Stroke in type 2 diabetes mellitus patients admitted to emergency unit in Central African country (Congo): Preliminary findings[*]

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ABSTRACT

Background: The cardiovascular risk factors including type 2 diabetes mellitus (T2DM) are a public health problem in sub-Saharan Africa. The aim of this study is to determine the prevalence and factors associated with stroke in T2DM patients admitted to the emergency Unit in Brazzaville. **Patients and Methods:** This is the preliminary findings of a cross-sectional study including patients with T2DM, admitted in Emergency Unit of University Hospital of Brazzaville from January to April 2011. One hundred and seven patients were included. Sex ratio was 1.5. **Results:** The mean age was 60.3 ± 10.2 years (range 40 - 80 years). Stroke story was noted in 5 cases (4.6%). The main pathologies were metabolic complications (n = 51; 47.6%) and cardiovascular diseases (n = 36; 33.6%), dominated by stroke (17 cases). Epidemiological factors associated with stroke were high standard living (OR = 3, 95% CI: 1.02 - 8.9, p = 0.03), polypharmacy (OR = 3.7, 95% CI: 1.27 - 10.8, p = 0.01), previous hospitalization (OR = 3.1, 95% CI: 1.07 - 8.9, p = 0.03), and the absence of antiplatelet therapy (OR = 4.2, 95% CI 1.2 to 15, p = 0.03). Clinical associated factors were coma (OR = 3.3, 95% CI 1.14 to 9.6, p = 0.02) and the presence of severe hypertension (OR = 4, 95% CI: 1.2 - 12, p = 0.02).

Finally, prognostic factors were the transfer in intensive care unit (OR = 9.8, 95% CI: 2.7 - 34, p < 0.001). **Conclusion:** The first cardiovascular complication in patients with T2DM admitted in emergency at University Hospital of Brazzaville is stroke. Primary prevention in high-risk patients is still inadequate.

Keywords: Type 2 Diabetes Mellitus; Stroke; Emergency; Brazzaville

1. INTRODUCTION

The type 2 diabetes mellitus (T2DM) is a public health problem in sub-Saharan Africa (SSA) where its prevalence constantly increases and the complications of this disease become concerned [1]. The stroke represents a serious and frequent complication of T2DM because of its lethality, disability and relapse [2]. T2DM patient often has multiple risk factors, which lead to frequent occurrence of cardiovascular complications [1]. Thus, a comprehensive and efficient management of T2DM patients, includes the management of all risk factors. Several predictors of stroke have been described in black patient with T2DM. Among them, there is an increase in blood pressure, presence of infection, poor medical care, the addictions and occurrence of microvascular complications [3]. In SSA, the management of T2DM is difficult because of poverty, poor access to medical care, lack of equipment and qualified healthcare professionals [4,

[*]Competing interests: None.

5].

The aim of this study is to determine the prevalence and factors associated with stroke in T2DM patients admitted to the emergency Unit in Brazzaville.

2. PATIENTS AND METHODS

It is a cross-sectional study, conducted from January to April 2011 (4 months) in the emergency Unit of University Hospital of Brazzaville.

We included all patients admitted with a diagnosis of T2DM, with records including at least of standard boilogy, an electrocardiogram and chest X-ray. A CT scan performed within 48 hours was required for the diagnosis of stroke.

2.1. Variables Analyzed

They were epidemiological (age, sex, anthropometry, diabetes follow up, duration of diabetes, clinical history, outpatient treatment, adherence and reference), clinical (signs and diagnosis) and prognostic (transfer in intensive care unit and death).

2.2. Definitions

Obesity was defined as a body mass index greater than 30 kg/m^2. Polypharmacy was seen when taking more than three medications in outpatient treatment. Poor compliance was indicated by irregular intake of treatment. Reference represented patients addressed by a secondary health center. The high standard of living was based on occupation and monthly salary. Major hyperglycemia was defined when glycemia ≥5 g/L. Severe hypertension was defined when blood pressure ≥180/110 mm Hg.

2.3. Statistical Analysis

Data were treated with EPI INFO 3.3.2 software (CDC Atlanta, USA) and SPSS 10.0 for Windows (Chocago, IL, USA). Quantitative variables were expressed as mean and standard deviation, and qualitative staffing percentage. The chi-square test was used to compare qualitative variable and ANOVA for quantitative variable. The univariate risk of stroke was assessed in calculating Odds ratio (OR) with 95% confidence intervals (95% CI). Multivariates analyses such as logistic regression models were used to assess the independent determinants of stroke. The receiving operating characteristic (ROC) curve to predict stroke was plotted. The significance level was 0.05.

3. RESULTS

One hundred and seven patients were included. They were 65 women (60.7%), the sex ratio was 1.5. The mean age was 60.3 ± 10.2 years (range 40 and 80 years). The mean age by sex was 60.4 ± 9.8 years (range: 40 - 78 years) for women and 60.3 ± 11 years (range: 40 - 80 years) for men (p = 0.98). In ROC curve (**Figure 1**), age >62.5 ans to predict stroke (sensitivity 64.7%, specificity 57.8%) was no significant.

3.1. Epidemiological Status

High standard living was noted in 45 cases (42%), including 22 women (33.8%) and 23 men (54.8%). Patients were referred from a secondary health center in 26 cases (24.3%). The mean duration of T2DM was 7.6 ± 5.4 years (range 0 - 22 years), respectively 5 ± 7.7 years (range 0 - 2 years) for women and 7.6 ± 6 years (range 0 - 22 years) for men (p = 0.6). Duration of diabetes >10.5 years in ROC curve (**Figure 1**) was predicted stroke with sensibility 35.3% and specificity 74.4% (p = 0.048). The history of diabetes was known in 96 cases (90%), respectively 59 cases (90.8%) for women and 37 (88%) for men. Previous hospitalization was noted in 33 cases (30.8%). The distribution of patients by sex, duration of diabetes, poor adherence, polypharmacy and the number of medications is reported in **Table 1**.

Diabetes treatment included an oral antidiabetic alone in 63 cases (58.9%), insulin alone in 16 cases (15%) and both associated in 10 cases (9.3%). There wasn't diabetes treatment in 18 cases (16.8%).

A history of stroke was noted in 5 cases (4.6%). The antiplatelet therapy was ongoing in 13 patients (12.1%).

3.2. Clinical Features

The clinical signs presented by patients on admission are reported in **Table 2**.

Seventeen cases of cerebral ischemia divided in 16 constituted strokes and one transient ischemic attack
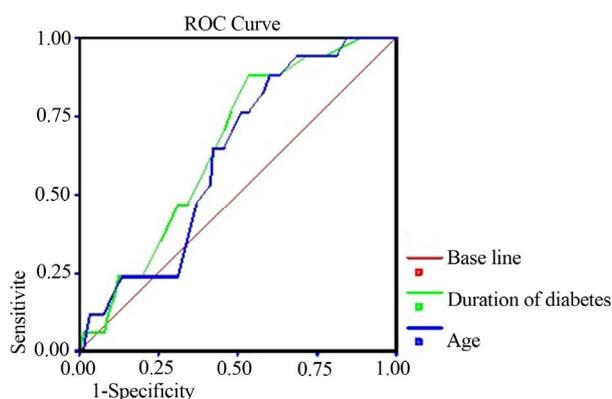
Figure 1. ROC curve of age and duration of diabetes to predict stroke. For age, area under curve (AUC) = 0.622 (95% CI: 0.497 - 0.747; p = 0.112). For duration of diabetes AUC = 0.652 (95% CI: 0.538 - 0.774).

Table 1. Sex distribution, monitoring of diabetes, poor adherence, polypharmacy, and the number of drugs being.

	Females (n = 65)	*Males* (n = 42)	*All* (n = 107)
Diabetes monitoring			
Although monitoring	26 (40)	12 (28.6)	38 (35.5)
Poorly monitored	33 (50.8)	24 (57.1)	57 (53.3)
Not followed	6 (9.2)	6 (14.3)	12 (11.2)
Poor compliance	26 (40)	15 (35.7)	41 (38.3)
Drug			
None	4 (6.2)	7 (16.7)	11 (10.3)
1	24 (36.9)	14 (33.3)	38 (35.5)
2	15 (23.1)	9 (21.4)	24 (22.4)
Polypharmacy	23 (35.4)	12 (28.6)	35 (32.7)

Table 2. Clinical signs listed in the admission of patients.

	n	%
Major hyperglycemia	45	42.1
Coma	37	34.6
Polyuri polydipsia signs	32	30
Fever	26	24.3
Dyspnea	23	21.5
Severe hypertension	17	15.8
Dehydration	17	15.8
Hemiplegia	15	14
Cough	13	12.1
Psychomotor agitation	12	11.2
State of shock	10	9.3
Convulsions	10	9.3
Hypoglycemia	10	9.3
Vomiting	7	6.5
Abdominal pain	7	6.5
Brief loss of consciousness	6	5.6
Heart rhythm disorders	5	4.6
Aphasia	3	2.8

Table 3. Synopsis of pathologies.

	n	*%*
Metabolic Complications	**51**	**47.6**
Decompensation of diabetes	28	26.2
Diabetic coma	16	**15**
Hypoglycemia	7	6.5
Cardiovascular disease	**36**	**33.6**
Stroke and transcient ischemic attack	17	15.8
Hypertensive encephalopathy	**11**	10.3
Heart failure	6	5.6
Arteriopathy	1	0.9
Infectious diseases	**26**	**28**
Bronchopulmonary infection	8	7.5
Diabetic foot	7	6.5
Gastrointestinal infection	5	4.7
Urinary tractus infection	2	1.9
Septicemia	2	1.9
Myositis	1	0.9
Erysipelas	1	0.9
Other	**1**	**0.9**
Uremic syndrome	1	0.9

able was independent determinant of stroke in logistic regression (**Table 5**). In ROC curve, only polypharmacy (**Figure 2**) was significant to predict stroke: sensitivity 58.8%, specificity 72.2% (p = 0.043).

The average duration in emergency unit was 32.5 ± 20 hours (range 12 to 96 hours). This duration was 47.4 ± 23.5 hours for patient with stroke vs 29.6 ± 18.5 hours for others (p < 0.001). A treatment in Intensive care Unit of University Hospital of Brazzaville was required in 13 cases (12.1%). Three cases of deaths were recorded (2.8%), including 2 cases of stroke (OR 11.8, 95% CI 1.01 to 139, p = 0.03).

4. DISCUSSION

4.1. Study Limitations

The study we conducted in an emergency unit, we were able to raise the profile of T2DM and other risk factors. It's a preliminary finding. The best would be to conduct a cohort study to determine the long-term prognosis. Indeed, glucose and blood pressure levels, recurrent stroke, readmissions and mortality are important to assess the real risk of morbidity and mortality. In addition, we had included the outcome of patients after orientation in intensive care unit or department of diabetology.

4.2. Epidemiological Aspects

The profile of our patients reflects the socio-demographic and epidemiological realities in SSA. Indeed, the low standard of living (58%), poor reference (24.3%),

were registered. It represents the first condition beyond those attributable to glycemic control (major hyperglycemia and hypoglycemia). All patients with cerebral ischemia were hypertensive (p < 0.0001) and were know diabetics (p = 0.06). The mean age of patients with stroke was 64.2 ± 7.8 years vs 59.6 ± 10.5 for other patients (p = 0.09). The mean duration of diabetes in patients with stroke was 9.7 ± 4.8 years vs 7.2 ± 5.4 years for other (p = 0.04). Diabetes follow up was regular in patients with stroke in 12 cases (70.6%) vs. 26 cases (28.9%) for others (p < 0.01).

The distribution of the main diseases is reported in **Table 3**.

Table 4 shows univariates Odds of stroke. Any vari-

Table 4. Univariates factors associated with stroke.

	Stroke (n = 17)	Without stroke (n = 90)	OR	95% IC	p-value
Epidemiological aspects					
Female	12 (70.6)	53 (58.9)	1.67	0.54 - 5.1	0.26
Age >75 years	3 (17.6)	9 (10)	1.92	0.46 - 8	0.19
High standard of living	11 (64.7)	34 (37.8)	3.01	1.02 - 8.9	0.03
Polypharmacy	10 (58.8)	25 (27.8)	3.7	1.27 - 10.8	0.01
History of stroke	2 (11.8)	3 (3.3)	3.86	0.59 - 25	0.1
Anterior hospitalization	9 (52.9)	24 (26.7)	3.09	1.07 - 8.9	0.03
Without antiplatelet	5 (29.4)	8 (8.9)	4.2	1.2 - 15	0.03
Poor compliance	5 (29.4)	36 (40)	0.6	0.2 - 1.9	0.29
Clinical aspects					
Obesity	16 (94.1)	70 (77.8)	4.5	0.5 - 36	0.06
Severe hypertension	6 (35.3)	11 (12.2)	4	1.2 - 12	0.02
Coma	10 (58.8)	27 (30)	3.3	1.14 - 9.6	0.02
Major hyperglycemia	3 (17.6)	42 (46.7)	0.24	0.06 - 0.91	0.01
Prognosis					
Transfer in intensive care unit	7 (41.2)	6 (6.7)	9.8	2.7 - 34	<0.001

Table 5. Independents determinants of stroke by logistic regression.

Independant variables	β coefficient	Standard error	Wald X^2	OR (95% CI)	p-value
Age (years)	0.026	0.047	0.559	1.02 (0.93 - 1.12)	0.575
Age >75 years (yes vs no)	−0.274	1.418	−0.382	0.58 (0.03 - 9)	0.701
Duration of diabetes	0.042	0.081	0.519	1.04 (0.88 - 1.22)	0.603
Anterior hospitalization (yes/no)	1.138	0.92	1.237	3.12 (0.51 - 19)	0.216
Coma (yes vs no)	2.069	1.159	1.784	7.92 (0.81 - 76)	0.074
Major glycemia (yes vs no)	−14.59	253.8	−0.05	$<0.01 (0 - >10^5)$	0.954
Severe hypertension (yes vs no)	1.001	0.842	1.188	2.72 (0.52 - 14)	0.234
HSL (yes vs no)	1.247	0.777	1.605	3.48 (0.75 - 15)	0.108
Obesity (yes vs no)	1.27	1.229	1.033	3.56 (0.32 - 39)	0.301
Polypharmacy (yes vs no)	0.734	0.855	0.858	2.08 (0.38 - 11)	0.39
Transfert intensive care (yes/no)	14.23	253.8	0.056	$>10^5 (<10^5 - >10^5)$	0.955
Sex (male vs female)	−1.464	0.875	−1.672	0.23 (0.04 - 1.28)	0.094

HSL: High standard of living.

poor adherence (64.5%), demonstrate the realities of management of cardiovascular disease in our environment [6].

Among metabolic complications, glycemic imbalance was found in 51.4% of cases and 42.1% of major hyperglycemia. It is recognized that the major hyperglycemia is pejorative in the acute stage of cardiovascular complications of T2DM [7]. It plays also a role in the early development of complications [8]. The specificity of this major hyperglycemia in the black people is the presence of ketosis, thus defining the ketosis prone T2DM [1,9]. The others complications is represented by hypoglycemia (9.3%). It is often secondary to poor adherence to treatment, but also the low status and illiteracy [6].

Associated pathologies, we identified cardiovascular disease with stroke in the foreground and infectious diseases. There were mainly represented by the bronchopulmonary infections and diabetic foot. The diabetic foot is often mixed in our context with a tricky treatment, sometimes leading to amputation in 20% of cases according to Longo-Mbenza *et al*. [10] and 43% reported by Monabeka *et al*. [11].

4.3. Stroke

Cardiovascular complications were mainly represented by stroke (15.8%) and hypertensive encephalopathy (10.3%). Any studied factor was independent determinant of stroke in our study. Many factors were commonly independently associated with ischemic stroke in T2DM patients [12]. Arboix *et al*., identified hypertension, atrial
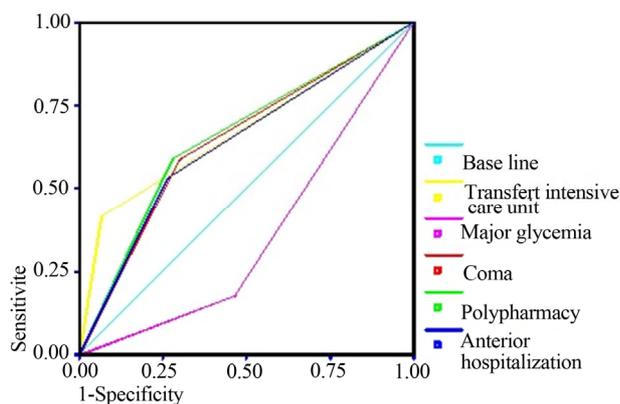
Figure 2. ROC curve to predict stroke for polypharmacy (AUC = 0.655; 95% CI: 0.508 - 0.803) Coma (AUC = 0.644; 95% CI: 0.497 - 0.791; p = 0.06) severe hypertension (AUC = 0.615; 95% CI: 0.457 - 0.774; p = 0.133) anterior hospitalization (AUC = 0.631; 95% CI: 0.481 - 0.782; p = 0.07).

fibrillation, congestive heart failure, and valvumopathy was causes of stroke [12]. The female sex was significantly associated with stroke and mortality [12]. This aspect was not significant in our study. According to Mbanya *et al.*, the prevalence of cardiovascular complications varies from 4 to 28 in diabetes, and 15% of patients with stroke have diabetes, and 5% of diabetes develop stroke [1]. In our series, the number of stroke appears to be limited, because we included only patients who had realized the CT brain scan. However, in Brazzaville, 50% of hypertensive emergencies are represented by stroke [13]. The diagnosis of stroke remains difficult in SSA. Indeed, the lack of equipment and qualified healthcare professionals limit the diagnosis and management [5]. It is certain that the achievement of CT scan improves the initial emergency treatment and prognosis [14]. The poor glycemic control in patients contributes to the early onset of complications including stroke [8], and alters the prognosis [7] what motivated the transfer resuscitation in a large number in our series. In addition, the social level of patients limit access to care [6]. In our series, stroke is univariate factor of mortality in T2DM patients. In addition, stroke is the leading cause of cardiovascular emergencies at University Hospital of Brazzaville [15]. Given these aspects, primary prevention using the lifestyle measures involving diet and physical activity reduces the risk of occurrence of complications especially stroke [16,17]. In primary prevention, the occurrence of diabetes is significantly lower in subjects with regular physical activity in addition to appropriate diet [16].

5. CONCLUSION

The risk of stroke is higher in T2DM. Given the difficulties of management of cardiovascular risk factors in sub-Saharan Africa, an active primary prevention would

not only lessen the cost of treatment, but also reduce the occurrence of complications.

6. ACKNOWLEDGEMENTS

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