


Research Article

# Challenges in Conducting Cerebral Scanning for Stroke in a Hospital in Sub-saharan Africa

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## Abstract

Stroke, due to its magnitude and mortality, is a real public health problem. To diagnose them, the Souro Sanou Teaching Hospital is equipped with a computed tomography (CT) scanner, to which access remains limited. So, it seemed important to study epidemiological aspects and conditions for carrying out CT scans in patients with stroke. This is a projective descriptive study. Data were collected over 6 months (1 December 2013 to 30 June 2014). Patients admitted to the Souro Sanou Teaching Hospital with clinical suspicion of stroke were included. We collected 153 cases of stroke. The mean age of the patients was  $62 \pm 15$  years, and the sex ratio was 1.43. The mean consultation time was  $2.05 \pm 1.36$  days with a range of 0 to 45 days. Approximately 68.63% of patients underwent brain scanning. The most common reasons for not having a brain scan were death before the scheduled date of the brain scan (41.67%) and lack of financial resources (39.58%). The mean delay for brain scans was  $08 \pm 06$  days. Mortality rate was 31.37%. In the management of stroke, the performance of brain scans is of great interest. However, several factors, including the high cost of a CT scan, may sometimes limit its accessibility.

## Keywords

Stroke, Brain Scan, Epidemiology, Burkina Faso

## 1. Introduction

Stroke is the leading cause of non-traumatic acquired disability in adults and the second leading cause of dementia after Alzheimer's disease [1]. It is also the second most common cause of death in the world [2]. In 2005, the World

Health Organisation estimated that there were approximately 5.7 million stroke-related deaths worldwide, 87% of which occurred in developing countries [3]. Current projections indicate that the incidence of stroke will increase in the

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coming years, from 16 million in 2005 to 23 million in 2030. Mortality is expected to increase from 5.7 to 7.8 million over the same period [4]. Stroke is therefore a major public health problem in terms of both scale and mortality.

Stroke management is only possible if an accurate radiological diagnosis is made with a precise assessment of the lesion before any therapeutic intervention. According to international recommendations, radiological diagnosis should be performed as an emergency (neurological emergency). Early treatment can improve vital and functional prognosis [5, 6]. In Burkina Faso, computed tomography (CT) scans are the main tool available for brain investigation.

What is the current practice of performing brain scans for stroke at the University Hospital Sourô Sanou (CHUSS) in Bobo-Dioulasso? To answer this question, we set out to study the epidemiological aspects and the conditions under which brain scans were performed in stroke at the CHUSS.

## 2. Methods

This was a cross-sectional study with prospective data collection over a 7-month period from 1 December 2013 to 30 June 2014. It took place in 6 CHUSS departments: Neurology, Cardiology, Intensive Care, Outpatient Emergency, Women's Medicine V, and Medical Imaging.

All patients diagnosed with stroke based on suggestive clinical features were included in this study. Recruitment was exhaustive and patients were systematically included until the end of the study period.

Clinical data were collected daily from the different wards

of the hospital and from the medical imaging department of the CHUSS. The patient or the patient's carer (in the case of impaired consciousness or aphasia) was asked to complete an individual questionnaire on the patient's sociodemographic characteristics, the date of stroke onset, and the length of time spent at the hospital. Data on the status of the brain scan (whether the scan had been performed or not) and the time taken to perform the scan were collected at the CHUSS medical imaging department.

Data were entered using EPI Data software version 3.1. Data were analyzed using R statistical analysis software version 3.0.2. The chi-squared test, with a significance level of  $p < 0.05$ , was used to compare the parameters studied.

Approval was sought and obtained from the administration and the various managers of the CHUSS departments involved in the study before the study began.

As far as possible, the patients and their carers were informed of the purpose of the study. The anonymity and confidentiality of the results that were made available to us have been respected.

## 3. Results

### 3.1. Age and Sex

We enrolled 153 patients in this study, of whom 58.82% were men and 41.18% were women, giving a sex ratio of 1.43 (Figure 1).

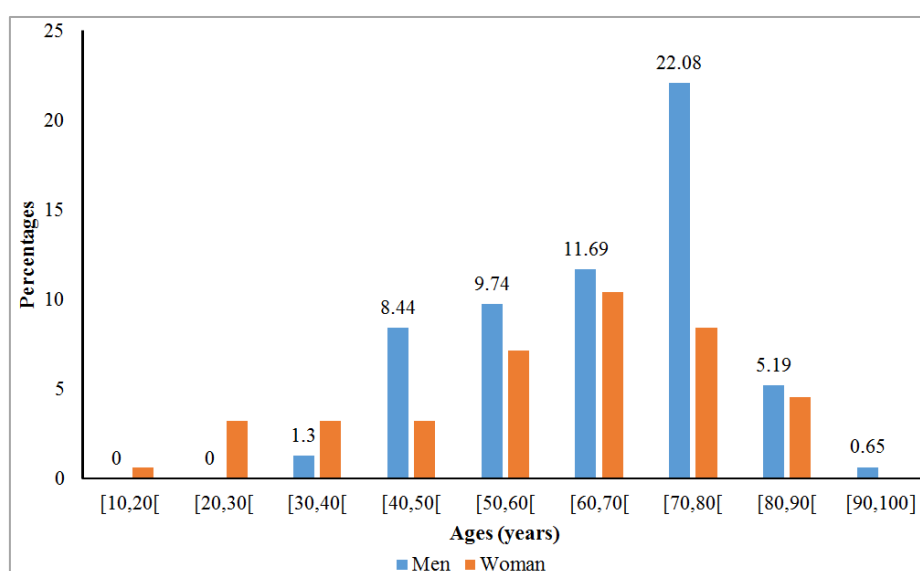


Figure 1. Patients' distribution by age and sex.

The mean age of our patients was  $62 \pm 15$  years, with extremes of 17 and 100 years.

Stroke occurred more frequently after the age of 50, with a

peak in the 70-80 age group (27.45% of cases).

Figure 1 shows the distribution of patients by age and sex.

### 3.2. Consultation and Hospitalisation

The mean consultation time at CHUSS was  $2.05 \pm 1.36$  days, with extremes of 0 and 45 days. Sixty percent of patients were seen within the first 24 hours and 72% within 48 hours of stroke onset.

The mean length of hospital stay was  $13 \pm 10$  days, with extremes of 1 and 53 days.

### 3.3. Degree of Accessibility of Brain Scans

Brain scans were performed on 68.63% of the patients in the study. Table 1 shows the reasons for not having a scan.

**Table 1.** Reasons for not having a brain scan.

Reasons for non-fulfilment	Number of people	Proportions (%)
Death before scheduled completion date	20	41,67
Refusal due to radiation	2	4,17
Lack of financial resources	19	39,58
Leaving without medical advice	7	14,58
TOTAL	48	100

Death before the scheduled date of the brain scan and lack of financial resources were the most common reasons for not having the scan, accounting for 41.67% and 39.58% of cases, respectively.

The mean time from stroke onset to brain scan was  $8 \pm 6$  days. Approximately 11.11% of patients had a brain scan within 24 hours of stroke onset and 47.06% within the first week.

The mean time to brain scan from the date of admission to the CHUSS was  $6 \pm 5$  days.

### 3.4. In-Hospital Stroke Mortality

Our patients were discharged normally in 58.82% of cases and without medical advice in 9.81% of cases. The stroke mortality rate in our study was 31.37%. Table 2 shows the distribution of mortality by age group.

**Table 2.** Mortality by age group.

Age range	Number of people	Proportions (%)
[20, 30]	1	2,08
[30, 40]	1	2,08

Age range	Number of people	Proportions (%)
[40, 50]	6	12,5
[50, 60]	9	18,75
[60, 70]	10	20,83
[70, 80]	17	35,42
[80, 90]	4	8,34
Total	48	100

The mortality rate in those aged 70 to 80 years was 35.42%. There was a significant difference between stroke mortality in each age group ( $p = 2.2 \cdot 10^{-16}$ ). Stroke mortality by time to consultation is shown in Table 3.

**Table 3.** Mortality by time to consultation.

Consultation period (C)	Number of people	Proportions (%)
$C \leq 1$ day	31	65,58
$1 \text{ day} < C \leq 2$ days	4	8,33
$2 \text{ days} < C \leq 7$ days	10	20,83
$7 \text{ days} < C \leq 14$ days	2	4,17
$C > 14$ days	1	2,08
Total	48	100

The mortality rate for patients who consulted the CHUSS within 24 hours was 65.58%. There was a significant difference in stroke mortality according to time to consultation ( $p = 3.48 \cdot 10^{-8}$ ). Stroke mortality by time to CT scan is shown in Table 4.

**Table 4.** Mortality by time to completion.

Completion times (R)	Number of people	Proportions (%)
$R \leq 1$ day	2	7,41
$1 \text{ day} < R \leq 3$ days	2	7,41
$3 \text{ days} < R \leq 7$ days	10	37,04
$7 \text{ days} < R \leq 14$ days	9	33,33
$14 \text{ days} < R \leq 6$ months	4	14,81
$R > 6$ months	0	0
Total	27	100

Stroke mortality in patients who had their brain scanned between 3 and 7 days after stroke onset was 37.04%. There was a significant difference in stroke mortality according to the time to scan ( $p = 4.8910^{-6}$ ).

## 4. Discussion

### 4.1. Study Limitations

We encountered several difficulties in conducting our study:

- 1) Selection bias: patients referred to CHUSS for stroke were often severe cases. This may explain the high mortality of patients in our study;
- 2) memory bias: data on the time of stroke onset and presentation were collected from patients or their relatives, who often have difficulty recalling exact dates and times.

### 4.2. Gender

The sex ratio of our study population (1.43) was similar to that found in the literature. Studies by Bamouni et al [7], Lougué et al [8] in Burkina Faso, Keita et al [9] in Mali and Chiasseu Mbeumi et al [10] in Cameroon also reported male predominance, with sex ratios of 1.63, 1.5, 1.33 and 1.78, respectively. This male predominance in the stroke population could be explained by the higher prevalence of certain cardiovascular risk factors in men, particularly smoking and alcoholism.

### 4.3. Age

The mean age of our patients (62 years) is close to that found in the literature. In the studies by Bamouni et al [7], Cowppli-Bony et al [11], Diango et al [12], and Balogou et al [13], the mean age of the patients ranged from 58 to 68 years. The high incidence of stroke in the elderly may be explained by the fact that age is a non-modifiable risk factor. In fact, Goldstein et al. found that the risk of stroke doubles every decade after the age of 55 [14].

### 4.4. Consultation Period

Patients in our study were seen within a relatively similar timeframe (60%) as in the study by Balogou et al. (2013, Togo), where around 70% of patients were seen within the first 24 hours of stroke [13]. In contrast, in the study by Mathieu-Blondet et al in France, around 90% of patients were seen within 03 hours of symptom onset [15]. Several factors may explain the delay in presenting to CHUSS. These include:

- 1) the long theoretical average radius of action of the health and social promotion centers, which are far from the population [16];

- 2) the poor state of the roads, which makes the transport of stroke patients to the health centers very difficult and painful;
- 3) The lack of medical transport, in particular the Emergency Medical Service;
- 4) The fact that some health workers are not familiar with the concept of emergency.
- 5) The unavailability of medical staff to make the diagnosis;
- 6) Ignorance of the concept of emergency by the patient's family and friends when faced with a sudden onset of neurological deficit, with a delay in the decision to take the patient quickly to a care centers.

The 2007 study by Viallon et al showed that the establishment of a care pathway and stroke awareness among the entire emergency medical team led to a significant improvement in the time to treatment. Raising awareness among the public should help to reduce the time between symptoms and the need for care [17].

### 4.5. Patients' Average Length of Stay

Patients' average length of stay

Our results (13 days) are similar to those reported in the study by Kouna Ndouongo et al [18] in Gabon, where the length of hospital stay was about 12 days. Several factors contribute to prolonged hospitalization:

- 1) late consultation
- 2) the slow mobilization of financial resources to cover the cost of investigations and treatment;
- 3) the delay in performing the brain scan;
- 4) the quality of care in the unit.

### 4.6. Degree of Accessibility of Brain Scans

Of the 153 stroke cases, 68.63% benefited from a brain CT scan. This proportion is similar to that found by Molua Aundu et al, who found that 69.30% of cases were scanned [19].

However, it is lower than the proportions reported by Balogou et al. in Togo and Ndoumba et al. in Cameroon, which were 90% and 75% respectively [13, 20]. Factors explaining the low accessibility of brain scans in our study are the high rate of death before the scheduled date for the scan and the lack of financial resources.

### 4.7. Time to Brain Scan

This delay (8 days) is close to that observed by Cowppli-Bony et al. in Côte d'Ivoire [11], which was an average of 6.7 days after stroke onset. In our study, 11.11% of patients were able to have a brain scan within 24 hours of stroke onset. This result is similar to that observed by Molua Aundu et al (2005, Kinshasa), in whom 11.9% of patients had a brain scan within the first 24 hours [19]. Reasons for the long delay in performing brain scans include the long consultation time and the time needed to obtain financial resources.

## 4.8. Stroke Mortality

In-hospital stroke mortality in our study was 31%. Similar results have been reported in studies by Diagana et al [21], Sagui [22], Keita et al [9] and Ndoumba et al [20], where mortality rates ranged from 20% to 50%. This high in-hospital stroke mortality may be related to factors such as delay in stroke presentation, diagnosis and treatment, and lack of thrombolysis centers. The medicalization of patient transport will improve the time to admission and treatment of stroke and thus reduce mortality [23].

## 5. Conclusions

Stroke is now a major public health problem that deserves the attention of decision-makers and financial partners alike. Because of the disability it causes in patients, this pathology has a major impact, particularly at the socioeconomic level. In this study, we have highlighted certain patient characteristics and the availability of brain scans. Finally, it seems that the CT scan is the reference radiological examination in the CHUSS, as it makes it possible to differentiate between ischaemic and hemorrhagic strokes and to determine the topography and extent of cerebral lesions. This examination, which is expensive in our context of poverty, has its limitations. A non-negligible number of stroke cases remain without a CT diagnosis because of certain factors that limit access to brain scans, mainly financial resources and death before the scan can be performed.

## Abbreviations

CT: Computed Tomography

CHUSS: University Hospital Sourô Sanou

## Conflicts of Interest

The authors declare no conflicts of interest.

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