

# Ischemic Stroke in Women Admitted in a Tertiary Hospital in Burkina Faso

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## Abstract

**Objective:** The objective of this study is to determine the characteristics of ischemic stroke in Women and to compare vascular risk factors, stroke severity and clinical outcome between patients aged under and older 50 years in a tertiary hospital in Burkina Faso.

**Methodology:** We conducted a cross sectional retrospective study on ischemic stroke in adult female patients (≥15 years) admitted in the neurology department of youth from January 1, 2008 to December 31, 2017.

**Results:** During study period, ischemic stroke accounted for 57.6% of all stroke. The mean age of women was of 58.88 (± 17.13) years. About 72.2 % of women was aged over 50 years. Hypertension was the most vascular risk factors (69.7%), followed by dyslipidemia (33.6%) and alcohol consumption (32.7%). Oral contraception pills (8.5%) was the most sex related factors followed by migraine (4.6%) and pregnancy or post-partum state (1.8%). The delay of arrival at emergency department was 4.69 days. At admission, 68% of women had severe neurological deficit (NIHSS ≥ 15). The most common causes of stroke were large vessel disease (37.7%), cardio embolic stroke (20%) and small vessel disease (9.5%). Length of stay was 14.21 days with 15.1% of mortality. Functional outcome at discharge was worse (mRS>2) in 79.6% of women. After bivariate analysis, hypertension, tobacco use, physical inactivity and diabetes mellitus were most frequent in older women (p=0.0001). Oral contraceptive pill, migraine, HIV and pregnancy were most frequent in young women (p<0.05).

**Conclusion:** There was a long delay between stroke onset and hospital admission. Hypertension was the most vascular risk factor in older women. The majority of women had severe stroke at admission and worse outcome at discharge.

**Keywords:** Ischemic stroke; Women; Stroke risk factors; Prognosis; Burkina Faso

## Introduction

Stroke is emerging as a leading cause of preventable death and disability worldwide [1]. Stroke is the first cause of death for women in France [2] and 60% of all stroke deaths involve women in Unites States [3]. If male sex has been considered a risk factor for stroke, females have a higher lifetime risk for stroke, are more likely to experience recurrent stroke, and are more likely to have more severe strokes [3]. Cohort studies indicate that women and men have differences in risk factor profiles [4,5] stroke presentation [4-6] and stroke etiology [7]. Women under age 50 are generally considered to have a lower incidence and prevalence of stroke than men [8]. With the exception of subarachnoid haemorrhage, there is little evidence of sex differences in stroke subtype. While Africa appears to have the highest incidence, prevalence and case fatality of stroke [9-12], there are few studies regarding stroke in women [13-15]. In Burkina Faso, there is no adequate data on ischemic stroke in Women. The objective

of this study is to determine the characteristics of ischemic stroke in Women and to compare vascular risk factors, stroke severity and clinical outcome between patients aged under and older 50 years in a tertiary hospital in Burkina Faso.

## Methodology

### Study area

Burkina Faso is a French speaking country in West Africa region. It covers an area of 274,200 square kilometers with an estimated population of 19,632,147 inhabitants in 2017. The country currently has 5 national Teaching University hospitals, including the first, the Yalgado Ouedraogo hospital in Ouagadougou. In this hospital, stroke management is provided by the emergency department, the resuscitation unit, the neurology department and the cardiology department. The neurology department consists of 3 neurologists and 15 residents in neurology. Its capacity of reception is of 23 beds.

## Study profile

We carried a cross-sectional study at neurology department of Yalgado Ouedraogo University teaching hospital during the period from 1 January 2008 to 31 December 2017.

## Population selection

Adult women patients ( $\geq 15$  years) were included in this study. Women were classified into young women (15-49 years) and old women ( $\geq 50$  years). Women with incomplete medical records were not included in this study.

## Assessments

The risk factors of stroke were defined in terms of hypertension, diabetes mellitus, physical inactivity, obesity, migraine, HIV infection, pregnancy, dyslipidemia, alcohol and tobacco consumption, ischemic heart diseases, valvular heart disease, history of transient ischemic attack or stroke, smoking and oral contraceptive pill. Hypertension was diagnosed if the patient had a history of hypertension, or if the blood pressure exceeded 140 (systolic) and/or 90 (diastolic) mmHg during hospitalization, or if the patient was receiving antihypertensive drugs. Diabetes Mellitus was diagnosed based on history and fasting serum glucose levels (110 mg/dl), or if the patient was receiving insulin or hypoglycemic drugs. Stress hyperglycemia was defined if patient had glycemic level  $>6.1$  mmol/l at admission. Hyperlipidemia was defined as fasting total blood cholesterol  $\geq 5.65$  mmol/L (2.20 g/L) and/or LDL-cholesterol  $\geq 4.1$  mmol/L (1.6 g/L) and/or triglyceride  $\geq 1.6$  mmol/l (1.35 g/L). Alcohol users were categorized into current users (users of any form of alcoholic drinks). Smoking was defined if patient say his smoking 10 cigarettes/day. Anemia was defined as hemoglobin levels 11 g/dl. Neurological deficit was defined as severe if NIHSS  $>15$ . Some investigations like brain CT, cervical ultrasound and Lipid profile were done in all cases. In some selected cases blood sugar, ECG, Echocardiography, lumbar puncture with CSF analysis, VIH test were done. We used the criteria of the NASCET, et al. [16] to define the degree of carotid stenosis in 3 categories ( $<50\%$ ;  $50-69\%$ ;  $>70\%$ ). Stroke was attributed to pregnancy or postpartum state if it happened during pregnancy or within 1 month after delivery. The stroke mechanism was classified into 5 categories according to the TOAST criteria: (1) small-vessel occlusion, (2) large-artery atherosclerosis (LAA), (3) cardioembolism, (4) stroke of other determined etiology, (5) stroke of undetermined etiology. The outcome was classified according to the modified Rankin score (mRS).

## Data collection and analysis

**Data collection:** Data were collected through a questionnaire by doctoral student in medicine and verified by us before inclusion. Questionnaires were checked for the completeness of information by us. The variables considered were socio demographic data (age, gender, profession, marital statuses, and residence), clinical data (complaints at admission, vascular risk factors, blood pressure at admission, stroke severity (Score de Glasgow, NIHSS at admission, Rankin score at discharge), paraclinical data (stroke subtype, stress hyperglycemia, lipid profile, presence of athermanous plaque at cervical ultrasound, abnormalities at electrocardiogram and echocardiography), therapeutic data (anticoagulant agents, antiagregant agents, statins).

**Data analysis:** Once the information was found to be complete, then it was fed into Epi-Info version 7.2.2.6 for data analysis. Mean and percentages were analyzed by Chi-square tests for large numbers and the exact Fischer test for small numbers. The test is considered statistically significant for  $p$  less than 0.05.

## Results

### Stroke subtype in women

During study period, 493 women were admitted in neurology department for acute stroke. Among them, 284 (57.6%) had ischemic stroke, 194 (39.4%) hemorrhagic stroke and 15 (3%) cerebral venous thrombosis. Our study was based on ischemic stroke.

### Sociodemographic characteristics

The mean age of women was  $58.88 (\pm 17.13)$  years, ranges [16, 106 years]. Of them, 79 (27, 82 %) were aged  $<50$  years and 205 (72, 18 %) were aged  $\geq 50$  years. Ninety three (30.8%) were aged 75 years and over. According to occupation, housewives was most represented in 69.4 % ( $n=197$ ), followed by salaries in 22.9% ( $n=65$ ) and students in 7.7% ( $n=22$ ). The majority of women was married in 71.8 ( $n=204$ ) and lived in urban area in 80.3 % ( $n=228$ ).

### Vascular risk factors

Hypertension was the most sex-non-specific modifiable risk factors accounting for 69.7% of cases, followed by dyslipidemia (33.6%) and alcohol consumption (32.7%). According to sex-specific risk factors, oral contraceptive pill, migraine and pregnancy or post-partum state was respectively present in 25(8.5%), 13(4.6%) and 5(1.8%) patients. Twenty (7%) women had history of cesarean delivery and 4(1.4%) history of hysterectomy. After bivariate analysis, hypertension, tobacco use, physical inactivity and diabetes mellitus were most frequent in older patients ( $p=0.0001$ ) while oral contraceptive pill, migraine, HIV infection and pregnancy were most frequent in young patients ( $p<0.05$ ).

### Clinical characteristics

The delay between stroke onset and admission at ED was 4.69 days, ranges [1, 30 days]. All the patients were admitted after thrombolysis delay (4h 30mn). Seventy women (24.7%) were admitted within 24 hours of stroke onset, 91(32%) within 72 hours and 123(43.3%) after 72 hours. There was no difference between the two group ( $p=0.8992$ ). The main complaints at admission was motor deficit in 284 (100%) women, language disorders in 179 (63%) and consciousness disorders in 57(20%). One hundred and ninety eight (69.7%) were hypertensive at admission. According to WHO classification, 93(32.8%) had grade 1, 72(25.4%) grade 2 and 32(11.3%) grade 3. Hypertension class 2 was associated to older age ( $p=0.0219$ ). The mean BMI score was  $26.67 \pm 14$  kg/m<sup>2</sup>. Thirty three (11.6%) women had severe obesity ( $p=0.8112$ ). The mean NIHSS score was 14.77 points. One hundred and ninety three (68%) patients had severe neurological deficit (NIHSS  $\geq 15$ ). Mostly in the group of older patients ( $p=0.6321$ ).

### Investigations

Brain CT was performed in a delay of  $2.06 \pm 0.7$  days after stroke onset (Ranges 1-5 days). The middle cerebral artery was the most represented (71.5%), followed by cerebral anterior artery (25.7%) and posterior circulation stroke (14.4%). There was significant link between involvement in ACA and old age ( $p=0.0424$ ). According to lipid profile, 95(33.5%) women had dyslipidemia. Among them, 30(10.56 %) had high level Cho (Total Cholesterol), 25(8.8%) had high level of LDL c and 20( ) had high level of TG. There was no difference between lipid profile and age group ( $p>0.05$ ). Blood glucose was measured in 207(72.9%) patients. Of whom, 110(53.1%) women had stress hyperglycemia ( $>6.1$  mmol/l). Stress hyperglycemia was most common in older patients than in young patients ( $p=0.0095$ ). Forty nine (17.25%) women had severe extra cranial carotid

stenosis ( $\geq 70\%$ ). There was no significant link between carotid stenosis and age group ( $p=0.74$ ). Of 119(42%) women who had done Electrocardiography (EKG), 47(39.5%) had left atrial hypertrophy, 32(26.9%) had left ventricular hypertrophy and 24(20.2%) had atrial fibrillation (9%). Of one hundred and sixty three (57.4%) women who had done transthoracic echocardiography, 73(44.8%) had ischemic cardiomyopathy, 49(30%) had hypertensive cardiomyopathy and 41(25.2%) had valvulopathy. There was significant link between the distribution of these lesions and old age ( $p=0.0402$ ). According to TOAST Classification, large vessel disease was the most finding (37.7%), followed by unknown cause (25.4%) and cardio embolic cause (20%). Others causes and small vessel disease (sVD) accounted respectively for 9.5% and 7.1% of cases. The distribution of stroke subtypes among young women was dominated by large vessel disease (30.4%) followed by cardio embolism stroke (19%), unknown causes (17.7%), others causes (16.5%). There was significant link respectively between Large vessel disease (LVD) and older age ( $p=0.0462$ ), others causes and young age ( $p=0.0159$ ).

### Treatment and in-hospital outcome

The main treatment was antiagregant agents (94%), stat in (87%), and antidepressive agent or anticoagulant (51.7%). The mean length of stay was 14.21 days (ranges 1-31 days). Physiotherapy was performed in 257(90.50%) women during hospitalization. Functional outcome at discharge was worse (mRS  $>2$ ) in 226(79.6%) women. There was significant difference between the two group ( $p=0.204$ ). Post stroke pneumonia was the most common complication (20%) followed by urinary tract infection (10.9%) and cutaneous infection (6%). In hospital mortality rate was 15.14%. Post stroke pneumonia was most frequent older patients ( $p=0.0234$ ).

### Discussion

Among women, ischemic stroke was the most prevalent stroke subtype with similar prevalence (57.6%) than in a study from Sudan (59.2%) [14].

### Sociodemographic characteristics

The mean age of women with ischemic stroke ( $58.88 \pm 17.13$  years) was similar than in others stroke studies in Africa, particularly in Nigeria ( $55.6 \pm 12.4$  years) [15] and in Senegal (63 years) [17]. This two studies concerned all stroke subtype in women. The age of women with ischemic stroke is elevated in Spain ( $76.02 \pm 12.93$  years) [18], in Brazil (71.5 years) [19] and in France (72.9 years) [17]. The younger age of women could be explained by the low life expectancy in our context. The majority of ischemic stroke (72.2 %) occurred in older patients, in line with the study of Leonardo in Brazil [19].

### Vascular risk factors

Hypertension was the most vascular risk factor in women with ischemic stroke (69.71%). Similar descriptions were observed by Caso V, et al. [18] in Spain (75%), Forster (83.8%) [20], and Musa in Nigeria (83.3%) [15]. The prevalence of Diabetes mellitus was lower than in the study of Gu in China: 15.9% versus 24.3% [21]. According to age group, hypertension and diabetes mellitus had significant role in the developing of ischemic stroke in older women, in concordance with several studies [22-24]. In contrast, oral contraceptive pills had significant role in developing of ischemic stroke in young age, as in literature [24]. The use of Contraceptive pills in young women was relatively less common in our study (8.8%) than in a study from Senegal (20.8%) [13]. HIV infection was identified as vascular risk factor. The increase in stroke risk was most pronounced in HIV-infected women

and in younger age groups [25]. In our study, there was significant link between HIV and young age in the development of ischemic stroke in young women in our context (Tables 1 and 2).

### Symptomatology

According to time arrival at ED, all the patients were admitted after thrombolysis delay (4h 30mn). This observation was consistent with several studies witch report longer times from symptom onset to emergency department (ED) arrival for women [26-28]. About seventy percent of women had severe stroke at admission (NIHSS $>15$ ), higher than in the study of GU (6.9%) [21] and Ong (20.9%) [29]. Women had higher NIHSS at admission (14.77) than in Spain ( $9.4 \pm 6.94$ ) [18] and China ( $5.4 \pm 5.6$ ) [21]. The high severity of stroke in Women could be explained by many factors, as socio-financial constraints, problem of transportation and absence of pre-hospital care facilities for stroke patients.

### Stroke investigations

Stroke investigations available in all our patients. The biological assessment had found that stress hyperglycemia was prevalent in women at admission (53.1%). In our study, women aged over

**Table 1:** Distribution of patients according to their delay of arrival at ED (N=284).

Delay of arrival at ED (hours)	Study population (N=284)	Age group (years)		P value
		<50 (n=79)	$\geq 50$ (n=205)	
4h30	0	0	0	
24	70(24.7%)	23(29.1%)	47(22.9%)	0.3521
24-48	57(20 %)	12(15.2%)	45(22%)	0.2672
48-72	34(12%)	06(7.6%)	28(13.7%)	0.2276
>72	123(43.3%)	38(48.1%)	85(41.5%)	0.3799

**Table 2:** Distribution of patients according to stroke risk factor ( N=284).

Stroke risk factor	Study population (N=284)	Age (years)		P value
		<50 ( n= 79)	$\geq 50$ (n=205)	
Hypertension	198 (69.7)	39 (19.7)	159 (80.3)	0.0001
Dyslipidemia	95 (33.4)	28 (29.5)	67(70.5)	0.534
Alcohol	93(32.8)	24 (25.8)	69 (74.2)	0.5977
Tobacco	75 (26.4)	4 (5.3)	71 (94.7)	0.0001
Physical inactivity	55 (19.4)	0 (0)	55 (100)	0.0001
Past history of cardiovascular disease	50 (17.6)	12 (24)	38 (76)	0.5069
Diabete mellitus	45 (15.6)	6 (13.3)	39 (86.7)	0.018
Obesity	33 (11.6)	8 (27.3)	25 (75.8)	0.6259
Oral contraceptive pill	25 (8.8)	25 (100)	0 (0)	0.0001
Migraine	13 (4.6)	9 (69.2)	4 (30.8)	0.0006
HIV infection	10 (3.5)	9 (90)	1 (10)	0.0001
Transient Ischemic Attack	9 (3.2)	0 (0)	9 (100)	0.0584
Pregnancy or post-partum	5 (1.8)	5 (100)	0 (0)	0.0086

50 years old had more stress hyperglycemia than young women. Hyperglycemia affects elderly AIS patients more deeply than younger AIS patients [30]. According to imaging findings, middle cerebral artery was the most involved in women (71.5%), in concordance with Fromm's study [31]. The involvement of ACA (25.7%) was relatively important in comparison with literature in which it's ranging from 1.1% to 2.3% [32]. Indeed, our study found a significant link between ACA involvement and older age in women stroke. Up to date, there are no published study in literature that analysed the link between stroke territory and age group in Women. TOAST Classification showed that large vessel disease was the most finding (37.7%), followed by unknown cause (25.4%) and cardio embolic cause (20%). This figure is different in the study of Caso in which cardio-embolic stroke was the leading cause (30%) [18]. The frequency of stroke with unknown origin (25.4 %) was similar than in literature (25-30%) [33]. This cause was most common in older women (28.3 %) than in young women. Stroke investigations were less frequent in older patients. Large vessel disease was significantly most common in older women. Many studies have shown that ECAS distributed more in older ages than in young ages [34]. The frequency of Large vessel disease in young women (22.4%) was similar than in young Asians women (24%) [35]. The frequency of Cardio-embolic stroke in young women (19%) was similar than in the study of Wassay in Asia (19%) [35]. This frequency seen to be high in our context because most women did not done some cardiovascular investigations (Holter ECG, Esophageal cardio echography). sVD (small vessel disease) play in important role in the development of cognitive impairment. Its frequency was relatively important in young women (11.4%) than in old women (8.8%) but there are no relationship with SVD and age group. In young women, the frequency of SVD was similar than in the study of Wassay (15%) [35]. This low frequency is due to the fact that Nuclear Magnetic Resonance Imaging of the brain was not common use in our context. There was relationship between others causes represented by angiitis and young age. The frequency of angiitis in young patients (16.5) was relatively higher than in the study of Wassay (11.4%) [35]. In Africa, there are not sex difference between HIV status and stroke [15] (Tables 3 and 4).

### Treatment and in-hospital outcome

Stroke treatments do not differ according to the age group. Antiaggregant agents was the leading treatment (94%), in line with a study from China (100%) [21]. The majority of women were treated with antidepressive drug (51.7%). Women seem to have twice more likely to experience post-stroke depression than men [36]. The length of stay was longer than in a study from Croatia (14.21 days vs. 5.4 days) [37]. Functional outcome at discharge was particularly worse in our context (79.6%), comparatively to the study from China (10.8%) [21]. Case fatality rate was higher (15.14%) than in the study of Ong (4.55%) [30]. This large proportion of unfavorable outcome could be explained by the longer time of admission, the severity of stroke and the high frequency of stress hyperglycemia among the patients. Post stroke pneumonia was the most common complication during hospitalization (20%), particularly in older women. Post stroke pneumonia and urinary tract infections were less frequent among young patients [32]. The high mortality is due to the absence of stroke unit in our hospital (Tables 5 and 6).

### Study limitations

This study had several limitations regarding to study profile. It was single hospital based study, so we can't generalize the results at all the patients admitted in Yalgado Ouedraogo Hospital. Second, our study did not compare sex difference in ischemic stroke by including a control group of men.

**Table 3:** Distribution of women according clinical stroke characteristics at admission (N=284).

Value	Study population (N=284)	Age group ( years)		P value
		<50 (n=79)	≥ 50 ( n=205)	
<b>Delay of arrival at ED ( hours)</b>				
4h30	0	0	0	-
24	70(24.7%)	23(29.1%)	47(22.9%)	0.3521
24-48	57(20 %)	12(15.2%)	45(22%)	0.2672
48-72	34(12%)	06(7.6%)	28(13.7%)	0.2276
>72	123(43.3%)	38(48.1%)	85(41.5%)	0.3799
<b>Blood pressure</b>				
Normal				0.0703
	87(30.6%)	31(39.2%)	56(27.3%)	
Grade1	93(32.8%)	29(36.7%)	64(33.2%)	0.4579
Grade2	72(25.4%)	12(15.2%)	60(29.3%)	0.0219
Grade3	32(11.2%)	7(8.9%)	25(12.2%)	0.5572
<b>Stroke severity at admission</b>				
Mean NIHSS	14,77	14,30	14,96	0.4518
< 15	91 (32%)	27 (34.2%)	64	0.6321
≥ 15	193 (68%)	52 (65.8%)	141	0.4518

**Table 4:** Distribution of patients according to investigation (N=284).

Features	Sample	Age (years)		P
		<50	≥ 50	
<b>CT scan territory (N=284)</b>				
ACM	203 (71.5%)	54	149	0.4691
<b>ACA</b>	<b>73 (25.7%)</b>	<b>27</b>	<b>46</b>	<b>0.0424</b>
ACP	41 (14.4 %)	8	33	0.1995
<b>Carotid Ultrasound (N=284)</b>				
< 50 %	66 (23,24%)	24	42	0.74
50-69 %	124 (43,66%)	31	93	
>70 %	45 (15.8%)	10	35	
Normal	49 (17.3%)	9	40	
<b>Echocardiography (n=163)</b>				
IC ( Ischemic Cardiopathy)	73 (44.8%)	15	58	0.0402
HTN-CM ( hypertensive cardiomyopathy)	49 (30.1%)	12	37	
Valvulopathy	41 (25.2%)	5	36	
<b>Electrocardiogram (n=119)</b>				
LAH ( Left atrial hypertrophy)	47 (39.5%)	17	30	0.8654
LVH ( left ventricular Hypertrophy).	32 (26.9 %)	9	23	
AF ( atrial fibrillation )	24 (20.2%)	10	14	
VES ( Ventricular extrasystoles)	16 (13.4%)	7	9	

**Table 5:** Distribution of patients according to stroke etiology (N=284).

Etiologies	Population study (N=284)	Tranches d'âge		P value
		<50 years (n=79)	≥ 50 years(n=205)	
Large vessel disease	107 (37.7%)	24(30.4%)	83 (40.5 %)	0.0462
Unknown cause	72 (25.4%)	14(17.7%)	58 (28.3 %)	0.3389
Cardioembolic stroke	57 (20 %)	15(19%)	42 (20.5%)	0.6321
Small vessel disease	27 (9.5%)	9 (11.4%)	18 (8.8%)	0.7991
<b>Others causes (angiitis )</b>	21 (7.4%)	<b>13 (16.5%)</b>	8 (3.9%)	<b>0.0159</b>

**Table 6:** Distribution of patients according to in hospital outcome (N=284).

Ranking score at discharge	Study population (N=284)	Tranches d'âge		P value
		<50 years	≥ 50 years	
0-2	58 (20.4%)	20	38	0,2040
3-5	226(79.6%)	59	167	
Complications				
Post stroke pneumonae	57 (20.1%)	9	48	0.0234
Urinary tract infection	31 (10.9%)	9	22	0.8728
Cutaneous infections	17 (6%)	5	12	0.8797
Hemorrhagic stroke	9 (3.2%)	2	7	0.7034
Post stroke epilepsia	2(1%)	1	1	0.4823
Cognitive disorders	5 (1.8%)	1	4	0.6939
Death	43(15.1%)	9	34	0.4932

## Conclusion

There was a long delay between stroke onset and hospital admission. Hypertension was the most vascular risk factor in older women. The majority of women had severe stroke at admission and worse outcome at discharge. There was difference with the group according to the frequency of hypertension, diabetes mellitus, contraceptive use and stroke etiologies.

## Declarations

### Ethics approval and consent to participate

Not applicable. It was retrospective study.

### Consent for publication

Not applicable.

### Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

### Competing Interests

The authors declare that they have no competing interests.

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## Authors' Contributions

AAD (Alfred Anselme Dabilgou), RN (René Nakielcé) and CN (Christian Napon) analyzed and interpreted the patient data. AAD (Alfred Anselme Dabilgou), AD (Alassane Dravé) and JMA K (Julie Marie Adeline Kyelem) were the major contributors in writing the manuscript. All authors read and approved the final manuscript.

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