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Research Article

Analysis of Age distribution at Onset Across Stroke Subtypes in developing countries: A comparative study on Later Presentation of Cerebral Hemorrhage

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Abstract

Background: Whether it is ischemic, hemorrhagic, cerebellar, or transient, age at the time of the event cannot be considered a simple demographic parameter; it constitutes a crucial factor likely to shed light on the nature of the underlying vascular process. While age is recognized as a major risk factor for all types of stroke, its distribution according to subtypes remains insufficiently characterized, particularly in rigorous comparative analyses. It is within this perspective that the present study aims to systematically analyze the variations in age according to stroke subtypes.

Methods: We conducted a cross-sectional analysis of patients diagnosed with ischemic stroke, cerebral hemorrhagic stroke, cerebellar stroke, or transient ischemic attack (TIA). Age differences across groups were assessed using one-way ANOVA, followed by Tukey's HSD post-hoc tests.

Results: A significant effect of stroke subtype on age was observed ($F(3,185) = 3.29$, $p = 0.0219$). Post-hoc analysis revealed that patients with cerebral hemorrhagic stroke were significantly older than those with ischemic stroke (mean difference = 5.7 years, 95% CI [0.47–10.94], $p = 0.027$). No other comparisons reached statistical significance. Graphical analyses showed that the majority of patients were aged 50–69, with a slightly higher proportion of women in the 60–69 group. Ischemic and haemorrhagic strokes were more frequent in men, though women showed a relatively higher proportion of ischemic events.

Conclusion: Age at stroke onset varies significantly by subtype. Cerebral haemorrhagic stroke is more likely to occur at an older age, supporting its association with vascular fragility and long-standing hypertension. In contrast, ischemic stroke spans a broader age spectrum, underscoring the need for vigilance across all adult age groups. These findings reinforce the clinical value of considering patient age in the early differentiation of stroke subtype, particularly in high-burden settings.

Key Words: stroke; brain hemorrhage; cerebral ischemic stroke;age comparison; africa

Introduction

Stroke, while broadly known in its terminology, encompasses a pathological diversity where each subtype presents a specific clinical and pathophysiological profile. Whether it is ischemic, hemorrhagic, cerebellar, or transient, age at the time of the event cannot be considered a simple demographic parameter; it constitutes a crucial factor likely to shed light on the nature of the underlying vascular process.

While age is recognized as a major risk factor for all types of strokes, its distribution according to subtypes remains insufficiently characterized,

particularly in rigorous comparative analyses. Global data suggest that age influences the type of stroke: notably, a study by Feigin et al., published in Lancet Neurol (2009), revealed that intracerebral hemorrhage generally occurs at a more advanced age than ischemic stroke, while ischemia can appear at more varied ages [1]. Could this trend observed in Western populations apply to our African context, where the early onset of arterial hypertension is increasingly frequent? Certain African studies provide insights into this question: the multicentric SIREN study conducted in West Africa showed differences in age according to stroke subtype, with a tendency for hemorrhagic forms to occur in older patients than ischemic forms [2]. Furthermore, a Ghanaian study using computed tomography scans confirmed this regional trend, reporting a higher average age in patients with hemorrhagic stroke compared to ischemic stroke [3].

It is within this perspective that the present study, conducted at the Yaoundé Emergency Center (Cameroon), is situated. It aims to systematically analyze the variations in age according to stroke subtypes, in order to refine the understanding of this risk factor and enrich the epidemiological reasoning on stroke in a relatively undocumented African context.

Methodology

We carried out a retrospective descriptive and analytical study based on patient records over a one-year period. The research took place at the Yaounde Emergency Center, situated in Yaounde, in the Centre Region of Cameroon. This medical facility comprises an Emergency Department, a Primary Care Unit, an Intensive Care Unit and an Inpatient Ward, for a total of 40 beds.

A total of 2,940 patient records, dated from January 1st to December 31st, 2024, were thoroughly reviewed to identify entries indicating possible stroke symptoms, diagnoses, or imaging results. From this pool, 318 records showed signs consistent with stroke-like conditions. These were selected for more detailed evaluation.

The 318 cases were assessed using established criteria to determine eligibility. After this screening, 189 cases met the requirements for inclusion. Acute neurological symptoms such as weakness on one side of the body, facial drooping, speech difficulties, or sensory changes. Notes indicating a clinical diagnosis of stroke, cerebrovascular accident, or related terminology. Availability of adequate information in the file for meaningful analysis. All age groups were considered. Cases of transient ischemic attacks (TIAs) that resolved completely within 24 hours were also included. Records lacking sufficient detail. Cases where neurological symptoms could be attributed to other confirmed conditions such as trauma, post-seizure paralysis, brain tumors, or abscesses.

Following the inclusion and exclusion process, 189 patient records were selected for the final analysis. A standardized Google Form was used to extract relevant data from the selected records. Information gathered included demographics (age and sex), known risk factors (e.g., high blood pressure, diabetes, smoking, atrial fibrillation), time of symptom onset and arrival at the facility, clinical signs and symptoms, available imaging results, documented diagnosis, treatments administered, and patient outcomes. The data were entered and managed in a Google Sheet and analyzed using R Studio version 2025.5.1.513 on Windows 10/11. A one-way analysis of variance (ANOVA) and Post-hoc pairwise comparisons using Tukey's HSD test for the statistical analysis.

This research adhered to ethical standards outlined in the Declaration of Helsinki. Approval was granted by the ethics committee of the University of Yaounde I. Patient anonymity was ensured by removing all identifying information during data extraction and analysis. The study depends on existing records, which may be incomplete or inaccurate. As the facility operates in a low-resource setting, access to advanced brain imaging was restricted, possibly affecting diagnostic accuracy. Being a retrospective chart review, there is a risk of unintentional exclusion or misclassification of cases. Lack of uniform follow-up data limited insights into long-term outcomes. This study offers important observations about the age on the prevalence of stroke subtypes in a resource-limited environment. The results can help guide future efforts to improve stroke presentation as a whole.

Results

Age differences across stroke types

We investigated whether age varied across stroke diagnosis sub-categories (cerebral ischemic stroke, cerebral hemorrhagic stroke, cerebellar stroke, and transient ischemic attack [TIA]). A one-way analysis of variance (ANOVA) demonstrated a statistically significant effect of age on stroke type $F(3, 185) = 3.29$, $p = 0.0219$.

Post-hoc pairwise comparisons using Tukey's HSD test revealed that patients with cerebral hemorrhagic stroke were significantly older than those with cerebral ischemic stroke (mean difference = 5.7 years, 95% CI [0.47, 10.94], $p = 0.027$). No other pairwise comparisons between stroke types were statistically significant (all $p > 0.05$) (Table 1)

Analysis	Comparison / Source	DF	Sum Sq	Mean Sq	Mean Difference (years)	95% CI (Lower–Upper)	F-value	p-value
ANOVA	Stroke Type	3	1709	569.7	—	—	3.29	**0.0219***
ANOVA	Residuals	185	32059	173.3	—	—	—	—
Tukey HSD	Cerebral Hemorrhagic – Cerebral Ischemic	—	—	—	**–5.70**	–10.94 to –0.47	—	**0.027**
Tukey HSD	Cerebellar – Cerebral Ischemic	—	—	—	–6.99	–24.37 to 10.39	—	0.725
Tukey HSD	TIA – Cerebral Ischemic	—	—	—	–7.99	–20.50 to 4.52	—	0.350
Tukey HSD	Cerebellar – Cerebral Hemorrhagic	—	—	—	–1.29	–18.83 to 16.25	—	0.998
Tukey HSD	TIA – Cerebral Hemorrhagic	—	—	—	–2.29	–15.02 to 10.44	—	0.966
Tukey HSD	TIA – Cerebellar	—	—	—	–1.00	–21.90 to 19.90	—	0.999

Table 1. Combined ANOVA and Tukey HSD Post-Hoc Summary for Age Differences Across Stroke Types

Graphical representation

Figure 1 displays the age group distribution by sex, showing that most patients fell into the 50–69 age range, with a slightly higher proportion of women in the 60–69 group.

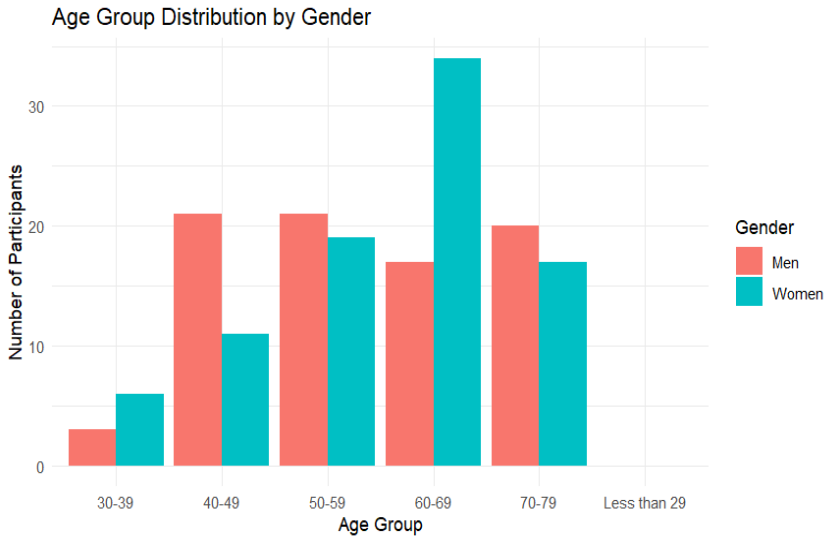

Figure 1: Age group distribution by gender.

Figure 2 demonstrates the distribution of stroke types by sex, where both ischemic and hemorrhagic strokes were more frequent in men, while women exhibited a relatively higher proportion of ischemic strokes.

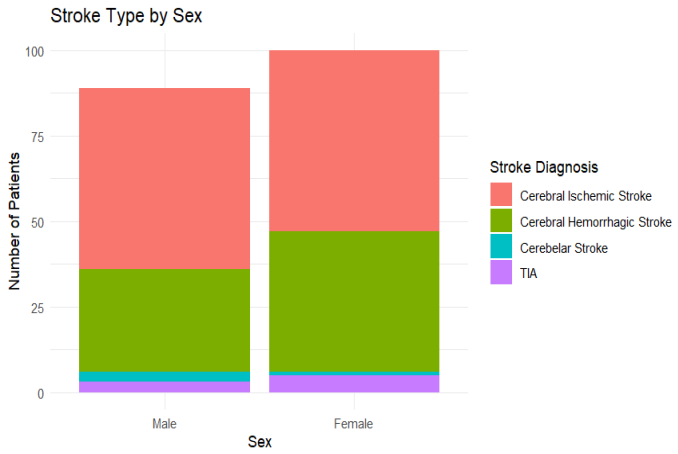

Figure 2: Stroke type distribution by sex.

Importantly, Figure 3 illustrates the age distribution of stroke patients stratified by sex and stroke subtype. The boxplots highlight that patients with cerebral hemorrhagic stroke presented with a higher median age than those with ischemic stroke, supporting the ANOVA and Tukey post-hoc results. No marked differences were evident for cerebellar stroke or TIA.

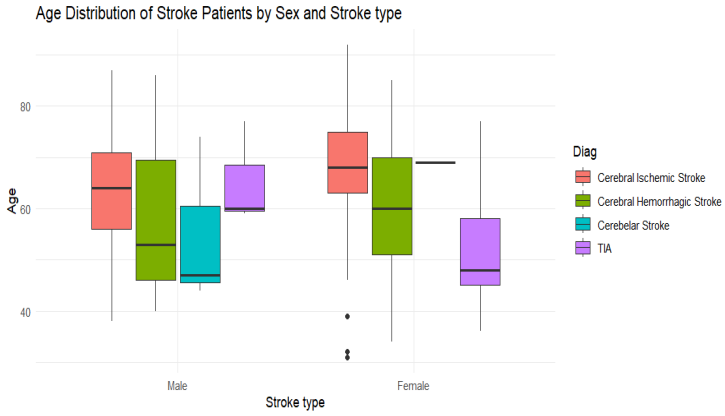

Figure 3: Boxplot of age distribution by stroke type and sex

Discussion

Clinical interpretation

Taken together, these findings indicate that age is associated with stroke subtype. Specifically, cerebral hemorrhagic stroke was more likely to occur at an older age compared with ischemic stroke. This is clinically relevant, as advanced age is a well-recognized risk factor for cerebral hemorrhage, possibly reflecting vascular fragility and cumulative hypertensive damage. In contrast, ischemic stroke appeared across a broader age range, including relatively younger patients.

Implications for clinical practice

The results underscore the importance of age in stroke risk stratification and diagnosis. In elderly patients presenting with acute neurological deficits, clinicians should maintain heightened vigilance for hemorrhagic stroke as a likely etiology. Conversely, ischemic stroke remains a significant concern across all adult age groups, reinforcing the need for early imaging to confirm the subtype and guide management.

Our results confirm that patients with hemorrhagic stroke are, on average, older than those with ischemic stroke, with an age difference of approximately 5.7 years. This finding aligns with existing literature suggesting that increasing age is a key risk factor for intracerebral hemorrhage, possibly due to cumulative vascular damage, long-standing hypertension, and cerebral amyloid angiopathy in the elderly population [6,7]. In contrast, ischemic strokes are distributed across a wider age range and may be more closely linked to modifiable atherosclerotic and cardioembolic risk factors [8].

Literature review:

Several studies conducted in Africa confirm the importance of age and risk factor control in the occurrence of different types of stroke: In Ethiopia, Fekadu et al. reported an average age of admission for stroke of about 61 years, with a slight predominance of hemorrhagic strokes in older patients, although the age difference was not always statistically significant [6]. In sub-Saharan Africa, a systematic review by Owolabi et al. highlights that patients with hemorrhagic stroke tend to be older than those with ischemic stroke, linked to a high prevalence of poorly controlled hypertension [3]. A study in the Democratic Republic of Congo described an average age of about 60 years for stroke patients, without clear differences between types, underscoring the variability among local populations [9,10]. These African data, although varied, generally point towards a more advanced age for hemorrhagic strokes, linked to vascular fragility associated with chronic hypertension.

The UK Biobank study recently showed that biological age estimated from clinical biomarkers and epigenetic profiles, is a key predictor of the risks of both ischemic and hemorrhagic stroke, highlighting the role of vascular aging in differentiating stroke subtypes [11,12]. In China, Guo Y et al. observed that hemorrhagic strokes often occur at an older age than ischemic strokes, a trend confirmed by several Asian cohorts [13,14]. A European meta-analysis by Feigin et al. also showed that the risk of hemorrhagic stroke increases significantly with age, more so than for ischemic stroke [1].

Significance of Our Results

The significant age difference observed in our study underscores the importance of a differentiated approach in prevention, diagnosis, and management depending on the type of stroke, particularly in an African context where the prevalence of hypertension is high and often poorly controlled. This has several implications:

Diagnostic vigilance – In elderly patients presenting with acute neurological deficits, clinicians should maintain heightened suspicion for hemorrhagic stroke until excluded by neuroimaging.

Preventive strategies – Given that hypertension and cerebral small vessel disease are major contributors to hemorrhage in the elderly, aggressive blood pressure management and vascular risk factor control are crucial in this population.

Resource allocation – Older patients with hemorrhagic stroke often require more intensive care and rehabilitation resources, highlighting the importance of anticipating care needs based on age and stroke type.

Limitations

The limitations include the small size of the subgroups, the lack of detailed data on comorbidities, and the observational nature of the study, which does not allow for establishing causal relationships.

Future Directions: Towards an age-dependent stroke risk prediction

Further research should focus on longitudinal, population-based cohorts to confirm these findings and explore mechanisms underlying the age-stroke subtype relationship. Particular attention should be given to the role of cerebral amyloid angiopathy, which is strongly age-dependent and may disproportionately contribute to hemorrhagic stroke in older adults. Integration of imaging biomarkers with clinical data could improve risk prediction models and refine individualized prevention strategies.

Conclusion

Our study highlights a significant age difference between stroke subtypes, with patients suffering from cerebral hemorrhagic stroke being, on average, older than those with ischemic stroke. This finding, consistent with data from the international literature but still poorly documented in African contexts, underscores the central role of vascular aging and chronic hypertension in the occurrence of cerebral hemorrhages in elderly subjects. The significance of this age difference, observed in our population, reinforces the value of a differentiated clinical approach based on the stroke subtype and the patient's profile. It also suggests the utility of earlier and more aggressive screening for vascular risk factors from middle age, as well as the systematic use of brain imaging in elderly patients presenting with an acute neurological deficit. Finally, these results open avenues for future research, particularly on the identification of specific biomarkers for cerebral aging and vascular vulnerability, which could improve the prediction, diagnosis, and personalized management of strokes in resource-limited countries.

Conflict Of Interest

All authors have no conflict of interest de declare

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