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EPIDEMIOLOGICAL AND CLINICAL FACTORS IN HEMORRHAGIC STROKE: A CROSS-SECTIONAL STUDY IN A REFERENCE HOSPITAL

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ABSTRACT

Objective: To analyze the epidemiological profile of patients with hemorrhagic stroke (HS) and its associations with clinical outcomes among patients admitted to a university hospital in Paraná, Brazil. **Methods:** A cross-sectional study conducted at a university hospital in Paraná between 2018 and 2022, involving 118 patients diagnosed with HS. Sociodemographic, clinical, and comorbidity data were analyzed. Statistical tests such as Chi-Square, ANOVA, and Student's t-test were employed. **Results:** The mean age was 67 years (±1.19), with an equal distribution between sexes (50%). Systemic arterial hypertension (74%) and diabetes mellitus (25%) were the most prevalent comorbidities. The in-hospital mortality rate was 40%, with a higher proportion among patients with renal diseases (60%) and those with a high Charlson comorbidity index score (100%). The mean time from symptom onset to hospital admission was 12 hours (±11.8). The mean length of stay was 10 days for survivors and 8 days for patients who succumbed (p=0.03). **Conclusion:** HS affected men and women equally and was associated with a high prevalence of comorbidities such as hypertension and diabetes. Despite the significant mortality rate, no statistically significant associations were observed between comorbidities and clinical outcomes. Prevention and rehabilitation strategies focusing on comorbidity management are essential to improve clinical outcomes.

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INTRODUCTION

Hemorrhagic stroke (HS) is one of the leading causes of morbidity and mortality worldwide, characterized by intracranial hemorrhages that often result in severe neurological deficits and high lethality rates(1). This type of stroke accounts for approximately 10-20% of all stroke cases, with its prevalence and risk factors varying significantly across populations, reflecting genetic, environmental, and cultural influences (2). Recent studies have highlighted the importance of understanding the epidemiological profile of affected patients, as factors such as age, gender, hypertension, and lifestyle habits play a central role in both the occurrence and clinical outcomes of the condition (3). Analyzing the epidemiological profile of these patients is crucial for developing prevention and management strategies, as the factors associated with hemorrhagic stroke differ substantially from those linked to ischemic stroke (IS). Furthermore, the heterogeneity in clinical outcomes, ranging from partial functional recovery to severe disabilities, underscores the need for detailed studies on the epidemiological characteristics across different regions (4). In Brazil, where the burden of cardiovascular diseases is substantial, regional studies on hemorrhagic stroke remain scarce.

However, evidence suggests that local population profiles, combined with socioeconomic disparities, may significantly influence the incidence and treatment outcomes (5). Given the relevance of this topic, the present study aims to address this gap by analyzing the epidemiological profile of patients with hemorrhagic stroke and its association with clinical outcomes among patients admitted to a university hospital in Paraná, Brazil.

METHODS

This is an epidemiological, observational, cross-sectional study guided by the STROBE framework(6). The research was conducted at a university hospital in Paraná, Brazil, evaluating patients hospitalized between October 10, 2018, and February 9, 2022, with a diagnosis of hemorrhagic stroke (HS). This institution is a teaching hospital, recognized for its expertise in medical, surgical, and multidisciplinary residency programs. Strategically located in the eastern macro-region of Paraná State, the hospital serves the healthcare needs of the 3rd, 4th, and 21st Health Regions of Paraná, encompassing 28 municipalities (7). The initial sample consisted of 833 patients admitted with ischemic and hemorrhagic strokes. However, the inclusion criteria for this study were limited to patients

aged 18 years or older diagnosed with hemorrhagic stroke. Patients with incomplete data or ischemic stroke were excluded. The final sample comprised 118 patients. Data collection was conducted in the first semester of 2023 using the GSUS® and Tasy® platforms, based on secondary data gathered by researchers, nursing students, and nursing residents from a university in Paraná, Brazil. The dependent variable was HS, while independent variables included age, gender, race, comorbidities, Charlson comorbidity index, alcohol consumption, smoking status, daily medication use, length of hospital stay, and clinical outcome. Quantitative data were entered into Microsoft Excel® and analyzed using EpiInfo™ software version 7.2.4.0. Categorical variables were expressed as relative and absolute frequencies, while continuous variables were presented as means and standard deviations for normally distributed data, or medians otherwise. Statistical tests including Chi-Square, Fisher's exact test, Student's t-test, Bonferroni correction, and ANOVA were applied, with a significance level of $p<0.05$ to assess associations between dependent and independent variables.

Helsinki, the CIOMS International Ethical Guidelines for Health-Related Research Involving Humans, and Brazilian ethical standards. Ethical approval was obtained under protocol CAAE: 61430822.0.0000.0105.

RESULTS

Among the 118 patients studied, 59 were female (50%) and 59 were male (50%). The mean age of the patients was 67 years (±1.19), and the majority (112 patients, 95%) self-identified as White, while only 6 (5%) self-identified as Black. Of the total patients, 108 (92%) presented with comorbidities, the most common being systemic arterial hypertension in 88 patients (74%), diabetes mellitus in 30 patients (25%), smoking in 26 patients (22%), and regular alcohol consumption in 12 patients (10%). Additionally, 31 patients (26%) had other associated comorbidities. Out of the 118 patients evaluated, 76 (65%) were on daily medications, with an average of at least two

Table 1. Prevalence, prevalence ratio (PR), and confidence interval (95% CI) of patients with hemorrhagic stroke according to sociodemographic and clinical variables, Paraná, 2018-2022

	Clinical outcome							
	Hospital discharge		Death		Total	RP	$IC_{95\%}$	p-valor
	nº	%	nº	%	nº			
Gender								
Female	30	50,8	29	49.1	59	1,53	(0,97 - 2,40)	0,061
Male	40	67.8	19	32.2	59			
Race								
White	66	58,9	46	41,1	112	1,23	(0,38 - 3,90)	0,529
Black	4	66,6	2	33,3	6			
Comorbidities								
Yes	63	58,3	45	41,6	108	1,38	(0,52 -3,67)	0,472
No	7	70	3	30	10			
CardiacComorbidity								
Yes	10	50	10	50	20	0,77	(0,47 - 1,28)	0,352
No	60	61,2	38	38,7	98			
PulmonaryComorbidity								
Yes	6	42,8	8	57,1	14	0,67	(0,40 - 1,12)	0,182
No	64	61,5	40	38,4	104			
Renal Comorbidity								
Yes	2	40	3	60	5	0,66	(0,31 - 1,40)	0,326
No	68	60,1	45	39,8	113			
Hypertension								
Yes	55	62,5	33	37,5	88	1,33	(0,85 - 2,08)	0,228
No	15	50	15	50	30			
Diabetes								
Yes	14	46,6	16	53,3	30	0,68	(0,44 - 1,05)	0,102
No	56	63,6	32	36,3	88			
Obesity								
Yes	2	25	6	75	8	1,67	(0,49 -5,66)	0,293
No	64	58,2	46	41,8	110			
Smoker								
Yes	17	65,3	9	34,6	26	1,22	(0,68 - 2,18)	0,476
No	53	57,6	39	42,3	92			
FormerSmoker								
Yes	7	77,7	2	22,2	9	1,89	(0,54 - 6,57)	0,209
No	63	57,8	46	42,2	109			
Alcohol User								
Yes	10	83,3	2	16,6	12	2,60	(0,72 - 9,39)	0,065
No	60	56,6	46	43,4	106			
Former Alcohol User								
Yes	5	71,4	2	28,5	7	1,45	(0,44 - 4,77)	0,401
No	65	58,5	46	41,4	111			
Other Comorbidities								
Yes	19	61,2	12	38,7	31	1,06	(0,64 - 1,77)	0,795
No	51	58,6	36	41,3	87			
Daily Medications								
Yes	46	60,5	30	39,4	76	1,08	(0,69 - 1,69)	0,720
No	24	57,1	18	42,8	42			
CharlsonComorbidity Index								
High	0	0	3	100	3	1,30	(0,62 - 2,71)	0,513
Moderate	4	50	4	50	8			
Low	66	61,6	41	38,3	107			

Source: Authors, 2024.

medications used (±2.2). Furthermore, the time from symptom onset to hospital admission had a mean duration of 12 hours (±11.8). These findings are summarized in Table 1 below. Regarding the length of hospital stay, the average duration was 9 days (±9.40). In terms of outcomes, 70 patients (59.3%) were discharged, while 48 (40%) died. Among the deceased patients, 49.15% (29) were female, with a mean age of 68 years, and 41.07% (46) identified as White. However, the analysis of variables related to mortality outcomes showed no significant associations, with a p-value of 0.529. Among patients with comorbidities, 41.67% (45) succumbed to the condition. Renal disease was the most prevalent comorbidity, present in 60% of fatal cases, followed by pulmonary diseases (57.14%), diabetes mellitus (53%), systemic arterial hypertension (37.50%), smoking (34.62%), and other comorbidities (38.71%). Nevertheless, none of these variables were statistically significantly associated with mortality outcomes ($p = 0.472$). Regarding medication use, patients who died had a mean use of at least two medications (±2.22). Among all patients, 39.47% (30) reported regular medication use. However, no statistically significant associations were observed between daily medication use and mortality outcomes ($p = 0.720$). The Charlson Comorbidity Index (CCI) was calculated as a tool to quantify the burden of comorbidities, categorizing patients into three levels: low, moderate, and high comorbidity burden, which aids in predicting 10-year mortality. Among the 118 patients analyzed, 107 (90%) were classified as having a low burden, 8 (6.78%) as moderate, and 3 (2.54%) as high. Among the deceased, 100% (3) had a high score, 50% (4) a moderate score, and 38.23% (48) a low score. However, no statistically significant associations were found. When comparing the time from symptom onset to hospital admission, patients who died had a mean of 12 hours (±11.8) before hospitalization. Regarding the length of hospital stay and outcomes, patients who died had an average stay of 8 days, while those discharged had an average stay of 10 days (±9.40), showing a statistically significant difference ($p = 0.03$). With respect to sequelae, dysarthria was the most common, affecting 10 patients (8.47%). Among the 57 patients who were discharged, all experienced some form of sequela related to HS.

DISCUSSION

As observed in the present study, both genders had an equal prevalence (50%) of hemorrhagic stroke (HS). However, among patients who died due to HS, females (49.15%) predominated compared to males (32.20%), without statistical significance. According to a study(8), in a cohort study conducted in Spain with 57,227 patients, men had a higher incidence of HS (57.3%) than women (43%) with statistical significance ($p<0.001$). However, in the same study, stroke-related deaths were more frequent in women (29.0%) than in men (23.7%), with statistically significant findings. Although research exists on gender differences in stroke patients, few analyses address this relationship specifically for hemorrhagic stroke. There is a disparity in the literature on whether gender is associated with HS outcomes(9). In the present study, patients discharged had a mean age of 67 years, while those who died had a mean age of 68 years, with no statistically significant differences between these variables. However, age is a recognized risk factor associated with HS mortality, including physiological factors, underlying medical conditions, complications, advanced age, and lifestyle (10). One study(11), who examined predictors of 30-day mortality in 460 HS patients in Thailand, individuals aged 65 to 70 years had an 8.5 times higher predicted 30-day mortality risk, those over 70 years had a 7.2 times risk, while those under 65 years had only a 3.0 times risk, with statistical significance ($p<0.05$). The increased likelihood of stroke in elderly patients is attributed to factors such as chronic inflammation, blood-brain barrier alterations, anticoagulant use, and a higher burden of pre-existing conditions such as hypertension, diabetes, and hyperlipidemia, which contribute to HS occurrence(12). Hypertension was the most prevalent comorbidity in the sample (74.5%); however, it was not associated with patient outcomes ($p=0.228$). According to the American Heart Association (AHA)(13), hypertension is an independent predictor of HS, as 75% of stroke patients have hypertension. Uncontrolled elevated blood pressure can cause lipohyalinosis, arteriosclerosis, hyperdistension, and weakening of arterial walls, potentially leading to HS(13). A Mexican study involving 172 patients with ischemic and hemorrhagic strokes identified hypertension as the main risk factor in both groups, present in 73% of HS patients. Among these, 54% had both hypertension and diabetes. This study emphasized the need for effective prevention, diagnosis, and treatment strategies for hypertension, as lower-income countries face higher morbidity and mortality rates linked to this condition compared to high-income countries(14).

In this study, approximately 91.5% (108) of the sample had at least one comorbidity, with 41.6% (45) of these patients dying. Stroke is a multifactorial condition strongly associated with comorbidities like atherosclerosis, hypertension, and diabetes mellitus (DM), all of which play significant roles in HS occurrence (15). The data revealed that 25.4% of patients had DM, 22.3% were daily smokers, 16.9% had cardiac diseases, and 11.8% had pulmonary conditions. Among those who died, the most common comorbidities were obesity (75%), renal disease (60%), pulmonary disease (57.1%), DM (53.3%), and cardiac disease (50%). According to Feigin et al. (2022), risk factors like smoking, diabetes, hypertension, cardiovascular diseases, dyslipidemia, and obesity contribute to increased HS prevalence in lower-income countries compared to middle- and high-income countries. One study (16) reported that approximately 60% of stroke deaths could be attributed to comorbidities such as hypertension, DM, and dyslipidemia. These conditions not only increase stroke risk but are also linked to worse prognoses and higher post-event mortality rates. These findings underscore the importance of controlling and treating comorbidities and highlight the need for effective interventions to reduce cerebrovascular disease burdens and improve clinical outcomes. While these conditions are treatable through lifestyle changes and medications, their high prevalence among stroke patients underscores the need for better management to reduce stroke risk and improve outcomes. Prevention and effective control of these comorbidities are crucial to reducing HS incidence and mortality(16). In this context, nurses play a vital role in developing health promotion and prevention strategies, including health education, lifestyle modifications, and comorbidity management (17,18). Regarding the Charlson Comorbidity Index (CCI), 90.68% of the sample had a low comorbidity burden. However, 100% of patients with a high CCI score and 50% with a moderate score died from HS. Although no statistically significant associations were found, these results contrast with other study (19), who reported that higher CCI scores were associated with increased stroke frequency ($p<0.001$). One study(20) similarly found a significant association between higher CCI scores and increased in-hospital mortality in a Serbian cohort.

When comparing hospital stays, patients discharged spent more days in the ICU (10 days) than those who died (7 days), with a significant difference ($p=0.03$). Similar results were found in a Dutch study(21), indicating high short-term mortality risk for stroke patients, which gradually decreases with longer ICU stays. A research project(22)also reported that HS cases accounted for the longest hospital stays, with a mean of 14.4 days. This association suggests that more complex cases require longer ICU stays ($p<0.05$). Medication use was analyzed, with 64% of the sample using two or more medications continuously. Among these, 39.7% died, compared to 42.8% among patients not on polypharmacy. No statistical significance was observed. However, a study in Ethiopia (23) associated polypharmacy with increased in-hospital mortality, especially for hypertension, anticoagulants, and dyslipidemia treatments. Nurses are crucial in stroke prevention through health education and interventions like blood pressure control and lifestyle modifications. Nurses actively participate in health promotion strategies, acting as educators and facilitators, empowering patients to make informed decisions and adopt preventive measures. Their involvement enhances awareness and education, aiming to reduce stroke incidence and improve population health outcomes (17,18). This study has limitations, including data collection from secondary electronic medical records, which may lack information or include inaccuracies. The cross-sectional design also precludes establishing temporal relationships between the variables analyzed. Despite its limitations, this study provides valuable insights for public

health planning by identifying clinical and epidemiological characteristics to guide preventive efforts and improve hospital management. For nursing, the findings emphasize the importance of health education, epidemiological-based prevention, medication management, and community comorbidity monitoring. Integrating preventive and educational measures into nursing practice can significantly reduce HS-related morbidity and mortality.

CONCLUSION

The findings indicate that HS equally affects men and women, with a mean age of 67 years, the majority being White. Systemic arterial hypertension and diabetes mellitus emerged as prevalent comorbidities, highlighting their roles in HS occurrence and clinical outcomes. Although the in-hospital mortality rate was significant (40%), no statistically significant associations were found between the analyzed comorbidities and mortality outcomes. However, patients with higher scores on the Charlson Comorbidity Index and those with renal diseases showed a tendency toward worse outcomes. Additionally, the average time from symptom onset to hospitalization was 12 hours, emphasizing the importance of early diagnosis and treatment to improve outcomes. The research objectives were achieved, providing a detailed overview of the epidemiological profile of HS patients. It underscores the importance of comorbidity management and the need for effective preventive and rehabilitation strategies. These findings can inform public policies aimed at risk factor prevention and improving the hospital management of hemorrhagic stroke patients. Finally, the study reinforces the critical role of nursing in health education, risk factor prevention, and comprehensive care for HS patients—from hospitalization to rehabilitation—promoting better clinical outcomes and quality of life.

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