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ORIGINAL REPORT

FUNCTIONAL RECOVERY AFTER STROKE IN BENIN: A SIX-MONTH FOLLOW-UP STUDY

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Objective: **Stroke is a major public health problem in developing countries. However, few studies have quantified the functional recovery of stroke patients in sub-Saharan Africa. This study examined the functional recovery of stroke patients in the Republic of Benin.**

Methods: **A total of 68 patients with acute stroke were recruited from hospitals and health centres in Benin. Patients were evaluated at enrolment and 1, 3 and 6 months post-stroke. The ACTIVLIM-Stroke scale, Barthel Index, and modified Rankin Scale were used to assess activity limitations, functional autonomy, and overall level of disability, respectively.**

Results: **Over the 6-month follow-up period, 18 patients died and 9 dropped out. Overall, the 3 measures highlighted progressive and significant functional recovery during the first 6 months. At enrolment, the mean score on ACTIVLIM-Stroke was 16% (standard deviation (SD) 9), indicating that patients were almost totally dependent and unable to perform most activities of daily living. At 6 months, the mean score for activity limitation reached 67% (SD 15) and most patients were able to perform some basic tasks easily. Patients had difficulty with tasks requiring walking and remained unable to perform certain activities requiring manual dexterity.**

Conclusion: **The study sample showed significant functional recovery (~50%) during the first 6 months post-stroke. We recommend the integration of group-based brisk walking into a cost-effective rehabilitation programme as a suitable way to increase functional recovery of chronic stroke patients in sub-Saharan Africa after hospital discharge.**

Key words: stroke; neuro-rehabilitation; functional recovery.

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INTRODUCTION

In its 1989 report, the World Health Organization (WHO) (1) recognized stroke as a major cause of death and disability worldwide. Recent global estimates found that stroke ranked as the second most common cause of death, with 5.9 million stroke-related deaths in 2010 (2). In sub-Saharan Africa the estimated pooled prevalence of stroke is 3.5 per 1,000 population, and this statistic is predicted to increase annually by 12% (3). Risk of death after stroke is much higher in low-income compared with high-income countries (4). Possible explanations for this observation have been proposed. For instance, low-income countries often lack political and operational programmes for the prevention and monitoring of cardiovascular risk factors, such as high blood pressure, in at-risk populations. Developing countries also lack qualified and motivated staff or adequate technical facilities for the management of large numbers of stroke cases (5). Several studies have concluded that stroke concerns relatively younger populations in developing compared with developed countries (5–8). In particular, stroke occurs 10–15 years earlier in African populations compared with stroke populations in developed countries (5, 8). Stroke in younger populations leads to a greater loss of potential years of life and huge economic and social burden (6). Early occurrence of stroke in African communities can be explained by a higher prevalence of exposure to risk factors, such as lack of regular exercise, poorly controlled hypertension, consumption of fats and alcohol, and HIV/AIDS (7). Ethnic predisposition also plays a role; although stroke itself is not hereditary, important risk factors for stroke (e.g. atherosclerosis and hypertension) are hereditary. Higher prevalence rates of hypertension have been observed in black African communities living in Africa or Western countries (7). A contemporary hypothesis is that black Africans are genetically predisposed to hypertension, with environmental factors playing an aggravating role. Patients in African countries have limited access to rehabilitation services. Furthermore, there is a dearth of high-quality published studies

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that adequately quantify functional recovery of stroke patients in sub-Saharan Africa. To our knowledge, no prospective longitudinal research has been conducted to measure outcomes and functional recovery of stroke patients in sub-Saharan Africa over a long period. Therefore, this study aimed to investigate the functional recovery of stroke patients in the Republic of Benin over a 6-month follow-up period.

PATIENTS AND METHODS

Study design and enrolment

This is a 6-month observational cohort study involving 68 participants. The study received approval from the ethics committee of the Université catholique de Louvain in Belgium and the local ethics committees of medical faculties in Cotonou and Parakou, Republic of Benin. Patients signified their agreement to participate by signing a consent form. Patients were recruited from the records of different hospitals and health centres in Benin. Patients were followed for 6 months after stroke and evaluated 4 times: at enrolment (t_0), 1 month post-stroke (t_1), 3 months post-stroke (t_2) and 6 months post-stroke (t_3).

Assessment tools

Participants were assessed with 4 tools:

- A general questionnaire: administered at admission to determine demographics (e.g. socio-professional status) and medical history (e.g. cardiovascular risk factors before stroke onset).
- ACTIVLIM-Stroke (9): a 20-item self-report instrument validated in populations in Benin and Belgium. Built on the Rasch model, ACTIVLIM-Stroke is designed to evaluate activity limitations among adult post-stroke patients. Answers to items are provided through a 3-level format ("impossible", "difficult", and "easy"). The psychometric properties of this questionnaire motivated our choice of the instrument as the main tool to assess functional outcome in our sample.
- Barthel Index (BI) (10): one of the most frequently used ordinal generic scales to assess a patient's functional independence in daily life. The total score ranges from 0 to 100, with higher scores indicating better functional status.
- Modified Rankin Scale (mRS) (11): a generic ordinal clinician-rated scale that categorizes severity of disability on the basis of observation. Patients are rated on 7 levels, from 0 ("no symptoms at all") to 6 ("dead"). An increasing mRS score indicates worsening status.

Inclusion criteria

The following conditions were verified before a patient was enrolled: age at least 18 years, diagnosed with acute stroke (enrolled < 30 days from stroke onset), consulted by a neurologist, and no post-stroke cognitive impairment (MMSE ≥ 24).

Data analysis

Data were analysed with the SPSS software package, version 16. Descriptive statistics were used to describe sample characteristics. One-way repeated analysis of variance (RM-ANOVA) was used to compare ACTIVLIM-Stroke scores obtained at different evaluation times. *Post-hoc* analyses with Bonferroni adjustment were performed to investigate the specific differences of scores between t_0, t_1, t_2 and t_3. Friedman's non-parametric statistical test was used to compare the results for successive measurements of BI and mRS.

RESULTS

A total of 76 eligible patients were identified. At enrolment, 2 declined to participate, and 6 did not meet inclusion criteria (i.e. MMSE score < 24); therefore, 68 participants were included in the sample at enrolment (Fig. 1). After 1 month post-stroke, 12 deaths were reported, and 5 patients could not be contacted, leaving a sample of 51 patients. After 3 months, 5 additional deaths were reported, and 4 patients could not be contacted. After 6 months, 41 survivors and 1 death were registered. The final totals were: 26.5% died, 13.2% dropped out and 60.3% were fully followed up to 6 months.

Sample characteristics

The mean age of the total sample at enrolment (68 patients) was 60 years (standard deviation (SD) 9), with 52% of the sample being men. Most participants (68%) were married or living with a partner. Almost half of participants (46%) were self-employed (independent), and over one-third (36%) had never attended school. Stroke type was ischaemic in 47%, intraparenchymal haemorrhage in 27%, and undetermined in 26% of the sample. In 56% of cases, stroke lesions were located in the right hemisphere (Table I). Regarding cardiovascular risk factors, three-quarters of patients had been diagnosed with hypertension before stroke onset. The remaining one-quarter of patients did not know their hypertension status before stroke onset. More than half of participants (68%) were unaware of their blood cholesterol levels before stroke onset. Over 90% of participants were at least 50 years old (Table II). All participants were admitted to a hospital or health centre. The baseline values on the assessment tools were similar ($p > 0.5$)

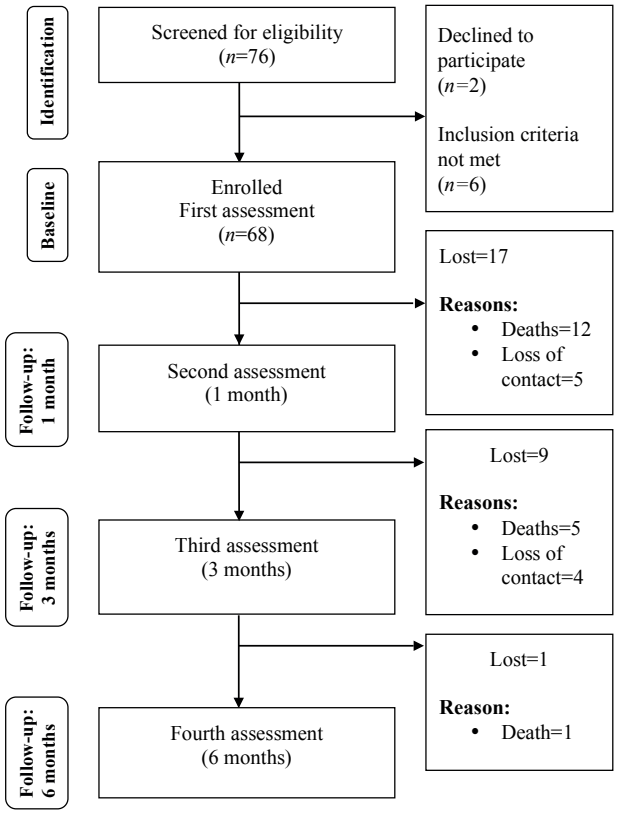

Fig. 1. Enrolment in study.

Table I. *Socio-demographic and epidemiological characteristics of the sample*

Characteristics	*n* (%)
Sex	
Male	35 (52)
Female	33 (48)
Marital status	
Cohabitation with partner	46 (68)
Divorced, single	2 (3)
Widower	20 (29)
Professional status	
Employee	18 (27)
Independent	32 (46)
Retired	18 (27)
Level of education	
Never attended school	25 (36)
Primary	17 (25)
Secondary	16 (24)
Superior, advanced	10 (15)
Social security	
Health insurance	79 (69)
Without health insurance	21 (31)
Type of stroke	
Ischaemic	33 (47)
Haemorrhagic	18 (27)
Undetermined	17 (26)
Location of stroke	
Cortical or hemispheric	28 (41)
Capsulo-lenticular (deep location)	30 (44)
Multiple location	10 (15)
Side of cerebral hemisphere injured	
Left	30 (44)
Right	38 (56)

between survivors and patients dropping out and dying. The mean and standard deviation (SD) duration of hospitalization of our sample was 22 days (SD 21). The percentages of patients receiving training after the stroke were, respectively, 38% at enrolment, 55% after 1 month (t_1), 24% after 3 months (t2) and 39% after 6 months (t_3). The training consisted of classical physical therapy sessions, 45–60 min, 3–5 times a week, during the first 3 months and 2 times a week after 3 months.

Functional recovery

Table III presents the ACTIVLIM-Stroke, BI, and mRS scores. The 3 functional measures highlighted progressive and significant functional recovery during the first 6 months after stroke, although the mRS did not show improvement in scores between enrolment and 1 month. Fig. 2 depicts the functional recovery of our sample at the 4 evaluation times using the ACTIVLIM-Stroke scale. The top panel shows the patients mean functional ability at the 4 times. The bottom panel illustrates the relationship between the ordinal total score and linear measures (in %) according to the calibration of the scale by Batcho et al. (9). The middle panel shows the expected response to a given item as a function of patient functional ability.

Table II. *Cardiovascular risk factors at enrolment (n=68)*

Factors	Present %	Absent %	Unknown %
Age ≥50 years	91	9	–
Hypertension	75	2	23
Diabetes	13	63	24
Hypercholesterolemia	3	29	68
Smoking	4	96	–
Alcohol	19	81	–
History of stroke	15	85	–

To understand the functional recovery of our sample, we will describe in detail the mean scores measured at the 4 evaluation times (Fig. 2, Table III).

- At enrolment (t_0), the mean score was 16% (SD 9), indicating that patients were unable to perform most activities of daily living (ADL). Patients were mostly bedridden and almost totally dependent.
- After 1 month (t_1), we observed a slight, but significant, increase (improvement) in the mean ACTIVLIM-Stroke score, to 25% (SD 22) ($p<0.01$). Patients began to be able to perform some ADLs with difficulty, including "opening a door", "brushing one's teeth", and "putting a key in a lock".
- After 3 months (t_2), functional recovery had increased significantly. Mean score was 43% (SD 25) ($p<0.001$). Patients began to be able to perform, with difficulty, ADLs requiring motor skills, such as "getting up from a chair", "taking off a t-shirt", and "getting out of a car".
- After 6 months (t_3), patients continued to recover; the mean score for activity limitation reached 67% (SD 15) ($p<0.001$). Most patients were able to perform some basic tasks easily, including "brushing one's teeth" and "using the toilet". They had difficulty in performing activities involving walking, such as "walking more than 1 km" and "walking upstairs". They remained unable to "carry a heavy load" or to perform some activities requiring manual dexterity, such as "tying one's laces".

In summary, Fig. 2 demonstrates that our sample of 41 patients improved their functional recovery by approximately 50% during the 6 months post-stroke.

Table III. *Evolution of functional recovery for the entire sample*

					Overall dif.	t_0 vs t_1	t_1 vs t_2	t_2 vs t_3
Scale	t_0 (*n*=68)	t_1 (*n*=51)	t_2 (*n*=42)	t_3 (*n*=41)	*p*-value		*Post-hoc*	
ACTIVLIM-Stroke, %, mean (SD)	16 (9)	25 (22)	43 (25)	67 (15)	<0.001	<0.01	<0.001	<0.001
BI, median, [P25 ; P75]	20 [0–85]	40 [10–95]	65 [50–100]	75 [65–100]	<0.001	<0.01	<0.001	<0.001
mRS, median, [P25 ; P75]	5 [4–5]	5 [4–5]	4 [3–5]	3 [3–5]	0.018	0.53	0.032	0.041

SD: standard deviation; mRS: Modified Rankin Scale; P: percentile; dif: differences; BI: Barthel Index; mRS: modified Rankin Scale.

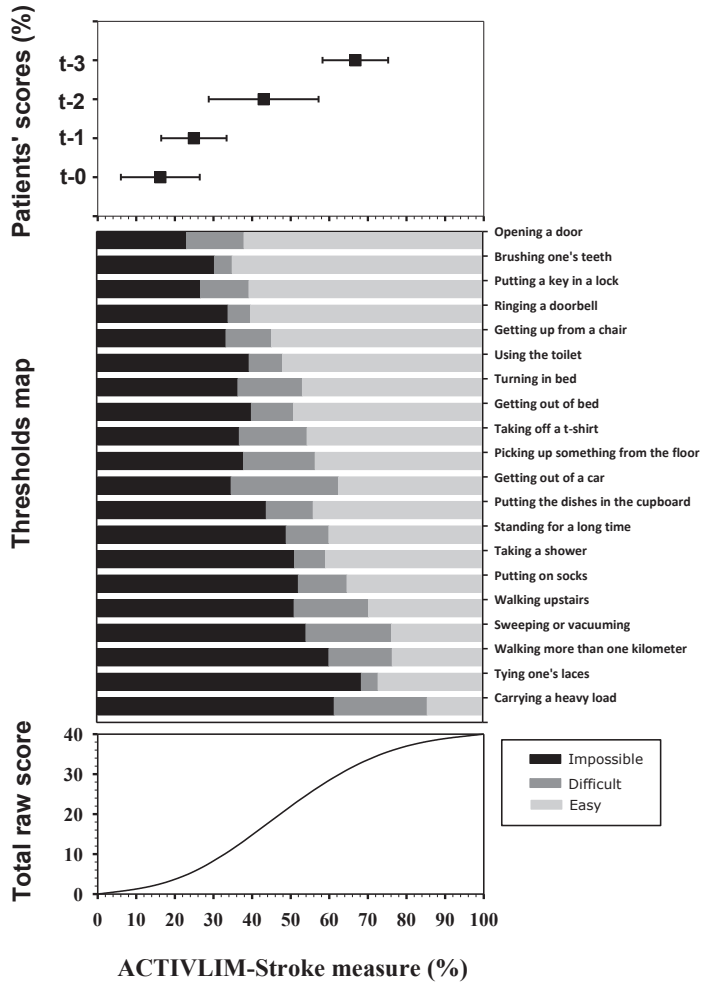

Fig. 2. Functional recovery of the sample at the 4 evaluation times (t_0, t_1, t_2, t_3) using the ACTIVLIM-Stroke scale.

Individual consideration of the functional recovery

The ACTIVLIM-Stroke scale provides measure with standard errors, enabling investigation of individual-level changes. Table IV reports the status of patients between consecutive evaluations, according to the ACTIVLIM-Stroke scale. Percentages are based on the sample size at each time-point. The results demonstrated that most patients improved their functional status, particularly from 1 to 6 months post-stroke.

Table IV. *Functional recovery across 6 months post-stroke using the ACTIVLIM-Stroke scale*

Patient's status	t_0 vs t_1 (n=68) n (%)	t_1 vs t_2 (n=51) n (%)	t_2 vs t_3 (n=42) n (%)
Improvement	36 (54)	39 (76)	40 (96)
Stable	14 (21)	3 (6)	–
Degradation	1 (1)	–	1 (2)
Deaths	12 (17)	5 (10)	1 (2)
Missing data	5 (7)	4 (8)	–

DISCUSSION

The purpose of this study was to investigate the functional recovery of stroke patients recruited from different localities in the Republic of Benin, a sub-Saharan Africa country. Global analysis of our sample showed that patients recovered more than 50% of normal functioning during the 6 months after stroke, with the mean ACTIVLIM-Stroke score increasing from 16% (SD 9) at enrolment to 67% (SD 15) at 6 months post-stroke ($p < 0.001$, Table III). Nevertheless, in clinical trials, change that is meaningful for a group might not be meaningful for individuals (12). Fortunately, because the ACTIVLIM-Stroke scale gives measures with standard errors, this instrument allows investigation of individual-level changes. The individual-based analysis indicated that 96% of our participants reported an increase in their ability to perform ADLs after 6 months post-stroke.

These promising results regarding rate of functional recovery can be partly explained by the observation that stroke patients in developing countries are generally younger (~60 years of age) compared with stroke patients in developed countries (> 70 years of age) (5, 8). Indeed, in a prospective community-based study of 515 consecutive acute stroke patients, Nakayama and colleagues (8) reported that age independently influenced stroke outcomes selectively in ADL-related aspects, but not in neurological aspects. Their results suggest a better compensatory ability in younger stroke patients. Hence, the mean age of our participants (60 years (SD 9)) might explain the observed good functional recovery.

By 6 months, most ADLs had become easy for participants, with the exception of activities demanding walking ability (e.g. "walking more than 1 km", "walking upstairs", and "carrying a heavy load") or manual dexterity (e.g. "tying one's laces"). Reduction in walking ability is a major devastating outcome of stroke, and its restoration is of great importance to patients and their relatives. Recently, Batcho et al. (13) reported that group-based brisk walking improved body functions and activities in community-dwelling stroke patients. In that study, a 3-month walking programme helped participants to reduce their impairments, improve their balance, and recover their functional autonomy. Thus, regular ground walking is a low-cost intervention that has the potential to stimulate functional recovery in chronic stroke survivors. This finding contributes to increasing evidence that exercise after stroke has many benefits, and that chronic stroke survivors may be encouraged to be active. We recommend integrating group-based brisk

walking in community-based rehabilitation (CBR) efforts (14). Promoted by WHO, CBR is a multi-sectorial strategy that focuses on enhancing the quality of life of people with disabilities and their families; its implementation requires combined efforts of people with disabilities, their families, and their communities. As the prevalence of disability in low-income countries increases (3), rehabilitation programmes will become increasingly necessary. Therefore, the implementation of evidence-based CBR in addition to models of rehabilitation from high-income countries may help to address the growing needs of rehabilitation programmes in the sub-Saharan Africa environment.

This study has been focused on the estimation of the functional recovery in a sample of Beninese stroke patients. According to the International Classification of Functioning, Disability and Health (ICF), disability is not just an anatomical and functional ability issue, but also involves the individual's involvement in real-life situations. Thus, we suggest that further investigations fill this gap by taking into account the participation dimension. Another limitation of our study is the sample size, meaning that our findings related to 68 patients cannot be generalized to the whole stroke population of sub-Saharan Africa.

In conclusion, our sample from the Republic of Benin showed mean improvement in functional recovery of approximately 50% during the 6 months after stroke. This good functional recovery may be explained by the young age of our sample (~60 years). We suggest the integration of group-based brisk walking in CBR programmes as an effective and economical approach to increase functional recovery in the chronic stroke population of sub-Saharan Africa.

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