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Research Article

Long-Term Mortality of Hemorrhagic Stroke Survivors in Bobo-Dioulasso, Burkina Faso: A Retrospective Hospital-Based Cohort Study

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Abstract

Introduction. Long-term survival of hemorrhagic strokes remains poorly evaluated in our context. They represent the most severe type of stroke, accounting for 10 to 20% of all stroke cases. These rates are elevated in sub-Saharan Africa, potentially accounting for as much as 35% of all strokes. This study's purpose was to analyze the long-term mortality of stroke survivors at the Souro Sanou University Hospital in Bobo-Dioulasso. Methods. This was a retrospective cohort of patients hospitalized from January 1, 2017 to December 31, 2019, discharged alive from the neurology department after haemorrhagic stroke. Data were analyzed using STATA 17.0 software. The 4-year survival probability was estimated. Predictors of mortality were identified using Cox regression. Results. A total of 57 patients were involved in this study. The mean age was 58.4 years (±12.4). The sex ratio was 1.19. Hypertension was the main cardiovascular risk factor (71.9%). Four patients had a history of heart disease. The level of consciousness was normal in 50 patients. The average length of hospital stay was 11.3 days. Cumulative post-hospital mortality was 21.1% at 4 years. Predictors of mortality were Glasgow coma scale>9 (p=0.001; HR = 0.09; CI 95%: 0.02-0.40) and presence of heart disease (p=0.015; HR = 5.87; CI 95%: 1.42-24.29). Conclusion. The long-term mortality associated with haemorrhagic stroke is high. Targeted interventions such as specialist hypertension clinics, cardiological follow-up and structured outpatient programmes could improve this long-term mortality considerably.

Keywords

Hemorrhagic Stroke, Mortality, Long-term Survival, Bobo-Dioulasso, Burkina Faso

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1. Introduction

Hemorrhagic strokes are the most severe form of stroke and account for 10 to 20% of all strokes [1]. These rates are higher in sub-Saharan Africa and can reach up to 35% of all strokes [2]. Qureshi et al [3] found an in-hospital mortality rate for hemorrhagic strokes of nearly 50%. Smith et al [4] reported 27.2%. The in-hospital mortality rate for hemorrhagic strokes was 31.3% in Dakar in 2018 [5], 23.8% in Gabon [6] in 2023 and 22.86% in Burkina Faso in 2019 [7]. However, while short-term mortality following a hemorrhagic stroke is high, long-term mortality is not well documented. For those who survive the initial phase, the 5-year survival rate is approximately 26.7% to 37.8% [8]. In Burkina Faso, this situation is worsened by a significant lack of long-term outcome data. Addressing this critical gap is an urgent public health priority, essential for developing strategies and for minimising mortality and lifelong disability.

This study's objective was to assess long-term mortality among survivors of hemorrhagic stroke (HS) at the Souro Sanou University Hospital Center in Bobo-Dioulasso.

2. Methodology

2.1. Nature, Setting, and Study Period

This was a retrospective cohort study with an analytical focus conducted in the neurology department of the Souro Sanou University Hospital in Bobo-Dioulasso. This facility is the only referral center for neurological disorders in this part of the country, with a capacity of 22 beds. This study focused on patients admitted to the neurology department for stroke between January 1, 2017, and December 31, 2019, who were discharged alive.

2.2. Selection Criteria and Diagnosis

All medical records of patients aged 15 years and older who were hospitalized for HS confirmed by brain CT scan and discharged alive during the study period were included. Data were collected from January 19 to May 29, 2022. Incomplete medical records were not included. Patients (or their parents) who did not provide consent or who could not be reached by phone were excluded. The consent form was prepared in writing, but the administration and approval were done verbally. Recruitment was exhaustive (all eligible cases were selected).

2.3. Variables Studied

For each patient, a questionnaire was completed to gather the following information from their medical records: and following interviews with the patients or their parents: sociodemographic variables; risk factors; reasons for hospitalization; time to consultation; vital signs; physical examination findings; length of hospitalization; ICH score; bedsore complications; Rankin score; neurological follow-up; post-hospitalization prognosis; and survival time.

Analysis of the variables of interest was performed on the complete dataset. Qualitative data were expressed as percentages (%), and quantitative variables as mean ± standard deviation. The analysis was performed using version 17.0 of the STATA software. Standard descriptive statistics were calculated for each variable. Survival was assessed using the Kaplan-Meier method. A multivariate Cox model was constructed based on the univariate analysis, using a stepwise downward reduction procedure, to identify predictors of post-hospital death.

2.4. Ethical Considerations

In the absence of a local ethics committee, this study received administrative approval from the Bobo-Dioulasso University Hospital. Informed consent was obtained from the patients or their caregivers. Patient anonymity was preserved, as the case report forms did not include their identities. Only case numbers were listed. The survey and verification of the forms were conducted by a medical student bound by medical confidentiality.

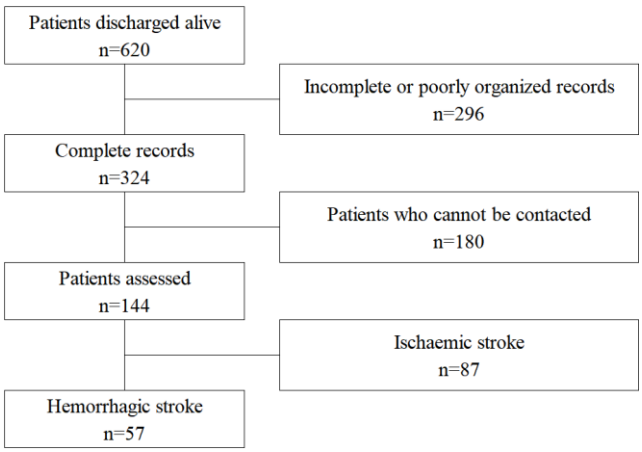

Figure 1. *Flowchart of the study population.*

3. Results

During the inpatient period, 620 patients were discharged alive from the neurology department. The present study included 57 cases of HS (Figure 1). The mean age of the HS cases was 58.4 years ± 12.4, ranging from 30 to 90 years. It was 60.1 years ±11.2 for men and 56.6 years ±13.8 for women. The sex ratio was 1.19. Most of patients were residents of Bobo-Dioulasso (54.4%). The main cerebrovascular risk factors (Table 1) were chronic hypertension (71.9%), alcoholism (19.3%), and smoking (10.5%). Four patients had a history of

heart disease. The level of consciousness was normal in 50 patients and bedsore complications were observed in 3 patients during hospitalization. Average length of hospital stay was 11.3 ± 5.3 days. Regarding neurological follow-up, 78.9% of patients attended at least one follow-up visit, and 5.3% continued regular follow-up. Cumulative post-hospitalization mortality at 3 months, 1 year, 2 years, 3 years, and 4 years was 3.5%, 8.8%, 12.3%, 14%, and 21.1%, respectively. The probability of survival at 4 years was 78.9% (Figure 2). Predictors of mortality (Table 2) were a Glasgow Coma Scale >9 (p=0.001; HR = 0.09; 95% CI: 0.02–0.40) and the presence of heart disease (p=0.015; HR = 5.87; 95% CI: 1.42–24.29).

Table 1. *General characteristics of the 57 patients included in the study.*

Features	n (%)
Age (years)	
≤60	36 (63,2)
>60	21 (36,8)
Gender	
Male	31 (63,2)
Female	26 (36,8)
Residential	
Urban	31 (51,7)
Rural	26 (48,3)
Admission timeframe	
<6 hours	3 (5,3)
6–24 hours	10 (17,5)
>24 hours	44 (77,2)
Vascular risk factors	
High blood pressure	41 (71,9)
Alcohol	11 (19,3)
Smoking	6 (10,5)
Diabetes	4 (7,0)
History of heart disease	4 (7,0)
Sedentary lifestyle	4 (7,0)
History of stroke	3 (5,2)
Overweight/Obesity	2 (3,5)
Length of hospital stay	
≤7 days	14 (24,6)
>7 days	43 (75,4)
ICH score	
0-1	47 (82,5)
2-3	10 (17,5)
Rankin's score on discharge	
0-2	18 (31,6)
3-5	39 (68,4)

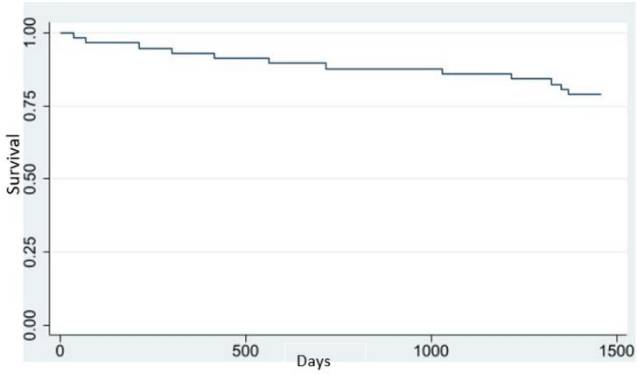

Figure 2. *Survival curve using the Kaplan-Meier method.*

4. Discussion

This study reports mortality among survivors of HS over a 4-year period. Mortality at 90 days, 1 year, 2 years, 3 years, and 4 years was 3.5%, 8.8%, 12.3%, 14%, and 21.1%, respectively. Our results were comparable to those of Namale et al [9] who found a 90 days mortality rate of 4.4% in Uganda. In Benin, Adoukonou et al [10] reported a 5-year mortality rate of 19.6%. Similarly, Sarfo et al [11] in Ghana noted a mortality rate of 15.7% after a mean follow-up of 32 months. Hansen et al [12] found a 5-year mortality rate of 26.2% among patients who survived 1 year after their HS. According to Smajlović et al [13], the annual mortality rate for HS is relatively constant at between 4% and 5% each year. The availability of high-level technical facilities and early appropriate care should predict better survival in developed countries. However, the younger age (mean 58.4 years) in our study could explain these comparable mortality rates.

The probability of 4-year survival was 78.9% in this study. A Glasgow Coma Scale of 9 or less was a predictor of mortality in our series. Our results were similar to those reported by Akani et al. [14] in Cote d'Ivoire and by Kuate-Tegueu et al. [15] in Cameroon. A study conducted in Turkey demonstrated that Glasgow Coma Scale and mortality were found to be strongly correlated in patients with altered consciousness after 1 month and 1 year [16]. This highlights the importance of the initial severity of stroke in both acute-phase and long-term mortality. Closer outpatient follow-up could improve survival among patients who experienced altered consciousness during hospitalization.

This study showed that the presence of heart disease was a

predictor of long-term mortality. In fact, a number of studies have demonstrated a substantial correlation between higher stroke mortality and the presence of heart disease [17, 18]. According to Hoad et al [19], 15% of patients who had a HS had at least one newly identified cardiovascular problem within four weeks. Hansen et al [11] demonstrated that 19% of deaths among survivors of acute HS were due to ischemic heart disease. According to Carlsson et al [20], cardiovascular causes accounted for 61% of mortality after HS. Hence the importance of screening for and managing heart disease during hemorrhagic strokes.

This study has several limitations: the small sample size, the retrospective collection of certain data which may have led to omissions and the single-center nature of the study. The representativeness of this study may be limited to the profile of the 57 patients and may not reflect overall trends.

Furthermore, this study did not receive any funding.

5. Conclusion

This study analyzed the long-term mortality among of hemorrhagic stroke survivors at the Bobo-Dioulasso teaching hospital. This mortality rate is relatively high. The initial severity of the stroke and a history of heart disease remain the predictors for this mortality. The results indicate that strengthening inpatient and outpatient care for disorders of consciousness and heart disease could improve the long-term prognosis for hemorrhagic stroke. Future population-based studies should help to enhance our understanding of the predictors of long-term mortality in hemorrhagic stroke.

Table 2. *Predictors of long-term mortality.*

Caracteristiques	**Anivariate analyseis**			**Multivariate analysis**		
	p-value	**Hazard ratio**	**IC 95%**	**p-value**	**Hazard ratio**	**IC 95%**
Age (years)	0,62			-	-	-
≤60		1				
>60		1,34	0,42-4,22			
Gender	0,7			-	-	-
Male		1				
Female		0,3	0,25-2,52			
Glasgow coma scale	<0,001			0,001		
3-9		1			1	
10-15		0,08	0,02-0,31		0,09	0,02-0,40
ICH score	0,94					
0-1		1				
2-3		0,94	0,20-4,31			
Rankin score	0,2			-	-	-
0-2		1				
3-5		2,68	0,59-12,28			
Length of hospital stay	0.98			-	-	-
≤7 days		1				
>7 days		0,98	0,26- 3,64			
Bedsore complications	0,46			-	-	-
Yes		1				

Caracteristiques	Anivariate analyseis			Multivariate analysis		
	p-value	Hazard ratio	IC 95%	p-value	Hazard ratio	IC 95%
No		0,46	0,06-3,59			
High blood pressure	0,85					
No		1		-	-	-
Yes		1,13	0,31-4,18			
Smoking	0,81			-	-	-
No		1				
Yes		0,77	0,09-5,99			
Alcohol	0,32			-	-	-
No		1				
Yes		0.35	0,04-2,27			
History of heart disease	0,004			0,015		
No		1			1	
Yes		7,23	1,91-27,35		5,87	1,42-24,29
History of stroke	0,07			-	-	-
No		1				
Yes		4,1	0,89-18,78			

Abbreviations

ICH Intracerebral Hemorrhage
HS Hemorrhagic Stroke
GCS Glasgow Coma Scale

Author Contributions

Ouedraogo Pingdewende Victor: Conceptualization, Formal Analysis, Methodology, Project administration, Resources, Supervision, Writing – original draft, Writing – review & editing

Drave Alassane: Data curation, Investigation, Methodology, Resources, Software, Visualization

Boudzoumou Diagambana Bertandrie Estelle: Data Curation, Formal Analysis, Investigation, Resources, Visualization, Software

Savadogo Abdoul Aziz: Validation

Ouedraogo Abaz: Validation

Kagone Amos Wendyam: Validation

Napon Christian: Project administration, Supervision, Validation

Conflicts of Interest

The authors declare no conflicts of interest.

References

[1] Koivunen RJ, Tatlisumak T, Satop ää J, Niemel ä M, Putaala J. Intracerebral hemorrhage at young age: long-term prognosis. Eur J Neurol 2015; 22: 1029-37.

[2] Global Burden of Disease Study Collaborators. Global, regional, and national burden of stroke, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. Lancet Neurol 2019; 18: 439-58.

[3] Qureshi AI, Tuhrim S, Broderick JP, Batjer HH, Hondo H, Hanley DF. Spontaneous intracerebral hemorrhage. N Engl J Med 2001; 344; 1450-60.

[4] Smith EE, Nandavar S, David D, DaiWai MO, Mathew JR, Jeffrey LS, et al. A Risk Score for In-Hospital Death in Patients Admitted With Ischemic or Hemorrhagic Stroke. Journal of the American Heart Association 2013; 2(1). e005207.

[5] Abdourahaman NA, Diagne SN, Basse AM, Sow AD, Ndiaye M, Diop GA, et al. Prognosis of hemorrhagic stroke in hospitalized patients at the ibrahima pierre ndiaye neurosciences clinic, Dakar, Senegal in 2018. Afr J Neurol Sci 2020; 39(1): 12-20.

[6] Nyangui MJ, Gnigone MP, Mambila MGA, Kots'a-Yuminy LC, Mboumba C, Nsounda A et al. haemorrhagic stroke in Gabon (Libreville): prognostic factors. Afr J Neurol Sci 2023; 42(1): 47-63.

[7] Ouedraogo PV, Bagbila WPAH, Drave A, Ouedraogo LA, Boudzoumou DE, Millogo A. Epidemiological, clinical and prognostic aspects of haemorrhagic strokes in older people in Bobo-Dioulasso, Burkina Faso. JNNP Guinee 2022; 1(22): 47-53.

[8] Peng Y, Ngo L, Hay K, Alghamry A, Colebourne K, Ranasinghe I. Long-Term Survival, Stroke Recurrence, and Life Expectancy After an Acute Stroke in Australia and New Zealand From 2008–2017: A Population-Wide Cohort Study. Stroke 2022; 53(8). https://doi.org/10.1161/STROKEAHA.121.038155

[9] Namale G, Kamacooko O, Makhoba A, Mugabi T, Ndagire M, Ssanyu P, et al. Predictors of 30-day and 90-day mortality among hemorrhagic and ischemic stroke patients in urban Uganda: a prospective hospital-based cohort study. BMC Cardiovasc Disord. 2020 Oct 8; 20(1): 442. https://doi.org/10.1186/s12872-020-01724-6

[10] Adoukonou T, Agbetou M, Bangbotche R, Kossi O, Fotso P, Magne J, et al. Long-term mortality of stroke survivors in Parakou: 5-year follow-up. J Stroke Cerebrovasc Dis 2020; 29: 104785.

[11] Sarfo FS, Akassi J, Kyem G, Adamu S, Awuah D, Kantanka O-S, et al. Long-term outcomes of stroke in a ghanaian outpatient clinic. J Stroke Cerebrovasc Dis 2018; 27(4): 1090-9.

[12] Hansen BM, Nilsson OG, Anderson H, Norrving B, Säveland H, Lindgren A. Long term (13 years) prognosis after primary intracerebral haemorrhage: a prospective population based study of long term mortality, prognostic factors and causes of death. J Neurol Neurosurg Psychiatry 2013; 84: 1150-5.

[13] Smajlović D, Kojić B, Sinanović O. Five-Year Survival After First-Ever Stroke. osn. J Basic Med Sci 2006; 6(3): 17-22.

[14] Akani AF, Kouame-Assouan AE, Gnazegbo A, Bony KE, Karidioula HA, Sylla A, et al. ICH score and vital prognosis of intracerebral hemorrhage in Bouake, Cote d'Ivoire. Afr J Neurol Sci 2018; 37(2): 17-23.

[15] Kuate-Tegueu C, Mapoure-Njankouo Y, Gopdjim-Massu L, Doumbe J, Noubissi-Dada G, Dissongo J II, et al. Stroke mortality and its determinants in a tertiary care Hospital at Douala (Cameroon). Health Sci Dis 2016; 17(1): 1-6.

[16] Börü ÜT, Gül L, Taşdemir M. A hospital-based study on long-term mortality and predictive factors after spontaneous intracerebral hemorrhage from Turkey. Neurol Asia 2009; 14: 11-4.

[17] Pana TA, Wood AD, Perdomo-Lampignano JA, Tiamkao S, Clark AB, Kongbunkiat K, et al. Impact of heart failure on stroke mortality and recurrence. Heart Asia 2019; 11: e011139.

[18] Collins TC, Petersen NJ, Menke TJ, Souchek J, Foster W, Ashton CM. Short-term, intermediate-term, and long-term mortality in patients hospitalized for stroke J Clin Epidemiol 2003; 56: 81–7.

[19] Hoad KL, Jones H, Miller G, Abdul-Rahim AH, Lip GY, Buckley BJ. Stroke-heart syndrome: Incidence and clinical outcomes of cardiac complications following intracerebral haemorrhage. Eur Stroke J. 2025 Mar; 10(1): 100-107.

[20] Carlsson M, Wilsgaard T, Johnsen SH, Johnsen L-H, Løchen M-L, Njølstad I, et al. Long-Term Survival, Causes of Death, and Trends in 5-Year Mortality After Intracerebral Hemorrhage. Stroke 2021; 52: 3883-90.