by Wahab (26%) [8], Osumtokum (28.4%) [35], and Komolafe (45%) [36]. The main predictors of mortality identified in our case were respectively stress hyperglycemia ($p = 0.000001$), blood sugar > 11 mmol / l ($p = 0.004$), hemorrhagic stroke ($p = 0.0001$) and treatment with insulin / oral hypoglycemic agents. Jorgensen and colleagues [37], in their large prospective Danish study found that plasma glucose level >11 mmol/L (>198 mg/dL) was associated with hospital mortality of 17% for non-diabetic patients, 24% for those with known diabetes and 32% for patients with hyperglycemia with no history of previous diabetes. For ischemic stroke, the main predictors of death were history of diabetes, severe hyperglycemia, and no treatment with insulin or oral hypoglycemic agents. In contrast, in hemorrhagic stroke, mortality was associated with a history of diabetes, glycemic level between 7-7.7 and combined treatment. There are no formal data to explain the specific mortality in patients with ischemic or hemorrhagic stroke and hyperglycemia on admission. Patients with no history of DM who had an ischemic stroke and moderately elevated glucose levels also had a threefold higher risk of short-term mortality and an increased risk of poor functional recovery compared with patients with lower glucose levels [38]. About 54.9% of patients had persistent hyperglycemia at discharge and predicts worse outcome. According to literature, patients with controlled hyperglycemia had significantly lower mortality rates than those with persistent hyperglycemia and similar rates as those with persistent euglycemia [39]. In contrast, an intensive management of hyperglycaemia in acute stroke is the risk of hypoglycemia, which may also be deleterious for the brain [40]. In our study, none patients had presented an episode of hypoglycemia. Insulin was administered subcutaneously three time per days in the totality of patients; There are no continuous monitoring of blood sugar in our context.

Study Limitations

This study is the first of its kind carried out in our context. This single hospital are several limitations related to its retrospective design. The definition of hyperglycemia in our study did not allow us to compare our results with those of other authors. This study included only patients with hyperglycemia. Not all drugs that could raise blood sugar could be reported, including glucose solutions, corticosteroids, and drugs containing dextrose. Radiologic data such as the size of the lesions, their location, and the presence of cerebral edema could not be reported. The protocol of insulin treatment, its duration and the delay of obtaining euglycemia were not possible in our study. We were unable to report the impact of hyperglycemia in stroke by comparing the patients with hyperglycemia and the others.

CONCLUSION

The frequency of hyperglycemia during the acute phase of stroke is low in our context. This comparative study found that stress hyperglycemia is common in patients with hemorrhagic stroke. Insulin is the primary treatment for hyperglycemia, especially in patients with ischemic stroke. Patients with hemorrhagic stroke tended not to take anti-diabetic medication. The mortality rate in stroke with hyperglycemia was comparable to that of studies in the African context. This study highlights the need for close collaboration between diabetologists and neurologists in the management of hyperglycemia in the acute phase of stroke.

Conflict of Interest: The authors do not declare any conflict.

Abbreviations

AIS: acute ischemic stroke
ICH: intracerebral hemorrhage
KDM: known diabetes mellitus
NDDM: New detected diabetes mellitus
SH: stress hyperglycemia

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