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Haematoma Volume in Haemorrhagic Stroke and Associated Factors in Bobo-Dioulasso, Burkina Faso

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Abstract

Background: Initial haematoma volume is one of the strongest predictors of prognosis in haemorrhagic stroke. The aim of this study was to analyse the factors associated with haematoma volume in haemorrhagic stroke at the Sourô Sanou University Hospital in Bobo-Dioulasso. **Methods**: This was a prospective cross-sectional study of patients admitted from 16 July to 15 October 2022 for haemorrhagic stroke. Data were analysed using STATA 17.0 software. **Results:** The study included 60 patients. Hypertension was the main cardiovascular risk factor (83.3%). The sex ratio was 1.2. The mean age was 58.1 ± 15.6 years. The mean arterial pressure at admission was 179.4 ± 31.8 mmHg for systolic and 112.7 ± 26.2 mmHg for diastolic. The NIHSS score at admission was greater than 15 in 27 (45%) patients. The mean length of hospital stay was 7.3 ± 9.7 days. The mean haematoma volume was 29.97 ± 31.35 cc with extremes ranging from 0.2 to 158 cc. Factors associated with haematoma volume greater than 60 mL were diastolic blood pressure (p = 0.008; OR = 1.05; 95% CI: 1.01 - 1.10) for each unit increase in diastolic blood pressure and NIHSS score (p = 0.02; OR = 1.11; 95% CI: 1.01 - 1.20) for each unit increase in NIHSS score. **Conclusion:** This study shows that the NIHSS score and diastolic blood pressure were the independent factors associated with haematoma volume. These therapeutic targets should make it possible to avoid expansion of haematoma volume and improve the prognosis of haemorrhagic stroke.

Keywords

Hemorrhagic Stroke, Volume, Expansion, Bobo-Dioulasso, Burkina Faso

1. Background

Worldwide, haemorrhagic stroke accounts for up to 27% of all acute strokes and is associated with very high morbidity and mortality [1] [2]. One of the strongest predictors of prognosis is the initial volume of the haematoma [3] and its expansion therefore represents the most important modifiable therapeutic target [4]. Chronic arterial hypertension is the main cause of haemorrhagic stroke [5]. A large number of clinical studies have confirmed that controlling arterial hypertension in patients with acute intracerebral haemorrhage can effectively reduce haematoma expansion and prevent neurological deterioration [6] [7]. In our context, no study has assessed haematoma volume during haemorrhagic stroke. The aim of this study was to analyse the factors associated with haematoma volume in stroke patients at the Sourô Sanou University Hospital in Bobo-Dioulasso.

2. Methods

This was a cross-sectional observational study, with descriptive and analytical aims and prospective data collection, carried out during the period from 16 July to 15 October 2022. It took place in the Sourô Sanou University Hospital in Bobo-Dioulasso. This hospital has a capacity of 550 beds in six departments. The study was carried out in the medical emergencies, neurology, cardiology and intensive care departments. The neurology department is the only referral center for neurological pathology in this part of the country, with 22 beds. The cardiology department has 20 beds, the intensive care unit 14 beds and the medical emergencies department 24 beds.

All patients aged 15 and over hospitalised for haemorrhagic stroke confirmed by brain CT scan during the study period were included in this study. Recruitment was exhaustive. Patients (or their parents) who did not give consent, cases of subarachnoid haemorrhage and incomplete files were excluded.

3. Tools

For each patient, a survey form was drawn up to collect the following information from the patients and/or their parents: socio-demographic variables; risk factors; reasons for hospitalisation; time to consultation; vital parameters; physical examination data by assessing the state of consciousness with the Glasgow Coma scale (categorised as normal if score 14-15/15, obnubilated if score 8-13/15 and comatose if score < 8/15); blood pressure on admission; NIHSS score on admission (categorised as minor to moderate if score≤ 15, severe to grave if score> 15), haematoma volume on brain CT scan on admission calculated by the formula $A \times B \times C/2$, where A, B and C were the diameters of the haematoma in the three spatial directions (divided into 2 categories; 0 - 60 cc and greater than 60 cc) where 60 cc in spontaneous intracerebral hemorrhage is a critical threshold indicating poor prognosis, high mortality risk, and often an indication for surgical intervention [8]; length of hospitalisation and in-hospital mortality.

4. Statistical Analysis

Statistical analysis was performed using STATA software version 17.0. The variables of interest were analysed on the basis of the complete data (Any row containing at least one missing value has been removed). The usual descriptive statistics parameters were estimated for each variable. Qualitative data were expressed as percentages (%) and quantitative variables as mean ± standard deviation. The significance threshold was set at $p < 0.05$. Factors associated with haematoma volume were determined by univariate and multivariate logistic regression. Independent variables with a significant p-value in the univariate analysis were selected for the multivariate analysis.

This study received administrative authorisation from the Sourô Sanou University Hospital of Bobo-Dioulasso. Informed consent was obtained from patients or those accompanying them. The anonymity of the patients was preserved.

5. Results

During the 3 months of data collection, there were 155 cases of stroke of all types, including 64 cases of haemorrhagic stroke, or 41.3% of all strokes. We included 60 patients (Figure 1). The sex ratio was 1.2. The mean age was 58.1 ± 15.6 years. The majority of patients lived in Bobo-Dioulasso (60%). The main cerebrovascular risk factors (Table 1) were chronic arterial hypertension (83.3%), alcoholism (35%), smoking (26.7%), previous stroke (15%) and diabetes mellitus (11.7%). Mean systolic blood pressure at entry was 179.4 ± 31.8 mmHg and 112.7 ± 26.2 mmHg for mean diastolic blood pressure. The NIHSS score at admission was greater than 15 in 27 (45%) patients. The mean length of hospitalisation was 7.3 ± 9.7 days. The mean haematoma volume was 29.97 ± 31.35 cc with extremes ranging from 0.2 to 158 cc. Thirteen (21.7%) patients had a haematoma volume exceeding 60 cc (Figure 2). The topography of the haematoma (Table 2) was supratentorial in 54 (90%) patients, deep in 39 (72.2%) and lobar in 16 (29.6%). Intra-hospital mortality was 31.25%. Factors associated with haematoma volume greater than 60 cc (Table 3) were diastolic blood pressure ($p = 0.008$; OR = 1.05; 95% CI: 1.01 - 1.10) for each unit increase in diastolic blood pressure and NIHSS score ($p = 0.02$; OR = 1.11; 95% CI: 1.01 - 1.20) for each unit increase in NIHSS score.

Table 1. General characteristics of our study population.

Characteristics	n (%)
Age (years)	
≤60	35 (58.3)
>60	25 (41.7)
Sex	
Male	33 (55)
Female	27 (45)

Continued

Residence	
Urban	36 (60)
Rural	24 (40)
Time to diagnosis	
<24 Hours	45 (75)
≥24 Hours	15 (25)
Vascular risk factors	
Hypertension	50 (83.3)
Alcohol	21 (35)
Diabetes	7 (11.7)
Smoking	16 (26.7)
Previous stroke	9 (15)
Use of antithrombotics	17 (28.3)
Glasgow Coma Scale	
<8	12 (20)
8 - 13	23 (38.3)
≥14	25 (41.7)
Length of hospitalisation	
≤7days	41 (68.3)
>7days	19 (31.7)
NIHSS Score	
≤15	33 (55)
>15	27 (45)
ICH Score	
0 - 2	43 (71.7)
3 - 6	17 (28.3)

Table 2. Mean haematoma volume by topography.

Topography	Headcount (%)	Mean cc ± standard deviation
Hemispheric	54 (90)	
Lobar	16 (26.7)	38.9 ± 34.1
Deep	39 (65)	29.2 ± 30.1
Hemispheric and sub tentorial	1 (1.6)	1
Sub tentorial	5 (8.4)	7.4 ± 6.7

Table 3. Factors associated with haematoma volume.

	Univariate analysis			Multivariate analysis		
Caracteristics	**p-value**	**OR**	**95% CI**	**p-value**	**OR**	**95% CI**
Age (≥60 years)	0.88	0.9	0.22 - 3.62	-	-	-
Sex	0.56	1.5	0.36 - 6.18	-	-	-
Residence	0.78	0.86	0.32 - 2.34			
Hypertension	0.31	0.43	0.08 - 2.18	-	-	-
Previous stroke	0.33	0.34	0.04 - 3.04	-	-	-
Diabetes	0.96	0.94	0.09 - 9.52	-	-	-
Smoking	0.16	2.8	0.66 - 11.75	-	-	-
Alcohol	0.36	1. 92	0.46 - 7.87	-	-	-
Use of antithrombotics	0.14	0.19	0.02 - 1.73			
Glasgow Coma Scale	**0.03**	0.81	0.67 - 0.98	0.72	0.92	0.62 - 1.38
NIHSS Score	**0.02**	1.09	1.01 - 1.17	**0.02**	1.11	1.01 - 1.20
Systolic blood pressure	**0.008**	1.04	1.01 - 1.06	0.72	1.01	0.96 - 1.05
Diastolic blood pressure	**0.006**	1.04	1.01 - 1.08	**0.008**	1.05	1.01 - 1.10

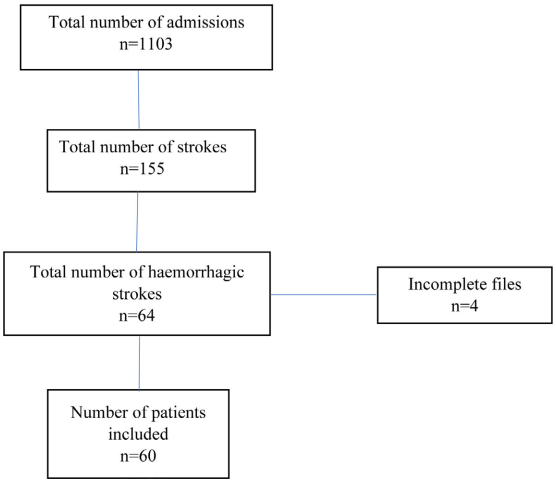

Figure 1. Flow chart of our study population.

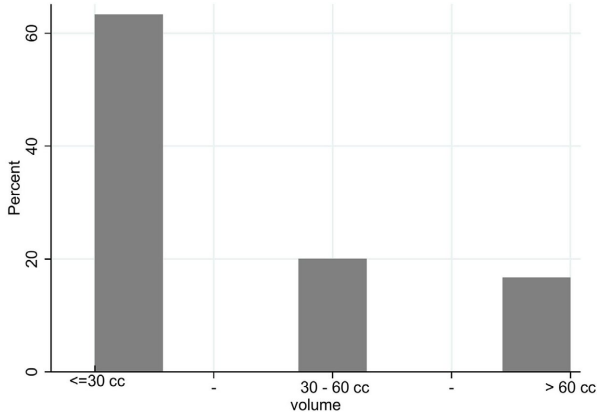

Figure 2. Distribution of the study population according to haematoma volume.

6. Discussion

This study reports data on haematoma volume in haemorrhagic stroke and associated factors. The mean haematoma volume was 29.97 ± 31.35 cc with extremes ranging from 0.2 to 158 cc. The topography was hemispheric and supratentorial in 90% of cases. Ayano *et al.* [9] reported a volume greater than 30 cc in 58.8% of cases and a hemispheric topography in 82.1%. For Amadou *et al.* [10], the volume of the haematoma was less than 30 cc in 57% of patients and greater than 30 cc in 43%. Haematoma volume is therefore a well-known predictor of functional and vital prognosis [11]. Davis *et al.* [12] have shown that a 1 cc increase in absolute haematoma volume results in a 7% increased probability of patients progressing from independence to dependence. Our study showed that haematoma volume increased significantly with diastolic blood pressure. According to Chobanian *et al.* [13], the risk of stroke begins when blood pressure reaches 115/75 mmHg and doubles for each 20 mmHg increase in systolic pressure and 10 mmHg increase in diastolic pressure. For Biffi *et al.* [14], diastolic blood pressure was associated with an increased risk of recurrence of non-lobar haemorrhagic stroke per 10 mmHg increase (HR: 1.21; 95% CI: 1.01 - 1.47). Vishram *et al.* [15] have reported that high diastolic blood pressure damages the endothelium of intracerebral arteries, causing blood vessel rupture. Hence the importance of strict control of blood pressure to avoid expansion of the haematoma volume and improve the prognosis of haemorrhagic stroke.

In this series, the severity of stroke as determined by the NIHSS score was associated with a large haematoma volume. Our results were comparable to those of an Egyptian study in which the volume of intracerebral haematoma on admission showed a significant positive correlation with the NIHSS score [16]. Dusenbury *et al.* [17] showed that the NIHSS score was more effective than the Glasgow Coma scale in predicting patients likely to have large haematomas. In fact, a larger haematoma volume could reflect a greater number of affected cerebral structures. Thus, the primary lesion is due to compression of brain tissue by the haematoma and an increase in intracranial pressure. Inflammation, disruption of the blood-brain barrier, oedema, overproduction of free radicals, glutamate-induced excitotoxicity and the release of haemoglobin and iron from the clot contribute to secondary injury [18].

7. Conclusion

Haematoma volume and expansion remain key factors in the prognosis of haemorrhagic stroke. This study shows that NIHSS score and diastolic blood pressure were the independent factors associated with haematoma volume. The identification of therapeutic targets to prevent the expansion of haematoma volume could reduce the severity of stroke and improve prognosis. Multicentre studies should determine the factors that predict haematoma volume expansion.

8. Limitations of This Study

This study presents several limits: the single-centre design, the short recruitment

period, the small sample, and the possible referral or survivor bias. This will balance the interpretation of the findings.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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